Generation Interconnection

System Impact Study Report

for

Queue Project AG1-102

WHITE MARSH 34.5 KV

6.16 MW Capacity / 19 MW Energy

August 2021

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1 Introduction

This System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 205, as well as the System Impact Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Dominion.

2 Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. 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 System Impact Study is performed.

The System Impact 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.

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3 General

The Interconnection Customer (IC), has proposed a Storage generating facility located in Gloucester County, Virginia. The installed facilities will have a total capability of 19 MW with 6.16 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is July 01, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-102
Project Name	WHITE MARSH 34.5 KV
State	Virginia
County	Gloucester
Transmission Owner	Dominion
MFO	19
MWE	19
MWC	6.16
Fuel	Storage
Basecase Study Year	2024

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

AG1-102 will interconnect at the White Marsh 34.5kV circuit which then runs up to the Dominion transmission system at the White Marsh 115 kV Substation.

5 Cost Summary

The AG1-102 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$To be provided in the two-party IA with ITO
Allocation towards System Network Upgrade Costs (PJM Identified - Summer Peak)*	$0
Allocation towards System Network Upgrade Costs (PJM Identified - Light Load)*	$0
Total Costs	$0

*As your project progresses through the study process and other projects modify their request or withdraw, then your cost allocation could change.

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This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Note 1: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. The allocation of costs for a network upgrade will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.

Note 2: For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently $0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

6 Transmission Owner Scope of Work

The required Attachment Facilities, Direct Connection and Non-Direct Connection work for the interconnection of AG1-102 to the Dominion Transmission System is detailed in the following sections. The associated one-line showing the generation project attachment facilities and primary direct and non-direct connection is 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 phase. 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.

The total physical interconnection costs are given in the table below:

Description	Total Cost
Total Physical Interconnection Costs	$To be provided in the two-party IA with ITO

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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.

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.

7 Schedule

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

8 Transmission Owner Analysis

Dominion assessed the impact of the proposed AG1-102 for compliance with NERC Reliability Criteria on the Dominion Transmission System. The system was assessed using the summer 2024 AG1 case provided to Dominion by PJM.

When performing a generation analysis, Dominion's main analysis includes load flow study results following a single contingency event for 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 Planning Event 3 and 6 Contingency Conditions (Loss of generator, transmission circuit, transformer, shunt device, or Single Pole of a DC line followed by the loss of a generator, transmission circuit, transformer, shunt device or single pole of a DC line) allow for re-dispatch of generating units to resolve potential reliability deficiencies. For Dominion Planning Criteria the re-dispatch of generating units for these

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contingency conditions is allowed as long as the projected loading does not exceed 100% of a facility Load Dump Rating.

8.1 Power Flow Analysis

PJM performed a power flow analysis of the transmission system using a 2024 summer peak load flow model and the results were verified by Dominion. Additionally, Dominion performed an analysis of its transmission system and no further deficiencies were identified.

9 Interconnection Customer Requirements

9.1 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.

9.2 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 section 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

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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.

9.3 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.

10 Revenue Metering and SCADA Requirements

10.1 PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 8 of Attachment O.

10.2 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

http://www.pjm.com/planning/design-engineering/to-tech-standards/

11 Summer Peak Analysis

The Queue Project AG1-102 was evaluated as a 19.0 MW (Capacity 6.16 MW) injection at the White Marsh 115 kV Substation in the Dominion area. Project AG1-102 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-102 was studied with a commercial probability of 100.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None

11.2 Multiple Facility Contingency

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

None

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11.3 Contribution to Previously Identified Overloads

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
166895533	945360	AF1-201 TAP	115.0	DVP	314177	3HAYES89	115.0	DVP	1	DVP_P7-1: LN 85-2016-B	tower	208.0	128.94	135.72	AC	14.91
173980525	945360	AF1-201 TAP	115.0	DVP	314177	3HAYES89	115.0	DVP	1	DVP_P4-2: 201632	breaker	208.0	107.55	113.61	AC	13.12
184598499	945360	AF1-201 TAP	115.0	DVP	314177	3HAYES89	115.0	DVP	1	DVP_P4-2: 2016T2024	breaker	208.0	107.17	113.21	AC	13.08

