



Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-246

GRETNA DP 69 KV

13.95 MW Capacity / 0 MW Energy

July, 2019

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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 Virginia Electric and Power Company (VEPCO).

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.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a \$10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model.

The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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 an uprate to an existing solar generating facility located in Mecklenburg County, Virginia. This project requests a Capacity-only increase of 13.95 MW. The installed facilities have a total capability of 50 MW with 32.95 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 12/15/2020. This study does not imply a TO commitment to this in-service date.

Queue Number	AE2-246
Project Name	GRETNA DP 69 KV
Interconnection Customer	
State	Virginia
County	Mecklenburg
Transmission Owner	Dominion
MFO	50
MWE	0
MWC	13.95
Fuel	Solar
Basecase Study Year	2022

3.1 Point of Interconnection

AE2-246 is an uprate to AC1-145 which will interconnect with the Dominion distribution system at Gretna DP 69 kV substation.

3.2 Cost Summary

The AE2-246 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$ N/A
Direct Connection Network Upgrade	\$ N/A
Non Direct Connection Network Upgrades	\$ N/A
Total Costs	\$ N/A

In addition, the AE2-246 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$ 35,947,000

Cost allocations for these upgrades will be provided in the System Impact Study Report.

The Feasibility Study is used to make a preliminary determination of the type and scope of Attachment Facilities, Local Upgrades, and Network Upgrades that will be necessary to accommodate the Interconnection Request and to provide the Interconnection Customer a preliminary estimate of the time that will be required to construct any necessary facilities and upgrades and the Interconnection Customer's cost responsibility. The System Impact Study provides refined and comprehensive estimates of cost responsibility and construction lead times for new facilities and system upgrades. Facilities Studies will include, commensurate with the degree of engineering specificity as provided in the Facilities Study Agreement, good faith estimates of the cost, determined in accordance with Section 217 of the Tariff,

- (a) to be charged to each affected New Service Customer for the Facilities and System Upgrades that are necessary to accommodate this queue project;
- (b) the time required to complete detailed design and construction of the facilities and upgrades; and
- (c) a description of any site-specific environmental issues or requirements that could reasonably be anticipated to affect the cost or time required to complete construction of such facilities and upgrades.

4 Transmission Owner Scope of Work

Dominion assessed the impact of the proposed Queue Project AE2-246 was evaluated as a 13.95 MW Capacity (0.0 MW Energy) injection at the AC1-145 69 kV substation in the Dominion Transmission System, for compliance with NERC Reliability Criteria on Dominion Transmission System. The system was assessed using the summer 2022 AE2 case provided to Dominion by PJM. When performing a generation analysis, Dominion's main analysis will be load flow study results under single contingency (both normal and stressed system conditions). Dominion Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. A full listing of Dominion's Planning Criteria and interconnection requirements can be found in the Company's Facility Connection Requirements which are publicly available at: <http://www.dominionenergy.com>.

The results of these studies evaluate the system under a limited set of operating conditions and do not guarantee the full delivery of the capacity and associated energy of this proposed generation facility under all operating conditions. NERC Planning and Operating Reliability Criteria allow for the re-dispatch of generating units to resolve projected and actual deficiencies in real time and planning studies. Specifically in Planning Studies NERC Category C Contingency Conditions (Bus Fault, Tower Line, N-1-1, and Stuck Breaker scenarios) allow for re-dispatch of generating units to resolve potential reliability deficiencies. For Dominion Planning

Criteria the re-dispatch of generating units for these contingency conditions is allowed as long as the projected loading does not exceed 100% of a facility Load Dump Rating.

The required Attachment Facilities, Direct Connection and Non-Direct Connection work for the interconnection of the AE2-246 generation project to the Dominion Transmission System is detailed in the following sections. The associated one-line with the generation project attachment facilities and primary direct and non-direct connection are shown in Attachment 1.

Note that the ITO findings were made from a conceptual review of this project. A more detailed review of the connection facilities and their cost will be identified in a future study phases. Further note that the cost estimate data contained in this document should be considered high level estimates since it was produced without a detailed engineering review. The applicant will be responsible for the actual cost of construction. ITO herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any reinforcements to the transmission systems.

