Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-104

SUFFOLK 115 KV

19.7 MW Capacity / 51 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 a Solar generating facility located in Suffolk Virginia. The installed facilities will have a total capability of 51 MW with 19.7 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 11/30/2021. This study does not imply a TO commitment to this in-service date.

Queue Number	**AE2-104**
Project Name	SUFFOLK 115 KV
Interconnection Customer	
State	Virginia
County	City of Suffolk
Transmission Owner	Dominion
MFO	51
MWE	51
MWC	19.7
Fuel	Solar
Basecase Study Year	2022

3.1 Primary Point of Interconnection

AE2-104 "Suffolk 115 kV" will interconnect with the Dominion's transmission system through the existing Suffolk 115 kV substation. 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 Secondary Point of Interconnection

The IC requested that a secondary POI "Suffolk 230 kV" be reviewed for network impacts (Option 2). This report does not provide costs for the physical interconnection of Option 2. It was just analyzed for network

impacts. Results are shown in the Network Impacts – Secondary Point of Interconnection section of this report.

3.3 Cost Summary

The AE2-104 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 1,700,000
Direct Connection Network Upgrade	$ 3,600,000
Non Direct Connection Network Upgrades	$
Total Costs	**$ 5,300,000**

In addition, the AE2-104 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	**$62,239,000**

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 AE2-104 was evaluated as a 19.7 MW Capacity (51.0 MW energy) injection at the Suffolk 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 AE2-104 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 AE2-104 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
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 AE2-104 Project, Dominion Energy will build a new two breaker bay in the existing Suffolk 115 kV substation 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
Two Breakers and Associated Equipment	$ 2,000,000
Transmission (one span)	$ 1,600,000
Total Direct Connection Facility Costs	**$ 3,600,000**

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 20.5 miles of 115 kV Line 106 from Bell Ave to AE1-085 Tap	$26,650,000
Add additional 230/115 kV transformer at Suffolk substation.	$12,000,000
Rebuild 8.4 miles of 115 kV Line 106 from AE1-085 Tap to Bakers Pond DP	$10,920,000
Add additional 230/115 kV transformer at Suffolk substation.	$6,000,000
Rebuild 2.45 miles of Line 106 from Bakers Pond DP to New Bohemia DP	$3,185,000
Rebuild 2.68 miles of Line 106 from New Bohemia DP to Poe	$3,484,000
Total Non-Direct Connection Facility Costs	**$62,239,000**

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 AE2-104 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 AE2-104 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 AE2-104 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 AE2-104 was evaluated as a 51.0 MW (Capacity 19.7 MW) at the Suffolk 115 kV substation in the Dominion area. Project AE2-104 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-104 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)

None

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
1801559	314329	3POE	DVP	314291	3PRGEORG	DVP	1	DVP_P4-2: 2002T2003	breaker	301.0	86.6	87.25	DC	4.35
1802852	314329	3POE	DVP	314291	3PRGEORG	DVP	1	DVP_P7-1: LN 2002-2003	tower	301.0	86.6	87.25	DC	4.35
1802850	314536	3SUFFOLK	DVP	314537	6SUFFOLK	DVP	1	DVP_P7-1: LN 15-106-A-A	tower	297.2	88.06	93.52	DC	16.21