11.4 Steady-State Voltage Requirements

To be determined

11.5 Potential Congestion due to Local Energy Deliverability

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

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
168344699	313828	3WHITEMARSH	115.0	DVP	945360	AF1-201 TAP	115.0	DVP	1	DVP_P1-2: LN 2016	operation	169.2	65.62	73.04	AC	13.03
168344400	313870	3RAPPAHNCK	115.0	DVP	314191	3WHITSTONE	115.0	DVP	1	Base Case	operation	138.2	75.42	76.42	AC	1.61
168344282	313886	3GREYSPT	115.0	DVP	314174	3HARMONY	115.0	DVP	1	Base Case	operation	138.2	85.22	86.37	AC	1.61
183773727	313886	3GREYSPT	115.0	DVP	314174	3HARMONY	115.0	DVP	1	DVP_P1-2: LN 224	operation	138.2	130.86	131.96	AC	1.59
168344396	314174	3HARMONY	115.0	DVP	313886	3GREYSPT	115.0	DVP	1	Base Case	operation	138.2	75.25	76.25	AC	1.61
168645895	314174	3HARMONY	115.0	DVP	314176	6HARMONY	230.0	DVP	1	DVP_P1-2: LN 89-B	operation	224.4	110.74	114.68	AC	9.87
168645897	314174	3HARMONY	115.0	DVP	314176	6HARMONY	230.0	DVP	1	Base Case	operation	220.2	74.29	75.89	AC	3.75
168646119	314174	3HARMONY	115.0	DVP	313828	3WHITEMARSH	115.0	DVP	1	DVP_P1-2: LN 2016	operation	169.2	74.36	77.87	AC	5.97

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ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
168646102	314177	3HAYES89	115.0	DVP	314180	6HAYES	230.0	DVP	1	DVP_P1-2: LN 2016	operation	237.9	80.95	86.38	AC	13.03
168344279	314191	3WHITSTONE	115.0	DVP	313870	3RAPPAHNCK	115.0	DVP	1	Base Case	operation	138.2	82.72	83.87	AC	1.61
183781241	314191	3WHITSTONE	115.0	DVP	313870	3RAPPAHNCK	115.0	DVP	1	DVP_P1-2: LN 224	operation	138.2	128.34	129.44	AC	1.59
169565975	945360	AF1-201 TAP	115.0	DVP	314177	3HAYES89	115.0	DVP	1	DVP_P1-2: LN 2016	operation	169.2	130.43	137.82	AC	13.03
169565977	945360	AF1-201 TAP	115.0	DVP	314177	3HAYES89	115.0	DVP	1	Base Case	operation	169.2	110.16	116.88	AC	11.68

11.6 System Reinforcements

ID	Idx	Facility	Upgrade Description	Cost	Cost Allocated to AG1-102	Upgrade Number
184598499,166895533,173980525	1	AF1-201 TAP 115.0 kV - 3HAYES89 115.0 kV Ckt 1	**DVP** **Project ID: n6819 (dom-145)** **Description: Reconductor 1.4 miles of 115 kV Line 89 from Hayes to AF1-201 Tap with 636 ACSR** **Type : FAC** **Cost : $840,000** **Time Estimate : 30-36 Months** **Ratings : 261.0/261.0/301.0** **Note: AF1-201 is the Driver for this reinforcement.** **Queue Project AG1-102 presently does not receive cost allocation for this upgrade.** **Note 1: as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AG1-102 could receive cost allocation.** **Note 2: Although Queue Project AG1-102 may not have cost responsibility for this upgrade, Queue Project AG1-102 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AG1-102 comes into service prior to completion of the upgrade, Queue Project AG1-102 will need an interim study**	$840,000	$0	n6819
			TOTAL COST	**$840,000**	$0	

Note : For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can

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change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently $0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

11.7 Flow Gate Details

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

11.7.1 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
166895533	945360	AF1-201 TAP	DVP	314177	3HAYES89	DVP	1	DVP_P7-1: LN 85-2016-B	tower	208.0	128.94	135.72	AC	14.91

