Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-115

JETERSVILLE-PONTON 115 KV

15 MW Capacity / 25 MW Energy

July 2020

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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 an uprate to a planned Solar generating facility located in Amelia, Virginia. This project is an increase to the Interconnection Customer's AF1-294 project, which will share the same point of interconnection. The AF2-115 queue position is a 25 MW uprate (15 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 66 MW with 39.6 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is December 01, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-115
Project Name	JETERSVILLE-PONTON 115 KV
State	Virginia
County	Amelia
Transmission Owner	Dominion
MFO	66
MWE	25
MWC	15
Fuel	Solar
Basecase Study Year	2023

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

AF2-115 will interconnect with the Dominion transmission system as an uprate to AF1-294 which is tapping the Jetersville to Ponton 115 kV line.

5 Cost Summary

The physical interconnection work identified in the AF1-294 project reports is sufficient to support the additional generation proposed under the AF2-115 project.

The AF2-115 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$ 0
Total System Network Upgrade Costs	$ 48,528,000
Total Costs	**$ 48,528,000**

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 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.

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

6 Transmission Owner Scope of Work

Dominion assessed the impact of the proposed Queue Project AF2-115 was evaluated as a 15 MW Capacity (25.0 MW Energy) injection at the AF1-294 115 kV substation in the Dominion Transmission System, for compliance with NERC Reliability Criteria on Dominion Transmission System. The system was assessed using the summer 2023 AF2 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 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.

The physical interconnection work identified in the AF1-294 project reports is sufficient to support the additional generation proposed under the AF2-115 project.

7 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.

8 Transmission Owner Analysis

8.1 Power Flow Analysis

PJM performed a power flow analysis of the transmission system using a 2023 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 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.

10.1.1 Meteorological Data Reporting Requirements

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

- Back Panel temperature (Fahrenheit)
- Irradiance (Watts/meter2)
- Ambient air temperature (Fahrenheit) – (Accepted, not required)
- Wind speed (meters/second) – (Accepted, not required)
- Wind direction (decimal degrees from true north) – (Accepted, not required)

10.2 Interconnected Transmission Owner 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.

11 Summer Peak - Load Flow Analysis

The Queue Project AF2-115 was evaluated as a 25.0 MW (Capacity 15.0 MW) uprate to AF1-294 which is an injection tapping the Jetersville to Ponton 115 kV line in the Dominion area. Project AF2-115 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-115 was studied with a commercial probability of 53%. 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
97733461	314677	6BUCKING	230.0	DVP	314747	6BREMO	230.0	DVP	1	DVP_P4-2: 511T591	breaker	699.0	120.86	122.14	DC	10.08
97733462	314677	6BUCKING	230.0	DVP	314747	6BREMO	230.0	DVP	1	DVP_P4-2: 556T591	breaker	699.0	120.95	122.22	DC	10.08
105989328	314677	6BUCKING	230.0	DVP	314747	6BREMO	230.0	DVP	1	DVP_P4-2: 511T556-A	breaker	699.0	120.95	122.22	DC	10.08
106270498	314677	6BUCKING	230.0	DVP	314747	6BREMO	230.0	DVP	1	DVP_P1-2: LN 556-B	single	571.520019531	121.18	122.24	DC	6.04
106270499	314677	6BUCKING	230.0	DVP	314747	6BREMO	230.0	DVP	1	3149068CLOVER 500 314936 AF1-246 TAP 5001	single	571.520019531	119.02	120.07	DC	6.04
97733476	314692	6FARMVIL	230.0	DVP	314677	6BUCKING	230.0	DVP	1	DVP_P4-2: 511T591	breaker	684.0	119.37	120.68	DC	10.08
97733478	314692	6FARMVIL	230.0	DVP	314677	6BUCKING	230.0	DVP	1	DVP_P4-2: 556T591	breaker	684.0	119.46	120.77	DC	10.08
105989333	314692	6FARMVIL	230.0	DVP	314677	6BUCKING	230.0	DVP	1	DVP_P4-2: 511T556-A	breaker	684.0	119.46	120.77	DC	10.08
106270509	314692	6FARMVIL	230.0	DVP	314677	6BUCKING	230.0	DVP	1	DVP_P1-2: LN 556-B	single	559.299987793	120.4	121.48	DC	6.04
106270510	314692	6FARMVIL	230.0	DVP	314677	6BUCKING	230.0	DVP	1	3149068CLOVER 500 314936 AF1-246 TAP 5001	single	559.299987793	118.19	119.27	DC	6.04