5 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
Rebuild / reconductor 0.9 miles of the Altavista to Otter 138kV line	\$ 1,350,000
Relay replacement at Altavista substation	\$ 120,000
Reconductor Johnson Mountain to Otter 138kV line and replace riser at Otter substation	\$ 10,670,000
Rebuild 1.64 miles of 69 kV Line 35 from Stone Mill to Altavista	\$ 2,132,000
Reconductor Johnson Mountain to New London 138kV line	\$ 21,650,000
Replace relays on the Skimmer 115/69kV #2 transformer	\$ 25,000
Total Non-Direct Connection Facility Costs	\$ 35,947,000

6 Schedule

The schedule for the required Network Impact Reinforcements will be more clearly identified in future study phases. The estimate elapsed time to complete each of the required reinforcements is identified in the “System Reinforcements” section of the report.

7 Transmission Owner Analysis

7.1 Power Flow Analysis

PJM performed a power flow analysis of the transmission system using a 2022 summer peak load flow model and the results were verified by Dominion. Additionally, Dominion performed an analysis of its transmission system. At the Primary POI, the AE2-246 project contributes to overloads on the Dominion transmission system as shown in the “Network Impact – Option 1” section of the report. The estimated cost of system reinforcements necessary to mitigate these overloads is also provided.

7.2 Short Circuit Analysis

PJM performed a short circuit analysis and the results were verified by Dominion. The connection of AE2-246 project to the system does not result in any newly overdutied circuit breakers on the Dominion transmission system and does not have a significant fault current contribution to existing overdutied circuit breakers

7.3 Stability Analysis

PJM will complete a dynamic stability analysis, if necessary, as part of the System Impact Study. The results of this analysis will be reviewed by Dominion. Should stability concerns be identified in PJM’s study, Dominion will develop appropriate system reinforcement(s) and included the estimated cost of any reinforcement(s) in Dominion’s System Impact Study report.

8 Interconnection Customer Requirements

8.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in Dominion’s “Dominion Energy Electric Transmission Generator Interconnection Requirements” documented in Dominion’s Facility Interconnection Requirements “Exhibit C” located at: <https://www.dominionenergy.com/company/moving-energy/electric-transmission-access>. Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

8.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with Dominion’s “Dominion’s Facility Interconnection Requirements” document located at: <https://www.dominionenergy.com/company/moving-energy/electric-transmission-access>. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated protection device (circuit breaker, circuit switcher, fuse) to protect the IC’s GSU transformer(s).
2. The purchase and installation of the minimum required Dominion generation interconnection relaying and control facilities as described in the System Protection noted above. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.
3. The purchase and installation of supervisory control and data acquisition (“SCADA”) equipment to provide information in a compatible format to the Dominion Transmission System Control Center.

4. Compliance with the Dominion and PJM generator power factor and voltage control requirements.

The GSU(s) associated with the IC queue request shall meet the grounding requirements as noted in Dominion’s “Dominion’s Facility Interconnection Requirements” document located at: <https://www.dominionenergy.com/company/moving-energy/electric-transmission-access>.

The IC will also be required to meet all PJM, SERC, and NERC reliability criteria and operating procedures for standards compliance. For example, the IC will need to properly locate and report the over and under voltage and over and under frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and SERC audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the Dominion system.

8.3 Power Factor Requirements

The IC shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the high-side of the facility substation transformer(s) connected to the Dominion transmission system.

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.

9.1.1 Meteorological Data Reporting Requirement

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

- Temperature (degrees Fahrenheit)
- Atmospheric pressure (hectopascals)
- Irradiance
- Forced outage data

9.2 Dominion Requirements

See Section 3.4.6 “Metering and Telecommunications” of Dominion’s “Dominion’s Facility Interconnection Requirements” document located at: <https://www.dominionenergy.com/company/moving-energy/electric-transmission-access>.