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
315034	1NORNECKC1	0.58	80|50	0.58
315035	1NORNECKC2	0.56	80|50	0.56
316077	AC2-138 C	0.15	80|50	0.15
316078	AC2-138 E	0.79	80|50	0.79
316156	AD2-030 C	1.23	80|50	1.23
316157	AD2-030 E	3.85	80|50	3.85
934141	AD1-041 C	17.22	80|50	17.22
934142	AD1-041 E	11.48	80|50	11.48
936591	AD2-074 C	10.02	80|50	10.02
936592	AD2-074 E	16.36	80|50	16.36
939245	AE1-155 C	20.37	80|50	20.37
939246	AE1-155 E	13.67	80|50	13.67

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Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
939611	AE1-191 C	34.44	80|50	34.44
939612	AE1-191 E	22.96	80|50	22.96
943741	AF1-042 C	5.25	80|50	5.25
943742	AF1-042 E	8.56	80|50	8.56
945361	AF1-201 C O1	76.51	80|50	76.51
945362	AF1-201 E O1	51.01	80|50	51.01
945831	AF1-248	0.05	80|50	0.05
957601	AF2-054 C	6.85	80|50	6.85
957602	AF2-054 E	4.57	80|50	4.57
957831	AF2-077 C	9.42	80|50	9.42
957832	AF2-077 E	6.28	80|50	6.28
958261	AF2-120 C	10.01	80|50	10.01
958262	AF2-120 E	6.68	80|50	6.68
961951	AG1-038 C	5.8	80|50	5.8
961952	AG1-038 E	8.01	80|50	8.01
962531	AG1-102 C	4.84	80|50	4.84
962532	AG1-102 E	10.08	80|50	10.08
962861	AG1-135 C	10.26	80|50	10.26
962862	AG1-135 E	6.84	80|50	6.84
962971	AG1-146 C	6.89	80|50	6.89
962972	AG1-146 E	4.59	80|50	4.59
962981	AG1-147 C	16.07	80|50	16.07
962982	AG1-147 E	10.72	80|50	10.72
963611	AG1-210 C	0.56	80|50	0.56
963612	AG1-210 E	0.85	80|50	0.85
966661	AG1-536 C	8.57	80|50	8.57
966662	AG1-536 E	11.52	80|50	11.52
LTFEXP_AC1-056	LTFEXP_AC1-056->LTFIMP_AC1-056	0.0614	Confirmed LTF	0.0614
LTFEXP_AC1-131	LTFEXP_AC1-131->LTFIMP_AC1-131	0.1829	Confirmed LTF	0.1829
LTFEXP_BlueG	LTFEXP_BlueG->LTFIMP_BlueG	0.0923	Confirmed LTF	0.0923
LTFEXP_CALDERWOOD	LTFEXP_CALDERWOOD->LTFIMP_CALDERWOOD	0.0562	Confirmed LTF	0.0562
LTFEXP_CATAWBA	LTFEXP_CATAWBA->LTFIMP_CATAWBA	0.062	Confirmed LTF	0.062
LTFEXP_CBM-N	LTFEXP_CBM-N->LTFIMP_CBM-N	0.0912	LTF/CBM	0.0912
LTFEXP_CHEOAH	LTFEXP_CHEOAH->LTFIMP_CHEOAH	0.0576	Confirmed LTF	0.0576
LTFEXP_COTTONWOOD	LTFEXP_COTTONWOOD->LTFIMP_COTTONWOOD	0.2019	Confirmed LTF	0.2019
LTFEXP_G-007A	LTFEXP_G-007A->LTFIMP_G-007A	0.1854	LTF/CMTX	0.1854
LTFEXP_GIBSON	LTFEXP_GIBSON->LTFIMP_GIBSON	0.03	Confirmed LTF	0.03
LTFEXP_HAMLET	LTFEXP_HAMLET->LTFIMP_HAMLET	0.1261	Confirmed LTF	0.1261
LTFEXP_PRAIRIE	LTFEXP_PRAIRIE->LTFIMP_PRAIRIE	0.178	Confirmed LTF	0.178
LTFEXP_TRIMBLE	LTFEXP_TRIMBLE->LTFIMP_TRIMBLE	0.0292	Confirmed LTF	0.0292

