



Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-092

KIDDS STORE-SHERWOOD 115 KV

82.8 MW Capacity / 138 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.

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.

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 a Solar generating facility located in Albemarle County, Virginia. The installed facilities will have a total capability of 138 MW with 82.8 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 03/01/2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AE2-092
Project Name	KIDDS STORE-SHERWOOD 115 KV
Interconnection Customer	
State	Virginia
County	Albemarle
Transmission Owner	Dominion
MFO	138
MWE	138
MWC	82.8
Fuel	Solar
Basecase Study Year	2022

3.1 Point of Interconnection

AE2-092 will interconnect with the Dominion transmission system as a tap of the Kidds Store to Sherwood 115 kV line through a new three breaker 115 kV switching station adjacent to the transmission right-of-way. This is the primary Point of Interconnection (POI) chose by the IC with the ITO’s transmission system. The IC is responsible for securing right-of-way, permits and constructing the proposed attachment line from the solar facility site to the proposed new switching station. Attachment 1 shows a one-line diagram of the proposed

interconnection facilities. The IC may not install any facilities on Dominion’s right-of-way without first obtaining the necessary approval from Dominion Energy.

3.2 Cost Summary

The AE2-092 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$ 1,700,000
Direct Connection Network Upgrade	\$ 7,100,000
Non Direct Connection Network Upgrades	\$
Total Costs	\$ 8,800,000

In addition, the AE2-092 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$ 112,795,000

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 AE2-092 was evaluated as a 82.8 MW Capacity (138.0 MW energy) injection at the AE2-092 115 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 AE2-092 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 Attachment Facilities

To accommodate the proposed AE2-092 Project, Dominion Energy will install one span of overhead 115 kV line to the point of interconnection (“POI”) including 115 kV interconnection metering. 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
Substation (Metering)	\$ 500,000

Description	Total Cost
Transmission (one span)	\$ 1,200,000
Total Attachment Facility Costs	\$ 1,700,000

It is estimated to take 18-24 months to complete this work upon execution of an Interconnection Construction Service Agreement (ICSA). These preliminary cost estimates are based on typical engineering costs. A more detailed engineering cost estimates are normally done when the IC provides an exact site plan location for the generation substation during the Facility Study phase. See Attachment 1.

6 Direct Connection Cost Estimate

To accommodate the proposed AE2-092 Project, Dominion Energy will build a new three breaker 115 kV Switching Station and re-arrange the existing section of line between Kidds Store and Sherwood Substations to allow for the proposed interconnection. 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
Three Breaker Ring and Associated Equipment	\$ 5,500,000
Transmission (one span)	\$ 1,600,000
Total Direct Connection Facility Costs	\$ 7,100,000

It is estimated to take 24-30 months to complete this work upon execution of an Interconnection Construction Service Agreement (ICSA). These preliminary cost estimates are based on typical engineering costs. A more detailed engineering cost estimates are normally done when the IC provides an exact site plan location for the generation substation during the Facility Study phase. See Attachment 1.

7 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 6.47 miles of 230 kV Line 2028 from Mt Eagle to Charlottesville	\$ 16,175,000
Rebuild 6.44 miles of 115 kV Line 39 from Sherwood to Red Hills	\$ 16,100,000

Description	Total Cost
Reconductor 3.6 miles of AE1-220 Tap to Clifford 138kV and replace substation equipment at Clifford substation	\$ 5,800,000
Rebuild 6.42 miles of 115 kV Line 91 from AE2-092 Tap to Sherwood	\$ 16,050,000
Reconductor 7.21 miles of AE1-108 Tap to Scottsville 138kV	\$ 10,820,000
Rebuild 0.16 miles of Line 2028 from Brema to Brema Dist	\$ 500,000
Rebuild 18.94 miles of 230 kV Line 2028 from Brema Dist to Mt Eagle	\$ 47,350,000
Total Non-Direct Connection Facility Costs	\$112,795,000

Remote Terminal Work: During the Facilities Study, ITO’s System Protection Engineering Department will review transmission line protection as well as anti-islanding required to accommodate the new generation and interconnection substation. System Protection Engineering will determine the minimal acceptable protection requirements to reliably interconnect the proposed generating facility with the transmission system. The review is based on maintaining system reliability by reviewing ITO’s protection requirements with the known transmission system configuration which includes generating facilities in the area. This review may determine that transmission line protection and communication upgrades are required at remote substations.

8 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.

9 Transmission Owner Analysis

9.1 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 AE2-092 project contributes to overloads on the Dominion transmission system as shown in the “Network Impact – Primary Point of Interconnection” section of the report. The estimated cost of system reinforcements necessary to mitigate these overloads is also provided. At the Secondary POI, the AE2-092 project contributes to overloads on the Dominion transmission system as shown in the “Network Impacts – Secondary Point of Interconnection” section of the report. Cost estimates are not provided for the secondary POI.

9.2 Short Circuit Analysis

PJM performed a short circuit analysis and the results were verified by Dominion. The connection of AE2-092 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

9.3 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.

10 Interconnection Customer Requirements

10.1 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.

10.2 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.

10.3 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.

11 Revenue Metering and SCADA Requirements

11.1 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.

11.1.1 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

11.2 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>.