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
96866982	314702	3KERR	115.0	DVP	304102	3GW KING TAP	115.0	CPLE	1	DVP_P4-2: 15832	breaker	199.0	115.77	116.81	DC	4.61
96866983	314702	3KERR	115.0	DVP	304102	3GW KING TAP	115.0	CPLE	1	DVP_P4-6: CAROLIN T122	breaker	199.0	119.7	120.38	DC	3.02
96867504	314702	3KERR	115.0	DVP	304102	3GW KING TAP	115.0	CPLE	1	DVP_P7-1: LN 22-90-A	tower	199.0	125.2	125.88	DC	2.99
96867505	314702	3KERR	115.0	DVP	304102	3GW KING TAP	115.0	CPLE	1	DVP_P7-1: LN 22-90-B	tower	199.0	115.17	115.84	DC	2.99

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
97942975	313867	6BREMODIST	230.0	DVP	313707	6FORK UNION	230.0	DVP	1	DVP_P1-2: LN 2027-B	operation	661.760009766	125.63	126.66	DC	6.75
106270495	314677	6BUCKING	230.0	DVP	314747	6BREMO	230.0	DVP	1	DVP_P1-2: LN 556-B	operation	571.520019531	144.94	146.51	DC	10.07
106270506	314692	6FARMVIL	230.0	DVP	314677	6BUCKING	230.0	DVP	1	DVP_P1-2: LN 556-B	operation	559.299987793	143.05	144.65	DC	10.07
97204531	314701	3LONEPN	115.0	DVP	314707	3MORAN	115.0	DVP	1	DVP_P1-2: LN 98-C	operation	203.979995728	105.69	117.94	DC	24.99
96867217	314702	3KERR	115.0	DVP	304102	3GW KING TAP	115.0	CPLE	1	DVP_P1-2: LN 1019	operation	199.0	102.69	103.25	DC	2.48
97204547	314707	3MORAN	115.0	DVP	314691	3FARMVIL	115.0	DVP	1	DVP_P1-2: LN 98-C	operation	203.979995728	103.48	115.74	DC	24.99
97942955	314747	6BREMO	230.0	DVP	313867	6BREMODIST	230.0	DVP	1	DVP_P1-2: LN 2027-B	operation	661.760009766	128.0	129.03	DC	6.75
97943174	933500	AC2-165 TAP	230.0	DVP	314333	6POWHATN	230.0	DVP	1	DVP_P1-2: LN 2028-A	operation	800.880004883	99.94	100.56	DC	4.92

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
105989333,97733478,9773346,106270510,106270509	2	6FARMVIL 230.0 kV - 6BUCKING 230.0 kV Ckt 1	DVP dom-035 (1101) : Rebuild 12.76 miles of 230 kV Line 298 from Buckingham to Farmville with 2-636 ACSR. Project Type : FAC Cost : $19,140,000 Time Estimate : 30-36 Months	$19,140,000
96867505,96867504,96866982,96866983	3	3KERR 115.0 kV - 3GW KING TAP 115.0 kV Ckt 1	CPLE NonPJMArea (923) : The external (i.e. Non-PJM) Transmission Owner, CPLE, will not evaluate this violation until the impact study phase. Project Type : FAC Cost : $0 Time Estimate : N/A Months DVP dom-002 (1068) : For DEV portion, rebuild 4.7 miles of 115 kV Line 45 from Kerr Dam to GW King Tap with 768 ACSS. Project Type : FAC Cost : $6,123,000 Time Estimate : 30-36 Months	$6,123,000
106270498,105989328,97733461,106270499,97733462	1	6BUCKING 230.0 kV - 6BREMO 230.0 kV Ckt 1	DVP dom-034 (1100) : Rebuild 15.51 miles of 230 kV Line 298 from Buckingham to Bremo with 2-636 ACSR. Project Type : FAC Cost : $23,265,000 Time Estimate : 30-36 Months	$23,265,000
			TOTAL COST	$48,528,000

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
106270498	314677	6BUCKING	DVP	314747	6BREMO	DVP	1	DVP_P1-2: LN 556-B	single	571.52	121.18	122.24	DC	6.04

