# Generation Interconnection

# Feasibility Study Report

# for

# Queue Project AG1-532

# FIELDS 34.5 KV

# 8.1 MW Capacity / 13.5 MW Energy

January 2021

# Table of Contents

# 1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Dominion.

# 2 Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

## 3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Greensville County, Virginia. The installed facilities will have a total capability of 13.5 MW with 8.1 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 12, 2022. This study does not imply a TO commitment to this in-service date.

| Queue Number | AG1-532 |
|---|---|
| Project Name | FIELDS 34.5 KV |
| State | Virginia |
| County | Greensville |
| Transmission Owner | Dominion |
| MFO | 13.5 |
| MWE | 13.5 |
| MWC | 8.1 |
| Fuel | Solar |
| Basecase Study Year | 2024 |

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

## 4 Point of Interconnection

AG1-532 will interconnect with the Dominion transmission system at the Purdy SW 115 kV substation.

## 5 Cost Summary

The AG1-532 project will be responsible for the following costs:

| Description | Total Cost |
|---|---|
| **Total Physical Interconnection Costs** | $ To be provided in the two-party IA with ITO |
| **Total System Network Upgrade Costs** | $6,000,000[1] |
| **Total Costs** | $6,000,000 |

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 2016-36, 2016-25 I.R.B. (6/20/2016). If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

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

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

## 6 Transmission Owner Scope of Work

*Remote Terminal Work:* During the Facilities Study, ITO's System Protection Engineering Department will review transmission line protection as well as anti-islanding required to accommodate the new generation and interconnection substation. System Protection Engineering will determine the minimal acceptable protection requirements to reliably interconnect the proposed generating facility with the transmission system. The review is based on maintaining system reliability by reviewing ITO's protection requirements with the known transmission system configuration which includes generating facilities in the area. This review may determine that transmission line protection and communication upgrades are required at remote substations.

# 7 Transmission Owner Analysis

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

When performing a generation analysis, Dominion's main analysis includes load flow study results following a single contingency event for both normal and stressed system conditions. Dominion Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. A full listing of Dominion's Planning Criteria and interconnection requirements can be found in the Company's Facility Connection Requirements which are publicly available at: http://www.dominionenergy.com.

The results of these studies evaluate the system under a limited set of operating conditions and do not guarantee the full delivery of the capacity and associated energy of this proposed generation facility under all operating conditions. NERC Planning and Operating Reliability Criteria allow for the re-dispatch of generating units to resolve projected and actual deficiencies in real time and planning studies. Specifically, in Planning Studies, NERC Planning Event 3 and 6 Contingency Conditions (Loss of generator, transmission circuit, transformer, shunt device, or Single Pole of a DC line followed by the loss of a generator, transmission circuit, transformer, shunt device or single pole of a DC line) allow for re-dispatch of generating units to resolve potential reliability deficiencies. For Dominion Planning Criteria the re-dispatch of generating units for these contingency conditions is allowed as long as the projected loading does not exceed 100% of a facility Load Dump Rating.

## 7.1 Power Flow Analysis

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

# 8 Interconnection Customer Requirements

## 8.1 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.

## 8.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with Dominion's "Dominion's Facility Interconnection Requirements" document located at: https://www.dominionenergy.com/company/moving-energy/electric-transmission-access. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated protection device (circuit breaker, circuit switcher, fuse) to protect the IC's GSU transformer(s).
2. The purchase and installation of the minimum required Dominion generation interconnection relaying and control facilities as described in the System Protection section noted above. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.
3. The purchase and installation of supervisory control and data acquisition ("SCADA") equipment to provide information in a compatible format to the Dominion Transmission System Control Center.
4. Compliance with the Dominion and PJM generator power factor and voltage control requirements.

The GSU(s) associated with the IC queue request shall meet the grounding requirements as noted in Dominion's "Dominion's Facility Interconnection Requirements" document located at: https://www.dominionenergy.com/company/moving-energy/electric-transmission-access.

The IC will also be required to meet all PJM, SERC, and NERC reliability criteria and operating procedures for standards compliance. For example, the IC will need to properly locate and report the over and under voltage and over and under frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and SERC audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the Dominion system.