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Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
LTFEXP_VFT	LTFEXP_VFT->LTFIMP_VFT	0.496	Confirmed LTF	0.496

11.8 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AA2-074	CPLE-PJM	Confirmed
AC1-056	PJM-AMIL	Confirmed
AC1-118	Westmoreland 34.5kV	In Service
AC1-131	PJM-CPLE	Confirmed
AC2-138	Northern Neck 34.5kV	In Service
AD1-041	Harmony Village-Shackleford 115 kV	Engineering and Procurement
AD2-030	Wan 34.5 kV	In Service
AD2-073	Sanders DP 230 kV	Engineering and Procurement
AD2-074	Garner DP-Lancaster 115 kV	Active
AE1-155	Garner-Northern Neck 115 kV	Active
AE1-191	Harmony Village-Shackleford 115 kV	Active
AF1-042	Garner DP-Lancaster 115 kV	Active
AF1-201	Hayes-White Marsh 115 kV	Active
AF1-248	Northern Neck 34.5 kV	Partially in Service - Under Construction
AF2-054	Wan 34.5 kV	Active
AF2-077	White Marsh 34.5 kV	Active
AF2-120	Garner-Northern Neck 115 kV	Active
AG1-038	Garner DP-Lancaster 115 kV	Active
AG1-102	White Marsh 34.5 kV	Active
AG1-135	Garner-Lancaster 115 kV	Active
AG1-146	Garner DP-Lancaster 115 kV	Active
AG1-147	Garner DP-Lancaster 115 kV	Active
AG1-210	Northern Neck 34.5 kV	Active
AG1-256	Northern Neck 230 kV	Active
AG1-536	Garner-Northern Neck 115 kV	Active

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11.9 Contingency Descriptions

Contingency Name	Contingency Definition
DVP_P4-2: 2016T2024	CONTINGENCY 'DVP_P4-2: 2016T2024' /* LANEXA 230 KV OPEN BRANCH FROM BUS 314174 TO BUS 314176 CKT 1 /* 3HARMONY 115.00 - 6HARMONY 230.00 OPEN BRANCH FROM BUS 314176 TO BUS 314189 CKT 1 /* 6HARMONY 230.00 - 6PAPERMILL 230.00 OPEN BRANCH FROM BUS 314189 TO BUS 314375 CKT 1 /* 6PAPERMILL 230.00 - 6CORRCTN 230.00 OPEN BRANCH FROM BUS 314375 TO BUS 314388 CKT 1 /* 6CORRCTN 230.00 - 6LANEXA 230.00 OPEN BUS 313846 /* ISLAND: 6HARMONY_1 230.00 OPEN BUS 314176 /* ISLAND: 6HARMONY 230.00 OPEN BUS 934391 /* ISLAND: AD1-063 C 230.00 OPEN BUS 934392 /* ISLAND: AD1-063 E 230.00 OPEN BUS 314189 /* ISLAND: 6PAPERMILL 230.00 OPEN BUS 314375 /* ISLAND: 6CORRCTN 230.00 OPEN BUS 923842 /* ISLAND: AB2-024 E 230.00 OPEN BRANCH FROM BUS 314214 TO BUS 314388 CKT 1 /* 6CHCKAHM 230.00 - 6LANEXA 230.00 END
DVP_P7-1: LN 85-2016-B	CONTINGENCY 'DVP_P7-1: LN 85-2016-B' /* . OPEN BRANCH FROM BUS 934140 TO BUS 314184 CKT 1 /* AD1-041 TAP 115.00 - 3SHACKLE 115.00 OPEN BRANCH FROM BUS 314184 TO BUS 314188 CKT 1 /* 3SHACKLE 115.00 - 3WEST PT 115.00 OPEN BRANCH FROM BUS 314188 TO BUS 314387 CKT 1 /* 3WEST PT 115.00 - 3LANEXA 115.00 OPEN BUS 314184 /* ISLAND: 3SHACKLE 115.00 OPEN BUS 925860 /* ISLAND: AC1-065 MAIN115.00 OPEN BUS 925862 /* ISLAND: AC1-065 COL 34.500 OPEN BUS 925863 /* ISLAND: AC1-065 C 0.3900 OPEN BUS 925864 /* ISLAND: AC1-065 TRE 13.800 OPEN BUS 925865 /* ISLAND: AC1-065 E 0.3900 OPEN BUS 314188 /* ISLAND: 3WEST PT 115.00 OPEN BRANCH FROM BUS 314174 TO BUS 314176 CKT 1 /* 3HARMONY 115.00 - 6HARMONY 230.00 OPEN BRANCH FROM BUS 314176 TO BUS 314189 CKT 1 /* 6HARMONY 230.00 - 6PAPERMILL 230.00 OPEN BRANCH FROM BUS 314189 TO BUS 314375 CKT 1 /* 6PAPERMILL 230.00 - 6CORRCTN 230.00 OPEN BRANCH FROM BUS 314375 TO BUS 314388 CKT 1 /* 6CORRCTN 230.00 - 6LANEXA 230.00 OPEN BUS 313846 /* ISLAND: 6HARMONY_1 230.00 OPEN BUS 314176 /* ISLAND: 6HARMONY 230.00 OPEN BUS 934391 /* ISLAND: AD1-063 C 230.00 OPEN BUS 934392 /* ISLAND: AD1-063 E 230.00 OPEN BUS 314189 /* ISLAND: 6PAPERMILL 230.00 OPEN BUS 314375 /* ISLAND: 6CORRCTN 230.00 OPEN BUS 923842 /* ISLAND: AB2-024 E 230.00 END