10 Network Impacts

The Queue Project AE2-246 was evaluated as a Capacity-only 13.9 MW uprate to AC1-145 which is an injection at the Gretna DP 69 kV substation in the Dominion area. Project AE2-246 was evaluated for compliance with

applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-246 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

11 Generation Deliverability

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

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
8038763	314730	2STONE MIL	DVP	314670	2ALTVSTA	DVP	1	Base Case	single	101.52	95.41	109.15	DC	13.95
8038766	314730	2STONE MIL	DVP	314670	2ALTVSTA	DVP	1	DVP_P1-2: LN 35-B	single	101.52	54.53	68.27	DC	13.95
7268776	314861	3SKIMMER	DVP	242886	05SKIMMR	AEP	1	AEP_P1-2_#375	single	55.0	93.16	94.91	DC	0.97
7268863	314861	3SKIMMER	DVP	242886	05SKIMMR	AEP	2	AEP_P1-2_#375	single	55.0	89.86	91.55	DC	0.93

12 Multiple Facility Contingency

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

None

13 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	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
7268489	242687	05JOHNMT	AEP	242734	05NEWLDN	AEP	1	Base Case	single	167.0	134.25	137.1	DC	4.76
7268490	242687	05JOHNMT	AEP	242734	05NEWLDN	AEP	1	AEP_P1-2_#5419-A	single	240.0	113.1	115.2	DC	5.04
7268461	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	Base Case	single	167.0	139.7	142.55	DC	4.76
7268464	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	AEP_P1-2_#5419-A	single	245.0	114.51	116.57	DC	5.04
7268444	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	Base Case	single	167.0	142.46	145.31	DC	4.76
7268448	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	AEP_P1-2_#5419-A	single	245.0	116.39	118.45	DC	5.04
7268774	314861	3SKIMMER	DVP	242886	05SKIMMR	AEP	1	AEP_SUBT_P1-3_#2109_3SKIMMER 115_2	single	55.0	110.57	112.24	DC	0.92
7268861	314861	3SKIMMER	DVP	242886	05SKIMMR	AEP	2	AEP_SUBT_P1-3_#146_3SKIMMER 115_1	single	55.0	105.13	106.79	DC	0.91

14 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	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPAC T
7269207	242561	05BOONSBORO	AEP	242765	05REUSEN	AEP	1	AEP_P1-2_#5479	operation	240.0	74.42	76.13	DC	4.1
7269154	242641	05FOREST	AEP	242561	05BOONSBORO	AEP	1	AEP_P1-2_#5479	operation	240.0	80.09	81.8	DC	4.1
7268484	242687	05JOHNMT	AEP	242734	05NEWLDN	AEP	1	Base Case	operation	167.0	156.09	158.94	DC	4.76
7268485	242687	05JOHNMT	AEP	242734	05NEWLDN	AEP	1	AEP_P1-2_#5419-A	operation	240.0	137.08	139.18	DC	5.04
7269009	242701	05LEESVI	AEP	247499	05SMITHMTN2	AEP	1	AEP_P1-2_#375	operation	284.0	71.05	73.85	DC	7.94
7269059	242734	05NEWLDN	AEP	242641	05FOREST	AEP	1	AEP_P1-2_#5479	operation	240.0	85.51	87.22	DC	4.1
7268458	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	Base Case	operation	167.0	161.54	164.39	DC	4.76
7268459	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	AEP_P1-2_#5419-A	operation	245.0	138.0	140.05	DC	5.04
7268442	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	Base Case	operation	167.0	164.29	167.14	DC	4.76
7268443	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	AEP_P1-2_#5419-A	operation	245.0	139.87	141.93	DC	5.04
8038833	314670	2ALTVSTA	DVP	314667	4ALTVSTA	DVP	1	Base Case	operation	128.78	152.74	163.57	DC	13.95
8039769	314688	3CRSTL HILL	DVP	927260	AC1-222 TAP	DVP	1	AEP_P1-2_#375	operation	285.76	74.4	75.84	DC	4.1
8039971	314714	3PERTH	DVP	314688	3CRSTL HILL	DVP	1	AEP_P1-2_#375	operation	285.76	58.56	59.99	DC	4.1
8038761	314730	2STONE MIL	DVP	314670	2ALTVSTA	DVP	1	Base Case	operation	101.52	193.75	207.5	DC	13.95
8039809	314733	2GRNA DP	DVP	314731	2GRETNA	DVP	1	Base Case	operation	104.34	108.11	121.48	DC	13.95
8039087	314735	2ALTAVISTADP	DVP	314730	2STONE MIL	DVP	1	Base Case	operation	85.54	164.02	180.32	DC	13.95
8039682	314739	2MT A TP	DVP	314735	2ALTAVISTADP	DVP	1	Base Case	operation	123.14	120.03	131.35	DC	13.95
7268775	314861	3SKIMMER	DVP	242886	05SKIMMR	AEP	1	AEP_SUBT_P1-3_#2109_3SKIMMER115_2	operation	55.0	110.28	111.04	DC	0.92
7268862	314861	3SKIMMER	DVP	242886	05SKIMMR	AEP	2	AEP_SUBT_P1-3_#146_3SKIMMER115_1	operation	55.0	103.32	104.07	DC	0.91
8039493	927260	AC1-222 TAP	DVP	314696	3SEGE HILL	DVP	1	Base Case	operation	285.76	61.56	62.58	DC	2.91