### 8.3 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.

## 9 Revenue Metering and SCADA Requirements

### 9.1 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.

### 9.2 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/meter$^2$)
- Ambient air temperature (Fahrenheit) - (Accepted, not required)
- Wind speed (meters/second) - (Accepted, not required)

- Wind direction (decimal degrees from true north) - (Accepted, not required)

## 9.3 Interconnected Transmission Owner Requirements

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

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

## 10 Summer Peak - Load Flow Analysis

The Queue Project AG1-532 was evaluated as a 13.5 MW (Capacity 8.1 MW) injection at the Purdy SW 115 kV substation in the Dominion area. Project AG1-532 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-532 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

## 10.1 Generation Deliverability

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

None

## 10.2 Multiple Facility Contingency

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

None

## 10.3 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **168575466** | 313725 | 6DRY BREAD | 230.0 | DVP | 314583 | 6LAKEVEW | 230.0 | DVP | 1 | 3144356SAPONY 230 940480 AE2-033 TAP 230 1 | single | 375.059997559 | 113.92 | 114.98 | DC | 4.0 |
| **168575467** | 313725 | 6DRY BREAD | 230.0 | DVP | 314583 | 6LAKEVEW | 230.0 | DVP | 1 | DVP_P1-2: LN 238-A | single | 375.059997559 | 113.92 | 114.98 | DC | 4.0 |
| **169067429** | 314562 | 3CLUBHSE | 115.0 | DVP | 314563 | 6CLUBHSE | 230.0 | DVP | 1 | DVP_P1-2: LN 2201 | single | 182.641998291 | 236.2 | 238.6 | DC | 4.38 |
| **169067430** | 314562 | 3CLUBHSE | 115.0 | DVP | 314563 | 6CLUBHSE | 230.0 | DVP | 1 | DVP_P1-2: LN 130 | single | 182.641998291 | 191.02 | 194.54 | DC | 6.44 |
| **169067431** | 314562 | 3CLUBHSE | 115.0 | DVP | 314563 | 6CLUBHSE | 230.0 | DVP | 1 | Base Case | single | 176.81401062 | 174.88 | 177.61 | DC | 4.82 |

## 10.4 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **168575464** | 313725 | 6DRY BREAD | 230.0 | DVP | 314583 | 6LAKEVEW | 230.0 | DVP | 1 | 3144356SAPONY 230 940480 AE2-033 TAP 230 1 | operation | 375.059997559 | 148.54 | 150.31 | DC | 6.66 |
| **168575465** | 313725 | 6DRY BREAD | 230.0 | DVP | 314583 | 6LAKEVEW | 230.0 | DVP | 1 | DVP_P1-2: LN 238-A | operation | 375.059997559 | 148.54 | 150.31 | DC | 6.66 |
| **169067427** | 314562 | 3CLUBHSE | 115.0 | DVP | 314563 | 6CLUBHSE | 230.0 | DVP | 1 | DVP_P1-2: LN 2201 | operation | 182.641998291 | 293.24 | 297.24 | DC | 7.3 |
| **169067428** | 314562 | 3CLUBHSE | 115.0 | DVP | 314563 | 6CLUBHSE | 230.0 | DVP | 1 | Base Case | operation | 176.814010602 | 234.29 | 238.83 | DC | 8.03 |
| **168575542** | 314563 | 6CLUBHSE | 230.0 | DVP | 313725 | 6DRY BREAD | 230.0 | DVP | 1 | 3144356SAPONY 230 940480 AE2-033 TAP 230 1 | operation | 375.059997559 | 132.24 | 134.02 | DC | 6.67 |

## 10.5 System Reinforcements - Summer Peak Load Flow - Primary POI

| ID | Idx | Facility | Upgrade Description | Cost |
|---|---|---|---|---|
| 168575467,168575466 | 1 | 6DRY BREAD 230.0 kV - 6LAKEVEW 230.0 kV Ckt 1 | DVP<br>b3121 (11) : PJM Baseline Upgrade b3121. Rebuild Clubhouse-Lakeview 230 kV Line #254 with single-circuit wood pole equivalent structures at the current 230 kV standard with a minimum rating of 1047 MVA. The baseline project has a projected in-service date of 12/31/2024.<br>Project Type : FAC<br>Cost : $0 | $0 |
| 169067431,169067430,169067429 | 2 | 3CLUBHSE 115.0 kV - 6CLUBHSE 230.0 kV Ckt 1 | DVP<br>n6114 (200) : Add additional 230/115 kV transformer at Clubhouse substation.<br>Project Type : CON<br>Cost : $6,000,000<br>Time Estimate : 16-18 Months | $6,000,000 |
| | | | TOTAL COST | $6,000,000[1] |