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
313853	3PONTONDP	0.2224	80/20	0.2224
314429	3JTRSVLE	0.8894	80/20	0.8894
314572	3EMPORIA	0.0292	80/20	0.0292
314677	6BUCKING	1.6255	80/20	1.6255
314704	3LAWRENC	0.2186	80/20	0.2186
315126	1ROARAP2	0.5601	80/20	0.5601
315153	1CLOVER1	22.4165	80/20	22.4165
315154	1CLOVER2	22.1931	80/20	22.1931
315158	1KERR 1	0.4151	80/20	0.4151
315159	1KERR 2	1.1623	80/20	1.1623
315160	1KERR 3	1.1623	80/20	1.1623
315161	1KERR 4	1.1623	80/20	1.1623
315162	1KERR 5	1.1623	80/20	1.1623
315163	1KERR 6	1.1623	80/20	1.1623
315164	1KERR 7	1.1623	80/20	1.1623
315266	1PLYWOOD A	1.5007	80/20	1.5007
923572	AB1-173 C OP	0.8992	80/20	0.8992
923582	AB1-173AC OP	0.8992	80/20	0.8992
923911	AB2-031 C O1	0.8926	80/20	0.8926
923991	AB2-040 C O1	2.9308	80/20	2.9308
924021	AB2-043 C O1	0.7438	80/20	0.7438
924161	AB2-060 C OP	2.1939	80/20	2.1939
924301	**AB2-077 C O1 (Suspended)**	**2.6879**	**80/20**	**2.6879**
924311	**AB2-078 C O1 (Suspended)**	**2.6879**	**80/20**	**2.6879**
924321	**AB2-079 C O1 (Suspended)**	**2.6879**	**80/20**	**2.6879**
925171	AB2-174 C O1	0.4858	80/20	0.4858
925611	AC1-036 C	1.8344	80/20	1.8344
925781	AC1-054 C O1	6.0680	80/20	6.0680
925831	AC1-062	0.1320	80/20	0.1320
925991	AC1-075 C	4.9449	80/20	4.9449
926021	AC1-080 C	1.6526	80/20	1.6526
926271	**AC1-105 C O1 (Suspended)**	**6.7508**	**80/20**	**6.7508**
926451	AC1-116 C	-0.3870	Adder	-0.46
927251	AC1-221 C	1.6580	80/20	1.6580
927261	AC1-222 C	4.0540	80/20	4.0540
932511	AC2-071 C	9.2838	80/20	9.2838
932761	AC2-100 C	3.8156	80/20	3.8156
934311	AD1-055 C	2.8148	80/20	2.8148

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
934341	AD1-058 C	4.1563	80/20	4.1563
934611	AD1-087 C O1	12.0219	80/20	12.0219
934621	AD1-088 C	35.2545	80/20	35.2545
934991	AD1-131 C	1.3627	80/20	1.3627
935171	AD1-152 C O1	11.9472	80/20	11.9472
935221	AD1-157 C	3.8737	80/20	3.8737
936161	AD2-022 C O1	4.1538	80/20	4.1538
936171	AD2-023 C O1	2.4230	80/20	2.4230
936261	AD2-033 C	23.7814	80/20	23.7814
936361	AD2-046 C O1	9.3719	80/20	9.3719
936481	AD2-063 C O1	23.7816	80/20	23.7816
937481	AD2-202 C O1	3.1859	80/20	3.1859
938371	AE1-056 C	16.6999	80/20	16.6999
939181	AE1-148 C O1	9.3928	80/20	9.3928
940241	AE2-006	0.9333	80/20	0.9333
940661	AE2-053 O1	3.4788	80/20	3.4788
941791	AE2-182 C	5.7276	80/20	5.7276
942451	AE2-258	3.2168	80/20	3.2168
942461	AE2-259 C O1	30.4704	80/20	30.4704
942751	AE2-291 C O1	6.6384	80/20	6.6384
942761	AE2-292 C O1	8.2654	80/20	8.2654
943901	AF1-058 C	2.2854	80/20	2.2854
943911	AF1-059	15.6580	80/20	15.6580
945811	AF1-246 C O1	12.3619	80/20	12.3619
946281	AF1-292 C	0.6072	80/20	0.6072
946301	AF1-294 C	9.9099	80/20	9.9099
957481	AF2-042 C O1	88.2990	80/20	88.2990
958211	AF2-115 C	6.0426	80/20	6.0426
958801	AF2-171 C O1	36.0315	80/20	36.0315
959311	AF2-222 C	33.3260	80/20	33.3260
959751	AF2-266 O1	14.7175	80/20	14.7175
960061	AF2-297 C O1	9.1416	80/20	9.1416
960081	AF2-299 C	1.0235	80/20	1.0235
960811	AF2-372 C	1.6978	80/20	1.6978
960821	AF2-373 C	1.1751	80/20	1.1751
961081	AF2-399 C	0.7797	80/20	0.7797
WEC	WEC	0.2892	Confirmed LTF	0.2892
LGEE	LGEE	0.5465	Confirmed LTF	0.5465
CPLE	CPLE	3.4094	Confirmed LTF	3.4094
CBM-W2	CBM-W2	12.0639	Confirmed LTF	12.0639
NY	NY	0.3816	Confirmed LTF	0.3816
CBM-W1	CBM-W1	10.7461	Confirmed LTF	10.7461
TVA	TVA	2.5704	Confirmed LTF	2.5704
CBM-S2	CBM-S2	22.8483	Confirmed LTF	22.8483
CBM-S1	CBM-S1	14.2540	Confirmed LTF	14.2540
MADISON	MADISON	0.7620	Confirmed LTF	0.7620
MEC	MEC	1.7829	Confirmed LTF	1.7829
AA2-074	AA2-074	2.3229	LTF	2.3229