12 Network Impacts – Primary Point of Interconnection

The Queue Project AE2-092 was evaluated as a 138.0 MW (Capacity 82.8 MW) injection tapping the Kidds Store to Sherwood 115 kV line in the Dominion area. Project AE2-092 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-092 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

12.1 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
1428704	938820	AE1-108 TAP	DVP	242792	05SCOTSV	AEP	1	DVP_P1-2: LN 2028	single	167.0	96.93	103.31	DC	10.64
1785871	941010	AE2-092 TAP	DVP	314774	3SHERWOD	DVP	1	DVP_P1-3: 6BREMO-TX#9	single	169.2	85.49	117.39	DC	53.98
1785875	941010	AE2-092 TAP	DVP	314774	3SHERWOD	DVP	1	DVP_P1-2: LN 2028	single	169.2	86.79	106.74	DC	33.75

12.2 Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	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
1784860	314774	3SHERWOD	DVP	314773	3RED HIL	DVP	1	DVP_P2-2: BREMO B1	bus	208.0	60.75	103.96	DC	89.87
1785382	314774	3SHERWOD	DVP	314773	3RED HIL	DVP	1	DVP_P4-2: 210622	breaker	208.0	60.75	103.96	DC	89.87
1785383	314774	3SHERWOD	DVP	314773	3RED HIL	DVP	1	DVP_P4-2: 29822	breaker	208.0	60.7	103.91	DC	89.87
1785384	314774	3SHERWOD	DVP	314773	3RED HIL	DVP	1	DVP_P4-2: 202722	breaker	208.0	60.51	103.72	DC	89.87
1785385	314774	3SHERWOD	DVP	314773	3RED HIL	DVP	1	DVP_P4-2: 202822	breaker	208.0	60.46	103.67	DC	89.87
1784774	941010	AE2-092 TAP	DVP	314774	3SHERWOD	DVP	1	DVP_P2-2: BREMO B1	bus	208.0	91.47	134.68	DC	89.87
1785164	941010	AE2-092 TAP	DVP	314774	3SHERWOD	DVP	1	DVP_P4-2: 210622	breaker	208.0	91.47	134.68	DC	89.87
1785165	941010	AE2-092 TAP	DVP	314774	3SHERWOD	DVP	1	DVP_P4-2: 29822	breaker	208.0	91.47	134.68	DC	89.87
1785166	941010	AE2-092 TAP	DVP	314774	3SHERWOD	DVP	1	DVP_P4-2: 202722	breaker	208.0	91.28	134.49	DC	89.87

12.3 Contribution to Previously Identified Overloads

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

ID	FROM BUS#	FROM BUS	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
1786064	313867	6BREMODIST	DVP	314765	6MTEAGLE	DVP	1	DVP_P1-2: LN 2027-B	single	661.76	118.99	122.66	DC	24.32
1786066	313867	6BREMODIST	DVP	314765	6MTEAGLE	DVP	1	DVP_P1-2: LN 2027-A	single	661.76	114.53	118.21	DC	24.32
1785987	314747	6BREMO	DVP	313867	6BREMODIST	DVP	1	DVP_P1-2: LN 2027-B	single	661.76	121.32	124.99	DC	24.32
1785989	314747	6BREMO	DVP	313867	6BREMODIST	DVP	1	DVP_P1-2: LN 2027-A	single	661.76	116.86	120.53	DC	24.32
1786134	314765	6MTEAGLE	DVP	314749	6CHARLVL	DVP	1	DVP_P1-2: LN 2027-B	single	661.76	115.64	119.32	DC	24.32
1786136	314765	6MTEAGLE	DVP	314749	6CHARLVL	DVP	1	DVP_P1-2: LN 2027-A	single	661.76	111.19	114.86	DC	24.32
1427350	938820	AE1-108 TAP	DVP	242792	05SCOTSV	AEP	1	DVP_P2-2: BREMO B1	bus	167.0	112.13	140.95	DC	48.13
1427956	938820	AE1-108 TAP	DVP	242792	05SCOTSV	AEP	1	AEP_P4_#8476_05CLOVR D 500_A	breaker	167.0	118.88	128.81	DC	16.58
1428702	938820	AE1-108 TAP	DVP	242792	05SCOTSV	AEP	1	AEP_P1-2_#7422	single	167.0	108.54	114.5	DC	9.95
1427804	939840	AE1-220 TAP	AEP	242603	05CLIFFR	AEP	1	AEP_P4_#8476_05CLOVR D 500_A	breaker	167.0	139.27	148.54	DC	15.48
1428574	939840	AE1-220 TAP	AEP	242603	05CLIFFR	AEP	1	AEP_P1-2_#7422	single	167.0	116.73	122.29	DC	9.29
1428575	939840	AE1-220 TAP	AEP	242603	05CLIFFR	AEP	1	DVP_P1-2: LN 2028	single	167.0	106.48	112.43	DC	9.94

12.4 Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	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
1428745	242613	05COLLEEN SS	AEP	939840	AE1-220 TAP	AEP	1	DVP_P1-3: 6BREMO-TX#9	operation	167.0	95.81	122.66	DC	44.84
1428725	242792	05SCOTSV	AEP	242613	05COLLEEN SS	AEP	1	DVP_P1-3: 6BREMO-TX#9	operation	167.0	98.21	125.06	DC	44.84
1786062	313867	6BREMODIST	DVP	314765	6MTEAGLE	DVP	1	DVP_P1-2: LN 2027-B	operation	661.76	134.38	140.5	DC	40.53

