



**Generation Interconnection
Feasibility Study Report
for
Queue Project AF2-300
ST. JOHNS 115 KV
12 MW Capacity / 20 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 Caroline, Virginia. This project is an increase to the Interconnection Customer's AE2-231 project, which will share the same point of interconnection. The AF2-300 queue position is a 20 MW uprate (12 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 64 MW with 38.4 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is December 12, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-300
Project Name	ST. JOHNS 115 KV
State	Virginia
County	Caroline
Transmission Owner	Dominion
MFO	64
MWE	20
MWC	12
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

AF2-300 will interconnect with the Dominion transmission system as an uprate to AE2-231 which is an injection on the existing St. Johns 115 kV.

5 Cost Summary

The AF2-300 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$ 0
Total System Network Upgrade Costs	\$ 51,455,000
Total Costs	\$ 51,455,000

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 AF2-300 was evaluated as a 12 MW Capacity (20.0 MW Energy) injection at the St. Johns 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.

Physical interconnection facilities identified in the AE2-231 project studies are sufficient for the AF2-300 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 AF2-300 was evaluated as a 20.0 MW (Capacity 12.0 MW) uprate to AE2-231 which is an injection at the St. Johns 115 kV substation in the Dominion area. Project AF2-300 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-300 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/D C	MW IMPACT
98088188	314150	6STJOHN	230.0	DVP	939260	AE1-157 TAP	230.0	DVP	1	314222 6HANOVER 230 939750 AE1-206 TAP 230 1	single	1123.30004883	118.24	119.3	DC	11.94
98088189	314150	6STJOHN	230.0	DVP	939260	AE1-157 TAP	230.0	DVP	1	DVP_P1-2: LN 2032-B	single	1123.30004883	118.21	119.28	DC	11.94
97803447	314212	6FOUR RIVERS	230.0	DVP	939750	AE1-206 TAP	230.0	DVP	1	DVP_P4-2: 25672	breaker	1354.0	100.98	102.45	DC	19.89
98088290	314212	6FOUR RIVERS	230.0	DVP	939750	AE1-206 TAP	230.0	DVP	1	DVP_P1-2: LN 256-B	single	1123.30004883	106.9	107.96	DC	11.94
97803326	314222	6HANOVER	230.0	DVP	314218	6ELMONT	230.0	DVP	1	DVP_P4-2: 25672	breaker	1409.0	122.7	124.11	DC	19.89
98088021	314222	6HANOVER	230.0	DVP	314218	6ELMONT	230.0	DVP	1	DVP_P1-2: LN 256-B	single	1123.30004883	129.0	130.06	DC	11.94
98088028	314222	6HANOVER	230.0	DVP	314218	6ELMONT	230.0	DVP	1	314150 6STJOHN 230 939260 AE1-157 TAP 230 1	single	1123.30004883	112.04	113.1	DC	11.94
98087991	939260	AE1-157 TAP	230.0	DVP	314197	6LDYSMIT H CT	230.0	DVP	1	314222 6HANOVER 230 939750 AE1-206 TAP 230 1	single	1123.30004883	135.21	136.27	DC	11.94
98087992	939260	AE1-157 TAP	230.0	DVP	314197	6LDYSMIT H CT	230.0	DVP	1	DVP_P1-2: LN 2032-B	single	1123.30004883	135.19	136.25	DC	11.94
97803291	939750	AE1-206 TAP	230.0	DVP	314222	6HANOVER	230.0	DVP	1	DVP_P4-2: 25672	breaker	1354.0	132.83	134.3	DC	19.89
98087979	939750	AE1-206 TAP	230.0	DVP	314222	6HANOVER	230.0	DVP	1	DVP_P1-2: LN 256-B	single	1123.30004883	135.21	136.27	DC	11.94

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
980879 87	93975 0	AE1-206 TAP	230. 0	DVP	31422 2	6HANOVE R	230. 0	DVP	1	314150 6STJOHN 230 939260 AE1-157 TAP 230 1	single	1123.300048 83	118.24	119.3	DC	11.94

