



**Generation Interconnection
Feasibility Study Report
for
Queue Project AF2-403
SHOCKOE DP-CHATHAM 69 KV
8 MW Capacity / 0 MW Energy**

July 2020

Table of Contents

1	Introduction.....	4
2	Preface.....	4
3	General.....	4
4	Point of Interconnection.....	5
5	Cost Summary.....	5
6	Transmission Owner Scope of Work.....	6
7	Schedule.....	6
8	Transmission Owner Analysis.....	7
8.1	Power Flow Analysis.....	7
9	Interconnection Customer Requirements.....	7
9.1	System Protection.....	7
9.2	Compliance Issues and Interconnection Customer Requirements.....	7
9.3	Power Factor Requirements.....	8
10	Revenue Metering and SCADA Requirements.....	8
10.1	PJM Requirements.....	8
10.2	Interconnected Transmission Owner Requirements.....	8
11	Summer Peak - Load Flow Analysis.....	8
11.1	Generation Deliverability.....	9
11.2	Multiple Facility Contingency.....	9
11.3	Contribution to Previously Identified Overloads.....	9
11.4	Potential Congestion due to Local Energy Deliverability.....	9
11.5	System Reinforcements - Summer Peak Load Flow - Primary POI.....	11
11.6	Flow Gate Details.....	12
11.6.1	Index 1.....	13
11.6.2	Index 2.....	14
11.6.3	Index 3.....	16
11.6.4	Index 4.....	18
11.6.5	Index 5.....	20
11.7	Queue Dependencies.....	21
11.8	Contingency Descriptions.....	22
12	Short Circuit Analysis.....	24

13 Affected Systems24

 13.1 TVA.....24

 13.2 Duke Energy Progress.....24

Attachment 1: One Line Diagram.....25

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 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/storage generating facility located in Campbell, Virginia. This project is an increase to the Interconnection Customer's AE2-187 project, which will share the same point of interconnection. The AF2-403 queue position is a 0 MW uprate (8 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 60 MW with 44 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is December 15, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-403
Project Name	SHOCKOE DP-CHATHAM 69 KV
State	Virginia
County	Pittsylvania
Transmission Owner	Dominion
MFO	60
MWE	0
MWC	8
Fuel	Storage
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

AF2-403 will interconnect with the Dominion transmission system as an uprate to AE2-187 which taps the Shockoe DP - Chatham 69 kV line.

5 Cost Summary

The AF2-403 project will utilize the interconnection facilities being developed under the AE2-187 project.

The AF2-403 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$ 0
Total System Network Upgrade Costs	\$ 53,272,000
Total Costs	\$ 53,272,000

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 AF2-403 was evaluated as an 8 MW Capacity (0.0 MW Energy) injection at the new AE2-187 69 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.

Note that the ITO findings were made from a conceptual review of this project and 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.

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.

10.2 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 AF2-403 was evaluated as a 0 MW (Capacity 8.0 MW) uprate to AE2-187 which is a tap on the Shockoe DP - Chatham 69 kV line in the Dominion area. Project AF2-403 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-403 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)

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
97589302	314730	2STONE MIL	69.0	DVP	314670	2ALTVSTA	69.0	DVP	1	DVP_P1-2: LN 35-A	single	101.52	98.32	106.2	DC	8.0

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
95975769	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	Base Case	single	167.0	129.06	130.69	DC	2.73
95975770	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	DVP_P1-2: LN 1016-B	single	240.0	118.29	119.71	DC	3.4
95975752	242741	05OTTER	138.0	AEP	242687	05JOHNMT	138.0	AEP	1	Base Case	single	167.0	133.91	135.54	DC	2.73
95975753	242741	05OTTER	138.0	AEP	242687	05JOHNMT	138.0	AEP	1	DVP_P1-2: LN 1016-B	single	245.0	119.14	120.53	DC	3.4
95542229	314667	4ALTVSTA	138.0	DVP	242741	05OTTER	138.0	AEP	1	Base Case	single	167.0	136.54	138.18	DC	2.73
95542230	314667	4ALTVSTA	138.0	DVP	242741	05OTTER	138.0	AEP	1	DVP_P1-2: LN 1016-A	single	245.0	115.86	117.25	DC	3.4
97589341	314670	2ALTVSTA	69.0	DVP	314667	4ALTVSTA	138.0	DVP	1	Base Case	single	128.78	102.74	108.95	DC	8.0
97589300	314730	2STONE MIL	69.0	DVP	314670	2ALTVSTA	69.0	DVP	1	Base Case	single	101.52	130.33	138.21	DC	8.0

