Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-173

HOPEWELL-SURRY 230 KV

12 MW Capacity / 20 MW Energy

January 2021

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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 Dominion.

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.

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 Surry County, Virginia. The installed facilities will have a total capability of 20 MW with 12 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is October 15, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-173
Project Name	HOPEWELL-SURRY 230 KV
State	Virginia
County	Surry
Transmission Owner	Dominion
MFO	20
MWE	20
MWC	12
Fuel	Solar
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

4.1 Primary Point of Interconnection

AG1-173 "Hopewell-Surry 230 kV" will interconnect with the Dominion transmission system as an uprate to AG1-171, sharing the POI and Attachment Facilities.

The IC is responsible for securing right-of-way, permits, and constructing the proposed attachment line from the generating facility site to the Point of Interconnection. The IC may not install any facilities on Dominion's right-of-way without first obtaining the necessary approval from Dominion Energy.

Costs provided are contingent on the AG1-171 project being built. Should the AG1-171 project withdraw from the Interconnection Queue, the AG1-173 project will assume the Attachment, Direct Connection, and Non-Direct Connection costs identified in the AG1-171 study report for connection to the Dominion system.

Attachment 1 shows a one-line diagram of the proposed interconnection facilities.

Note: Projects AG1-171 through AG1-175 were studied for feasibility analysis as tapping the Hopewell to Surry 230 kV line, Ckt. 2. The correct POI for this project, as noted in the above paragraph, is a direct connection at Colonial Trail 230 kV which is a substation tapping Hopewell to Surry 230 kV line, Ckt. 1. These two POIs are electrically close enough to make the analysis performed acceptable for a feasibility level study. This report is being issued with the intention of performing the analysis with the correct POI in the System Impact phase.

5 Cost Summary

The AG1-173 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$ 0
Total System Network Upgrade Costs	$ 7,500,000[1]
Total Costs	$ 7,500,000

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 2016-36, 2016-25 I.R.B. (6/20/2016). 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.

[1] This project currently causes and/or contributes to overloads of the Transmission System (see Summer Peak Load Flow Analysis section below) and therefore has potential to have cost allocation for the system reinforcements listed in the report. This will be re-evaluated in the System Impact phase. The results may vary with queue customers withdrawing from the queue and other generators deactivating over time. If a customer is the first to cause the need for a project (causes loading to exceed 100% of rating), then the customer is responsible. If a customer contributes to a facility that is already overloaded by a prior queue, then they may receive cost allocation.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

6 Transmission Owner Scope of Work

The required Attachment Facilities, Direct Connection and Non-Direct Connection work for the interconnection of AG1-173 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	$ 0

AG1-173 "Hopewell-Surry 230 kV" will interconnect with the Dominion transmission system as an uprate to AG1-171, sharing the POI and Attachment Facilities.

As AG1-173 is sharing the POI and Attachment Facilities with AG1-171, there are no associated interconnection costs for this project. Should the AG1-171 project withdraw from the Interconnection Queue,the AG1-173 project will assume the Attachment, Direct Connection, and Non-Direct Connection costs identified in the AG1-171 study report for connection to the Dominion system.

It is estimated to take 18-30 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 estimated schedule for the Attachment Facilities, Direct Connection and Non-Direct Connection work is identified in the "Transmission Owner Scope of Work" section of this report.

The estimated schedule for the required Network Impact Reinforcements is identified in the "System Reinforcements" section of this report.

If the customer is ultimately responsible for network upgrades, then the schedule for those upgrades will be refined in future study phases. The customer would need to wait for those upgrades to be completed prior to commercial operation unless determined deliverable by an interim deliverability study. The elapsed time to complete any network upgrades is provided in the System Reinforcements table of this report.

8 Transmission Owner Analysis

Dominion assessed the impact of the proposed AG1-171 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 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 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 Meteorological Data Reporting Requirements

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

- Back Panel temperature (Fahrenheit) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Irradiance (Watts/meter2) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Ambient air temperature (Fahrenheit) - (Accepted, not required)
- Wind speed (meters/second) - (Accepted, not required)
- Wind direction (decimal degrees from true north) - (Accepted, not required)

10.3 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 - Load Flow Analysis

The Queue Project AG1-173 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection tapping the Hopewell to Surry 230 kV line, Ckt. 2 in the Dominion area. Project AG1-173 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-173 was studied with a commercial probability of 53.0 %.