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
7865024	313867	6BREMOMODIST	DVP	314765	6MTEAGLE	DVP	1	Base Case	operation	661.76	90.05	94.09	DC	26.7
1786449	313868	6CARTERV	DVP	933500	AC2-165 TAP	DVP	1	DVP_P1-2: LN 2028	operation	800.88	89.9	94.59	DC	37.54
1786423	314310	6JUDES F	DVP	314322	6MDLTHAN	DVP	1	DVP_P1-2: LN 2028	operation	800.88	93.97	98.66	DC	37.53
1786401	314333	6POWHATN	DVP	314310	6JUDES F	DVP	1	DVP_P1-2: LN 2028	operation	800.88	97.73	102.42	DC	37.53
1786211	314744	3BREMO	DVP	314747	6BREMO	DVP	1	DVP_P1-2: LN 91-B	operation	269.78	86.03	127.93	DC	113.03
1786404	314746	4BREMO	DVP	938820	AE1-108 TAP	DVP	1	AEP_P1-2_#7422	operation	156.98	91.86	102.43	DC	16.58
1785985	314747	6BREMO	DVP	313867	6BREMOMODIST	DVP	1	DVP_P1-2: LN 2027-B	operation	661.76	136.7	142.83	DC	40.53
1785993	314747	6BREMO	DVP	313867	6BREMOMODIST	DVP	1	Base Case	operation	661.76	92.38	96.42	DC	26.7
1786445	314747	6BREMO	DVP	313868	6CARTERV	DVP	1	DVP_P1-2: LN 2028	operation	800.88	90.6	95.29	DC	37.54
1786132	314765	6MTEAGLE	DVP	314749	6CHARLVL	DVP	1	DVP_P1-2: LN 2027-B	operation	661.76	129.33	135.46	DC	40.53
1786233	314774	3SHERWOD	DVP	314773	3RED HIL	DVP	1	DVP_P1-3: 6BREMO-TX#9	operation	169.2	71.11	124.28	DC	89.96
1786396	933500	AC2-165 TAP	DVP	314333	6POWHATN	DVP	1	DVP_P1-2: LN 2028	operation	800.88	98.13	102.82	DC	37.54
1428698	938820	AE1-108 TAP	DVP	242792	05SCOTSV	AEP	1	AEP_P1-2_#7422	operation	167.0	118.82	128.75	DC	16.58
1428706	938820	AE1-108 TAP	DVP	242792	05SCOTSV	AEP	1	Base Case	operation	167.0	91.41	100.83	DC	15.74
1428570	939840	AE1-220 TAP	AEP	242603	05CLIFFR	AEP	1	AEP_P1-2_#7422	operation	167.0	139.21	148.48	DC	15.48
1428573	939840	AE1-220 TAP	AEP	242603	05CLIFFR	AEP	1	Base Case	operation	167.0	114.08	122.88	DC	14.7
1785869	941010	AE2-092 TAP	DVP	314774	3SHERWOD	DVP	1	DVP_P1-3: 6BREMO-TX#9	operation	169.2	108.93	162.1	DC	89.96

12.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
1786134,1786136	7	6MTEAGLE 230.0 kV - 6CHARLVL 230.0 kV Ckt 1	<u>DVP</u> dom-073 (487) : Rebuild 6.47 miles of 230 kV Line 2028 from Mt Eagle to Charlottesville with 2-636 ACSR. Project Type : FAC Cost : \$16,175,000 Time Estimate : 30-36 Months	\$16,175,000
1785385,1785384, 1785383,1784860, 1785382	4	3SHERWOD 115.0 kV - 3RED HIL 115.0 kV Ckt 1	<u>DVP</u> dom-099 (523) : Rebuild 6.44 miles of 115 kV Line 39 from Sherwood to Red Hills with 2-636 ACSR. Project Type : FAC Cost : \$16,100,000 Time Estimate : 30-36 Months	\$16,100,000
1428574,1428575, 1427804	8	AE1-220 TAP 138.0 kV - 05CLIFFR 138.0 kV Ckt 1	<u>AEP</u> AEP_AE1_REF_r0036 (146) : Current End Ratings: S/N: 167, S/E: 167 Reconductor 3.6 miles of AE1-220 Tap to Clifford 138kV and replace substation equipment at Clifford substation Project Type : FAC Cost : \$5,800,000 Time Estimate : 12-18 Months	\$5,800,000
1785875,1785166, 1785165,1785164, 1785871,1784774	3	AE2-092 TAP 115.0 kV - 3SHERWOD 115.0 kV Ckt 1	<u>DVP</u> dom-096 (518) : Rebuild 6.42 miles of 115 kV Line 91 from AE2-092 Tap to Sherwood with 2-636 ACSR. Project Type : FAC Cost : \$16,050,000 Time Estimate : 30-36 Months	\$16,050,000
1427350,1428704,14 28702,1427956	2	AE1-108 TAP 138.0 kV - 05SCOTSV 138.0 kV Ckt 1	<u>AEP</u> AEP_AE1_REF_r0008 (125) : Current End Ratings: S/N: 167, S/E: 167 Reconductor 7.21 miles of AE1-108 Tap to Scottsville 138kV Project Type : FAC Cost : \$10,820,000 Time Estimate : 18-24 Months	\$10,820,000
1785987,1785989	6	6BREMO 230.0 kV - 6BREMODIST 230.0 kV Ckt 1	<u>DVP</u> dom-071 (484) : Rebuild 0.16 miles of Line 2028 from Bremo to Bremo Dist with 2-636 ACSR. Project Type : FAC Cost : \$500,000 Time Estimate : 30-36 Months	\$500,000
1786066,1786064	5	6BREMODIST 230.0 kV - 6MTEAGLE 230.0 kV Ckt 1	<u>DVP</u> dom-072 (485) : Rebuild 18.94 miles of 230 kV Line 2028 from Bremo Dist to Mt Eagle with 2-636 ACSR. Project Type : FAC Cost : \$47,350,000 Time Estimate : 36-40 Months	\$47,350,000

ID	Index	Facility	Upgrade Description	Cost
			TOTAL COST	\$112,795,000

12.6 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 gage 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.