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
1801422	313879	3BELL AVE 2	DVP	938630	AE1-085 TAP	DVP	1	DVP_P4-2: 56372	breaker	136.0	110.14	111.02	DC	2.66
1801423	313879	3BELL AVE 2	DVP	938630	AE1-085 TAP	DVP	1	DVP_P4-2: 23872	breaker	136.0	106.18	107.03	DC	2.57
1801174	314273	3BAKRS P	DVP	314280	3NEWBOHE	DVP	1	DVP_P4-2: 56372	breaker	136.0	152.79	153.67	DC	2.66
1801175	314273	3BAKRS P	DVP	314280	3NEWBOHE	DVP	1	DVP_P4-2: 23872	breaker	136.0	148.35	149.2	DC	2.57
1801241	314280	3NEWBOHE	DVP	314329	3POE	DVP	1	DVP_P4-2: 56372	breaker	136.0	144.63	145.51	DC	2.66
1801242	314280	3NEWBOHE	DVP	314329	3POE	DVP	1	DVP_P4-2: 23872	breaker	136.0	140.18	141.04	DC	2.57
1801231	314536	3SUFFOLK	DVP	314537	6SUFFOLK	DVP	1	DVP_P4-3: SUFFOLK H542	breaker	297.2	122.92	134.5	DC	34.43
1801232	314536	3SUFFOLK	DVP	314537	6SUFFOLK	DVP	1	DVP_P4-5: L1TL5	breaker	297.2	122.45	134.14	DC	34.74
1801277	314536	3SUFFOLK	DVP	314537	6SUFFOLK	DVP	3	DVP_P4-3: YTH5	breaker	307.0	117.1	128.13	DC	33.89
1801118	938630	AE1-085 TAP	DVP	314273	3BAKRS P	DVP	1	DVP_P4-2: 56372	breaker	136.0	164.33	165.21	DC	2.66
1801119	938630	AE1-085 TAP	DVP	314273	3BAKRS P	DVP	1	DVP_P4-2: 23872	breaker	136.0	159.89	160.74	DC	2.57

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
1802303	313879	3BELL AVE 2	DVP	938630	AE1-085 TAP	DVP	1	Base Case	operation	110.92	117.58	118.63	DC	2.58
1801860	314273	3BAKRS P	DVP	314280	3NEWBOHE	DVP	1	Base Case	operation	110.92	170.19	171.24	DC	2.58
7875573	314273	3BAKRS P	DVP	314280	3NEWBOHE	DVP	1	DVP_P1-1: G-6 1CHESTF6	operation	110.92	175.51	176.56	DC	2.58
1801971	314280	3NEWBOHE	DVP	314329	3POE	DVP	1	Base Case	operation	110.92	160.28	161.32	DC	2.58
7875666	314280	3NEWBOHE	DVP	314329	3POE	DVP	1	DVP_P1-1: G-6 1CHESTF6	operation	110.92	165.5	166.55	DC	2.58
1801699	314536	3SUFFOLK	DVP	314532	3OAKRI23	DVP	1	Base Case	operation	110.92	94.92	95.96	DC	2.58
1802566	314536	3SUFFOLK	DVP	314537	6SUFFOLK	DVP	1	DVP_P1-3: 6SUFFOLK-TX#5	operation	248.44	84.28	92.57	DC	20.6
1801848	932590	AC2-079 TAP	DVP	314528	3IVOR106	DVP	1	Base Case	operation	110.92	92.93	93.98	DC	2.58
1801725	938630	AE1-085 TAP	DVP	314273	3BAKRS P	DVP	1	Base Case	operation	110.92	184.44	185.48	DC	2.58
7875360	938630	AE1-085 TAP	DVP	314273	3BAKRS P	DVP	1	DVP_P1-1: G-6 1CHESTF6	operation	110.92	189.67	190.71	DC	2.58

12.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
1801423,1801422	3	3BELL AVE 2 115.0 kV - AE1-085 TAP 115.0 kV Ckt 1	dom-056 (143) : Rebuild 20.5 miles of 115 kV Line 106 from Bell Ave to AE1-085 Tap with 636 ACSR. Project Type : FAC Cost : $26,650,000 Time Estimate : 36-40 Months	$26,650,000
1801232,1802850,1801231	2	3SUFFOLK 115.0 kV - 6SUFFOLK 230.0 kV Ckt 1	dom-015 (74) : Add additional 230/115 kV transformer at Suffolk substation. Project Type : CON Cost : $6,000,000 Time Estimate : 16-18 Months	$12,000,000
1801119,1801118	7	AE1-085 TAP 115.0 kV - 3BAKRS P 115.0 kV Ckt 1	dom-057 (144) : Rebuild 8.4 miles of 115 kV Line 106 from AE1-085 Tap to Bakers Pond DP with 636 ACSR. Project Type : FAC Cost : $10,920,000 Time Estimate : 30-36 Months	$10,920,000
1801277	6	3SUFFOLK 115.0 kV - 6SUFFOLK 230.0 kV Ckt 3	dom-015 (74) : Add additional 230/115 kV transformer at Suffolk substation. Project Type : CON Cost : $6,000,000 Time Estimate : 16-18 Months	$6,000,000
1801175,1801174	4	3BAKRS P 115.0 kV - 3NEWBOHE 115.0 kV Ckt 1	dom-058 (145) : Rebuild 2.45 miles of Line 106 from Bakers Pond DP to New Bohemia DP with 636 ACSR. Project Type : FAC Cost : $3,185,000 Time Estimate : 30-36 Months	$3,185,000
1801242,1801241	5	3NEWBOHE 115.0 kV - 3POE 115.0 kV Ckt 1	dom-059 (146) : Rebuild 2.68 miles of Line 106 from New Bohemia DP to Poe with 636 ACSR. Project Type : FAC Cost : $3,484,000 Time Estimate : 30-36 Months	$3,484,000
1802852,1801559	1	3POE 115.0 kV - 3PRGEORG 115.0 kV Ckt 1	No Reinforcement Needed. Not a valid violation	$0
			TOTAL COST	$62,239,000