## 10.6 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".

### 10.6.1 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **168575467** | 313725 | 6DRY BREAD | DVP | 314583 | 6LAKEVEW | DVP | 1 | DVP_P1-2: LN 238-A | single | 375.06 | 113.92 | 114.98 | DC | 4.0 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **313506** | AB1-173 C OP | 12.0489 | 80/20 | 12.0489 |
| **313527** | AB2-043 C | 0.2911 | 80/20 | 0.2911 |
| **314429** | 3JTRSVLE | 0.1505 | 80/20 | 0.1505 |
| **314572** | 3EMPORIA | 1.0948 | 80/20 | 1.0948 |
| **314704** | 3LAWRENC | 0.6548 | 80/20 | 0.6548 |
| **315158** | 1KERR 1 | 0.1517 | 80/20 | 0.1517 |
| **315159** | 1KERR 2 | 0.4247 | 80/20 | 0.4247 |
| **315160** | 1KERR 3 | 0.4247 | 80/20 | 0.4247 |
| **315161** | 1KERR 4 | 0.4247 | 80/20 | 0.4247 |
| **315162** | 1KERR 5 | 0.4247 | 80/20 | 0.4247 |
| **315163** | 1KERR 6 | 0.4247 | 80/20 | 0.4247 |
| **315164** | 1KERR 7 | 0.4247 | 80/20 | 0.4247 |
| **316087** | AB2-174 C | 2.3145 | 80/20 | 2.3145 |
| **316096** | AB2-100 C1 | 4.0768 | 80/20 | 4.0768 |
| **316098** | AB2-100 C2 | 4.0768 | 80/20 | 4.0768 |
| **316129** | AC1-054 C | 2.5570 | 80/20 | 2.5570 |
| **316131** | AB2-060 C | 0.8247 | 80/20 | 0.8247 |
| **923991** | AB2-040 C O1 | 13.1226 | 80/20 | 13.1226 |
| **924301** | **AB2-077 C O1 (Suspended)** | **1.1296** | **80/20** | **1.1296** |
| **924311** | **AB2-078 C O1 (Suspended)** | **1.1296** | **80/20** | **1.1296** |
| **924321** | **AB2-079 C O1 (Suspended)** | **1.1296** | **80/20** | **1.1296** |
| **925611** | AC1-036 C | 0.1047 | 80/20 | 0.1047 |
| **935221** | AD1-157 C | 0.0759 | 80/20 | 0.0759 |
| **936265** | AD2-033 C | 6.3203 | 80/20 | 6.3203 |
| **936361** | AD2-046 C O1 | 3.8168 | 80/20 | 3.8168 |
| **936485** | AD2-063 C | 8.0766 | 80/20 | 8.0766 |
| **938371** | AE1-056 C | 2.0731 | 80/20 | 2.0731 |
| **939181** | AE1-148 C | 3.8205 | 80/20 | 3.8205 |
| **940481** | AE2-033 C | 67.1808 | 80/20 | 67.1808 |
| **940661** | AE2-053 O1 | 1.4150 | 80/20 | 1.4150 |
| **942451** | AE2-258 | 1.3766 | 80/20 | 1.3766 |
| **942471** | AE2-260 C O1 | 62.4253 | 80/20 | 62.4253 |
| **943911** | AF1-059 | 27.2641 | 80/20 | 27.2641 |
| **946011** | AF1-266 | 56.2356 | 80/20 | 56.2356 |
| **946281** | AF1-292 C | 4.3932 | 80/20 | 4.3932 |
| **946301** | AF1-294 C | 1.5201 | 80/20 | 1.5201 |
| **958211** | AF2-115 C | 0.8942 | 80/20 | 0.8942 |
| **958801** | AF2-171 C | 5.4000 | 80/20 | 5.4000 |
| **959311** | AF2-222 C | 7.4660 | 80/20 | 7.4660 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **960081** | AF2-299 C | 7.4043 | 80/20 | 7.4043 |
| **961791** | AG1-021 C | 0.7153 | 80/20 | 0.7153 |
| **961891** | AG1-030 C | 5.9139 | 80/20 | 5.9139 |