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
106270509	314692	6FARMVIL	DVP	314677	6BUCKING	DVP	1	DVP_P1-2: LN 556-B	single	559.3	120.4	121.48	DC	6.04

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
313853	3PONTONDP	0.2224	80/20	0.2224
314429	3JTRSVLE	0.8896	80/20	0.8896
314572	3EMPORIA	0.0293	80/20	0.0293
314704	3LAWRENC	0.2187	80/20	0.2187
315126	1ROARAP2	0.5607	80/20	0.5607
315153	1CLOVER1	22.4218	80/20	22.4218
315154	1CLOVER2	22.1984	80/20	22.1984
315158	1KERR 1	0.4153	80/20	0.4153
315159	1KERR 2	1.1628	80/20	1.1628
315160	1KERR 3	1.1628	80/20	1.1628
315161	1KERR 4	1.1628	80/20	1.1628
315162	1KERR 5	1.1628	80/20	1.1628
315163	1KERR 6	1.1628	80/20	1.1628
315164	1KERR 7	1.1628	80/20	1.1628
315266	1PLYWOOD A	1.5012	80/20	1.5012
923572	AB1-173 C OP	0.9002	80/20	0.9002
923582	AB1-173AC OP	0.9002	80/20	0.9002
923911	AB2-031 C O1	0.8935	80/20	0.8935
923991	AB2-040 C O1	2.9339	80/20	2.9339
924021	AB2-043 C O1	0.7440	80/20	0.7440
924161	AB2-060 C OP	2.1946	80/20	2.1946
924301	**AB2-077 C O1 (Suspended)**	**2.6887**	**80/20**	**2.6887**
924311	**AB2-078 C O1 (Suspended)**	**2.6887**	**80/20**	**2.6887**
924321	**AB2-079 C O1 (Suspended)**	**2.6887**	**80/20**	**2.6887**
925171	AB2-174 C O1	0.4863	80/20	0.4863
925611	AC1-036 C	1.8348	80/20	1.8348
925781	AC1-054 C O1	6.0711	80/20	6.0711
925831	AC1-062	0.1320	80/20	0.1320
925991	AC1-075 C	4.9476	80/20	4.9476
926021	AC1-080 C	1.6535	80/20	1.6535
926271	**AC1-105 C O1 (Suspended)**	**6.7531**	**80/20**	**6.7531**
926451	AC1-116 C	-0.3868	Adder	-0.46
927251	AC1-221 C	1.6590	80/20	1.6590
927261	AC1-222 C	4.0556	80/20	4.0556
932761	AC2-100 C	3.8180	80/20	3.8180
934311	AD1-055 C	2.8159	80/20	2.8159
934341	AD1-058 C	4.1589	80/20	4.1589
934611	AD1-087 C O1	12.0253	80/20	12.0253

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
934621	AD1-088 C	35.2595	80/20	35.2595
934991	AD1-131 C	1.3636	80/20	1.3636
935171	AD1-152 C O1	11.9506	80/20	11.9506
935221	AD1-157 C	3.8743	80/20	3.8743
936161	AD2-022 C O1	4.1580	80/20	4.1580
936171	AD2-023 C O1	2.4255	80/20	2.4255
936261	AD2-033 C	23.7869	80/20	23.7869
936361	AD2-046 C O1	9.3757	80/20	9.3757
936481	AD2-063 C O1	23.7879	80/20	23.7879
937481	AD2-202 C O1	3.1868	80/20	3.1868
938371	AE1-056 C	16.7026	80/20	16.7026
938561	AE1-075 C	-0.9128	Adder	-1.07
939181	AE1-148 C O1	9.3965	80/20	9.3965
940241	AE2-006	0.9335	80/20	0.9335
940661	AE2-053 O1	3.4802	80/20	3.4802
941791	AE2-182 C	5.7284	80/20	5.7284
942451	AE2-258	3.2178	80/20	3.2178
942461	AE2-259 C O1	30.4746	80/20	30.4746
942751	AE2-291 C O1	6.6426	80/20	6.6426
942761	AE2-292 C O1	8.2707	80/20	8.2707
943901	AF1-058 C	2.2862	80/20	2.2862
943911	AF1-059	15.6650	80/20	15.6650
945811	AF1-246 C O1	12.3648	80/20	12.3648
946281	AF1-292 C	0.6079	80/20	0.6079
946301	AF1-294 C	9.9116	80/20	9.9116
957481	AF2-042 C O1	88.3200	80/20	88.3200
958211	AF2-115 C	6.0437	80/20	6.0437
958801	AF2-171 C O1	36.0378	80/20	36.0378
959311	AF2-222 C	33.3330	80/20	33.3330
959751	AF2-266 O1	14.7210	80/20	14.7210
960061	AF2-297 C O1	9.1450	80/20	9.1450
960081	AF2-299 C	1.0245	80/20	1.0245
960811	AF2-372 C	1.6984	80/20	1.6984
960821	AF2-373 C	1.1755	80/20	1.1755
961081	AF2-399 C	0.7798	80/20	0.7798
WEC	WEC	0.2914	Confirmed LTF	0.2914
LGEE	LGEE	0.5505	Confirmed LTF	0.5505
CPLE	CPLE	3.4140	Confirmed LTF	3.4140
CBM-W2	CBM-W2	12.1212	Confirmed LTF	12.1212
NY	NY	0.3777	Confirmed LTF	0.3777
CBM-W1	CBM-W1	10.8337	Confirmed LTF	10.8337
TVA	TVA	2.5802	Confirmed LTF	2.5802
CBM-S2	CBM-S2	22.8888	Confirmed LTF	22.8888
CBM-S1	CBM-S1	14.3136	Confirmed LTF	14.3136
MADISON	MADISON	0.7620	Confirmed LTF	0.7620
MEC	MEC	1.7940	Confirmed LTF	1.7940
AA2-074	AA2-074	2.3261	LTF	2.3261