Contingency Name	Contingency Definition
DVP_P1-2: LN 224	CONTINGENCY 'DVP_P1-2: LN 224' OPEN BRANCH FROM BUS 314172 TO BUS 314182 CKT 1 /* 6DUNNSVL 230.00 - 6NORNECK 230.00 OPEN BRANCH FROM BUS 314172 TO BUS 314388 CKT 1 /* 6DUNNSVL 230.00 - 6LANEXA 230.00 OPEN BUS 314172 /* ISLAND: 6DUNNSVL 230.00 END
DVP_P1-2: LN 2016	CONTINGENCY 'DVP_P1-2: LN 2016' OPEN BRANCH FROM BUS 314174 TO BUS 314176 CKT 1 /* 3HARMONY 115.00 - 6HARMONY 230.00 OPEN BRANCH FROM BUS 314176 TO BUS 314189 CKT 1 /* 6HARMONY 230.00 - 6PAPERMILL 230.00 OPEN BRANCH FROM BUS 314189 TO BUS 314375 CKT 1 /* 6PAPERMILL 230.00 - 6CORRCTN 230.00 OPEN BRANCH FROM BUS 314375 TO BUS 314388 CKT 1 /* 6CORRCTN 230.00 - 6LANEXA 230.00 OPEN BUS 313846 /* ISLAND: 6HARMONY_1 230.00 OPEN BUS 314176 /* ISLAND: 6HARMONY 230.00 OPEN BUS 934391 /* ISLAND: AD1-063 C 230.00 OPEN BUS 934392 /* ISLAND: AD1-063 E 230.00 OPEN BUS 314189 /* ISLAND: 6PAPERMILL 230.00 OPEN BUS 314375 /* ISLAND: 6CORRCTN 230.00 OPEN BUS 923842 /* ISLAND: AB2-024 E 230.00 END
Base Case	
DVP_P1-2: LN 89-B	CONTINGENCY 'DVP_P1-2: LN 89-B' OPEN BRANCH FROM BUS 945360 TO BUS 314177 CKT 1 /* AF1-201 TAP 115.00 - 3HAYES89 115.00 END