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/D C	MW IMPACT
95975764	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	Base Case	operation	167.0	166.6	168.23	DC	2.73
95975765	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	DVP_P1-2: LN 1016-B	operation	240.0	166.42	167.84	DC	3.4
95542332	242701	05LEESVI	138.0	AEP	314667	4ALTVSTA	138.0	DVP	1	Base Case	operation	205.0	115.6	119.25	DC	7.49
95542333	242701	05LEESVI	138.0	AEP	314667	4ALTVSTA	138.0	DVP	1	24254905BANSTR 138 940080 AE1-250 TAP 138 1	operation	284.0	112.35	114.74	DC	6.78
95542334	242701	05LEESVI	138.0	AEP	314667	4ALTVSTA	138.0	DVP	1	AEP_P1-2_#5366-A	operation	284.0	112.35	114.74	DC	6.78
95975930	242734	05NEWLDN	138.0	AEP	242569	05BRUSHT	138.0	AEP	1	AEP_P1-2_#5481	operation	205.0	103.38	104.48	DC	2.26
95975747	242741	05OTTER	138.0	AEP	242687	05JOHNMT	138.0	AEP	1	Base Case	operation	167.0	171.45	173.08	DC	2.73
95975748	242741	05OTTER	138.0	AEP	242687	05JOHNMT	138.0	AEP	1	DVP_P1-2: LN 1016-B	operation	245.0	166.29	167.68	DC	3.4
95975935	247499	05SMITHMT N2	138.0	AEP	242701	05LEESVI	138.0	AEP	1	24254905BANSTR 138 940080 AE1-250 TAP 138 1	operation	284.0	97.63	100.01	DC	6.78
97589605	314666	3ALTVSTA	115.0	DVP	314667	4ALTVSTA	138.0	DVP	1	DVP_P1-3: 4ALTVST A-TX#4	operation	126.524002075	100.28	104.35	DC	5.14
95542224	314667	4ALTVSTA	138.0	DVP	242741	05OTTER	138.0	AEP	1	Base Case	operation	167.0	174.08	175.72	DC	2.73
95542225	314667	4ALTVSTA	138.0	DVP	242741	05OTTER	138.0	AEP	1	DVP_P1-2: LN 1016-A	operation	245.0	162.11	163.49	DC	3.4
97589619	314667	4ALTVSTA	138.0	DVP	314666	3ALTVSTA	115.0	DVP	2	DVP_P1-3: 4ALTVST A-TX#3	operation	130.472000122	102.28	103.95	DC	2.19
97589338	314670	2ALTVSTA	69.0	DVP	314667	4ALTVSTA	138.0	DVP	1	Base Case	operation	128.779998779	193.35	199.57	DC	8.0
97589297	314730	2STONE MIL	69.0	DVP	314670	2ALTVSTA	69.0	DVP	1	Base Case	operation	101.519996643	245.27	253.15	DC	8.0
97589630	314733	2GRNA DP	69.0	DVP	314731	2GRETNA	69.0	DVP	1	Base Case	operation	111.86000061	93.6	100.75	DC	8.0
97589373	314735	2ALTAVISTA DP	69.0	DVP	314730	2STONE MIL	69.0	DVP	1	Base Case	operation	85.5400009155	154.55	163.9	DC	8.0
97589509	314736	2SHKO DP	69.0	DVP	314685	2CHTM TP	69.0	DVP	1	Base Case	operation	54.5200004578	115.92	130.59	DC	8.0
97589553	314739	2MT A TP	69.0	DVP	314735	2ALTAVISTA DP	69.0	DVP	1	Base Case	operation	123.13999939	113.45	119.94	DC	8.0
95542348	314861	3SKIMMER	115.0	DVP	242886	05SKIMMR	69.0	AEP	1	DVP_P1-3: 3SKIMMER-ID#2	operation	53.0	119.19	119.65	DC	0.54
95542352	314861	3SKIMMER	115.0	DVP	242886	05SKIMMR	69.0	AEP	2	DVP_P1-3: 3SKIMMER-ID#1	operation	53.0	118.3	118.75	DC	0.53