12.6.1 Contingency Descriptions

Contingency Name	Contingency Definition
Base Case	
DVP_P4-2: 202822	CONTINGENCY 'DVP_P4-2: 202822' /* BREMO 230 KV OPEN BRANCH FROM BUS 313867 TO BUS 314747 CKT 1 /* 6BREMOMODIST 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 313867 TO BUS 314765 CKT 1 /* 6BREMOMODIST 230.00 - 6MTEAGLE 230.00 OPEN BRANCH FROM BUS 314749 TO BUS 314765 CKT 1 /* 6CHARLVL 230.00 - 6MTEAGLE 230.00 OPEN BUS 313867 /* ISLAND: 6BREMOMODIST 230.00 OPEN BUS 314765 /* ISLAND: 6MTEAGLE 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 314747 CKT 1 /* 6BEARGRDN 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 315191 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN G118.000 OPEN BUS 315191 /* ISLAND: 1BEARGRDN G118.000 OPEN BRANCH FROM BUS 314326 TO BUS 314747 CKT 2 /* 6BEARGRDN 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 315192 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN G218.000 OPEN BRANCH FROM BUS 314326 TO BUS 315193 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN S122.000 OPEN BUS 315192 /* ISLAND: 1BEARGRDN G218.000 OPEN BUS 315193 /* ISLAND: 1BEARGRDN S122.000 OPEN BRANCH FROM BUS 314677 TO BUS 314747 CKT 1 /* 6BUCKING 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 313868 TO BUS 314747 CKT 1 /* 6CARTERV 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314744 TO BUS 314747 CKT 1 /* 3BREMO 115.00 - 6BREMO 230.00 OPEN BUS 314747 /* 6BREMO 230.00 KV OPEN BUS 314326 /* ISLAND: 6BEARGRDN 230.00 END
DVP_P1-2: LN 91-B	CONTINGENCY 'DVP_P1-2: LN 91-B' OPEN BRANCH FROM BUS 941010 TO BUS 314774 CKT 1 /* AE2-092 TAP 115.00 - 3SHERWOD 115.00 END

Contingency Name	Contingency Definition
DVP_P4-2: 210622	CONTINGENCY 'DVP_P4-2: 210622' /* BREMO 230 KV OPEN BRANCH FROM BUS 314326 TO BUS 314747 CKT 1 /* 6BEARGRDN 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 315191 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN G118.000 OPEN BUS 315191 /* ISLAND: 1BEARGRDN G118.000 OPEN BRANCH FROM BUS 314326 TO BUS 314747 CKT 2 /* 6BEARGRDN 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 315192 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN G218.000 OPEN BRANCH FROM BUS 314326 TO BUS 315193 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN S122.000 OPEN BUS 315192 /* ISLAND: 1BEARGRDN G218.000 OPEN BUS 315193 /* ISLAND: 1BEARGRDN S122.000 OPEN BRANCH FROM BUS 314677 TO BUS 314747 CKT 1 /* 6BUCKING 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 313868 TO BUS 314747 CKT 1 /* 6CARTERV 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 313867 TO BUS 314747 CKT 1 /* 6BREMODIST 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314744 TO BUS 314747 CKT 1 /* 3BREMO 115.00 - 6BREMO 230.00 OPEN BUS 314747 /* 6BREMO 230.00 KV OPEN BUS 314326 /* ISLAND: 6BEARGRDN 230.00 END
DVP_P1-2: LN 2027-B	CONTINGENCY 'DVP_P1-2: LN 2027-B' OPEN BRANCH FROM BUS 933500 TO BUS 314333 CKT 1 /* AC2-165 TAP 230.00 - 6POWHATN 230.00 OPEN BRANCH FROM BUS 314310 TO BUS 314322 CKT 1 /* 6JUDES F 230.00 - 6MDLTHAN 230.00 OPEN BRANCH FROM BUS 314310 TO BUS 314333 CKT 1 /* 6JUDES F 230.00 - 6POWHATN 230.00 OPEN BUS 314310 /* ISLAND: 6JUDES F 230.00 OPEN BUS 314333 /* ISLAND: 6POWHATN 230.00 END
DVP_P1-2: LN 2027-A	CONTINGENCY 'DVP_P1-2: LN 2027-A' OPEN BRANCH FROM BUS 313868 TO BUS 933500 CKT 1 /* 6CARTERV 230.00 - AC2-165 TAP 230.00 OPEN BRANCH FROM BUS 313868 TO BUS 314747 CKT 1 /* 6CARTERV 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314310 TO BUS 314333 CKT 1 /* 6JUDES F 230.00 - 6POWHATN 230.00 OPEN BUS 313868 /* ISLAND: 6CARTERV 230.00 END