Contingency Name	Contingency Definition
DVP_P4-2: 201632	CONTINGENCY 'DVP_P4-2: 201632' /* LANEXA 230 KV OPEN BRANCH FROM BUS 314174 TO BUS 314176 CKT 1 /* 3HARMONY 115.00 - 6HARMONY 230.00 OPEN BRANCH FROM BUS 314176 TO BUS 314189 CKT 1 /* 6HARMONY 230.00 - 6PAPERMILL 230.00 OPEN BRANCH FROM BUS 314189 TO BUS 314375 CKT 1 /* 6PAPERMILL 230.00 - 6CORRCTN 230.00 OPEN BRANCH FROM BUS 314375 TO BUS 314388 CKT 1 /* 6CORRCTN 230.00 - 6LANEXA 230.00 OPEN BUS 313846 /* ISLAND: 6HARMONY_1 230.00 OPEN BUS 314176 /* ISLAND: 6HARMONY 230.00 OPEN BUS 934391 /* ISLAND: AD1-063 C 230.00 OPEN BUS 934392 /* ISLAND: AD1-063 E 230.00 OPEN BUS 314189 /* ISLAND: 6PAPERMILL 230.00 OPEN BUS 314375 /* ISLAND: 6CORRCTN 230.00 OPEN BUS 923842 /* ISLAND: AB2-024 E 230.00 OPEN BRANCH FROM BUS 314387 TO BUS 314388 CKT 2 /* 3LANEXA 115.00 - 6LANEXA 230.00 OPEN BUS 314440 /* 6LANEX_1 230.00 KV END

12 Light Load Analysis

The Queue Project AG1-102 was evaluated as a 19.1 MW (Capacity 6.16 MW) injection at the White Marsh 115 kV Substation in the Dominion area. Project AG1-102 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-102 was studied with a commercial probability of 100.0 %. Potential network impacts were as follows:

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)

None

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)

None

12.4 Steady-State Voltage Requirements

To be determined

12.5 Potential Congestion due to Local Energy Deliverability

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

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
168344398	313870	3RAPPAHNCK	115.0	DVP	314191	3WHITSTONE	115.0	DVP	1	DVP_P1-2: LN 224	operation	138.179992676	78.45	79.52	AC	1.72
168344394	314174	3HARMONY	115.0	DVP	313886	3GREYSPT	115.0	DVP	1	DVP_P1-2: LN 224	operation	138.179992676	79.89	80.93	AC	1.72

12.6 System Reinforcements

None

12.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AE2-041	Harmony Village 230 kV	Active
AE2-122	Birdneck-Landstown 230 kV	Active
AE2-123	Birdneck-Landstown 230 kV	Active
AE2-124	Landstown 230 kV	Active
AF1-018	Harmony Village 230 kV	Active
AF1-123	Fentress 500 kV	Active
AF1-124	Fentress 500 kV	Active
AF1-125	Fentress 500 kV	Active
AF1-201	Hayes-White Marsh 115 kV	Active
AF2-013	Arnold's Corner-Dahlgren 230 kV	Active
AG1-019	Arnold's Corner-Dahlgren 230 kV	Active
AG1-057	Harmony Village 230 kV	Active
AG1-102	White Marsh 34.5 kV	Active
AG1-210	Northern Neck 34.5 kV	Active
AG1-256	Northern Neck 230 kV	Active
AG1-322	Birchwood 230 kV	Active
AG1-536	Garner-Northern Neck 115 kV	Active

12.8 Contingency Descriptions

Contingency Name	Contingency Definition
DVP_P1-2: LN 224	CONTINGENCY 'DVP_P1-2: LN 224' OPEN BRANCH FROM BUS 314172 TO BUS 314182 CKT 1 /* 6DUNNSVL 230.00 - 6NORNECK 230.00 OPEN BRANCH FROM BUS 314172 TO BUS 314388 CKT 1 /* 6DUNNSVL 230.00 - 6LANEXA 230.00 OPEN BUS 314172 /* ISLAND: 6DUNNSVL 230.00 END

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13 Short Circuit Analysis

None found to be overdutied.

13.1 System Reinforcements - Short Circuit

No reinforcements required.

14 Stability and Reactive Power

PJM does not require a Stability Analysis for this project.

15 Affected Systems

15.1 Duke Energy Progress

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

16 Attachment 1: One Line Diagram