If “No Reinforcement Needed. Not a valid violation” was provided as the Upgrade Description for a facility in the System Reinforcements table then that facility met one of the following conditions:

a. The loading on the facility at your queue position was less than 100%; therefore, the facility is not yet overloaded, but may be overloaded by end of the AE2 queue.
b. The TO reviewed their ratings on the facility and determined that the current rating was greater than the rating in PJM’s model. This new rating was greater than the loading at your queue position making the violation invalid.

c. The TO reviewed the contingency and determined that contingency was not valid; therefore the violation is invalid. Any contingency corrections will be assessed and corrected in the AE2 impact study phase.

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
DVP_P7-1: LN 2002-2003	CONTINGENCY 'DVP_P7-1: LN 2002-2003' OPEN BRANCH FROM BUS 314282 TO BUS 314331 CKT 1 /* 6CARSON 230.00 - 6POE 230.00 OPEN BRANCH FROM BUS 314329 TO BUS 314331 CKT 1 /* 3POE 115.00 - 6POE 230.00 OPEN BRANCH FROM BUS 314263 TO BUS 314287 CKT 1 /* 6TYLER1 230.00 - 6CHESTF B 230.00 OPEN BRANCH FROM BUS 314263 TO BUS 314299 CKT 1 /* 6TYLER1 230.00 - 6HARROWG 230.00 OPEN BRANCH FROM BUS 314299 TO BUS 314331 CKT 1 /* 6HARROWG 230.00 - 6POE 230.00 OPEN BRANCH FROM BUS 314329 TO BUS 314331 CKT 2 /* 3POE 115.00 - 6POE 230.00 OPEN BUS 314263 /* ISLAND: 6TYLER1 230.00 OPEN BUS 314299 /* ISLAND: 6HARROWG 230.00 END
DVP_P4-2: 2002T2003	CONTINGENCY 'DVP_P4-2: 2002T2003' /* POE 230 KV OPEN BRANCH FROM BUS 314282 TO BUS 314331 CKT 1 /* 6CARSON 230.00 - 6POE 230.00 OPEN BRANCH FROM BUS 314329 TO BUS 314331 CKT 1 /* 3POE 115.00 - 6POE 230.00 OPEN BRANCH FROM BUS 314263 TO BUS 314287 CKT 1 /* 6TYLER1 230.00 - 6CHESTF B 230.00 OPEN BRANCH FROM BUS 314263 TO BUS 314299 CKT 1 /* 6TYLER1 230.00 - 6HARROWG 230.00 OPEN BRANCH FROM BUS 314299 TO BUS 314331 CKT 1 /* 6HARROWG 230.00 - 6POE 230.00 OPEN BRANCH FROM BUS 314329 TO BUS 314331 CKT 2 /* 3POE 115.00 - 6POE 230.00 OPEN BUS 314263 /* ISLAND: 6TYLER1 230.00 OPEN BUS 314299 /* ISLAND: 6HARROWG 230.00 END
DVP_P1-3: 6SUFFOLK-TX#5	CONTINGENCY 'DVP_P1-3: 6SUFFOLK-TX#5' OPEN BRANCH FROM BUS 314536 TO BUS 314537 CKT 2 /* 3SUFFOLK 115.00 - 6SUFFOLK 230.00 END
DVP_P4-2: 23872	CONTINGENCY 'DVP_P4-2: 23872' /* CARSON 230 KV OPEN BRANCH FROM BUS 314282 TO BUS 314435 CKT 1 /* 6CARSON 230.00 - 6SAPONY 230.00 OPEN BRANCH FROM BUS 314435 TO BUS 940480 CKT 1 /* 6SAPONY 230.00 - AE2-033 TAP 230.00 /* CONTINGENCY LINE ADDED FOR AE2 BUILD OPEN BUS 314435 /* ISLAND: 6SAPONY 230.00 OPEN BRANCH FROM BUS 314282 TO BUS 314902 CKT 1 /* 6CARSON 230.00 - 8CARSON 500.00 OPEN BUS 314455 /* 6CARSO_1 230.00 KV END