15 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
7268444,7268448	7	4ALTVSTA 138.0 kV - 05OTTER 138.0 kV Ckt 1	<p><u>AEP</u> AEPA0014a (178) : Rebuild / reconductor 0.9 miles of overhead conductor (ACSR ~ 397.5 ~ 30/7 ~ LARK) Project Type : FAC Cost : \$1,350,000 Time Estimate : 24-36 Months</p> <p><u>DVP</u> dom-001 (443) : Relay Change Outs (Secondary) at Altavista Substation Project Type : FAC Cost : \$120,000 Time Estimate : 6-12 Months</p>	\$1,470,000
7268464,7268461	6	05OTTER 138.0 kV - 05JOHNMT 138.0 kV Ckt 1	<p><u>AEP</u> AEP_AE1_REF_r0038 (148) : Current AEP End Rating: S/N: 164, S/E: 205 1) Replace Otter Riser, Sub cond 477 ACSR 26/7 STD. \$175k 2) Replace JohnMt - Otter Line, ACSR ~ 397.5 ~ 30/7 ~ LARK Conductor Section 1, 7 Miles. \$10.5M Project Type : FAC Cost : \$10,670,000 Time Estimate : 18-24 Months</p>	\$10,670,000
8038763,8038766	2	2STONE MIL 69.0 kV - 2ALTVSTA 69.0 kV Ckt 1	<p><u>DVP</u> dom-111 (617) : Rebuild 1.64 miles of 69 kV Line 35 from Stone Mill to Altavista with 768 ACSS. Project Type : FAC Cost : \$2,132,000 Time Estimate : 30-36 Months</p>	\$2,132,000
7268489,7268490	5	05JOHNMT 138.0 kV - 05NEWLDN 138.0 kV Ckt 1	<p><u>AEP</u> AEP_AE1_REF_r0039 (149) : Current Station Rating: S/N: 167, S/E: 240 1) Replace 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</p>	\$21,650,000
7268776,7268774	3	3SKIMMER 115.0 kV - 05SKIMMR 69.0 kV Ckt 1	<p><u>AEP</u> AEPA0016a (183) : Increase relay thermal limit above 80 MVA Project Type : FAC Cost : \$25,000 Time Estimate : 12-18 Months</p>	\$25,000
7268863,7268861	4	3SKIMMER 115.0 kV - 05SKIMMR 69.0 kV Ckt 2	<p><u>DVP</u> No violation. Limiting equipment owned by AEP.</p>	
			TOTAL COST	\$ 35,947,000

16 Flow Gate Details

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gauge other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