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
95542230,9554 2229	4	4ALTVSTA 138.0 kV - 05OTTER 138.0 kV Ckt 1	<p><u>AEP</u> AEPA0014a (228) : Rebuild / reconductor 0.9 miles of overhead conductor (ACSR ~ 397.5 ~ 30/7 ~ LARK) Project Type : FAC Cost : \$1,350,000 Time Estimate : 24-36 Months</p> <p>AEPA0014b (229) : Replace 795 AAC station conductors at Altavista Project Type : FAC Cost : \$100,000 Time Estimate : 12-18 Months</p> <p><u>DVP</u> dom-001 (1091) : Relay Change Outs (Secondary) at Altavista Substation Project Type : FAC Cost : \$120,000 Time Estimate : 6-12 Months</p>	\$1,570,000
95975753,9597 5752	3	05OTTER 138.0 kV - 05JOHNMT 138.0 kV Ckt 1	<p><u>AEP</u> AEPA0019a (241) : Replace JohnMt - Otter Line, ACSR ~ 397.5 ~ 30/7 ~ LARK Conductor Section 1, 7 Miles. \$10.5M Project Type : FAC Cost : \$10,500,000 Time Estimate : 24-36 Months</p> <p>AEPA0019b (242) : Replace 795 AAC station conductors at Otter Project Type : FAC Cost : \$10,670,000 Time Estimate : 18-24 Months</p>	\$21,170,000
97589302,9758 9300	1	2STONE MIL 69.0 kV - 2ALTVSTA 69.0 kV Ckt 1	<p><u>DVP</u> dom-111 (1201) : Rebuild 1.64 miles of 69 kV Line 35 from Stone Mill to Altavista with 768 ACSS. Project Type : FAC Cost : \$2,132,000 Time Estimate : 30-36 Months</p>	\$2,132,000

ID	Idx	Facility	Upgrade Description	Cost
95975769,95975770	2	05JOHNMT 138.0 kV - 05NEWLDN 138.0 kV Ckt 1	<u>AEP</u> AEPA0020a (244) : Current Station Rating: S/N: 167, S/E: 240 1) Rebuild/reconductor ACSR ~ 397.5 ~ 30/7 ~ LARK ~ Fe Clamps 9 d, Conductor Section 1, 14.43 miles Project Type : FAC Cost : \$21,650,000 Time Estimate : 12-18 Months AEPA0020b (245) : Replace 1200 A Wavetrap at New London Project Type : FAC Cost : \$50,000 Time Estimate : 24-36 Months AEPA0020c (246) : Replace 7 Sub cond 1590 AAC 61 Str. At New London Project Type : FAC Cost : \$700,000 Time Estimate : 12-18 months Months	\$22,400,000
97589341	5	2ALTVSTA 69.0 kV - 4ALTVSTA 138.0 kV Ckt 1	<u>DVP</u> dom-121 (1211) : Add additional 138/69 kV transformer at Altavista substation Project Type : CON Cost : \$6,000,000 Time Estimate : 16-18 Months	\$6,000,000
			TOTAL COST	\$53,272,000

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
97589300	314730	2STONE MIL	DVP	314670	2ALTVSTA	DVP	1	Base Case	single	101.52	130.33	138.21	DC	8.0

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
925661	AC1-042 C	15.9600	80/20	15.9600
926641	AC1-145 C	19.0000	80/20	19.0000
939941	AE1-230 C	7.2000	80/20	7.2000
941801	AE2-185 C	36.0000	80/20	36.0000
941821	AE2-187 C	36.0000	80/20	36.0000
942671	AE2-283 C	39.6000	80/20	39.6000
945081	AF1-173	13.9500	80/20	13.9500
961121	AF2-403	8.0000	80/20	8.0000

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
95975770	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	DVP_P1-2: LN 1016-B	single	240.0	118.29	119.71