Contingency Name	Contingency Definition
DVP_P4-5: L1TL5	CONTINGENCY 'DVP_P4-5: L1TL5' /* SUFFOLK 115 KV OPEN BRANCH FROM BUS 314536 TO BUS 314537 CKT 3 /* 3SUFFOLK 115.00 - 6SUFFOLK 230.00 OPEN BRANCH FROM BUS 314536 TO BUS 314537 CKT 2 /* 3SUFFOLK 115.00 - 6SUFFOLK 230.00 END
DVP_P4-3: SUFFOLK H542	CONTINGENCY 'DVP_P4-3: SUFFOLK H542' /* SUFFOLK 230 KV OPEN BRANCH FROM BUS 314536 TO BUS 314537 CKT 3 /* 3SUFFOLK 115.00 - 6SUFFOLK 230.00 OPEN BRANCH FROM BUS 314536 TO BUS 314537 CKT 2 /* 3SUFFOLK 115.00 - 6SUFFOLK 230.00 OPEN BRANCH FROM BUS 314537 TO BUS 314928 CKT 2 /* 6SUFFOLK 230.00 - 8SUFFOLK 500.00 END
DVP_P4-2: 56372	CONTINGENCY 'DVP_P4-2: 56372' /* CARSON 500 KV OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 OPEN BRANCH FROM BUS 314282 TO BUS 314902 CKT 1 /* 6CARSON 230.00 - 8CARSON 500.00 END
DVP_P1-1: G-6 1CHESTF6	CONTINGENCY 'DVP_P1-1: G-6 1CHESTF6' /* 1CHESTF6 24.000 REMOVE MACHINE 6 FROM BUS 315065 /* 1CHESTF6 24.000 UNIT: 6 END
DVP_P7-1: LN 15-106-A-A	CONTINGENCY 'DVP_P7-1: LN 15-106-A-A' OPEN BRANCH FROM BUS 939190 TO BUS 314329 CKT 1 /* AE1-149 TAP 115.00 - 3POE 115.00 OPEN BRANCH FROM BUS 938630 TO BUS 314273 CKT 1 /* AE1-085 TAP 115.00 - 3BAKRS P 115.00 OPEN BRANCH FROM BUS 314262 TO BUS 314280 CKT 1 /* 3NEWBO_1 115.00 - 3NEWBOHE 115.00 OPEN BRANCH FROM BUS 314273 TO BUS 314280 CKT 1 /* 3BAKRS P 115.00 - 3NEWBOHE 115.00 OPEN BRANCH FROM BUS 314280 TO BUS 314329 CKT 1 /* 3NEWBOHE 115.00 - 3POE 115.00 OPEN BUS 314262 /* ISLAND: 3NEWBO_1 115.00 OPEN BUS 314273 /* ISLAND: 3BAKRS P 115.00 OPEN BUS 314280 /* ISLAND: 3NEWBOHE 115.00 END
Base Case	
DVP_P4-3: YTH5	CONTINGENCY 'DVP_P4-3: YTH5' /* SUFFOLK 230 KV OPEN BRANCH FROM BUS 314536 TO BUS 314537 CKT 1 /* 3SUFFOLK 115.00 - 6SUFFOLK 230.00 OPEN BRANCH FROM BUS 314536 TO BUS 314537 CKT 2 /* 3SUFFOLK 115.00 - 6SUFFOLK 230.00 OPEN BRANCH FROM BUS 314537 TO BUS 314928 CKT 1 /* 6SUFFOLK 230.00 - 8SUFFOLK 500.00 REMOVE SWSHUNT FROM BUS 314537 END