16.1 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_SUBT_P1-3_#146_3SKIMMER 115_1	CONTINGENCY 'AEP_SUBT_P1-3_#146_3SKIMMER 115_1' OPEN BRANCH FROM BUS 314861 TO BUS 242886 CKT 1 / 314861 3SKIMMER 115 242886 05SKIMMR 69.0 1 END
AEP_SUBT_P1-3_#2109_3SKIMMER 115_2	CONTINGENCY 'AEP_SUBT_P1-3_#2109_3SKIMMER 115_2' OPEN BRANCH FROM BUS 314861 TO BUS 242886 CKT 2 / 314861 3SKIMMER 115 242886 05SKIMMR 69.0 2 END
DVP_P1-2: LN 35-B	CONTINGENCY 'DVP_P1-2: LN 35-B' OPEN BRANCH FROM BUS 314729 TO BUS 942670 CKT 1 /* 2GLADYS 69.000 - AE2-283 TAP 69.000 OPEN BUS 314729 /* ISLAND: 2GLADYS 69.000 END
AEP_P4_#10294_05NEWLDN 138_D	CONTINGENCY 'AEP_P4_#10294_05NEWLDN 138_D' 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 OPEN BRANCH FROM BUS 242687 TO BUS 242741 CKT 1 / 242687 05JOHNMT 138 242741 05OTTER 138 1 OPEN BRANCH FROM BUS 242741 TO BUS 314667 CKT 1 / 242741 05OTTER 138 314667 4ALTVSTA 138 1 END

Contingency Name	Contingency Definition
AEP_P4_#10317_05REUSEN 138_D	CONTINGENCY 'AEP_P4_#10317_05REUSEN 138_D' OPEN BRANCH FROM BUS 242561 TO BUS 242641 CKT 1 / 242561 05BOONSBORO 138 242641 05FOREST 138 1 OPEN BRANCH FROM BUS 242561 TO BUS 242765 CKT 1 / 242561 05BOONSBORO 138 242765 05REUSEN 138 1 OPEN BRANCH FROM BUS 242591 TO BUS 242765 CKT 1 / 242591 05CENTRR 138 242765 05REUSEN 138 1 OPEN BRANCH FROM BUS 242641 TO BUS 242734 CKT 1 / 242641 05FOREST 138 242734 05NEWLDN 138 1 OPEN BRANCH FROM BUS 242719 TO BUS 242765 CKT 1 / 242719 05MONEL 138 242765 05REUSEN 138 1 OPEN BRANCH FROM BUS 242765 TO BUS 242882 CKT 4 / 242765 05REUSEN 138 242882 05REUSENS 69.0 4 OPEN BRANCH FROM BUS 242765 TO BUS 242889 CKT 1 / 242765 05REUSEN 138 242889 05REUSENS 34.5 1 REMOVE SWSHUNT FROM BUS 242765 / 242765 05REUSEN 138 OPEN BRANCH FROM BUS 242860 TO BUS 242882 CKT 1 / 242860 05ABERT 69.0 242882 05REUSENS 69.0 1 OPEN BRANCH FROM BUS 242876 TO BUS 242882 CKT 1 / 242876 05MONROE A 69.0 242882 05REUSENS 69.0 1 OPEN BRANCH FROM BUS 247360 TO BUS 242882 CKT 1 / 247360 05PEAKLANDSS69.0 242882 05REUSENS 69.0 1 REMOVE SWSHUNT FROM BUS 242882 / 242882 05REUSENS 69.0 OPEN BRANCH FROM BUS 247866 TO BUS 242889 CKT 1 / 247866 05GLAMORGNSS34.5 242889 05REUSENS 34.5 1 REMOVE UNIT 1 FROM BUS 242889 / 242889 05REUSENS 34.5 END
AEP_P1-2_#5419-A	CONTINGENCY 'AEP_P1-2_#5419-A' OPEN BRANCH FROM BUS 242607 TO BUS 243892 CKT 1 / 242607 05CLOVRD 138 243892 05MEADS8 138 1 OPEN BRANCH FROM BUS 243892 TO BUS 939010 CKT 1 / 243892 05MEADS8 138 939010 AE1- 130 TAP 138 1 OPEN BRANCH FROM BUS 243892 TO BUS 243893 CKT Z1 / 243892 05MEADS8 138 243893 05MEADS 8 24.9 Z1 END
AEP_P1-2_#5479	CONTINGENCY 'AEP_P1-2_#5479' OPEN BRANCH FROM BUS 242569 TO BUS 243945 CKT 1 / 242569 05BRUSHT 138 243945 05LYNBROOK 138 1 OPEN BRANCH FROM BUS 242569 TO BUS 242734 CKT 1 / 242569 05BRUSHT 138 242734 05NEWLDN 138 1 END
AEP_P1-2_#375	CONTINGENCY 'AEP_P1-2_#375' OPEN BRANCH FROM BUS 242687 TO BUS 242734 CKT 1 / 242687 05JOHNMT 138 242734 05NEWLDN 138 1 OPEN BRANCH FROM BUS 242687 TO BUS 242741 CKT 1 / 242687 05JOHNMT 138 242741 05OTTER 138 1 OPEN BRANCH FROM BUS 242741 TO BUS 314667 CKT 1 / 242741 05OTTER 138 314667 4ALTVSTA 138 1 END
Base Case	