11.6.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
96867504	314702	3KERR	DVP	304102	3GW KING TAP	CPLE	1	DVP_P7-1: LN 22-90-A	tower	199.0	125.2	125.88	DC	2.99

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
315158	1KERR 1	0.9045	50/50	0.9045
315159	1KERR 2	2.5325	50/50	2.5325
315160	1KERR 3	2.5325	50/50	2.5325
315161	1KERR 4	2.5325	50/50	2.5325
315162	1KERR 5	2.5325	50/50	2.5325
315163	1KERR 6	2.5325	50/50	2.5325
315164	1KERR 7	2.5325	50/50	2.5325
924021	AB2-043 C O1	0.6344	50/50	0.6344
924022	AB2-043 E O1	3.2887	50/50	3.2887
924161	AB2-060 C OP	1.8032	50/50	1.8032
924162	AB2-060 E OP	4.9193	50/50	4.9193
924301	**AB2-077 C O1 (Suspended)**	**2.3771**	**50/50**	**2.3771**
924302	**AB2-077 E O1 (Suspended)**	**1.5847**	**50/50**	**1.5847**
924311	**AB2-078 C O1 (Suspended)**	**2.3771**	**50/50**	**2.3771**
924312	**AB2-078 E O1 (Suspended)**	**1.5847**	**50/50**	**1.5847**
924321	**AB2-079 C O1 (Suspended)**	**2.3771**	**50/50**	**2.3771**
924322	**AB2-079 E O1 (Suspended)**	**1.5847**	**50/50**	**1.5847**
925611	AC1-036 C	0.8793	50/50	0.8793
925612	AC1-036 E	1.4347	50/50	1.4347
925781	AC1-054 C O1	15.5554	50/50	15.5554
925782	AC1-054 E O1	7.1660	50/50	7.1660
926271	**AC1-105 C O1 (Suspended)**	**2.4430**	**Adder**	**2.87**
926272	**AC1-105 E O1 (Suspended)**	**1.2161**	**Adder**	**1.43**
935221	AD1-157 C	0.8226	Adder	0.97
935222	AD1-157 E	0.5484	Adder	0.65
936261	AD2-033 C	12.6017	50/50	12.6017
936262	AD2-033 E	8.4011	50/50	8.4011
936361	AD2-046 C O1	17.8275	50/50	17.8275
936362	AD2-046 E O1	8.1981	50/50	8.1981
936481	AD2-063 C O1	16.1154	50/50	16.1154
936482	AD2-063 E O1	10.6541	50/50	10.6541
938371	AE1-056 C	3.5463	Adder	4.17
938372	AE1-056 E	1.9377	Adder	2.28
939181	AE1-148 C O1	17.2082	50/50	17.2082