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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
980881 86	31415 0	6STJOHN	230. 0	DVP	93926 0	AE1-157 TAP	230. 0	DVP	1	314222 6HANOV ER 230 939750 AE1-206 TAP 230 1	operati on	1123.300048 83	133.44	135.21	DC	19.89
980881 92	31419 7	6LDYSMI TH CT	230. 0	DVP	31419 6	6LADYSMI TH	230. 0	DVP	1	314222 6HANOV ER 230 939750 AE1-206 TAP 230 1	operati on	1151.5	133.02	134.31	DC	14.79
980882 88	31421 2	6FOUR RIVERS	230. 0	DVP	93975 0	AE1-206 TAP	230. 0	DVP	1	DVP_P1- 2: LN 256-B	operati on	1123.300048 83	121.59	123.36	DC	19.89
980880 19	31422 2	6HANOV ER	230. 0	DVP	31421 8	6ELMONT	230. 0	DVP	1	DVP_P1- 2: LN 256-B	operati on	1123.300048 83	153.79	155.56	DC	19.89
980879 89	93926 0	AE1-157 TAP	230. 0	DVP	31419 7	6LDYSMIT H CT	230. 0	DVP	1	314222 6HANOV ER 230 939750 AE1-206 TAP 230 1	operati on	1123.300048 83	159.99	161.76	DC	19.89
980879 77	93975 0	AE1-206 TAP	230. 0	DVP	31422 2	6HANOVE R	230. 0	DVP	1	DVP_P1- 2: LN 256-B	operati on	1123.300048 83	159.99	161.76	DC	19.89

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
97803447,9808 8290	2	6FOUR RIVERS 230.0 kV - AE1- 206 TAP 230.0 kV Ckt 1	<u>DVP</u> dom-210 (1309) : Rebuild 2.4 miles of 230 kV Line 2032 from Four Rivers to AE1-206 Tap with 2-768 ACSS (@250 C). Replace Breaker, Wavetrap, Relay (Secondary CT) and Line Lead at Four River 230 kV. Replace Breaker at AE1-206 230 kV generation station. Project Type : FAC Cost : \$6,320,000 Time Estimate : 36-40 Months	\$6,320,000
98087991,9808 7992	4	AE1-157 TAP 230.0 kV - 6LDYSMITH CT 230.0 kV Ckt 1	<u>DVP</u> dom-252 (1351) : Wreck and rebuild 7.9 miles of existing single circuit line 256 between Ladysmith CT to AE1-157 Tap 230 kV. Add new circuit between Ladysmith CT to AE1-157 Tap 230 kV, constructed as a double circuit line. Utilize 2-636 ACSR for all new and modified circuits. Add two breakers at Ladysmith CT and a breaker at AE1-157 Station. Project Type : CON Cost : \$23,350,000 Time Estimate : 36-40 Months	\$23,350,000
98088188,9808 8189	1	6STJOHN 230.0 kV - AE1-157 TAP 230.0 kV Ckt 1	<u>DVP</u> dom-248 (1347) : Rebuild 4.45 miles of 230 kV Line 246 from St. John to AE1-157 Tap with 2-768.2 ACSS 250C. Replace Line Lead at St Johns 230 kV. Project Type : FAC Cost : \$11,125,000 Time Estimate : 30-36 Months	\$11,125,000
98088021,9808 8028,97803326	3	6HANOVER 230.0 kV - 6ELMONT 230.0 kV Ckt 1	<u>DVP</u> dom-250 (1349) : Rebuild 3.19 miles of 230 kV Line 2032 from Hanover to Elmont with 2-768.2 ACSS 250C. Replace Line Switch, Wavetrap and Relay (Secondary CT) at Elmont 230 kV. Project Type : FAC Cost : \$5,355,000 Time Estimate : 30-36 Months	\$5,355,000
98087979,9808 7987,97803291	5	AE1-206 TAP 230.0 kV - 6HANOVER 230.0 kV Ckt 1	<u>DVP</u> dom-253 (1352) : Rebuild 3.37 miles of 230 kV Line 2032 from AE1-206 Tap to Hanover with 2-768.2 ACSS 250C. Replace Line Switch at Hanover 230 kV Project Type : FAC Cost : \$5,305,000 Time Estimate : 30-36 Months	\$5,305,000
			TOTAL COST	\$51,455,000

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
98088189	314150	6STJOHN	DVP	939260	AE1-157 TAP	DVP	1	DVP_P1-2: LN 2032-B	single	1123.3	118.21	119.28	DC	11.94