16.2 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
8038763	314730	2STONE MIL	DVP	314670	2ALTVSTA	DVP	1	Base Case	single	101.52	95.41	109.15	DC	13.95

Bus #	Bus	MW Impact
925661	AC1-042 C	15.96
926641	AC1-145 C	19.0
939941	AE1-230 C1	7.2
941801	AE2-185 C	45.0
941821	AE2-187 C	45.0
942331	AE2-246	13.95
942671	AE2-283 C	39.6

16.3 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
7268774	314861	3SKIMMER	DVP	242886	05SKIMMR	AEP	1	AEP_SUBT_P1-3_#2109_3SKIMMER115_2	single	55.0	110.57	112.24	DC	0.92

Bus #	Bus	MW Impact
315156	1HALLBR1	0.64
315165	1HURT 1	3.62
315166	1HURT 2	3.62
925661	AC1-042 C	1.05
925991	AC1-075 C	1.92
926021	AC1-080 C	0.64
926641	AC1-145 C	1.25
939941	AE1-230 C1	0.48
941801	AE2-185 C	2.97
941821	AE2-187 C	2.97
942331	AE2-246	0.92
942671	AE2-283 C	2.61
942751	AE2-291 C O1	3.74
942761	AE2-292 C O1	4.66
BLUEG	BLUEG	0.33
CANNELTON	CANNELTON	0.02
CARR	CARR	0.0
CBM-S2	CBM-S2	0.29
COFFEEN	COFFEEN	0.03
COTTONWOOD	COTTONWOOD	0.01
CPL	CPL	0.19
DUCKCREEK	DUCKCREEK	0.06
EDWARDS	EDWARDS	0.03
ELMERSMITH	ELMERSMITH	0.03
FARMERCITY	FARMERCITY	0.01
GIBSON	GIBSON	0.01
NEWTON	NEWTON	0.07
PRAIRIE	PRAIRIE	0.1
RENSELAER	RENSELAER	0.0
SMITHLAND	SMITHLAND	0.01
TATANKA	TATANKA	0.03
TILTON	TILTON	0.04
TRIMBLE	TRIMBLE	0.04
TVA	TVA	0.01

16.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7268861	314861	3SKIMMER	DVP	242886	05SKIMMR	AEP	2	AEP_SUBT_P1-3_#146_3SKIMMER115_1	single	55.0	105.13	106.79	DC	0.91

