Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-253

HICKORY-MOYOCK 230 KV

34.5 MW Capacity / 50 MW Energy

July, 2019

Table of Contents

1 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.

2 General

The Interconnection Customer (IC) has proposed an uprate to the proposed AD2-160 solar generating facility located in Currituck County, North Carolina. This project requests an increase to the install capability of the AD2-160 project by 50 MW with 34.5 MW of this output being recognized by PJM as additional Capacity. The installed facilities will have a total capability of 100 MW with 67.3 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is November 30, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	**AE2-253**
Project Name	HICKORY-MOYOCK 230 KV
Interconnection Customer	
State	North Carolina
County	Currituck
Transmission Owner	Dominion
MFO	100
MWE	50
MWC	34.5
Fuel	Solar
Basecase Study Year	2022

2.1 Point of Interconnection

AE2-253 will interconnect with the Dominion transmission system as an uprate to the AD2-160 solar generator request. AD2-160 230 kV interconnection switchyard taps the Moyock to Hickory 230 kV line. See Attachment 1 for the One Line Diagram.

2.2 Cost Summary

The AE2-253 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$0
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$ To be determined in Facilities Study phase
Total Costs	$ To be determined in Facilities Study phase

In addition, the AE2-253 project may be responsible for a contribution to the following costs:

Description	Total Cost
System Upgrades	$174,096,000

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

3 Transmission Owner Scope of Work

Dominion assessed the impact of the proposed Queue Project AE2-253 was evaluated as a 34.5 MW Capacity (50.0 MW Energy) injection at the existing AD2-160 230 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 AE2-253 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.

4 Attachment Facilities

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

None.

5 Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

None.

6 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
Remote Terminal Work	$ TBD in Facilities Study Phase
Total Non-Direct Connection Facility Costs	$ TBD in Facilities Study Phase

Remote Terminal Work: During the Facilities Study phase, 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.

7 System Reinforcements Cost Estimate

Upgrade Description	Cost
PJM Baseline Upgrade b3057. Rebuild 6.1 miles of Waller-Skiffess Creek 230 kV Line (#2154) between Waller and Kings Mill to current standards with a minimum summer emergency rating of 1047 MVA utilizing single circuit steel structures. Remove this 6.1 mile section of Line #58 between Waller and Kings Mill. Rebuild the 1.6 miles of Line #2154 and #19 between Kings Mill and Skiffes Creek to current standards with a minimum summer emergency rating of 1047 MVA at 230 kV for Line #2154 and 261 MVA at 115 kV for Line #19, utilizing double circuit steel structures. The baseline project has a projected in-service date of 12/30/2024.	$0
Rebuild 18.75 miles of 500 kV Line 594 from Spotsylvania to Morrisville with 3-1351.5 113C ACSR.	$58,125,000
Rebuild 37.41 miles of 500 kV Line 563 from Carson to Midlothian with 3-1351.5 125C ACSR.	$115,971,000
TOTAL COST	**$174,096,000**

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 AE2-253 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.

9.2 Short Circuit Analysis

PJM performed a short circuit analysis and the results were verified by Dominion. The connection of AE2-253 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.

11.2 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

The Queue Project AE2-253 was evaluated as a 50.0 MW (Capacity 34.5 MW) uprate to the AD2-160 solar project which will interconnect to the Moyock to Hickory 230 kV line through a new interconnection switchyard in the Dominion area. Project AE2-253 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-253 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

13 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
8048642	314296	6PENNIMAN	DVP	314415	6WALR209	DVP	1	DVP_P1-2: LN 563	single	441.8	99.57	100.04	DC	2.08
8048906	314902	8CARSON	DVP	314914	8MDLTHAN	DVP	1	DVP_P1-2: LN 574	single	3218.56	99.97	100.24	DC	8.8
8049012	314934	8SPOTSYL	DVP	314916	8MORRSVL	DVP	1	Base Case	single	3218.56	99.83	100.0	DC	5.58

14 Multiple Facility Contingency

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

None

15 Contribution to Previously Identified Overloads

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

None

16 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.