Contingency Name	Contingency Definition
DVP_P2-2: BREMO B1	CONTINGENCY 'DVP_P2-2: BREMO B1' /* BREMO 230 KV OPEN BRANCH FROM BUS 314326 TO BUS 314747 CKT 1 /* 6BEARGRDN 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 315191 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN G118.000 OPEN BUS 315191 /* ISLAND: 1BEARGRDN G118.000 OPEN BRANCH FROM BUS 314326 TO BUS 314747 CKT 2 /* 6BEARGRDN 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 315192 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN G218.000 OPEN BRANCH FROM BUS 314326 TO BUS 315193 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN S122.000 OPEN BUS 315192 /* ISLAND: 1BEARGRDN G218.000 OPEN BUS 315193 /* ISLAND: 1BEARGRDN S122.000 OPEN BRANCH FROM BUS 314677 TO BUS 314747 CKT 1 /* 6BUCKING 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 313868 TO BUS 314747 CKT 1 /* 6CARTERV 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 313867 TO BUS 314747 CKT 1 /* 6BREMODIST 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314744 TO BUS 314747 CKT 1 /* 3BREMO 115.00 - 6BREMO 230.00 OPEN BUS 314747 /* 6BREMO 230.00 KV OPEN BUS 314326 /* ISLAND: 6BEARGRDN 230.00 END
DVP_P1-3: 6BREMO-TX#9	CONTINGENCY 'DVP_P1-3: 6BREMO-TX#9' OPEN BRANCH FROM BUS 314744 TO BUS 314747 CKT 1 /* 3BREMO 115.00 - 6BREMO 230.00 END
DVP_P4-2: 29822	CONTINGENCY 'DVP_P4-2: 29822' /* BREMO 230 KV OPEN BRANCH FROM BUS 314677 TO BUS 314692 CKT 1 /* 6BUCKING 230.00 - 6FARMVIL 230.00 OPEN BRANCH FROM BUS 314677 TO BUS 314747 CKT 1 /* 6BUCKING 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314691 TO BUS 314692 CKT 2 /* 3FARMVIL 115.00 - 6FARMVIL 230.00 OPEN BUS 314677 /* ISLAND: 6BUCKING 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 314747 CKT 1 /* 6BEARGRDN 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 315191 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN G118.000 OPEN BUS 315191 /* ISLAND: 1BEARGRDN G118.000 OPEN BRANCH FROM BUS 314326 TO BUS 314747 CKT 2 /* 6BEARGRDN 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 315192 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN G218.000 OPEN BRANCH FROM BUS 314326 TO BUS 315193 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN S122.000 OPEN BUS 315192 /* ISLAND: 1BEARGRDN G218.000 OPEN BUS 315193 /* ISLAND: 1BEARGRDN S122.000 OPEN BRANCH FROM BUS 313868 TO BUS 314747 CKT 1 /* 6CARTERV 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 313867 TO BUS 314747 CKT 1 /* 6BREMODIST 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314744 TO BUS 314747 CKT 1 /* 3BREMO 115.00 - 6BREMO 230.00 OPEN BUS 314747 /* 6BREMO 230.00 KV OPEN BUS 314326 /* ISLAND: 6BEARGRDN 230.00 END

Contingency Name	Contingency Definition
DVP_P4-2: 202722	CONTINGENCY 'DVP_P4-2: 202722' /* BREMO 230 KV OPEN BRANCH FROM BUS 313868 TO BUS 933500 CKT 1 /* 6CARTERV 230.00 - AC2-165 TAP 230.00 /* CONTINGENCY LINE ADDED FOR AE1 BUILD OPEN BRANCH FROM BUS 313868 TO BUS 314747 CKT 1 /* 6CARTERV 230.00 - 6BREMO 230.00 OPEN BUS 313868 /* ISLAND: 6CARTERV 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 314747 CKT 1 /* 6BEARGRDN 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 315191 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN G118.000 OPEN BUS 315191 /* ISLAND: 1BEARGRDN G118.000 OPEN BRANCH FROM BUS 314326 TO BUS 314747 CKT 2 /* 6BEARGRDN 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314326 TO BUS 315192 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN G218.000 OPEN BRANCH FROM BUS 314326 TO BUS 315193 CKT 1 /* 6BEARGRDN 230.00 - 1BEARGRDN S122.000 OPEN BUS 315192 /* ISLAND: 1BEARGRDN G218.000 OPEN BUS 315193 /* ISLAND: 1BEARGRDN S122.000 OPEN BRANCH FROM BUS 314677 TO BUS 314747 CKT 1 /* 6BUCKING 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 313867 TO BUS 314747 CKT 1 /* 6BREMODIST 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 314744 TO BUS 314747 CKT 1 /* 3BREMO 115.00 - 6BREMO 230.00 OPEN BUS 314747 /* 6BREMO 230.00 KV OPEN BUS 314326 /* ISLAND: 6BEARGRDN 230.00 END
AEP_P4_#8476_05CLOVRD 500_A	CONTINGENCY 'AEP_P4_#8476_05CLOVRD 500_A' OPEN BRANCH FROM BUS 242519 TO BUS 314912 CKT 1 / 242519 05CLOVRD 500 314912 8LEXNGTN 500 1 OPEN BRANCH FROM BUS 242519 TO BUS 242524 CKT 15 / 242519 05CLOVRD 500 242524 05CLOVRD 345 15 END
AEP_P1-2_#7422	CONTINGENCY 'AEP_P1-2_#7422' OPEN BRANCH FROM BUS 242519 TO BUS 314912 CKT 1 / 242519 05CLOVRD 500 314912 8LEXNGTN 500 1 END
DVP_P1-2: LN 2028	CONTINGENCY 'DVP_P1-2: LN 2028' OPEN BRANCH FROM BUS 313867 TO BUS 314747 CKT 1 /* 6BREMODIST 230.00 - 6BREMO 230.00 OPEN BRANCH FROM BUS 313867 TO BUS 314765 CKT 1 /* 6BREMODIST 230.00 - 6MTEAGLE 230.00 OPEN BRANCH FROM BUS 314749 TO BUS 314765 CKT 1 /* 6CHARLVL 230.00 - 6MTEAGLE 230.00 OPEN BUS 313867 /* ISLAND: 6BREMODIST 230.00 OPEN BUS 314765 /* ISLAND: 6MTEAGLE 230.00 END