Bus #	Bus	MW Impact
315156	1HALLBR1	0.63
315165	1HURT 1	3.59
315166	1HURT 2	3.59
925661	AC1-042 C	1.04
926641	AC1-145 C	1.24
939941	AE1-230 C1	0.47
941801	AE2-185 C	2.95
941821	AE2-187 C	2.95
942331	AE2-246	0.91
942671	AE2-283 C	2.59
942751	AE2-291 C O1	3.71
942761	AE2-292 C O1	4.62
BLUEG	BLUEG	0.33
CANNELTON	CANNELTON	0.02
CARR	CARR	0.0
CBM-S2	CBM-S2	0.29
COFFEEN	COFFEEN	0.03
COTTONWOOD	COTTONWOOD	0.01
CPL	CPL	0.19
DUCKCREEK	DUCKCREEK	0.06
EDWARDS	EDWARDS	0.03
ELMERSMITH	ELMERSMITH	0.03
FARMERCITY	FARMERCITY	0.01
GIBSON	GIBSON	0.01
NEWTON	NEWTON	0.07
PRAIRIE	PRAIRIE	0.1
RENSELAER	RENSELAER	0.0
SMITHLAND	SMITHLAND	0.01
TATANKA	TATANKA	0.03
TILTON	TILTON	0.04
TRIMBLE	TRIMBLE	0.04
TVA	TVA	0.01

16.5 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7268489	242687	05JOHNMT	AEP	242734	05NEWLDN	AEP	1	Base Case	single	167.0	134.25	137.1	DC	4.76

Bus #	Bus	MW Impact
246843	05SMG1	0.8
246844	05SMG2	2.09
246845	05SMG3	1.23
246846	05SMG4	2.16
246847	05SMG5	0.82
247284	05LEESVG	1.31
315156	1HALLBR1	2.25
315165	1HURT 1	12.78
315166	1HURT 2	12.78
315266	1PLYWOOD A	0.31
919841	AA2-070	0.4
925661	AC1-042 C	5.45
925991	AC1-075 C	6.8
926021	AC1-080 C	2.27
926051	AC1-083 C O1	2.77
926271	AC1-105 C O1	1.87
926641	AC1-145 C	6.49
927261	AC1-222 C	1.98
933941	AD1-017 C	0.55
934311	AD1-055 C	1.37
936331	AD2-043 C	2.69
938451	AE1-064 C	6.11
939941	AE1-230 C1	2.46
940081	AE1-250 C	5.02
941801	AE2-185 C	15.36
941821	AE2-187 C	15.36
942331	AE2-246	4.76
942671	AE2-283 C	13.52
942751	AE2-291 C O1	13.24
942761	AE2-292 C O1	16.49
BLUEG	BLUEG	1.34
CANNELTON	CANNELTON	0.07
CARR	CARR	0.02
CBM-S2	CBM-S2	1.18
COFFEEN	COFFEEN	0.11
COTTONWOOD	COTTONWOOD	0.03
CPLE	CPLE	0.79
DUCKCREEK	DUCKCREEK	0.26
EDWARDS	EDWARDS	0.12
ELMERSMITH	ELMERSMITH	0.11
FARMERCITY	FARMERCITY	0.06
GIBSON	GIBSON	0.05

Bus #	Bus	MW Impact
NEWTON	NEWTON	0.3
PRAIRIE	PRAIRIE	0.43
RENSELAER	RENSELAER	0.01
SMITHLAND	SMITHLAND	0.03
TATANKA	TATANKA	0.12
TILTON	TILTON	0.15
TRIMBLE	TRIMBLE	0.15
TVA	TVA	0.06

16.6 Index 6

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
7268461	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	Base Case	single	167.0	139.7	142.55	DC	4.76