None

17 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
8048642	1	6PENNIMAN 230.0 kV - 6WALR209 230.0 kV Ckt 1	**b3057 (278)** : PJM Baseline Upgrade b3057. Rebuild 6.1 miles of Waller-Skiffess Creek 230 kV Line (#2154) between Waller and Kings Mill to current standards with a minimum summer emergency rating of 1047 MVA utilizing single circuit steel structures. Remove this 6.1 mile section of Line #58 between Waller and Kings Mill. Rebuild the 1.6 miles of Line #2154 and #19 between Kings Mill and Skiffes Creek to current standards with a minimum summer emergency rating of 1047 MVA at 230 kV for Line #2154 and 261 MVA at 115 kV for Line #19, utilizing double circuit steel structures. The baseline project has an projected in-service date of 12/30/2024. **Project Type** : CON **Cost** : $0 **Time Estimate** : N/A Months	$0
8049012	3	8SPOTSYL 500.0 kV - 8MORRSVL 500.0 kV Ckt 1	**dom-019 (79)** : Rebuild 18.75 miles of 500 kV Line 594 from Spotsylvania to Morrisvile with 3-1351.5 113C ACSR. **Project Type** : FAC **Cost** : $58,125,000 **Time Estimate** : 48-60 Months	$58,125,000
8048906	2	8CARSON 500.0 kV - 8MDLTHAN 500.0 kV Ckt 1	**dom-029 (92)** : Rebuild 37.41 miles of 500 kV Line 563 from Carson to Midlothian with 3-1351.5 125C ACSR. **Project Type** : FAC **Cost** : $115,971,000 **Time Estimate** : 48-60 Months	$115,971,000
			TOTAL COST	**$174,096,000**

18 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.

18.1 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
8048642	314296	6PENNIMAN	DVP	314415	6WALR209	DVP	1	DVP_P1-2: LN 563	single	441.8	99.57	100.04	DC	2.08

Bus #	Bus	MW Impact
314421	6WINCHST	0.08
314507	3THOMPSN	0.08
314638	6ELIZ CT	0.05
314639	6TANGLEW	0.1
314643	3O INLET	0.11
315090	1YORKTN1	21.99
315091	1YORKTN2	22.82
315092	1YORKTN3	13.4
315098	1CHESPKA	0.11
315099	1CHESPKB	0.28
315108	1ELIZAR1	0.81
315109	1ELIZAR2	0.8
315110	1ELIZAR3	0.82
315116	1SURRY 1	5.83
315119	1GRAVEL3	0.59
315120	1GRAVEL4	0.6
315121	1GRAVEL5	0.59
315122	1GRAVEL6	0.6
315233	1SURRY 2	7.22
315260	1GOSPORTA	0.09
315261	1GOSPORTB	0.11
315262	1GOSPORTC	0.1
901081	W1-029 C	0.27
916191	Z1-068 C	0.01
919151	AA1-139 C	0.61
923831	AB2-022 C	0.09
925521	AC1-027 C	0.08
926661	AC1-147 C	0.09
926751	AC1-161 C O1	10.83
932041	AC2-012 C	3.47
933291	AC2-141 C	10.83
933731	AC2-196 C	0.07
934061	AD1-033 C	2.56
935111	AD1-144 C	0.08
936391	AD2-049 C	1.07
937221	AD2-160 C O1	1.98
937251	AD2-164	3.36
937541	AD2-215 C	0.66
938181	AE1-027 C	0.79
938191	AE1-028 C	0.46
938531	AE1-072 C O1	5.89