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
939182	AE1-148 E O1	11.4721	50/50	11.4721
940241	AE2-006	0.4474	50/50	0.4474
940661	AE2-053 O1	6.3734	50/50	6.3734
942451	AE2-258	2.7439	50/50	2.7439
942461	AE2-259 C O1	3.7842	Adder	4.45
942462	AE2-259 E O1	2.5228	Adder	2.97
943901	AF1-058 C	0.5680	Adder	0.67
943902	AF1-058 E	0.3787	Adder	0.45
943911	AF1-059	12.3260	50/50	12.3260
946301	AF1-294 C	2.4967	Adder	2.94
946302	AF1-294 E	1.6644	Adder	1.96
958211	AF2-115 C	0.8068	Adder	1.79
958212	AF2-115 E	0.5379	Adder	1.19
958801	AF2-171 C O1	10.8423	50/50	10.8423
958802	AF2-171 E O1	7.2282	50/50	7.2282
959311	AF2-222 C	14.9350	50/50	14.9350
959312	AF2-222 E	10.0065	50/50	10.0065
960061	AF2-297 C O1	1.2042	Adder	2.67
960062	AF2-297 E O1	0.8028	Adder	1.78
960811	AF2-372 C	1.5015	50/50	1.5015
960812	AF2-372 E	2.4504	50/50	2.4504
960821	AF2-373 C	0.2913	Adder	0.65
960822	AF2-373 E	0.4370	Adder	0.97
961081	AF2-399 C	0.2324	50/50	0.2324
961082	AF2-399 E	0.3930	50/50	0.3930
NEWTON	NEWTON	0.4481	Confirmed LTF	0.4481
FARMERCITY	FARMERCITY	0.0260	Confirmed LTF	0.0260
G-007A	G-007A	0.1726	Confirmed LTF	0.1726
VFT	VFT	0.4579	Confirmed LTF	0.4579
CALDERWOOD	CALDERWOOD	0.3713	Confirmed LTF	0.3713
PRAIRIE	PRAIRIE	1.2243	Confirmed LTF	1.2243
CHEOAH	CHEOAH	0.3814	Confirmed LTF	0.3814
EDWARDS	EDWARDS	0.1347	Confirmed LTF	0.1347
TILTON	TILTON	0.2375	Confirmed LTF	0.2375
GIBSON	GIBSON	0.2151	Confirmed LTF	0.2151
BLUEG	BLUEG	0.6597	Confirmed LTF	0.6597
TRIMBLE	TRIMBLE	0.2092	Confirmed LTF	0.2092
CATAWBA	CATAWBA	0.4193	Confirmed LTF	0.4193

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
AA2-074	CPLE-PJM	Confirmed
AB1-173	Brink-Trego 115kV	Engineering and Procurement
AB1-173A	Brink-Trego 115kV	Engineering and Procurement
AB2-031	Brink-Trego 115kV	Engineering and Procurement
AB2-040	Brink 115kV	Engineering and Procurement
AB2-043	Chase City 115kV	Under Construction
AB2-060	Chase City-Lunenburg 115kV	Under Construction
AB2-077	Buggs Island-Chase City 115kV	Suspended
AB2-078	Buggs Island-Chase City 115kV	Suspended
AB2-079	Buggs Island-Chase City 115kV	Suspended
AB2-174	Emporia-Trego 115kV	Under Construction
AC1-036	Twittys Creek 34.5kV	Engineering and Procurement
AC1-054	Kerr Dam–Eatons Ferry 115 kV	Engineering and Procurement
AC1-062	Jetersville 34.5kV	In Service
AC1-075	Perth-Hickory Grove 115kV	Engineering and Procurement
AC1-080	Perth-Hickory Grove 115kV	Engineering and Procurement
AC1-105	Halifax-Mt. Laurel 115kV	Suspended
AC1-116	Mount Eagle 34.5kV	Engineering and Procurement
AC1-221	Halifax-Person 230kV	Engineering and Procurement
AC1-222	Crystal Hill-Halifax 115kV	Engineering and Procurement
AC2-071	Buckingham 35kV	Engineering and Procurement
AC2-100	Halifax-Person 230kV	Active
AD1-055	Crystal Hill-Halifax 115 kV	Engineering and Procurement
AD1-058	Halifax-Person 230 kV	Engineering and Procurement
AD1-087	Clover-Sedge Hill 230 kV	Active
AD1-088	Briery-Clover 230 kV	Active
AD1-131	Sedge Hill-Person 230 kV	Active
AD1-152	Clover-Sedge Hill 230 kV	Active
AD1-157	South Creek 34.5 kV	Engineering and Procurement
AD2-022	East Danville-Roxborough 230 kV	Active
AD2-023	E. Danville-Roxborough 230 kV	Active
AD2-033	Chase City-Lunenburg 115 kV	Active
AD2-046	Boydton DP-Kerr Dam 115 kV	Active
AD2-063	Central-Chase City 115kV	Active
AD2-202	Clover-Sedge Hill 230kV	Active
AE1-056	Red House-South Creek 115 kV	Active
AE1-075	Powhatan 34.5 kV	Engineering and Procurement
AE1-148	Kerr Dam-Ridge Rd 115 kV	Active
AE2-006	Twittys Creek 34.5 kV	Engineering and Procurement