Bus #	Bus	MW Impact
246843	05SMG1	0.8
246844	05SMG2	2.09
246845	05SMG3	1.23
246846	05SMG4	2.16
246847	05SMG5	0.82
247284	05LEESVG	1.31
315156	1HALLBR1	2.25
315165	1HURT 1	12.78
315166	1HURT 2	12.78
315266	1PLYWOOD A	0.31
919841	AA2-070	0.4
925661	AC1-042 C	5.45
925991	AC1-075 C	6.8
926021	AC1-080 C	2.27
926051	AC1-083 C O1	2.77
926271	AC1-105 C O1	1.87
926641	AC1-145 C	6.49
927261	AC1-222 C	1.98
933941	AD1-017 C	0.55
934311	AD1-055 C	1.37
936331	AD2-043 C	2.69
938451	AE1-064 C	6.11
939941	AE1-230 C1	2.46
940081	AE1-250 C	5.02
941801	AE2-185 C	15.36
941821	AE2-187 C	15.36
942331	AE2-246	4.76
942671	AE2-283 C	13.52
942751	AE2-291 C O1	13.24
942761	AE2-292 C O1	16.49
BLUEG	BLUEG	1.34
CANNELTON	CANNELTON	0.07
CARR	CARR	0.02
CBM-S2	CBM-S2	1.18
COFFEEN	COFFEEN	0.11
COTTONWOOD	COTTONWOOD	0.03
CPLE	CPLE	0.79
DUCKCREEK	DUCKCREEK	0.26
EDWARDS	EDWARDS	0.12
ELMERSMITH	ELMERSMITH	0.11
FARMERCITY	FARMERCITY	0.06
GIBSON	GIBSON	0.05

Bus #	Bus	MW Impact
NEWTON	NEWTON	0.3
PRAIRIE	PRAIRIE	0.43
RENSELAER	RENSELAER	0.01
SMITHLAND	SMITHLAND	0.03
TATANKA	TATANKA	0.12
TILTON	TILTON	0.15
TRIMBLE	TRIMBLE	0.15
TVA	TVA	0.06

16.7 Index 7

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
7268444	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	Base Case	single	167.0	142.46	145.31	DC	4.76

Bus #	Bus	MW Impact
246843	05SMG1	0.8
246844	05SMG2	2.09
246845	05SMG3	1.23
246846	05SMG4	2.16
246847	05SMG5	0.82
247284	05LEESVG	1.31
315156	1HALLBR1	2.25
315165	1HURT 1	12.78
315166	1HURT 2	12.78
315266	1PLYWOOD A	0.31
919841	AA2-070	0.4
925661	AC1-042 C	5.45
925991	AC1-075 C	6.8
926021	AC1-080 C	2.27
926051	AC1-083 C O1	2.77
926271	AC1-105 C O1	1.87
926641	AC1-145 C	6.49
927261	AC1-222 C	1.98
933941	AD1-017 C	0.55
934311	AD1-055 C	1.37
936331	AD2-043 C	2.69
938451	AE1-064 C	6.11
939941	AE1-230 C1	2.46
940081	AE1-250 C	5.02
941801	AE2-185 C	15.36
941821	AE2-187 C	15.36
942331	AE2-246	4.76
942671	AE2-283 C	13.52
942751	AE2-291 C O1	13.24
942761	AE2-292 C O1	16.49
BLUEG	BLUEG	1.34
CANNELTON	CANNELTON	0.07
CARR	CARR	0.02
CBM-S2	CBM-S2	1.18
COFFEEN	COFFEEN	0.11
COTTONWOOD	COTTONWOOD	0.03
CPLE	CPLE	0.79
DUCKCREEK	DUCKCREEK	0.26
EDWARDS	EDWARDS	0.12
ELMERSMITH	ELMERSMITH	0.11
FARMERCITY	FARMERCITY	0.06
GIBSON	GIBSON	0.05

Bus #	Bus	MW Impact
NEWTON	NEWTON	0.3
PRAIRIE	PRAIRIE	0.43
RENSELAER	RENSELAER	0.01
SMITHLAND	SMITHLAND	0.03
TATANKA	TATANKA	0.12
TILTON	TILTON	0.15
TRIMBLE	TRIMBLE	0.15
TVA	TVA	0.06

Affected Systems

17 Affected Systems

17.1 LG&E

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

17.2 MISO

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

17.3 TVA

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

17.4 Duke Energy Progress

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

17.5 NYISO

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

Short Circuit

17.6 Short Circuit

The following Breakers are overduty: None

Attachment 1 – Single Line Diagram