Note: Projects AG1-171 through AG1-175 were studied for feasibility analysis as tapping the Hopewell to Surry 230 kV line, Ckt. 2. The correct POI for this project is a direct connection at Colonial Trail 230 kV which is a substation tapping Hopewell to Surry 230 kV line, Ckt. 1. These two POIs are electrically close enough to make the analysis performed acceptable for a feasibility level study. This report is being issued with the intention of performing the analysis with the correct POI in the System Impact phase.

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

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
163171470	314303	6HOPEWLL	230.0	DVP	314286	6CHESTFA	230.0	DVP	1	DVP_P2-2: BASIN B7	bus	549.0	179.98	180.99	DC	5.63
163171745	314303	6HOPEWLL	230.0	DVP	314286	6CHESTFA	230.0	DVP	1	DVP_P7-1: LN 212-240-D	tower	549.0	201.99	203.62	DC	8.97
163171746	314303	6HOPEWLL	230.0	DVP	314286	6CHESTFA	230.0	DVP	1	DVP_P7-1: LN 212-240-C	tower	549.0	194.72	196.35	DC	8.97
163171815	314303	6HOPEWLL	230.0	DVP	314287	6CHESTFB	230.0	DVP	1	DVP_P7-1: LN 212-240-D	tower	549.0	160.56	162.24	DC	9.22
168685463	314303	6HOPEWLL	230.0	DVP	314286	6CHESTFA	230.0	DVP	1	DVP_P1-2: LN 211	single	449.320007324	180.67	181.73	DC	4.91

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
16868546 5	314303	6HOPEWLL	230.0	DVP	314286	6CHESTF A	230.0	DVP	1	DVP_P1-2: LN 240-D	single	449.320007324	165.22	166.24	DC	4.57
16868549 6	314303	6HOPEWLL	230.0	DVP	314287	6CHESTF B	230.0	DVP	1	DVP_P1-2: LN 228	single	449.320007324	171.82	172.94	DC	5.09
16868549 9	314303	6HOPEWLL	230.0	DVP	314287	6CHESTF B	230.0	DVP	1	DVP_P1-2: LN 240-D	single	449.320007324	131.01	132.06	DC	4.72

11.4 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	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
168685461	314303	6HOPEWLL	230.0	DVP	314286	6CHESTF A	230.0	DVP	1	DVP_P1-2: LN 211	operation	449.320007324	202.22	204.0	DC	8.19
168685464	314303	6HOPEWLL	230.0	DVP	314286	6CHESTF A	230.0	DVP	1	Base Case	operation	449.320007324	169.85	170.98	DC	5.2
168685495	314303	6HOPEWLL	230.0	DVP	314287	6CHESTF B	230.0	DVP	1	DVP_P1-2: LN 228	operation	449.320007324	189.84	191.69	DC	8.49
168685498	314303	6HOPEWLL	230.0	DVP	314287	6CHESTF B	230.0	DVP	1	Base Case	operation	449.320007324	135.43	136.62	DC	5.45
169606574	935160	AD1-151 TAP	230.0	DVP	314303	6HOPEWLL	230.0	DVP	2	DVP_P1-2: LN 2197	operation	678.679992676	111.06	112.76	DC	11.52
168953482	961610	AG1-000B TAP	230.0	DVP	314538	6SURRY	230.0	DVP	2	314303 6HOPEWLL 230 935160 AD1-151 TAP 230 2	operation	678.679992676	108.87	111.82	DC	20.0

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
168685465,163171746,163171745,168685463,163171470	1	6HOPEWLL 230.0 kV - 6CHESTF A 230.0 kV Ckt 1	**DVP** **b2922 (1158) : PJM Baseline Upgrade b2922. Rebuild 8 of 11 miles of 230kV Lines #211 and #228 to current standard with a summer emergency rating of 1046 MVA for rebuilt section. Proposed conductor is 2-636 ACSR. The baseline project has a projected in-service date of 12/01/2020.** **Project Type : FAC** **Cost : $0** **n6155 (1397) : Rebuild 3 miles of 230 kV Line 211 from Hopewell to Chesterfield with 2-636 ACSR.** **Project Type : FAC** **Cost : $7,500,000** **Time Estimate : 30-36 Months**	$7,500,000
168685499,163171815,168685496	2	6HOPEWLL 230.0 kV - 6CHESTF B 230.0 kV Ckt 1		
			TOTAL COST	**$7,500,000**

11.6 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".