12.6.2 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
1802852	314329	3POE	DVP	314291	3PRGEORG	DVP	1	DVP_P7-1: LN 2002-2003	tower	301.0	86.6	87.25	DC	4.35

Bus #	Bus	MW Impact
925061	AB2-161 C O1	7.21
925062	AB2-161 E O1	11.77
932581	AC2-078 C O1	13.92
932582	AC2-078 E O1	22.7
932591	AC2-079 C O1	7.66
932592	AC2-079 E O1	12.49
934571	AD1-082 C	16.44
934572	AD1-082 E	9.38
936661	AD2-085 C	4.76
936662	AD2-085 E	7.76
938631	AE1-085 C O1	35.61
938632	AE1-085 E O1	23.74
939191	AE1-149 C O1	39.42
939192	AE1-149 E O1	26.28
940061	AE1-248 C O1	34.16
940062	AE1-248 E O1	22.78
940651	AE2-052	13.21
941101	AE2-104 C O1	1.68
941102	AE2-104 E O1	2.67
941601	AE2-157 C O1	27.32
941602	AE2-157 E O1	18.22
942341	AE2-247 C	2.06
942342	AE2-247 E	2.85
CARR	CARR	0.02
CBM-S1	CBM-S1	0.51
CBM-S2	CBM-S2	0.6
CBM-W1	CBM-W1	0.51
CBM-W2	CBM-W2	3.32
CIN	CIN	0.23
CPLE	CPLE	0.32
G-007	G-007	0.07
IPL	IPL	0.14
LGEE	LGEE	0.07
MEC	MEC	0.51
MECS	MECS	0.21
O-066	O-066	0.46
RENSSELAER	RENSSELAER	0.02
WEC	WEC	0.06

12.6.3 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
1801232	314536	3SUFFOLK	DVP	314537	6SUFFOLK	DVP	1	DVP_P4-5: L1TL5	breaker	297.2	122.45	134.14	DC	34.74

Bus #	Bus	MW Impact
314539	3UNCAMP	6.35
314541	3WATKINS	1.58
314589	3MURPHYS	0.07
314617	3TUNIS	0.59
315115	1S HAMPT1	2.5
900672	V4-068 E	0.33
907092	X1-038 E	15.88
920041	AA2-088 C OP	1.26
920042	AA2-088 E OP	16.86
923801	AB2-015 C O1	20.96
923802	AB2-015 E O1	17.19
925061	AB2-161 C O1	7.91
925062	AB2-161 E O1	12.9
932581	AC2-078 C O1	4.76
932582	AC2-078 E O1	7.76
932591	AC2-079 C O1	17.59
932592	AC2-079 E O1	28.7
934571	AD1-082 C	18.03
934572	AD1-082 E	10.28
936661	AD2-085 C	10.41
936662	AD2-085 E	16.98
936711	AD2-090 C O1	14.78
936712	AD2-090 E O1	9.85
938631	AE1-085 C O1	14.33
938632	AE1-085 E O1	9.56
938771	AE1-103 C O1	9.53
938772	AE1-103 E O1	13.16
939191	AE1-149 C O1	9.99
939192	AE1-149 E O1	6.66
940061	AE1-248 C O1	37.47
940062	AE1-248 E O1	24.98
940651	AE2-052	3.35
941101	AE2-104 C O1	13.42
941102	AE2-104 E O1	21.32
941601	AE2-157 C O1	20.88
941602	AE2-157 E O1	13.92
942341	AE2-247 C	4.51
942342	AE2-247 E	6.23
CARR	CARR	0.02
CBM-S1	CBM-S1	0.4
CBM-S2	CBM-S2	0.47
CBM-W1	CBM-W1	0.4

Bus #	Bus	MW Impact
CBM-W2	CBM-W2	2.59
CIN	CIN	0.18
CPLE	CPLE	0.26
G-007	G-007	0.07
IPL	IPL	0.11
LGEE	LGEE	0.05
MEC	MEC	0.4
MECS	MECS	0.17
O-066	O-066	0.42
RENSSELAER	RENSSELAER	0.02
WEC	WEC	0.05