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
315043	1FOUR RIVERA	16.6420	80/20	16.6420
315044	1FOUR RIVERB	16.6420	80/20	16.6420
315045	1FOUR RIVERC	20.4165	80/20	20.4165
315046	1FOUR RIVERD	16.6420	80/20	16.6420
315047	1FOUR RIVERE	16.6420	80/20	16.6420
315048	1FOUR RIVERF	20.4165	80/20	20.4165
315610	6AA1-145GAS	58.3329	80/20	58.3329
924061	AB2-050	3.4313	80/20	3.4313
926551	AC1-134	8.5784	80/20	8.5784
939751	AE1-206 C O1	170.0817	80/20	170.0817
942191	AE2-231 C O1	26.2582	80/20	26.2582
946001	AF1-265	149.1945	80/20	149.1945
957411	AF2-035 C	39.7852	80/20	39.7852
960091	AF2-300 C	11.9356	80/20	11.9356
NEWTON	NEWTON	0.5770	Confirmed LTF	0.5770
FARMERCITY	FARMERCITY	0.0301	Confirmed LTF	0.0301
CALDERWOOD	CALDERWOOD	0.2669	Confirmed LTF	0.2669
NY	NY	0.3003	Confirmed LTF	0.3003
PRAIRIE	PRAIRIE	1.3871	Confirmed LTF	1.3871
CHEOAH	CHEOAH	0.2688	Confirmed LTF	0.2688
EDWARDS	EDWARDS	0.1879	Confirmed LTF	0.1879
TILTON	TILTON	0.3383	Confirmed LTF	0.3383
GIBSON	GIBSON	0.2932	Confirmed LTF	0.2932
BLUEG	BLUEG	0.9322	Confirmed LTF	0.9322
TRIMBLE	TRIMBLE	0.2988	Confirmed LTF	0.2988
CATAWBA	CATAWBA	0.1879	Confirmed LTF	0.1879

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
98088290	314212	6FOUR RIVERS	DVP	939750	AE1-206 TAP	DVP	1	DVP_P1-2: LN 256-B	single	1123.3	106.9	107.96	DC	11.94

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
315043	1FOUR RIVERA	16.6420	80/20	16.6420
315044	1FOUR RIVERB	16.6420	80/20	16.6420
315045	1FOUR RIVERC	20.4165	80/20	20.4165
315046	1FOUR RIVERD	16.6420	80/20	16.6420
315047	1FOUR RIVERE	16.6420	80/20	16.6420
315048	1FOUR RIVERF	20.4165	80/20	20.4165
315610	6AA1-145GAS	58.3329	80/20	58.3329
924061	AB2-050	3.4313	80/20	3.4313
926551	AC1-134	8.5784	80/20	8.5784
939261	AE1-157 C O1	77.3822	80/20	77.3822
939271	AE1-158 C O1	78.9736	80/20	78.9736
942191	AE2-231 C O1	26.2582	80/20	26.2582
957411	AF2-035 C	39.7852	80/20	39.7852
957551	AF2-049 C	34.3147	80/20	34.3147
960091	AF2-300 C	11.9356	80/20	11.9356
NEWTON	NEWTON	0.5770	Confirmed LTF	0.5770
FARMERCITY	FARMERCITY	0.0301	Confirmed LTF	0.0301
CALDERWOOD	CALDERWOOD	0.2669	Confirmed LTF	0.2669
NY	NY	0.3003	Confirmed LTF	0.3003
PRAIRIE	PRAIRIE	1.3871	Confirmed LTF	1.3871
CHEOAH	CHEOAH	0.2688	Confirmed LTF	0.2688
EDWARDS	EDWARDS	0.1879	Confirmed LTF	0.1879
TILTON	TILTON	0.3383	Confirmed LTF	0.3383
GIBSON	GIBSON	0.2932	Confirmed LTF	0.2932
BLUEG	BLUEG	0.9322	Confirmed LTF	0.9322
TRIMBLE	TRIMBLE	0.2988	Confirmed LTF	0.2988
CATAWBA	CATAWBA	0.1879	Confirmed LTF	0.1879

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
98088021	314222	6HANOVER	DVP	314218	6ELMONT	DVP	1	DVP_P1-2: LN 256-B	single	1123.3	129.0	130.06	DC	11.94