11.6.1 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
163171745	314303	6HOPEWLL	DVP	314286	6CHESTFA	DVP	1	DVP_P7-1: LN 212-240-D	tower	549.0	201.99	203.62	DC	8.97

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
314314	3LOCKS	0.1627	50/50	0.1627
314331	6POE	1.6284	50/50	1.6284
315065	**1CHESTF6 (Deactivation : 31/05/2023)**	**121.9427**	**50/50**	**121.9427**
315073	1STONECA	17.2239	50/50	17.2239
315074	**1HOPCGN1 (Deactivation : 25/06/2019)**	**0.0449**	**50/50**	**0.0449**
315075	**1HOPCGN2 (Deactivation : 25/06/2019)**	**0.0449**	**50/50**	**0.0449**
315076	1HOPPOLC	3.7577	50/50	3.7577
315077	1HOPHCF1	5.8736	50/50	5.8736
315078	1HOPHCF2	5.8736	50/50	5.8736
315079	1HOPHCF3	5.8736	50/50	5.8736
315080	1HOPHCF4	8.9165	50/50	8.9165
316033	AB2-134 C	5.0810	50/50	5.0810
316083	**AB2-161 C (Suspended)**	**2.5509**	**50/50**	**2.5509**
316084	**AB2-161 E (Suspended)**	**4.1621**	**50/50**	**4.1621**
316108	**AB2-160 C (Suspended)**	**3.1345**	**50/50**	**3.1345**
316109	**AB2-160 E (Suspended)**	**5.1143**	**50/50**	**5.1143**
316132	AB2-190 C	50.2365	50/50	50.2365
924814	AB2-134 E	31.6669	50/50	31.6669
925332	AB2-190 E	21.5299	50/50	21.5299
927225	AC1-216 C	3.8784	50/50	3.8784
927226	AC1-216 E	19.3321	50/50	19.3321
932581	AC2-078 C O1	3.1396	50/50	3.1396
932582	AC2-078 E O1	5.1224	50/50	5.1224
934014	AD1-025 C	42.2525	50/50	42.2525
934015	AD1-025 E	25.0285	50/50	25.0285
934575	AD1-082 C	5.8135	50/50	5.8135
934576	AD1-082 E	3.3162	50/50	3.3162
935164	AD1-151 C	40.3686	50/50	40.3686
935165	AD1-151 E	26.9124	50/50	26.9124
936041	AD2-007 C	2.0184	50/50	2.0184
936042	AD2-007 E	1.3905	50/50	1.3905
936051	AD2-008 C	7.3561	50/50	7.3561
936052	AD2-008 E	16.0129	50/50	16.0129
938634	AE1-085 C	7.0310	50/50	7.0310
938635	AE1-085 E	3.5155	50/50	3.5155
939195	AE1-149 C	9.3186	50/50	9.3186
939196	AE1-149 E	6.2124	50/50	6.2124
940061	AE2-000BC O1	7.7088	50/50	7.7088