12.6.2 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
1427350	938820	AE1-108 TAP	DVP	242792	05SCOTSV	AEP	1	DVP_P2-2: BREMO B1	bus	167.0	112.13	140.95	DC	48.13

Bus #	Bus	MW Impact
315170	1BREMO 3	33.73
315171	1BREMO 4	74.12
938821	AE1-108 C O1	61.28
938822	AE1-108 E O1	40.85
941011	AE2-092 C	28.88
941012	AE2-092 E	19.25
BLUEG	BLUEG	1.44
CALDERWOOD	CALDERWOOD	0.2
CANNELTON	CANNELTON	0.09
CATAWBA	CATAWBA	0.13
CBM-N	CBM-N	0.1
CHEOAH	CHEOAH	0.19
CHILHOWEE	CHILHOWEE	0.07
COFFEEN	COFFEEN	0.15
COTTONWOOD	COTTONWOOD	0.7
DUCKCREEK	DUCKCREEK	0.32
EDWARDS	EDWARDS	0.14
ELMERSMITH	ELMERSMITH	0.16
FARMERCITY	FARMERCITY	0.1
G-007A	G-007A	0.39
GIBSON	GIBSON	0.06
HAMLET	HAMLET	0.19
NEWTON	NEWTON	0.4
NYISO	NYISO	0.43
PRAIRIE	PRAIRIE	0.77
SANTEETLA	SANTEETLA	0.05
SMITHLAND	SMITHLAND	0.07
TATANKA	TATANKA	0.18
TILTON	TILTON	0.17
TRIMBLE	TRIMBLE	0.16
TVA	TVA	0.61
UNIONPOWER	UNIONPOWER	0.26
VFT	VFT	1.04

12.6.3 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
1785166	941010	AE2-092 TAP	DVP	314774	3SHERWOD	DVP	1	DVP_P4-2: 202722	breaker	208.0	91.28	134.49	DC	89.87

Bus #	Bus	MW Impact
315170	1BREMO 3	37.26
315171	1BREMO 4	81.88
938821	AE1-108 C O1	46.72
938822	AE1-108 E O1	31.15
939841	AE1-220 C O1	14.59
939842	AE1-220 E O1	7.29
941011	AE2-092 C	53.92
941012	AE2-092 E	35.95
CARR	CARR	0.05
CBM-S1	CBM-S1	1.08
CBM-S2	CBM-S2	0.59
CBM-W1	CBM-W1	1.48
CBM-W2	CBM-W2	7.31
CIN	CIN	0.68
CPLE	CPLE	0.21
G-007	G-007	0.17
IPL	IPL	0.44
LGEE	LGEE	0.2
MEC	MEC	1.32
MECS	MECS	0.73
O-066	O-066	1.1
RENSSELAER	RENSSELAER	0.04
WEC	WEC	0.18

12.6.4 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
1785385	314774	3SHERWOD	DVP	314773	3RED HIL	DVP	1	DVP_P4-2: 202822	breaker	208.0	60.46	103.67	DC	89.87

Bus #	Bus	MW Impact
315170	1BREMO 3	37.26
315171	1BREMO 4	81.88
938821	AE1-108 C O1	46.72
938822	AE1-108 E O1	31.15
939841	AE1-220 C O1	14.59
939842	AE1-220 E O1	7.29
941011	AE2-092 C	53.92
941012	AE2-092 E	35.95
CARR	CARR	0.05
CBM-S1	CBM-S1	1.08
CBM-S2	CBM-S2	0.59
CBM-W1	CBM-W1	1.48
CBM-W2	CBM-W2	7.31
CIN	CIN	0.68
CPLE	CPLE	0.21
G-007	G-007	0.17
IPL	IPL	0.44
LGEE	LGEE	0.2
MEC	MEC	1.32
MECS	MECS	0.73
O-066	O-066	1.1
RENSSELAER	RENSSELAER	0.04
WEC	WEC	0.18

12.6.5 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
1786064	313867	6BREMODIST	DVP	314765	6MTEAGLE	DVP	1	DVP_P1-2: LN 2027-B	single	661.76	118.99	122.66	DC	24.32

Bus #	Bus	MW Impact
314429	3JTRSVLE	0.43
314704	3LAWRENC	0.11
315150	1BUGGS 1	7.33
315151	1BUGGS 2	7.33
315153	1CLOVER1	5.27
315154	1CLOVER2	5.2
315158	1KERR 1	0.15
315159	1KERR 2	0.61
315160	1KERR 3	0.6
315161	1KERR 4	0.6
315162	1KERR 5	0.6
315163	1KERR 6	0.6
315164	1KERR 7	0.6
315170	1BREMO 3	30.25
315171	1BREMO 4	66.46
315191	1BEARGRDN G1	10.83
315192	1BEARGRDN G2	10.83
315193	1BEARGRDN S1	22.29
315266	1PLYWOOD A	0.49
920291	AA2-127	2.25
924021	AB2-043 C O1	0.31
924031	AB2-045 C	0.77
924161	AB2-060 C O1	0.91
924301	AB2-077 C O1	0.19
924311	AB2-078 C O1	0.19
924321	AB2-079 C O1	0.19
924401	AB2-089 C	1.15
925171	AB2-174 C O1	2.12
925611	AC1-036 C	0.14
925781	AC1-054 C O1	3.68
925831	AC1-062	0.06
925991	AC1-075 C	2.53
926021	AC1-080 C	0.84
926271	AC1-105 C O1	3.2
927251	AC1-221 C	0.76
927261	AC1-222 C	1.83
932511	AC2-071 C	0.76
932761	AC2-100 C	1.74
933501	AC2-165 C	32.68
934231	AD1-050 C	2.53
934311	AD1-055 C	1.27