Bus #	Bus	MW Impact
939311	AE1-162 C	0.7
939411	AE1-173 C	25.65
939421	AE1-174 C	0.18
939431	AE1-175 C	1.17
940251	AE2-007	58.98
940471	AE2-031 C O1	9.96
940491	AE2-034 C	2.49
940641	AE2-051 C O1	4.56
940891	AE2-078 C	0.9
940901	AE2-079 C	0.9
940911	AE2-080 C	0.9
941101	AE2-104 C O1	1.11
941281	AE2-122 C O1	9.68
941291	AE2-123 C O1	9.95
941301	AE2-124 C O1	9.05
941501	AE2-147 C	5.19
941591	AE2-156	6.1
942131	AE2-225 C	0.74
942171	AE2-229 C	0.74
942401	AE2-253 C	2.08
942851	AE2-304 C	0.2
942921	AE2-311 C O1	13.03
CARR	CARR	0.21
CBM-S1	CBM-S1	2.59
CBM-S2	CBM-S2	3.21
CBM-W1	CBM-W1	2.22
CBM-W2	CBM-W2	16.48
CIN	CIN	1.03
CPLE	CPLE	1.68
IPL	IPL	0.64
LGEE	LGEE	0.3
MEC	MEC	2.41
MECS	MECS	0.77
RENSSELAER	RENSSELAER	0.16
WEC	WEC	0.27

18.2 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
8048906	314902	8CARSON	DVP	314914	8MDLTHAN	DVP	1	DVP_P1-2: LN 574	single	3218.56	99.97	100.24	DC	8.8

Bus #	Bus	MW Impact
314507	3THOMPSN	0.35
314589	3MURPHYS	0.09
314638	6ELIZ CT	0.23
314639	6TANGLEW	0.43
314643	3O INLET	0.46
315090	1YORKTN1	33.06
315091	1YORKTN2	34.31
315098	1CHESPKA	0.46
315099	1CHESPKB	1.15
315102	1BRUNSWICKG1	10.83
315103	1BRUNSWICKG2	10.83
315104	1BRUNSWICKG3	10.83
315105	1BRUNSWICKS1	22.49
315108	1ELIZAR1	3.39
315109	1ELIZAR2	3.33
315110	1ELIZAR3	3.44
315115	1S HAMPT1	1.52
315131	1EDGECMA	12.35
315132	1EDGECMB	12.35
315150	1BUGGS 1	13.45
315151	1BUGGS 2	13.45
315153	1CLOVER1	13.96
315154	1CLOVER2	13.78
315233	1SURRY 2	24.73
315260	1GOSPORTA	0.37
315261	1GOSPORTB	0.47
315262	1GOSPORTC	0.4
315292	1DOMTR78	1.42
315293	1DOMTR9	1.16
315294	1DOMTR10	2.1
901081	W1-029 C	1.18
916041	Z1-036 C	1.17
916191	Z1-068 C	0.05
916301	Z1-086 C	66.08
918511	AA1-065 C OP	1.5
919151	AA1-139 C	2.61
919701	AA2-057 C	9.5
920041	AA2-088 C OP	1.07
920691	AA2-178 C	1.63
923801	AB2-015 C O1	11.81
923831	AB2-022 C	0.4

Bus #	Bus	MW Impact
923851	AB2-025 C	0.4
923911	AB2-031 C O1	2.98
924401	AB2-089 C	2.65
924491	AB2-098 C	0.78
924501	AB2-099 C	0.8
924511	AB2-100 C	15.53
925061	AB2-161 C O1	4.22
925121	AB2-169 C	1.09
925171	AB2-174 C O1	9.36
925521	AC1-027 C	0.35
925591	AC1-034 C	9.09
925781	AC1-054 C O1	9.03
926071	AC1-086 C	27.87
926201	AC1-098 C	8.28
926211	AC1-099 C	2.77
926271	AC1-105 C O1	6.82
926661	AC1-147 C	0.39
926751	AC1-161 C O1	44.84
927021	AC1-189 C	11.75
927141	AC1-208 C	12.11
927221	AC1-216 C O1	10.1
927251	AC1-221 C	2.86
927261	AC1-222 C	4.43
932041	AC2-012 C	14.45
932581	AC2-078 C O1	4.64
932591	AC2-079 C O1	7.54
932631	AC2-084 C	11.8
932761	AC2-100 C	6.57
933291	AC2-141 C	44.84
933731	AC2-196 C	0.31
933991	AD1-023 C	18.2
934011	AD1-025 C	17.37
934061	AD1-033 C	10.76
934201	AD1-047 C	10.68
934231	AD1-050 C	5.84
934311	AD1-055 C	3.08
934331	AD1-057 C O1	13.38
934341	AD1-058 C	7.16
934521	AD1-076 C	75.63
934571	AD1-082 C	9.61
934611	AD1-087 C O1	11.6
934621	AD1-088 C	15.64
934991	AD1-131 C	2.35
935111	AD1-144 C	0.29
935171	AD1-152 C O1	11.52
936041	AD2-007	1.84
936051	AD2-008 C	3.02
936331	AD2-043 C	5.77
936361	AD2-046 C O1	10.7
936391	AD2-049 C	2.18
936401	AD2-051 C O1	11.95
936531	AD2-068 C	6.98