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
315043	1FOUR RIVERA	16.6420	80/20	16.6420
315044	1FOUR RIVERB	16.6420	80/20	16.6420
315045	1FOUR RIVERC	20.4165	80/20	20.4165
315046	1FOUR RIVERD	16.6420	80/20	16.6420
315047	1FOUR RIVERE	16.6420	80/20	16.6420
315048	1FOUR RIVERF	20.4165	80/20	20.4165
315610	6AA1-145GAS	58.3329	80/20	58.3329
924061	AB2-050	3.4313	80/20	3.4313
926551	AC1-134	8.5784	80/20	8.5784
939261	AE1-157 C O1	77.3822	80/20	77.3822
939271	AE1-158 C O1	78.9736	80/20	78.9736
939751	AE1-206 C O1	170.0817	80/20	170.0817
942191	AE2-231 C O1	26.2582	80/20	26.2582
946001	AF1-265	149.1945	80/20	149.1945
957411	AF2-035 C	39.7852	80/20	39.7852
957551	AF2-049 C	34.3147	80/20	34.3147
960091	AF2-300 C	11.9356	80/20	11.9356
NEWTON	NEWTON	0.5770	Confirmed LTF	0.5770
FARMERCITY	FARMERCITY	0.0301	Confirmed LTF	0.0301
CALDERWOOD	CALDERWOOD	0.2669	Confirmed LTF	0.2669
NY	NY	0.3003	Confirmed LTF	0.3003
PRAIRIE	PRAIRIE	1.3871	Confirmed LTF	1.3871
CHEOAH	CHEOAH	0.2688	Confirmed LTF	0.2688
EDWARDS	EDWARDS	0.1879	Confirmed LTF	0.1879
TILTON	TILTON	0.3383	Confirmed LTF	0.3383
GIBSON	GIBSON	0.2932	Confirmed LTF	0.2932
BLUEG	BLUEG	0.9322	Confirmed LTF	0.9322
TRIMBLE	TRIMBLE	0.2988	Confirmed LTF	0.2988
CATAWBA	CATAWBA	0.1879	Confirmed LTF	0.1879

11.6.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
98087992	939260	AE1-157 TAP	DVP	314197	6LDYSMITH CT	DVP	1	DVP_P1-2: LN 2032-B	single	1123.3	135.19	136.25	DC	11.94

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
315043	1FOUR RIVERA	16.6420	80/20	16.6420
315044	1FOUR RIVERB	16.6420	80/20	16.6420
315045	1FOUR RIVERC	20.4165	80/20	20.4165
315046	1FOUR RIVERD	16.6420	80/20	16.6420
315047	1FOUR RIVERE	16.6420	80/20	16.6420
315048	1FOUR RIVERF	20.4165	80/20	20.4165
315610	6AA1-145GAS	58.3329	80/20	58.3329
924061	AB2-050	3.4313	80/20	3.4313
926551	AC1-134	8.5784	80/20	8.5784
939261	AE1-157 C O1	77.3822	80/20	77.3822
939271	AE1-158 C O1	78.9736	80/20	78.9736
939751	AE1-206 C O1	170.0817	80/20	170.0817
942191	AE2-231 C O1	26.2582	80/20	26.2582
946001	AF1-265	149.1945	80/20	149.1945
957411	AF2-035 C	39.7852	80/20	39.7852
957551	AF2-049 C	34.3147	80/20	34.3147
960091	AF2-300 C	11.9356	80/20	11.9356
NEWTON	NEWTON	0.5770	Confirmed LTF	0.5770
FARMERCITY	FARMERCITY	0.0301	Confirmed LTF	0.0301
CALDERWOOD	CALDERWOOD	0.2669	Confirmed LTF	0.2669
NY	NY	0.3003	Confirmed LTF	0.3003
PRAIRIE	PRAIRIE	1.3871	Confirmed LTF	1.3871
CHEOAH	CHEOAH	0.2688	Confirmed LTF	0.2688
EDWARDS	EDWARDS	0.1879	Confirmed LTF	0.1879
TILTON	TILTON	0.3383	Confirmed LTF	0.3383
GIBSON	GIBSON	0.2932	Confirmed LTF	0.2932
BLUEG	BLUEG	0.9322	Confirmed LTF	0.9322
TRIMBLE	TRIMBLE	0.2988	Confirmed LTF	0.2988
CATAWBA	CATAWBA	0.1879	Confirmed LTF	0.1879

11.6.5 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC/DC	MW IMPACT
98087979	939750	AE1-206 TAP	DVP	314222	6HANOVER	DVP	1	DVP_P1-2: LN 256-B	single	1123.3	135.21	136.27	DC	11.94