Bus #	Bus	MW Impact
934341	AD1-058 C	1.89
934611	AD1-087 C O1	4.25
934621	AD1-088 C	14.59
934991	AD1-131 C	0.62
935171	AD1-152 C O1	4.22
935221	AD1-157 C	0.3
935231	AD1-160 C	1.78
936261	AD2-033 C	14.42
936331	AD2-043 C	2.38
936361	AD2-046 C O1	5.5
936481	AD2-063 C O1	14.23
937481	AD2-202 C O1	1.17
938371	AE1-056 C	10.47
938821	AE1-108 C O1	38.04
939181	AE1-148 C O1	5.53
939371	AE1-168 C	20.88
939841	AE1-220 C O1	12.08
940241	AE2-006	0.57
940661	AE2-053	2.06
941011	AE2-092 C	24.32
941791	AE2-182 C	2.64
942451	AE2-258	1.89
942461	AE2-259 C O1	19.25
942711	AE2-287 C O1	6.46
942751	AE2-291 C O1	3.68
942761	AE2-292 C O1	4.58
943051	AE2-328 C	19.73
AA2-074	AA2-074	1.47
CARR	CARR	0.29
CBM-S1	CBM-S1	2.8
CBM-S2	CBM-S2	4.07
CBM-W1	CBM-W1	1.67
CBM-W2	CBM-W2	17.07
CIN	CIN	0.84
CPL	CPL	2.17
IPL	IPL	0.51
LGEE	LGEE	0.25
MEC	MEC	2.21
MECS	MECS	0.22
RENSSELAER	RENSSELAER	0.23
WEC	WEC	0.22

12.6.6 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
1785987	314747	6BREMO	DVP	313867	6BREMODIST	DVP	1	DVP_P1-2: LN 2027-B	single	661.76	121.32	124.99	DC	24.32

Bus #	Bus	MW Impact
314429	3JTRSVLE	0.43
314704	3LAWRENC	0.11
315150	1BUGGS 1	7.33
315151	1BUGGS 2	7.33
315153	1CLOVER1	5.27
315154	1CLOVER2	5.2
315158	1KERR 1	0.15
315159	1KERR 2	0.61
315160	1KERR 3	0.6
315161	1KERR 4	0.6
315162	1KERR 5	0.6
315163	1KERR 6	0.6
315164	1KERR 7	0.6
315170	1BREMO 3	30.25
315171	1BREMO 4	66.46
315191	1BEARGRDN G1	10.83
315192	1BEARGRDN G2	10.83
315193	1BEARGRDN S1	22.29
315266	1PLYWOOD A	0.49
920291	AA2-127	2.25
924021	AB2-043 C O1	0.31
924031	AB2-045 C	0.77
924161	AB2-060 C O1	0.91
924301	AB2-077 C O1	0.19
924311	AB2-078 C O1	0.19
924321	AB2-079 C O1	0.19
924401	AB2-089 C	1.15
925171	AB2-174 C O1	2.12
925611	AC1-036 C	0.14
925781	AC1-054 C O1	3.68
925831	AC1-062	0.06
925991	AC1-075 C	2.53
926021	AC1-080 C	0.84
926271	AC1-105 C O1	3.2
927251	AC1-221 C	0.76
927261	AC1-222 C	1.83
932511	AC2-071 C	0.76
932761	AC2-100 C	1.74
933501	AC2-165 C	32.68
934231	AD1-050 C	2.53
934311	AD1-055 C	1.27

Bus #	Bus	MW Impact
934341	AD1-058 C	1.89
934611	AD1-087 C O1	4.25
934621	AD1-088 C	14.59
934991	AD1-131 C	0.62
935171	AD1-152 C O1	4.22
935221	AD1-157 C	0.3
935231	AD1-160 C	1.78
936261	AD2-033 C	14.42
936331	AD2-043 C	2.38
936361	AD2-046 C O1	5.5
936481	AD2-063 C O1	14.23
937481	AD2-202 C O1	1.17
938371	AE1-056 C	10.47
938821	AE1-108 C O1	38.04
939181	AE1-148 C O1	5.53
939371	AE1-168 C	20.88
939841	AE1-220 C O1	12.08
940241	AE2-006	0.57
940661	AE2-053	2.06
941011	AE2-092 C	24.32
941791	AE2-182 C	2.64
942451	AE2-258	1.89
942461	AE2-259 C O1	19.25
942711	AE2-287 C O1	6.46
942751	AE2-291 C O1	3.68
942761	AE2-292 C O1	4.58
943051	AE2-328 C	19.73
AA2-074	AA2-074	1.47
CARR	CARR	0.29
CBM-S1	CBM-S1	2.8
CBM-S2	CBM-S2	4.07
CBM-W1	CBM-W1	1.67
CBM-W2	CBM-W2	17.07
CIN	CIN	0.84
CPL	CPL	2.17
IPL	IPL	0.51
LGEE	LGEE	0.25
MEC	MEC	2.21
MECS	MECS	0.22
RENSSELAER	RENSSELAER	0.23
WEC	WEC	0.22