Bus #	Bus	MW Impact
936661	AD2-085 C	4.51
936701	AD2-089 C	9.73
936711	AD2-090 C O1	9.82
937221	AD2-160 C O1	8.37
937251	AD2-164	5.65
937481	AD2-202 C O1	3.19
937541	AD2-215 C	2.37
937571	AD2-169 C	13.33
938171	AE1-026 C1 O	38.72
938172	AE1-026 C2 O	5.6
938181	AE1-027 C	3.35
938191	AE1-028 C	1.95
938221	AE1-035 C	3.08
938491	AE1-068 C O1	108.37
938501	AE1-069 C O1	84.67
938531	AE1-072 C O1	25.05
938631	AE1-085 C O1	12.6
938661	AE1-088	4.58
938771	AE1-103 C O1	4.99
939071	AE1-135 C O1	27.9
939181	AE1-148 C O1	10.52
939191	AE1-149 C O1	11.99
939311	AE1-162 C	2.72
939411	AE1-173 C	153.97
939421	AE1-174 C	0.19
939431	AE1-175 C	2.42
940061	AE1-248 C O1	19.98
940251	AE2-007	246.18
940471	AE2-031 C O1	53.25
940481	AE2-033 C	21.32
940491	AE2-034 C	11.73
940521	AE2-037 C O1	10.95
940541	AE2-040	4.27
940571	AE2-044 C	5.95
940641	AE2-051 C O1	30.8
940651	AE2-052	4.02
940661	AE2-053	3.92
940891	AE2-078 C	2.76
940901	AE2-079 C	2.76
940911	AE2-080 C	2.76
941031	AE2-094 C	71.17
941101	AE2-104 C O1	4.84
941281	AE2-122 C O1	40.54
941291	AE2-123 C O1	41.66
941301	AE2-124 C O1	37.91
941501	AE2-147 C	22.4
941541	AE2-151 C	1.48
941591	AE2-156	25.42
941601	AE2-157 C O1	12.96
941791	AE2-182 C	2.83
941951	AE2-207	3.85
942131	AE2-225 C	3.02

Bus #	Bus	MW Impact
942171	AE2-229 C	3.02
942211	AE2-233 C	23.25
942341	AE2-247 C	1.95
942401	AE2-253 C	8.8
942451	AE2-258	2.64
942471	AE2-260 C O1	19.23
942711	AE2-287 C O1	16.37
942851	AE2-304 C	0.89
942921	AE2-311 C O1	77.28
942931	AE2-313 C	63.89
943171	AE2-346 C	2.4
AA2-074	AA2-074	8.08
CARR	CARR	1.65
CBM-S1	CBM-S1	20.75
CBM-S2	CBM-S2	23.45
CBM-W1	CBM-W1	19.53
CBM-W2	CBM-W2	133.68
CIN	CIN	9.07
CPLE	CPLE	11.88
IPL	IPL	5.67
LGEE	LGEE	2.65
MEC	MEC	20.31
MECS	MECS	7.51
RENSSELAER	RENSSELAER	1.3
WEC	WEC	2.4
Z1-043	Z1-043	9.45