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
940062	AE2-000BE O1	5.1392	50/50	5.1392
940651	AE2-052	3.1062	50/50	3.1062
942001	AE2-212 C	1.8040	50/50	1.8040
942002	AE2-212 E	1.2026	50/50	1.2026
942151	AE2-227 C	-1.6043	Adder	-1.89
942161	AE2-228 C	2.0668	50/50	2.0668
942162	AE2-228 E	1.3778	50/50	1.3778
942371	AE2-250 C O1	5.5679	50/50	5.5679
942372	AE2-250 E O1	2.9386	50/50	2.9386
942551	AE2-270	67.2810	50/50	67.2810
944641	AF1-129	102.3233	50/50	102.3233
946261	AF1-291 C	2.0962	50/50	2.0962
946262	AF1-291 E	1.3974	50/50	1.3974
957711	AF2-065 C	34.3133	50/50	34.3133
957712	AF2-065 E	32.9677	50/50	32.9677
958141	AF2-108	1.2553	50/50	1.2553
959641	AF2-255 C	-0.4011	Adder	-0.47
959651	AF2-256 C	0.5167	50/50	0.5167
959652	AF2-256 E	0.3445	50/50	0.3445
959661	AF2-257 C	0.5240	50/50	0.5240
959662	AF2-257 E	0.3494	50/50	0.3494
959671	AF2-258 C	0.4510	50/50	0.4510
959672	AF2-258 E	0.3007	50/50	0.3007
959681	AF2-259 C	1.8830	50/50	1.8830
959682	AF2-259 E	1.2553	50/50	1.2553
961611	AG1-000B C	39.9201	50/50	39.9201
961711	AG1-011	71.7664	50/50	71.7664
962271	AG1-075 C O1	9.6099	50/50	9.6099
962272	AG1-075 E O1	5.8566	50/50	5.8566
963221	AG1-171 C	5.3825	50/50	5.3825
963222	AG1-171 E	3.5883	50/50	3.5883
963231	AG1-172 C	5.3825	50/50	5.3825
963232	AG1-172 E	3.5883	50/50	3.5883
963241	AG1-173 C	5.3825	50/50	5.3825
963242	AG1-173 E	3.5883	50/50	3.5883
963251	AG1-174 C	5.3825	50/50	5.3825
963252	AG1-174 E	3.5883	50/50	3.5883
963261	AG1-175 C	5.3825	50/50	5.3825
963262	AG1-175 E	3.5883	50/50	3.5883
966731	AG1-544 C	5.4912	50/50	5.4912
966732	AG1-544 E	2.9460	50/50	2.9460
966741	AG1-545 C	1.8129	50/50	1.8129
966742	AG1-545 E	0.9719	50/50	0.9719
WEC	WEC	0.0554	Confirmed LTF	0.0554
LGEE	LGEE	0.1156	Confirmed LTF	0.1156
CPLE	CPLE	0.8463	Confirmed LTF	0.8463
CBM-W2	CBM-W2	2.8851	Confirmed LTF	2.8851
NY	NY	0.1587	Confirmed LTF	0.1587
TVA	TVA	0.5712	Confirmed LTF	0.5712
O-066	O-066	2.1536	Confirmed LTF	2.1536
SIGE	SIGE	0.0549	Confirmed LTF	0.0549
CBM-S2	CBM-S2	9.6674	Confirmed LTF	9.6674

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
CBM-S1	CBM-S1	0.1395	Confirmed LTF	0.1395
G-007	G-007	0.3370	Confirmed LTF	0.3370
MEC	MEC	0.3607	Confirmed LTF	0.3607
LAGN	LAGN	0.7105	Confirmed LTF	0.7105
CBM-W1	CBM-W1	2.2572	Confirmed LTF	2.2572

11.6.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
168685496	314303	6HOPEWLL	DVP	314287	6CHESTFB	DVP	1	DVP_P1-2: LN 228	single	449.32	171.82	172.94	DC	5.09

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
314421	6WINCHST	0.0650	80/20	0.0650
314507	3THOMPSN	0.1637	80/20	0.1637
315074	**1HOPCGN1 (Deactivation : 25/06/2019)**	**0.0566**	**80/20**	**0.0566**
315075	**1HOPCGN2 (Deactivation : 25/06/2019)**	**0.0566**	**80/20**	**0.0566**
315076	1HOPPOLC	4.7446	80/20	4.7446
315077	1HOPHCF1	7.4163	80/20	7.4163
315078	1HOPHCF2	7.4163	80/20	7.4163
315079	1HOPHCF3	7.4163	80/20	7.4163
315080	1HOPHCF4	11.2584	80/20	11.2584
315098	1CHESPKA	0.2164	80/20	0.2164
315099	**1CHESPKB (Deactivation : 31/05/2019)**	**1.5000**	**80/20**	**1.5000**
315110	1ELIZAR3	1.5591	80/20	1.5591
315116	1SURRY 1	32.2643	80/20	32.2643
315117	1GRAVELC	1.1307	80/20	1.1307
315119	1GRAVEL3	3.2776	80/20	3.2776
315120	1GRAVEL4	3.3196	80/20	3.3196
315121	1GRAVEL5	3.2776	80/20	3.2776
315122	1GRAVEL6	3.3158	80/20	3.3158
315260	1GOSPORTA	0.1726	80/20	0.1726
315261	1GOSPORTB	0.2205	80/20	0.2205
315262	1GOSPORTC	0.1871	80/20	0.1871
316033	AB2-134 C	4.3923	80/20	4.3923
316132	AB2-190 C	47.5362	80/20	47.5362
316150	**AD2-215 C (Withdrawn : 01/14/2021)**	**0.1554**	**80/20**	**0.1554**
316258	AE1-162 C	0.3500	80/20	0.3500
926661	AC1-147 C	0.1830	80/20	0.1830
927225	AC1-216 C	3.3527	80/20	3.3527
932044	AC2-012 C	5.2463	80/20	5.2463
934014	AD1-025 C	36.5251	80/20	36.5251
935111	AD1-144 C	0.1538	80/20	0.1538
935164	AD1-151 C	38.1987	80/20	38.1987
936041	AD2-007 C	1.7448	80/20	1.7448
936051	AD2-008 C	6.3589	80/20	6.3589
940251	**AE2-007 O1 (Withdrawn : 12/11/2020)**	**86.6486**	**80/20**	**86.6486**
940891	AE2-078 C	2.8954	80/20	2.8954
940901	AE2-079 C	2.8954	80/20	2.8954
941591	AE2-156 O1	9.1170	80/20	9.1170