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
315043	1FOUR RIVERA	16.6420	80/20	16.6420
315044	1FOUR RIVERB	16.6420	80/20	16.6420
315045	1FOUR RIVERC	20.4165	80/20	20.4165
315046	1FOUR RIVERD	16.6420	80/20	16.6420
315047	1FOUR RIVERE	16.6420	80/20	16.6420
315048	1FOUR RIVERF	20.4165	80/20	20.4165
315610	6AA1-145GAS	58.3329	80/20	58.3329
924061	AB2-050	3.4313	80/20	3.4313
926551	AC1-134	8.5784	80/20	8.5784
939261	AE1-157 C O1	77.3822	80/20	77.3822
939271	AE1-158 C O1	78.9736	80/20	78.9736
939751	AE1-206 C O1	170.0817	80/20	170.0817
942191	AE2-231 C O1	26.2582	80/20	26.2582
946001	AF1-265	149.1945	80/20	149.1945
957411	AF2-035 C	39.7852	80/20	39.7852
957551	AF2-049 C	34.3147	80/20	34.3147
960091	AF2-300 C	11.9356	80/20	11.9356
NEWTON	NEWTON	0.5770	Confirmed LTF	0.5770
FARMERCITY	FARMERCITY	0.0301	Confirmed LTF	0.0301
CALDERWOOD	CALDERWOOD	0.2669	Confirmed LTF	0.2669
NY	NY	0.3003	Confirmed LTF	0.3003
PRAIRIE	PRAIRIE	1.3871	Confirmed LTF	1.3871
CHEOAH	CHEOAH	0.2688	Confirmed LTF	0.2688
EDWARDS	EDWARDS	0.1879	Confirmed LTF	0.1879
TILTON	TILTON	0.3383	Confirmed LTF	0.3383
GIBSON	GIBSON	0.2932	Confirmed LTF	0.2932
BLUEG	BLUEG	0.9322	Confirmed LTF	0.9322
TRIMBLE	TRIMBLE	0.2988	Confirmed LTF	0.2988
CATAWBA	CATAWBA	0.1879	Confirmed LTF	0.1879

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
AA1-145	Four Rivers 230kV	In Service
AB2-050	Four Rivers 230kV	In Service
AC1-134	Four Rivers 230kV	In Service
AE1-157	Ladysmith CT-St. Johns 230 kV	Active
AE1-158	Ladysmith CT-St. Johns 230 kV	Active
AE1-206	Four Rivers-Hanover 230 kV	Active
AE2-231	St. Johns 115 kV	Active
AF1-265	Four Rivers-Hanover 230 kV	Active
AF2-035	St. Johns 115 kV	Active
AF2-049	Ladysmith CT-St. Johns 230 kV	Active
AF2-300	St. Johns 115 kV	Active

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
DVP_P1-2: LN 2032-B	CONTINGENCY 'DVP_P1-2: LN 2032-B' OPEN BRANCH FROM BUS 939750 TO BUS 314222 CKT 1 /* AE1-206 TAP 230.00 - 6HANOVER 230.00 OPEN BRANCH FROM BUS 314218 TO BUS 314222 CKT 1 /* 6ELMONT 230.00 - 6HANOVER 230.00 OPEN BUS 314222 /* ISLAND: 6HANOVER 230.00 END

Contingency Name	Contingency Definition
DVP_P4-2: 25672	CONTINGENCY 'DVP_P4-2: 25672' /* LADYSMITH CT 230 KV OPEN BRANCH FROM BUS 939260 TO BUS 314197 CKT 1 /* AE1-157 TAP 230.00 - 6LDYSMITH CT230.00 OPEN BRANCH FROM BUS 314197 TO BUS 315039 CKT 1 /* 6LDYSMITH CT230.00 - 1LDYSMT3 18.000 OPEN BUS 315039 /* ISLAND: 1LDYSMT3 18.000 OPEN BRANCH FROM BUS 314197 TO BUS 315040 CKT 1 /* 6LDYSMITH CT230.00 - 1LDYSMT4 18.000 OPEN BUS 315040 /* ISLAND: 1LDYSMT4 18.000 OPEN BRANCH FROM BUS 314197 TO BUS 315041 CKT 1 /* 6LDYSMITH CT230.00 - 1LDYSMT5 18.000 OPEN BUS 315041 /* ISLAND: 1LDYSMT5 18.000 END
314150 6STJOHN 230 939260 AE1-157 TAP 230 1	CONTINGENCY '314150 6STJOHN 230 939260 AE1-157 TAP 230 1' OPEN BRANCH FROM BUS 314150 TO BUS 939260 CKT 1 END
314222 6HANOVER 230 939750 AE1-206 TAP 230 1	CONTINGENCY '314222 6HANOVER 230 939750 AE1-206 TAP 230 1' OPEN BRANCH FROM BUS 314222 TO BUS 939750 CKT 1 END
DVP_P1-2: LN 256-B	CONTINGENCY 'DVP_P1-2: LN 256-B' OPEN BRANCH FROM BUS 939260 TO BUS 314197 CKT 1 /* AE1-157 TAP 230.00 - 6LDYSMITH CT230.00 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).