Queue Number	Project Name	Status
AE2-053	Kerr Dam-Ridge Road 115 kV	Active
AE2-182	Briery-Clover 230 kV	Active
AE2-258	Chase City 115 kV	Active
AE2-259	Curdsville-Willis Mtn 115 kV	Active
AE2-291	Grit DP-Perth 115 kV	Active
AE2-292	Grit DP-Perth 115 kV	Active
AF1-058	Welco 34.5 kV	Engineering and Procurement
AF1-059	Brodnax-South Hill 115 kV	Active
AF1-246	Clover-Rawlings 500 kV	Active
AF1-292	Fields Crossroads 34.5 kV	Active
AF1-294	Jetersville-Ponton 115 kV	Active
AF2-042	Clover 500 kV	Active
AF2-115	Jetersville-Ponton 115 kV	Active
AF2-171	Madisonville 115 kV	Active
AF2-222	Pamplin-Chase City 115 kV	Active
AF2-266	Clover 230 kV	Active
AF2-297	Sedge Hill 115 kV	Active
AF2-299	Fields 34.5 kV	Active
AF2-372	Black Branch 34.5 kV	Active
AF2-373	Mount Laurel 115 kV	Active
AF2-399	Crewe 12.5 kV	Active

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
DVP_P4-2: 15832	CONTINGENCY 'DVP_P4-2: 15832' /* FARMVILLE 115 KV OPEN BRANCH FROM BUS 314519 TO BUS 314701 CKT 1 /* 3LONEPINE_1 115.00 - 3LONEPN 115.00 OPEN BRANCH FROM BUS 314691 TO BUS 314707 CKT 1 /* 3FARMVIL 115.00 - 3MORAN 115.00 OPEN BRANCH FROM BUS 314701 TO BUS 314707 CKT 1 /* 3LONEPN 115.00 - 3MORAN 115.00 OPEN BUS 314519 /* ISLAND: 3LONEPINE_1 115.00 OPEN BUS 314707 /* ISLAND: 3MORAN 115.00 OPEN BUS 314691 /* 3FARMVIL 115.00 KV END

Contingency Name	Contingency Definition
DVP_P4-6: CAROLIN T122	CONTINGENCY 'DVP_P4-6: CAROLIN T122' /* CAROLINA 115 KV OPEN BRANCH FROM BUS 314559 TO BUS 315126 CKT 1 /* 3CAROLNA 115.00 - 1ROARAP2 14.400 OPEN BRANCH FROM BUS 314559 TO BUS 315128 CKT 1 /* 3CAROLNA 115.00 - 1ROARAP4 14.400 OPEN BUS 315126 /* ISLAND: 1ROARAP2 14.400 OPEN BUS 315128 /* ISLAND: 1ROARAP4 14.400 OPEN BRANCH FROM BUS 314559 TO BUS 314571 CKT 1 /* 3CAROLNA 115.00 - 3EATON F 115.00 OPEN BRANCH FROM BUS 313722 TO BUS 314559 CKT 1 /* 3OCCONEECHEE115.00 - 3CAROLNA 115.00 OPEN BRANCH FROM BUS 314259 TO BUS 314559 CKT Z1 /* 3CAROL56_1 115.00 - 3CAROLNA 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314578 CKT 1 /* 3CAROLNA 115.00 - 3HORNRTN 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314585 CKT 1 /* 3CAROLNA 115.00 - 3L GASTN 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314600 CKT 1 /* 3CAROLNA 115.00 - 3PLHITP 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 /* 3CAROLNA 115.00 - 6CAROLNA 230.00 OPEN BUS 314559 /* 3CAROLNA 115.00 KV END
314906 8CLOVER 500 314936 AF1-246 TAP 500 1	CONTINGENCY '314906 8CLOVER 500 314936 AF1-246 TAP 500 1' OPEN BRANCH FROM BUS 314906 TO BUS 945810 CKT 1 END
DVP_P1-2: LN 556-B	CONTINGENCY 'DVP_P1-2: LN 556-B' OPEN BRANCH FROM BUS 945810 TO BUS 314936 CKT 1 /* AF1-246 TAP 500.00 - 8RAWLINGS 500.00 END
DVP_P7-1: LN 22-90-A	CONTINGENCY 'DVP_P7-1: LN 22-90-A' OPEN BRANCH FROM BUS 314559 TO BUS 314571 CKT 1 /* 3CAROLNA 115.00 - 3EATON F 115.00 OPEN BRANCH FROM BUS 314571 TO BUS 925780 CKT 1 /* 3EATON F 115.00 - AC1-054 TAP 115.00 OPEN BUS 314571 /* ISLAND: 3EATON F 115.00 OPEN BRANCH FROM BUS 314265 TO BUS 314584 CKT 1 /* 3FIVEFORKSDP115.00 - 3LITTLTN 115.00 OPEN BRANCH FROM BUS 314265 TO BUS 314673 CKT 1 /* 3FIVEFORKSDP115.00 - 3PALMERSPRNG115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314585 CKT 1 /* 3CAROLNA 115.00 - 3L GASTN 115.00 OPEN BRANCH FROM BUS 314584 TO BUS 314585 CKT 1 /* 3LITTLTN 115.00 - 3L GASTN 115.00 OPEN BUS 314265 /* ISLAND: 3FIVEFORKSDP115.00 OPEN BUS 314584 /* ISLAND: 3LITTLTN 115.00 OPEN BUS 314585 /* ISLAND: 3L GASTN 115.00 END