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
942161	AE2-228 C	-1.5594	Adder	-1.83
942551	AE2-270	60.6255	80/20	60.6255
943621	AF1-033 C	2.8954	80/20	2.8954
946261	AF1-291 C	-1.5553	Adder	-1.83
957631	AF2-057	1.8408	80/20	1.8408
957711	AF2-065 C	30.9190	80/20	30.9190
959651	AF2-256 C	-0.3898	Adder	-0.46
961611	AG1-000B C	24.4189	80/20	24.4189
961711	AG1-011	62.0384	80/20	62.0384
962321	**AG1-081 C (Withdrawn : 01/15/2021)**	**2.6322**	**80/20**	**2.6322**
963221	AG1-171 C	5.0932	80/20	5.0932
963231	AG1-172 C	5.0932	80/20	5.0932
963241	AG1-173 C	5.0932	80/20	5.0932
963251	AG1-174 C	5.0932	80/20	5.0932
963261	AG1-175 C	5.0932	80/20	5.0932
965001	AG1-364 C O1	3.6524	80/20	3.6524
966611	AG1-531 C	5.8658	80/20	5.8658
CPLE	CPLE	0.6668	Confirmed LTF	0.6668
CBM-W2	CBM-W2	0.2061	Confirmed LTF	0.2061
NY	NY	0.3230	Confirmed LTF	0.3230
PRAIRIE	PRAIRIE	0.1007	Confirmed LTF	0.1007
TVA	TVA	0.1540	Confirmed LTF	0.1540
SIGE	SIGE	0.0541	Confirmed LTF	0.0541
CBM-S2	CBM-S2	6.7234	Confirmed LTF	6.7234
CBM-S1	CBM-S1	0.0258	Confirmed LTF	0.0258
GIBSON	GIBSON	0.0628	Confirmed LTF	0.0628
BLUEG	BLUEG	0.2187	Confirmed LTF	0.2187
TRIMBLE	TRIMBLE	0.0723	Confirmed LTF	0.0723
LAGN	LAGN	0.1890	Confirmed LTF	0.1890

11.7 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
AB2-134	Hopewell-Surry 230kV	In Service
AB2-160	Reams 115kV	Suspended
AB2-161	Waverly #2 DP 115kV	Suspended
AB2-190	Hopewell-Surry 230kV	Engineering and Procurement
AC1-147	Grassfield 34.5kV	Engineering and Procurement
AC1-216	Hopewell-Surry 230kV	Partially in Service - Under Construction
AC2-012	Grassfield-Great Bridge 115kV	Active
AC2-078	Disputanta-Waverly 115kV	Engineering and Procurement
AD1-025	Hopewell-Surry 230 kV	Active
AD1-082	Bakers Pond-Ivor 115kV	Engineering and Procurement
AD1-144	Kings Fork 34.5 kV	Partially in Service - Under Construction
AD1-151	Hopewell-Surry 230 kV	Active
AD2-007	Hopewell-Surry 230 kV	Active
AD2-008	Hopewell-Surry 230 kV	Active
AD2-215	Kings Fork 34.5 kV	Withdrawn
AE1-085	Bakers Pond-Bell Ave 115 kV	Active
AE1-149	Disputanta-Poe 115 kV	Active
AE1-162	Smithfield 34.5 kV	Engineering and Procurement
AE2-000B	N/A	N/A
AE2-007	Chesapeake 230 kV	Withdrawn
AE2-052	Disputanta-Poe 115 kV	Active
AE2-078	Poolesville 34.5 kV	Engineering and Procurement
AE2-079	Poolesville 34.5 kV	Engineering and Procurement
AE2-156	Yadkin 115 kV	Active
AE2-212	Harrowgate 34 kV	Active
AE2-227	Iron Bridge 34 kV	Engineering and Procurement
AE2-228	Tyler 34 kv	Engineering and Procurement
AE2-250	Purdy Sw.-Reams 115 kV	Active
AE2-270	Hopewell-Surry 230 kV	Active
AF1-033	Poolesville 34 kV	Engineering and Procurement
AF1-129	Chesterfield 230 kV	Active
AF1-291	Tyler 34.5 kV	Engineering and Procurement
AF2-057	Grassfield 34.5 kV	Active
AF2-065	Surry-Hopewell 230 kV	Active
AF2-108	Locks 34.5 kV	Active
AF2-255	Iron Bridge 34.5 kV	Engineering and Procurement
AF2-256	Tyler 34.5 kV	Engineering and Procurement
AF2-257	Tyler 34.5 kV	Active
AF2-258	Harrowgate 34.5 kV	Active