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
925661	AC1-042 C	6.7868	80/20	6.7868
926641	AC1-145 C	8.0796	80/20	8.0796
939941	AE1-230 C	3.0617	80/20	3.0617
941801	AE2-185 C	15.3086	80/20	15.3086
941821	AE2-187 C	15.3086	80/20	15.3086
942671	AE2-283 C	16.8395	80/20	16.8395
945081	AF1-173	5.9321	80/20	5.9321
961121	AF2-403	3.4019	80/20	3.4019
315156	1HALLBR1	3.69	80/20	3.69
925991	AC1-075 C	15.636	80/20	15.636
926021	AC1-080 C	5.2256	80/20	5.2256
927261	AC1-222 C	9.3489	80/20	9.3489
934311	AD1-055 C	6.4912	80/20	6.4912
942751	AE2-291 C O1	24.9849	80/20	24.9849
942761	AE2-292 C O1	31.1086	80/20	31.1086
247284	05LEESVG	2.3575	80/20	2.3575
246843	05SMG1	1.5773	80/20	1.5773
246847	05SMG5	1.5773	80/20	1.5773
246844	05SMG2	4.1631	80/20	4.1631
246845	05SMG3	2.3629	80/20	2.3629
246846	05SMG4	4.1631	80/20	4.1631
919841	AA2-070	0.7651	80/20	0.7651
938451	AE1-064 C	8.4934	80/20	8.4934
926051	AC1-083 C O1	3.6689	80/20	3.6689
933941	AD1-017 C	0.7338	80/20	0.7338
940081	AE1-250 C	6.4206	80/20	6.4206
926521	AC1-123 C O1	3.2531	80/20	3.2531
939011	AE1-130 C	3.292	80/20	3.292
CPL	CPL	0.4048	Confirmed LTF	0.4048
CBM-S2	CBM-S2	2.312	Confirmed LTF	2.312
NY	NY	0.0415	Confirmed LTF	0.0415
TRIMBLE	TRIMBLE	0.0384	Confirmed LTF	0.0384
BLUEG	BLUEG	0.1163	Confirmed LTF	0.1163
TILTON	TILTON	0.0391	Confirmed LTF	0.0391
GIBSON	GIBSON	0.0317	Confirmed LTF	0.0317
EDWARDS	EDWARDS	0.0196	Confirmed LTF	0.0196
MADISON	MADISON	0.1048	Confirmed LTF	0.1048
TVA	TVA	0.07	Confirmed LTF	0.07
NEWTON	NEWTON	0.0494	Confirmed LTF	0.0494
CBM-S1	CBM-S1	0.2471	Confirmed LTF	0.2471
FARMERCITY	FARMERCITY	0.0013	Confirmed LTF	0.0013

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
PRAIRIE	PRAIRIE	0.0542	Confirmed LTF	0.0542
CBM-W2	CBM-W2	0.0819	Confirmed LTF	0.0819

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
95975752	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	Base Case	single	167.0	133.91	135.54	DC	2.73

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
246843	05SMG1	1.1678	80/20	1.1678
246844	05SMG2	3.0823	80/20	3.0823
246845	05SMG3	1.7494	80/20	1.7494
246846	05SMG4	3.0823	80/20	3.0823
246847	05SMG5	1.1678	80/20	1.1678
247284	05LEESVG	1.8553	80/20	1.8553
315156	1HALLBR1	2.7785	80/20	2.7785
315266	1PLYWOOD A	0.4352	80/20	0.4352
919841	AA2-070	0.5665	80/20	0.5665
925661	AC1-042 C	5.4443	80/20	5.4443
925991	AC1-075 C	6.7757	80/20	6.7757
926021	AC1-080 C	2.2644	80/20	2.2644
926051	AC1-083 C O1	2.7911	80/20	2.7911
926271	AC1-105 C O1 (Suspended)	1.8710	80/20	1.8710
926641	AC1-145 C	6.4813	80/20	6.4813
927261	AC1-222 C	1.9836	80/20	1.9836
933941	AD1-017 C	0.5582	80/20	0.5582
934311	AD1-055 C	1.3773	80/20	1.3773
938451	AE1-064 C	6.1559	80/20	6.1559
939941	AE1-230 C	2.4561	80/20	2.4561
940081	AE1-250 C	5.0616	80/20	5.0616
941801	AE2-185 C	12.2803	80/20	12.2803
941821	AE2-187 C	12.2803	80/20	12.2803
942671	AE2-283 C	13.5084	80/20	13.5084
942751	AE2-291 C O1	13.2076	80/20	13.2076
942761	AE2-292 C O1	16.4447	80/20	16.4447
943901	AF1-058 C	0.7358	80/20	0.7358
945081	AF1-173	4.7586	80/20	4.7586
960061	AF2-297 C O1	2.9434	80/20	2.9434
961121	AF2-403	2.7290	80/20	2.7290
NEWTON	NEWTON	0.2063	Confirmed LTF	0.2063
CPLE	CPLE	0.7998	Confirmed LTF	0.7998
FARMERCITY	FARMERCITY	0.0081	Confirmed LTF	0.0081
G-007A	G-007A	0.0096	Confirmed LTF	0.0096
VFT	VFT	0.0193	Confirmed LTF	0.0193
NY	NY	0.0144	Confirmed LTF	0.0144
PRAIRIE	PRAIRIE	0.3668	Confirmed LTF	0.3668
EDWARDS	EDWARDS	0.0721	Confirmed LTF	0.0721
CBM-S2	CBM-S2	4.2078	Confirmed LTF	4.2078
TILTON	TILTON	0.1392	Confirmed LTF	0.1392
MADISON	MADISON	0.2157	Confirmed LTF	0.2157