12.6.4 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
1801422	313879	3BELL AVE 2	DVP	938630	AE1-085 TAP	DVP	1	DVP_P4-2: 56372	breaker	136.0	110.14	111.02	DC	2.66

Bus #	Bus	MW Impact
925061	AB2-161 C O1	8.55
925062	AB2-161 E O1	13.95
932591	AC2-079 C O1	8.31
932592	AC2-079 E O1	13.56
934571	AD1-082 C	19.49
934572	AD1-082 E	11.12
940061	AE1-248 C O1	40.5
940062	AE1-248 E O1	27.0
940652	AE2-052 BAT	0.6
941101	AE2-104 C O1	1.03
941102	AE2-104 E O1	1.63
941532	AE2-150 EBAT	11.06
CARR	CARR	0.02
CBM-S1	CBM-S1	0.44
CBM-S2	CBM-S2	0.52
CBM-W1	CBM-W1	0.43
CBM-W2	CBM-W2	2.88
CIN	CIN	0.19
CPLE	CPLE	0.27
G-007	G-007	0.08
IPL	IPL	0.12
LGEE	LGEE	0.06
MEC	MEC	0.44
MECS	MECS	0.17
O-066	O-066	0.51
RENSSELAER	RENSSELAER	0.02
WEC	WEC	0.05

12.6.5 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
1801174	314273	3BAKRSP	DVP	314280	3NEWBOHE	DVP	1	DVP_P4-2: 56372	breaker	136.0	152.79	153.67	DC	2.66

Bus #	Bus	MW Impact
925061	AB2-161 C O1	8.55
925062	AB2-161 E O1	13.95
932591	AC2-079 C O1	8.31
932592	AC2-079 E O1	13.56
934571	AD1-082 C	19.49
934572	AD1-082 E	11.12
938631	AE1-085 C O1	44.28
938632	AE1-085 E O1	29.52
940061	AE1-248 C O1	40.5
940062	AE1-248 E O1	27.0
940652	AE2-052 BAT	0.6
941101	AE2-104 C O1	1.03
941102	AE2-104 E O1	1.63
CARR	CARR	0.02
CBM-S1	CBM-S1	0.44
CBM-S2	CBM-S2	0.52
CBM-W1	CBM-W1	0.43
CBM-W2	CBM-W2	2.88
CIN	CIN	0.19
CPLE	CPLE	0.27
G-007	G-007	0.08
IPL	IPL	0.12
LGEE	LGEE	0.06
MEC	MEC	0.44
MECS	MECS	0.17
O-066	O-066	0.51
RENSSELAER	RENSSELAER	0.02
WEC	WEC	0.05

12.6.6 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
1801241	314280	3NEWBOHE	DVP	314329	3POE	DVP	1	DVP_P4-2: 56372	breaker	136.0	144.63	145.51	DC	2.66

Bus #	Bus	MW Impact
925061	AB2-161 C O1	8.55
925062	AB2-161 E O1	13.95
932591	AC2-079 C O1	8.31
932592	AC2-079 E O1	13.56
934571	AD1-082 C	19.49
934572	AD1-082 E	11.12
938631	AE1-085 C O1	44.28
938632	AE1-085 E O1	29.52
940061	AE1-248 C O1	40.5
940062	AE1-248 E O1	27.0
940652	AE2-052 BAT	0.6
941101	AE2-104 C O1	1.03
941102	AE2-104 E O1	1.63
CARR	CARR	0.02
CBM-S1	CBM-S1	0.44
CBM-S2	CBM-S2	0.52
CBM-W1	CBM-W1	0.43
CBM-W2	CBM-W2	2.88
CIN	CIN	0.19
CPLE	CPLE	0.27
G-007	G-007	0.08
IPL	IPL	0.12
LGEE	LGEE	0.06
MEC	MEC	0.44
MECS	MECS	0.17
O-066	O-066	0.51
RENSSELAER	RENSSELAER	0.02
WEC	WEC	0.05

12.6.7 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
1801277	314536	3SUFFOLK	DVP	314537	6SUFFOLK	DVP	3	DVP_P4-3: YTH5	breaker	307.0	117.1	128.13	DC	33.89