Queue Number	Project Name	Status
AF2-259	Locks 34.5 kV	Active
AG1-000B	N/A	N/A
AG1-011	Colonial Trial 230 kV	Active
AG1-075	Purdy-Sapony 115 kV	Active
AG1-081	Poolesville 34.5 kV	Withdrawn
AG1-171	Hopewell-Surry 230kV	Active
AG1-172	Hopewell-Surry 230 kV	Active
AG1-173	Hopewell-Surry 230 kV	Active
AG1-174	Hopewell-Surry 230 kV	Active
AG1-175	Hopewell-Surry 230 kV	Active
AG1-364	Deep Creek 115 kV	Active
AG1-531	Poolesville-Winchester 230 kV	Active
AG1-544	Bakers Pond DP 115 kV	Active
AG1-545	W. Quaker Rd-Disputanta 34.5 kV	Active

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
DVP_P1-2: LN 211	CONTINGENCY 'DVP_P1-2: LN 211' OPEN BRANCH FROM BUS 314287 TO BUS 314303 CKT 1 /* 6CHESTF B 230.00 - 6HOPEWLL 230.00 END
DVP_P1-2: LN 240-D	CONTINGENCY 'DVP_P1-2: LN 240-D' OPEN BRANCH FROM BUS 314538 TO BUS 961610 CKT 2 /* 6SURRY 230.00 - AG1-000B TAP 230.00 END
DVP_P1-2: LN 228	CONTINGENCY 'DVP_P1-2: LN 228' OPEN BRANCH FROM BUS 314286 TO BUS 314303 CKT 1 /* 6CHESTF A 230.00 - 6HOPEWLL 230.00 END
DVP_P1-2: LN 2197	CONTINGENCY 'DVP_P1-2: LN 2197' OPEN BRANCH FROM BUS 313896 TO BUS 314303 CKT 1 /* 6COLONIAL TR230.00 - 6HOPEWLL 230.00 END
DVP_P7-1: LN 212-240-D	CONTINGENCY 'DVP_P7-1: LN 212-240-D' /* . OPEN BRANCH FROM BUS 313896 TO BUS 314538 CKT 1 /* 6COLONIAL TR230.00 - 6SURRY 230.00 OPEN BRANCH FROM BUS 961610 TO BUS 314538 CKT 2 /* AG1-000B TAP 230.00 - 6SURRY 230.00 END
DVP_P7-1: LN 212-240-C	CONTINGENCY 'DVP_P7-1: LN 212-240-C' /* . OPEN BRANCH FROM BUS 313896 TO BUS 314538 CKT 1 /* 6COLONIAL TR230.00 - 6SURRY 230.00 OPEN BRANCH FROM BUS 961610 TO BUS 942550 CKT 2 /* AG1-000B TAP 230.00 - AE2-270 TAP 230.00 END
Base Case	
314303 6HOPEWLL 230 935160 AD1-151 TAP 230 2	CONTINGENCY '314303 6HOPEWLL 230 935160 AD1-151 TAP 230 2' OPEN BRANCH FROM BUS 314303 TO BUS 935160 CKT 2 END

Contingency Name	Contingency Definition
DVP_P2-2: BASIN B7	CONTINGENCY 'DVP_P2-2: BASIN B7' /* BASIN 230 KV OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHESTF B 230.00 OPEN BRANCH FROM BUS 314276 TO BUS 314339 CKT 1 /* 6BASIN 230.00 - 6SPRUNCE 230.00 OPEN BRANCH FROM BUS 314274 TO BUS 314276 CKT 2 /* 3BASIN 115.00 - 6BASIN 230.00 END

12 Short Circuit Analysis

The following Breakers are overdutied:

None.

12.1 System Reinforcements - Short Circuit

None.

13 Affected Systems

13.1 TVA

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

13.2 Duke Energy Progress

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

14 Attachment 1: One Line Diagram