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
GIBSON	GIBSON	0.1179	Confirmed LTF	0.1179
BLUEG	BLUEG	0.4132	Confirmed LTF	0.4132
TRIMBLE	TRIMBLE	0.1347	Confirmed LTF	0.1347

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
95542229	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	Base Case	single	167.0	136.54	138.18	DC	2.73

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
246843	05SMG1	1.1678	80/20	1.1678
246844	05SMG2	3.0823	80/20	3.0823
246845	05SMG3	1.7494	80/20	1.7494
246846	05SMG4	3.0823	80/20	3.0823
246847	05SMG5	1.1678	80/20	1.1678
247284	05LEESVG	1.8553	80/20	1.8553
315156	1HALLBR1	2.7785	80/20	2.7785
315266	1PLYWOOD A	0.4352	80/20	0.4352
919841	AA2-070	0.5665	80/20	0.5665
925661	AC1-042 C	5.4443	80/20	5.4443
925991	AC1-075 C	6.7757	80/20	6.7757
926021	AC1-080 C	2.2644	80/20	2.2644
926051	AC1-083 C O1	2.7911	80/20	2.7911
926271	AC1-105 C O1 (Suspended)	1.8710	80/20	1.8710
926641	AC1-145 C	6.4813	80/20	6.4813
927261	AC1-222 C	1.9836	80/20	1.9836
933941	AD1-017 C	0.5582	80/20	0.5582
934311	AD1-055 C	1.3773	80/20	1.3773
938451	AE1-064 C	6.1559	80/20	6.1559
939941	AE1-230 C	2.4561	80/20	2.4561
940081	AE1-250 C	5.0616	80/20	5.0616
941801	AE2-185 C	12.2803	80/20	12.2803
941821	AE2-187 C	12.2803	80/20	12.2803
942671	AE2-283 C	13.5084	80/20	13.5084
942751	AE2-291 C O1	13.2076	80/20	13.2076
942761	AE2-292 C O1	16.4447	80/20	16.4447
943901	AF1-058 C	0.7358	80/20	0.7358
945081	AF1-173	4.7586	80/20	4.7586
960061	AF2-297 C O1	2.9434	80/20	2.9434
961121	AF2-403	2.7290	80/20	2.7290
NEWTON	NEWTON	0.2063	Confirmed LTF	0.2063
CPLE	CPLE	0.7998	Confirmed LTF	0.7998
FARMERCITY	FARMERCITY	0.0081	Confirmed LTF	0.0081
G-007A	G-007A	0.0096	Confirmed LTF	0.0096
VFT	VFT	0.0193	Confirmed LTF	0.0193
NY	NY	0.0144	Confirmed LTF	0.0144
PRAIRIE	PRAIRIE	0.3668	Confirmed LTF	0.3668
EDWARDS	EDWARDS	0.0721	Confirmed LTF	0.0721
CBM-S2	CBM-S2	4.2078	Confirmed LTF	4.2078
TILTON	TILTON	0.1392	Confirmed LTF	0.1392
MADISON	MADISON	0.2157	Confirmed LTF	0.2157

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
GIBSON	GIBSON	0.1179	Confirmed LTF	0.1179
BLUEG	BLUEG	0.4132	Confirmed LTF	0.4132
TRIMBLE	TRIMBLE	0.1347	Confirmed LTF	0.1347