Contingency Name	Contingency Definition
DVP_P4-2: 556T591	CONTINGENCY 'DVP_P4-2: 556T591' /* RAWLINGS 500 KV OPEN BRANCH FROM BUS 945810 TO BUS 314936 CKT 1 /* AF1-246 TAP 500.00 - 8RAWLINGS 500.00 OPEN BRANCH FROM BUS 314935 TO BUS 314936 CKT 1 /* 8HERITAGE 500.00 - 8RAWLINGS 500.00 END
DVP_P1-2: LN 98-C	CONTINGENCY 'DVP_P1-2: LN 98-C' OPEN BRANCH FROM BUS 924160 TO BUS 314267 CKT 1 /* AB2-060 TAP 115.00 - 3CHASCTY2 115.00 END
DVP_P7-1: LN 22-90-B	CONTINGENCY 'DVP_P7-1: LN 22-90-B' OPEN BRANCH FROM BUS 925780 TO BUS 314702 CKT 1 /* AC1-054 TAP 115.00 - 3KERR 115.00 OPEN BRANCH FROM BUS 314265 TO BUS 314584 CKT 1 /* 3FIVEFORKSDP115.00 - 3LITTLTN 115.00 OPEN BRANCH FROM BUS 314265 TO BUS 314673 CKT 1 /* 3FIVEFORKSDP115.00 - 3PALMERSPRNG115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314585 CKT 1 /* 3CAROLNA 115.00 - 3L GASTN 115.00 OPEN BRANCH FROM BUS 314584 TO BUS 314585 CKT 1 /* 3LITTLTN 115.00 - 3L GASTN 115.00 OPEN BUS 314265 /* ISLAND: 3FIVEFORKSDP115.00 OPEN BUS 314584 /* ISLAND: 3LITTLTN 115.00 OPEN BUS 314585 /* ISLAND: 3L GASTN 115.00 END
DVP_P1-2: LN 2027-B	CONTINGENCY 'DVP_P1-2: LN 2027-B' OPEN BRANCH FROM BUS 933500 TO BUS 314333 CKT 1 /* AC2-165 TAP 230.00 - 6POWHATN 230.00 OPEN BRANCH FROM BUS 314310 TO BUS 314322 CKT 1 /* 6JUDES F 230.00 - 6MDLTHAN 230.00 OPEN BRANCH FROM BUS 314310 TO BUS 314333 CKT 1 /* 6JUDES F 230.00 - 6POWHATN 230.00 OPEN BUS 314310 /* ISLAND: 6JUDES F 230.00 OPEN BUS 314333 /* ISLAND: 6POWHATN 230.00 OPEN BUS 923862 /* ISLAND: AB2-026 E 230.00 END
DVP_P1-2: LN 1019	CONTINGENCY 'DVP_P1-2: LN 1019' OPEN BRANCH FROM BUS 314673 TO BUS 314702 CKT 1 /* 3PALMERSPRNG115.00 - 3KERR 115.00 END

Contingency Name	Contingency Definition
DVP_P1-2: LN 2028-A	CONTINGENCY 'DVP_P1-2: LN 2028-A' OPEN BRANCH FROM BUS 961060 TO BUS 314765 CKT 1 /* AF2-397 TAP 230.00 - 6MTEAGLE 230.00 OPEN BRANCH FROM BUS 314749 TO BUS 314765 CKT 1 /* 6CHARLVL 230.00 - 6MTEAGLE 230.00 OPEN BUS 314765 /* ISLAND: 6MTEAGLE 230.00 OPEN BUS 926451 /* ISLAND: AC1-116 C 230.00 OPEN BUS 926452 /* ISLAND: AC1-116 E 230.00 END
DVP_P4-2: 511T556-A	CONTINGENCY 'DVP_P4-2: 511T556-A' /* RAWLINGS 500 KV OPEN BRANCH FROM BUS 940470 TO BUS 314936 CKT 1 /* AE2-031 TAP 500.00 - 8RAWLINGS 500.00 OPEN BRANCH FROM BUS 945810 TO BUS 314936 CKT 1 /* AF1-246 TAP 500.00 - 8RAWLINGS 500.00 END
DVP_P4-2: 511T591	CONTINGENCY 'DVP_P4-2: 511T591' /* RAWLINGS 500 KV OPEN BRANCH FROM BUS 940470 TO BUS 314936 CKT 1 /* AE2-031 TAP 500.00 - 8RAWLINGS 500.00 OPEN BRANCH FROM BUS 314935 TO BUS 314936 CKT 1 /* 8HERITAGE 500.00 - 8RAWLINGS 500.00 END

12 Short Circuit Analysis

Short circuit analysis will be provided in the System Impact Study report.

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).

Attachment 1: One Line Diagram