12.6.7 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
1786134	314765	6MTEAGLE	DVP	314749	6CHARLVL	DVP	1	DVP_P1-2: LN 2027-B	single	661.76	115.64	119.32	DC	24.32

Bus #	Bus	MW Impact
314429	3JTRSVLE	0.43
314704	3LAWRENC	0.11
315150	1BUGGS 1	7.32
315151	1BUGGS 2	7.32
315153	1CLOVER1	5.27
315154	1CLOVER2	5.2
315158	1KERR 1	0.15
315159	1KERR 2	0.61
315160	1KERR 3	0.6
315161	1KERR 4	0.6
315162	1KERR 5	0.6
315163	1KERR 6	0.6
315164	1KERR 7	0.6
315170	1BREMO 3	30.25
315171	1BREMO 4	66.46
315191	1BEARGRDN G1	10.83
315192	1BEARGRDN G2	10.83
315193	1BEARGRDN S1	22.29
315266	1PLYWOOD A	0.49
920291	AA2-127	2.25
924021	AB2-043 C O1	0.31
924031	AB2-045 C	0.77
924161	AB2-060 C O1	0.91
924301	AB2-077 C O1	0.19
924311	AB2-078 C O1	0.19
924321	AB2-079 C O1	0.19
924401	AB2-089 C	1.15
925171	AB2-174 C O1	2.12
925611	AC1-036 C	0.14
925781	AC1-054 C O1	3.68
925831	AC1-062	0.06
925991	AC1-075 C	2.53
926021	AC1-080 C	0.84
926271	AC1-105 C O1	3.2
926451	AC1-116 C	0.45
927251	AC1-221 C	0.76
927261	AC1-222 C	1.83
932511	AC2-071 C	0.76
932761	AC2-100 C	1.74
933501	AC2-165 C	32.68
934231	AD1-050 C	2.53

Bus #	Bus	MW Impact
934311	AD1-055 C	1.27
934341	AD1-058 C	1.89
934611	AD1-087 C O1	4.25
934621	AD1-088 C	14.58
934991	AD1-131 C	0.62
935171	AD1-152 C O1	4.22
935221	AD1-157 C	0.3
935231	AD1-160 C	1.78
936261	AD2-033 C	14.41
936331	AD2-043 C	2.38
936361	AD2-046 C O1	5.5
936481	AD2-063 C O1	14.23
937481	AD2-202 C O1	1.17
938371	AE1-056 C	10.47
938821	AE1-108 C O1	38.04
939181	AE1-148 C O1	5.52
939371	AE1-168 C	20.87
939841	AE1-220 C O1	12.07
940241	AE2-006	0.57
940661	AE2-053	2.06
941011	AE2-092 C	24.32
941791	AE2-182 C	2.64
942451	AE2-258	1.89
942461	AE2-259 C O1	19.25
942711	AE2-287 C O1	6.45
942751	AE2-291 C O1	3.67
942761	AE2-292 C O1	4.57
943051	AE2-328 C	19.73
AA2-074	AA2-074	1.47
CARR	CARR	0.29
CBM-S1	CBM-S1	2.79
CBM-S2	CBM-S2	4.06
CBM-W1	CBM-W1	1.65
CBM-W2	CBM-W2	17.0
CIN	CIN	0.83
CPLE	CPLE	2.17
IPL	IPL	0.5
LGEE	LGEE	0.24
MEC	MEC	2.2
MECS	MECS	0.21
RENSSELAER	RENSSELAER	0.23
WEC	WEC	0.22

12.6.8 Index 8

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
1427804	939840	AE1-220 TAP	AEP	242603	05CLIFFR	AEP	1	AEP_P4_#8476_05CLOVRD 500_A	breaker	167.0	139.27	148.54	DC	15.48

Bus #	Bus	MW Impact
315170	1BREMO 3	10.42
315171	1BREMO 4	22.89
938821	AE1-108 C O1	30.53
938822	AE1-108 E O1	20.36
939841	AE1-220 C O1	43.51
939842	AE1-220 E O1	21.72
941011	AE2-092 C	9.29
941012	AE2-092 E	6.19
BLUEG	BLUEG	4.76
CALDERWOOD	CALDERWOOD	0.57
CANNELTON	CANNELTON	0.29
CATAWBA	CATAWBA	0.29
CBM-N	CBM-N	0.24
CHEOAH	CHEOAH	0.51
CHILHOWEE	CHILHOWEE	0.19
COFFEEN	COFFEEN	0.49
COTTONWOOD	COTTONWOOD	2.01
DUCKCREEK	DUCKCREEK	1.03
EDWARDS	EDWARDS	0.47
ELMERSMITH	ELMERSMITH	0.5
FARMERCITY	FARMERCITY	0.32
G-007A	G-007A	1.01
GIBSON	GIBSON	0.19
HAMLET	HAMLET	0.32
NEWTON	NEWTON	1.28
NYISO	NYISO	1.04
PRAIRIE	PRAIRIE	2.42
SANTEETLA	SANTEETLA	0.15
SMITHLAND	SMITHLAND	0.2
TATANKA	TATANKA	0.57
TILTON	TILTON	0.57
TRIMBLE	TRIMBLE	0.53
TVA	TVA	1.76
UNIONPOWER	UNIONPOWER	0.73
VFT	VFT	2.69

Affected Systems

13 Affected Systems

13.1 LG&E

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

13.2 MISO

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

13.3 TVA

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

13.4 Duke Energy Progress

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

13.5 NYISO

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

Short Circuit

14 Short Circuit

The following Breakers are overduty: None

Attachment 1

System Configuration