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
97589341	314670	2ALTVSTA	DVP	314667	4ALTVSTA	DVP	1	Base Case	single	128.78	102.74	108.95	DC	8.0

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
925661	AC1-042 C	15.9600	80/20	15.9600
926641	AC1-145 C	19.0000	80/20	19.0000
939941	AE1-230 C	7.2000	80/20	7.2000
941801	AE2-185 C	36.0000	80/20	36.0000
941821	AE2-187 C	36.0000	80/20	36.0000
942671	AE2-283 C	39.6000	80/20	39.6000
945081	AF1-173	13.9500	80/20	13.9500
961121	AF2-403	8.0000	80/20	8.0000

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
AA2-070	Smith Mountain 138kV	In Service
AC1-042	Altavista-Mt. Airy 69kV	Engineering and Procurement
AC1-075	Perth-Hickory Grove 115kV	Engineering and Procurement
AC1-080	Perth-Hickory Grove 115kV	Engineering and Procurement
AC1-083	Smith Mountain-Bearskin 138kV	Active
AC1-105	Halifax-Mt. Laurel 115kV	Suspended
AC1-145	Gretna DP 69 kV	Engineering and Procurement
AC1-222	Crystal Hill-Halifax 115kV	Engineering and Procurement
AD1-017	Smith Mountain-Bearskin 138 kV	Active
AD1-055	Crystal Hill-Halifax 115 kV	Engineering and Procurement
AE1-064	Rockcastle 138 kV	Active
AE1-230	Shockoe 69 kV	Active
AE1-250	Smith Mountain-E. Danville 138 kV	Active
AE2-185	Gladys DP-Stonemill Switching Station 69 kV	Active
AE2-187	Shockoe DP-Chatham 69 kV	Active
AE2-283	Gladys-Stone Mill 69 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
AF1-173	Gretna DP-Shockoe DP 69 kV	Active
AF2-297	Sedge Hill 115 kV	Active
AF2-403	Shockoe DP-Chatham 69 kV	Active

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P1-2_#5366-A	CONTINGENCY 'AEP_P1-2_#5366-A' OPEN BRANCH FROM BUS 242549 TO BUS 940080 CKT 1 / 242549 05BANSTR 138 940080 AE1-250 TAP 138 1 OPEN BRANCH FROM BUS 242549 TO BUS 242632 CKT 1 / 242549 05BANSTR 138 242632 05EDAN 2 138 1 OPEN BRANCH FROM BUS 242549 TO BUS 314668 CKT Z1 / 242549 05BANSTR 138 314668 4BANISTR 138 Z1 END
DVP_P1-2: LN 35-A	CONTINGENCY 'DVP_P1-2: LN 35-A' OPEN BRANCH FROM BUS 314729 TO BUS 942670 CKT 1 /* 2GLADYS 69.000 - AE2- 283 TAP 69.000 END
DVP_P1-3: 3SKIMMER-ID#1	CONTINGENCY 'DVP_P1-3: 3SKIMMER-ID#1' OPEN BRANCH FROM BUS 242886 TO BUS 314861 CKT 1 /* 05SKIMMR 69.000 - 3SKIMMER 115.00 END
DVP_P1-3: 3SKIMMER-ID#2	CONTINGENCY 'DVP_P1-3: 3SKIMMER-ID#2' OPEN BRANCH FROM BUS 242886 TO BUS 314861 CKT 2 /* 05SKIMMR 69.000 - 3SKIMMER 115.00 END
242549 05BANSTR 138 940080 AE1-250 TAP 138 1	CONTINGENCY '242549 05BANSTR 138 940080 AE1-250 TAP 138 1' OPEN BRANCH FROM BUS 242549 TO BUS 940080 CKT 1 END