18.3 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
8049012	314934	8SPOTSYL	DVP	314916	8MORRSVL	DVP	1	Base Case	single	3218.56	99.83	100.0	DC	5.58

Bus #	Bus	MW Impact
314250	6ROCKVILLE	0.22
314314	3LOCKS	0.19
314507	3THOMPSN	0.22
315053	1BELMED1	15.41
315054	1BELMED2	15.41
315055	1BELMED3	12.79
315058	1CHESTF3	15.83
315059	1CHESTF4	25.66
315074	1HOPCGN1	7.39
315075	1HOPCGN2	7.3
315083	1SPRUNCA	9.64
315084	1SPRUNCB	9.64
315085	1SPRUNCC	7.14
315086	1SPRUNCD	7.14
315090	1YORKTN1	25.33
315091	1YORKTN2	26.29
315098	1CHESPKA	0.3
315099	1CHESPKB	0.74
315102	1BRUNSWICKG1	5.41
315103	1BRUNSWICKG2	5.41
315104	1BRUNSWICKG3	5.41
315105	1BRUNSWICKS1	11.24
315108	1ELIZAR1	2.17
315109	1ELIZAR2	2.14
315110	1ELIZAR3	2.2
315116	1SURRY 1	16.55
315120	1GRAVEL4	1.7
315122	1GRAVEL6	1.7
315225	1N ANNA1	38.32
315226	1N ANNA2	38.4
315233	1SURRY 2	16.68
315260	1GOSPORTA	0.24
315261	1GOSPORTB	0.3
315262	1GOSPORTC	0.26
916191	Z1-068 C	0.03
916301	Z1-086 C	32.92
919151	AA1-139 C	1.65
923801	AB2-015 C O1	7.58
923911	AB2-031 C O1	1.91
924241	AB2-068 O1	161.3
924501	AB2-099 C	0.5
924511	AB2-100 C	10.01

Bus #	Bus	MW Impact
925021	AB2-158 C	1.46
925051	AB2-160 C O1	4.9
925061	AB2-161 C O1	3.05
925171	AB2-174 C O1	6.0
925331	AB2-190 C	17.95
925521	AC1-027 C	0.22
925821	AC1-061	0.0
925861	AC1-065 C	2.86
926001	AC1-076 C	5.44
926071	AC1-086 C	17.5
926291	AC1-107 O1	243.47
926661	AC1-147 C	0.25
926731	AC1-158 C	188.56
926751	AC1-161 C O1	27.77
926781	AC1-164 C	34.11
927041	AC1-191 C O1	7.8
927221	AC1-216 C O1	8.79
932041	AC2-012 C	9.29
932581	AC2-078 C O1	3.68
932591	AC2-079 C O1	5.18
932831	AC2-110 C	1.14
933061	AC2-130	2.08
933291	AC2-141 C	27.77
933501	AC2-165 C	8.55
933731	AC2-196 C	0.2
933991	AD1-023 C	11.34
934011	AD1-025 C	15.1
934061	AD1-033 C	6.83
934141	AD1-041 C	4.49
934201	AD1-047 C	6.83
934521	AD1-076 C	47.19
934541	AD1-078 C	3.31
934571	AD1-082 C	6.96
935161	AD1-151 C O1	14.42
935211	AD1-156 C	0.24
936041	AD2-007	1.6
936051	AD2-008 C	2.63
936151	AD2-021	0.2
936241	AD2-030 C	1.95
936301	AD2-039 C	1.14
936391	AD2-049 C	1.6
936401	AD2-051 C O1	7.44
936661	AD2-085 C	3.11
936711	AD2-090 C O1	6.28
937221	AD2-160 C O1	5.3
937251	AD2-164	4.26
937541	AD2-215 C	1.58
937571	AD2-169 C	8.5
938031	AE1-004 C	1.14
938171	AE1-026 C1 O	24.12
938172	AE1-026 C2 O	3.49
938181	AE1-027 C	2.13