Bus #	Bus	MW Impact
314539	3UNCAMP	6.19
314541	3WATKINS	1.54
314589	3MURPHYS	0.07
314617	3TUNIS	0.56
315115	1S HAMPT1	2.43
900672	V4-068 E	0.32
907092	X1-038 E	15.46
920041	AA2-088 C OP	1.22
920042	AA2-088 E OP	16.36
923801	AB2-015 C O1	20.4
923802	AB2-015 E O1	16.73
925061	AB2-161 C O1	7.71
925062	AB2-161 E O1	12.59
932581	AC2-078 C O1	4.64
932582	AC2-078 E O1	7.57
932591	AC2-079 C O1	17.16
932592	AC2-079 E O1	27.99
934571	AD1-082 C	17.58
934572	AD1-082 E	10.03
936661	AD2-085 C	10.15
936662	AD2-085 E	16.56
936711	AD2-090 C O1	14.37
936712	AD2-090 E O1	9.58
938631	AE1-085 C O1	13.97
938632	AE1-085 E O1	9.32
938771	AE1-103 C O1	9.28
938772	AE1-103 E O1	12.81
939191	AE1-149 C O1	9.74
939192	AE1-149 E O1	6.49
940061	AE1-248 C O1	36.54
940062	AE1-248 E O1	24.36
940651	AE2-052	3.26
941101	AE2-104 C O1	13.09
941102	AE2-104 E O1	20.8
941601	AE2-157 C O1	20.37
941602	AE2-157 E O1	13.58
942341	AE2-247 C	4.4
942342	AE2-247 E	6.08
CARR	CARR	0.02
CBM-S1	CBM-S1	0.35
CBM-S2	CBM-S2	0.41
CBM-W1	CBM-W1	0.36

Bus #	Bus	MW Impact
CBM-W2	CBM-W2	2.29
CIN	CIN	0.16
CPLE	CPLE	0.22
G-007	G-007	0.06
IPL	IPL	0.1
LGEE	LGEE	0.05
MEC	MEC	0.36
MECS	MECS	0.15
O-066	O-066	0.36
RENSSELAER	RENSSELAER	0.01
WEC	WEC	0.04

12.6.8 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
1801118	938630	AE1-085 TAP	DVP	314273	3BAKRS P	DVP	1	DVP_P4-2: 56372	breaker	136.0	164.33	165.21	DC	2.66

Bus #	Bus	MW Impact
925061	AB2-161 C O1	8.55
925062	AB2-161 E O1	13.95
932591	AC2-079 C O1	8.31
932592	AC2-079 E O1	13.56
934571	AD1-082 C	19.49
934572	AD1-082 E	11.12
938631	AE1-085 C O1	44.28
938632	AE1-085 E O1	29.52
940061	AE1-248 C O1	40.5
940062	AE1-248 E O1	27.0
940652	AE2-052 BAT	0.6
941101	AE2-104 C O1	1.03
941102	AE2-104 E O1	1.63
CARR	CARR	0.02
CBM-S1	CBM-S1	0.44
CBM-S2	CBM-S2	0.52
CBM-W1	CBM-W1	0.43
CBM-W2	CBM-W2	2.88
CIN	CIN	0.19
CPLE	CPLE	0.27
G-007	G-007	0.08
IPL	IPL	0.12
LGEE	LGEE	0.06
MEC	MEC	0.44
MECS	MECS	0.17
O-066	O-066	0.51
RENSSELAER	RENSSELAER	0.02
WEC	WEC	0.05

Short Circuit

12.7 Short Circuit

The following Breakers are overduty: None

13 Network Impacts – Secondary Point of Interconnection

The Queue Project AE2-104 was evaluated as a 51.0 MW (Capacity 19.7 MW) injection at the Suffolk 230 kV substation in the Dominion area. Project AE2-104 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-104 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

13.1 Generation Deliverability

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

None

13.2 Multiple Facility Contingency

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

None

13.3 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)

None

13.4 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.

None

Short Circuit

13.5 Short Circuit

The following Breakers are overduty: None

Affected Systems

14 Affected Systems

14.1 LG&E

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

14.2 MISO

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

14.3 TVA

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

14.4 Duke Energy Progress

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

14.5 NYISO

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

Attachment 1

System Configuration