Contingency Name	Contingency Definition
AEP_P4_#10317_05REUSEN 138_D	CONTINGENCY 'AEP_P4_#10317_05REUSEN 138_D' OPEN BRANCH FROM BUS 242561 TO BUS 242641 CKT 1 / 242561 05BOONSBORO 138 242641 05FOREST 138 1 OPEN BRANCH FROM BUS 242561 TO BUS 242765 CKT 1 / 242561 05BOONSBORO 138 242765 05REUSEN 138 1 OPEN BRANCH FROM BUS 242591 TO BUS 242765 CKT 1 / 242591 05CENTRR 138 242765 05REUSEN 138 1 OPEN BRANCH FROM BUS 242641 TO BUS 242734 CKT 1 / 242641 05FOREST 138 242734 05NEWLDN 138 1 OPEN BRANCH FROM BUS 242719 TO BUS 242765 CKT 1 / 242719 05MONEL 138 242765 05REUSEN 138 1 OPEN BRANCH FROM BUS 242765 TO BUS 242882 CKT 4 / 242765 05REUSEN 138 242882 05REUSENS 69.0 4 OPEN BRANCH FROM BUS 242765 TO BUS 242889 CKT 1 / 242765 05REUSEN 138 242889 05REUSENS 34.5 1 REMOVE SWSHUNT FROM BUS 242765 / 242765 05REUSEN 138 OPEN BRANCH FROM BUS 242860 TO BUS 242882 CKT 1 / 242860 05ABERT 69.0 242882 05REUSENS 69.0 1 OPEN BRANCH FROM BUS 242876 TO BUS 242882 CKT 1 / 242876 05MONROE A 69.0 242882 05REUSENS 69.0 1 OPEN BRANCH FROM BUS 247360 TO BUS 242882 CKT 1 / 247360 05PEAKLANDSS69.0 242882 05REUSENS 69.0 1 REMOVE SWSHUNT FROM BUS 242882 / 242882 05REUSENS 69.0 OPEN BRANCH FROM BUS 247866 TO BUS 242889 CKT 1 / 247866 05GLAMORGNSS34.5 242889 05REUSENS 34.5 1 REMOVE UNIT 1 FROM BUS 242889 / 242889 05REUSENS 34.5 END
AEP_P1-2_#5481	CONTINGENCY 'AEP_P1-2_#5481' OPEN BRANCH FROM BUS 242561 TO BUS 242641 CKT 1 / 242561 05BOONSBORO 138 242641 05FOREST 138 1 OPEN BRANCH FROM BUS 242561 TO BUS 242765 CKT 1 / 242561 05BOONSBORO 138 242765 05REUSEN 138 1 OPEN BRANCH FROM BUS 242641 TO BUS 242734 CKT 1 / 242641 05FOREST 138 242734 05NEWLDN 138 1 END
Base Case	
DVP_P1-3: 4ALTVSTA-TX#4	CONTINGENCY 'DVP_P1-3: 4ALTVSTA-TX#4' OPEN BRANCH FROM BUS 314666 TO BUS 314667 CKT 2 /* 3ALTVSTA 115.00 - 4ALTVSTA 138.00 END
DVP_P4-2: 151T1016	CONTINGENCY 'DVP_P4-2: 151T1016' /* SEDGE HILL 115 KV OPEN BRANCH FROM BUS 313825 TO BUS 314696 CKT 1 /* 3PLYWOOD 115.00 - 3SEEDGE HILL 115.00 OPEN BRANCH FROM BUS 927260 TO BUS 314696 CKT 1 /* AC1-222 TAP 115.00 - 3SEEDGE HILL 115.00 END

Contingency Name	Contingency Definition
DVP_P1-2: LN 1016-A	CONTINGENCY 'DVP_P1-2: LN 1016-A' OPEN BRANCH FROM BUS 314688 TO BUS 927260 CKT 1 /* 3CRSTL HILL 115.00 - AC1-222 TAP 115.00 OPEN BRANCH FROM BUS 314688 TO BUS 314714 CKT 1 /* 3CRSTL HILL 115.00 - 3PERTH 115.00 OPEN BUS 314688 /* ISLAND: 3CRSTL HILL 115.00 END
DVP_P1-3: 4ALTVSTA-TX#3	CONTINGENCY 'DVP_P1-3: 4ALTVSTA-TX#3' OPEN BRANCH FROM BUS 314666 TO BUS 314667 CKT 1 /* 3ALTVSTA 115.00 - 4ALTVSTA 138.00 END
DVP_P1-2: LN 1016-B	CONTINGENCY 'DVP_P1-2: LN 1016-B' OPEN BRANCH FROM BUS 927260 TO BUS 314696 CKT 1 /* AC1-222 TAP 115.00 - 3SEEDGE HILL 115.00 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