Bus #	Bus	MW Impact
938191	AE1-028 C	1.23
938221	AE1-035 C	1.91
938491	AE1-068 C O1	53.86
938501	AE1-069 C O1	42.19
938531	AE1-072 C O1	15.87
938551	AE1-074 C	2.31
938561	AE1-075 C	1.9
938631	AE1-085 C O1	9.87
938661	AE1-088	1.5
938771	AE1-103 C O1	3.21
939071	AE1-135 C O1	18.06
939191	AE1-149 C O1	9.69
939231	AE1-154 C	1.96
939311	AE1-162 C	1.94
939411	AE1-173 C	82.14
939421	AE1-174 C	0.17
939431	AE1-175 C	2.1
939611	AE1-191 C	8.99
939751	AE1-206 C O1	26.45
940061	AE1-248 C O1	14.46
940071	AE1-249 C	6.46
940231	AE2-005 C	1.14
940251	AE2-007	157.75
940421	AE2-026 C	3.73
940431	AE2-027 C O1	11.52
940471	AE2-031 C O1	29.53
940481	AE2-033 C	14.02
940491	AE2-034 C	7.35
940521	AE2-037 C O1	6.81
940541	AE2-040	2.82
940551	AE2-041	6.05
940641	AE2-051 C O1	15.66
940651	AE2-052	3.25
940891	AE2-078 C	2.12
940901	AE2-079 C	2.12
940911	AE2-080 C	2.12
941031	AE2-094 C	35.21
941101	AE2-104 C O1	3.15
941281	AE2-122 C O1	25.85
941291	AE2-123 C O1	26.57
941301	AE2-124 C O1	24.16
941381	AE2-134	3.47
941501	AE2-147 C	14.19
941541	AE2-151 C	0.92
941581	AE2-155 C	0.54
941591	AE2-156	16.32
941601	AE2-157 C O1	9.65
942001	AE2-212 C	1.94
942131	AE2-225 C	1.93
942151	AE2-227 C O1	1.94
942161	AE2-228 C O1	1.94
942171	AE2-229 C	1.93

Bus #	Bus	MW Impact
942211	AE2-233 C	11.5
942341	AE2-247 C	1.35
942371	AE2-250 C O1	8.7
942401	AE2-253 C	5.58
942471	AE2-260 C O1	12.44
942531	AE2-268 C	1.45
942551	AE2-270	24.06
942851	AE2-304 C	0.56
942921	AE2-311 C O1	41.18
942931	AE2-313 C	31.8
943171	AE2-346 C	1.5
AA2-074	AA2-074	4.46
CARR	CARR	1.38
CBM-S1	CBM-S1	9.95
CBM-S2	CBM-S2	12.77
CBM-W1	CBM-W1	6.19
CBM-W2	CBM-W2	60.53
CIN	CIN	3.25
CPLE	CPLE	6.55
IPL	IPL	1.98
LGEE	LGEE	0.98
MEC	MEC	8.08
MECS	MECS	0.81
RENSSELAER	RENSSELAER	1.09
WEC	WEC	0.82

Affected Systems

19 Affected Systems

19.1 LG&E

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

19.2 MISO

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

19.3 TVA

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

19.4 Duke Energy Progress

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

19.5 NYISO

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

20 Contingency Descriptions

Contingency Name	Contingency Definition
Base Case	
DVP_P1-2: LN 563	CONTINGENCY 'DVP_P1-2: LN 563' OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 END
DVP_P1-2: LN 574	CONTINGENCY 'DVP_P1-2: LN 574' OPEN BRANCH FROM BUS 314908 TO BUS 314911 CKT 1 /* 8ELMONT 500.00 - 8LADYSMITH 500.00 END

Short Circuit

21 Short Circuit

The following Breakers are overduty:

None

22 Attachment 1: One Line Diagram