| **962041** | AG1-048 C | 4.4708 | 80/20 | 4.4708 |
| **963171** | AG1-166 C | 0.7153 | 80/20 | 0.7153 |
| **963181** | AG1-167 C | 0.7153 | 80/20 | 0.7153 |
| **963191** | AG1-168 C | 0.7153 | 80/20 | 0.7153 |
| **963201** | AG1-169 C | 0.7153 | 80/20 | 0.7153 |
| **963211** | AG1-170 C | 0.7153 | 80/20 | 0.7153 |
| **963301** | AG1-179 C | 11.5730 | 80/20 | 11.5730 |
| **963311** | AG1-180 | 5.6386 | 80/20 | 5.6386 |
| **963321** | AG1-181 C O1 | 8.1014 | 80/20 | 8.1014 |
| **963361** | AG1-185 O1 | 3.9196 | 80/20 | 3.9196 |
| **963641** | AG1-215 C | 0.3338 | 80/20 | 0.3338 |
| **964111** | AG1-272 C | 1.1898 | 80/20 | 1.1898 |
| **964121** | AG1-273 C | 1.1898 | 80/20 | 1.1898 |
| **964131** | AG1-274 C | 1.1898 | 80/20 | 1.1898 |
| **964241** | AG1-285 C O1 | 6.9023 | 80/20 | 6.9023 |
| **964791** | AG1-342 C | 1.3915 | 80/20 | 1.3915 |
| **964821** | AG1-345 C | 0.2871 | 80/20 | 0.2871 |
| **965191** | AG1-384 C | 1.1898 | 80/20 | 1.1898 |
| **965281** | AG1-393 C | 0.7153 | 80/20 | 0.7153 |
| **965451** | AG1-413 C O1 | 11.4608 | 80/20 | 11.4608 |
| **965591** | AG1-427 C | 6.5163 | 80/20 | 6.5163 |
| **965601** | AG1-428 C O1 | 9.6613 | 80/20 | 9.6613 |
| **965721** | AG1-440 C | 2.7747 | 80/20 | 2.7747 |
| **965731** | AG1-441 C | 2.7747 | 80/20 | 2.7747 |
| **965771** | AG1-445 | 1.6032 | 80/20 | 1.6032 |
| **965781** | AG1-446 | 1.6032 | 80/20 | 1.6032 |
| **966621** | AG1-532 C | 3.9983 | 80/20 | 3.9983 |
| **966751** | AG1-546 C | 5.5243 | 80/20 | 5.5243 |
| **CALDERWOOD** | CALDERWOOD | 0.0626 | Confirmed LTF | 0.0626 |
| **NY** | NY | 0.0160 | Confirmed LTF | 0.0160 |
| **PRAIRIE** | PRAIRIE | 0.1963 | Confirmed LTF | 0.1963 |
| **CHEOAH** | CHEOAH | 0.0646 | Confirmed LTF | 0.0646 |
| **COTTONWOOD** | COTTONWOOD | 0.2373 | Confirmed LTF | 0.2373 |
| **HAMLET** | HAMLET | 0.1923 | Confirmed LTF | 0.1923 |
| **GIBSON** | GIBSON | 0.0317 | Confirmed LTF | 0.0317 |
| **BLUEG** | BLUEG | 0.0920 | Confirmed LTF | 0.0920 |
| **TRIMBLE** | TRIMBLE | 0.0295 | Confirmed LTF | 0.0295 |
| **CATAWBA** | CATAWBA | 0.0753 | Confirmed LTF | 0.0753 |

### 10.6.2 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **169067429** | 314562 | 3CLUBHSE | DVP | 314563 | 6CLUBHSE | DVP | 1 | DVP_P1-2: LN 2201 | single | 182.64 | 236.2 | 238.6 | DC | 4.38 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **313506** | AB1-173 C OP | 14.9250 | 80/20 | 14.9250 |
| **313527** | AB2-043 C | 0.3856 | 80/20 | 0.3856 |
| **313719** | 3CHESTNUT | 0.5206 | 80/20 | 0.5206 |
| **314429** | 3JTRSVLE | 0.1956 | 80/20 | 0.1956 |
| **314572** | 3EMPORIA | 1.2299 | 80/20 | 1.2299 |
| **314582** | 3KELFORD | 0.1483 | 80/20 | 0.1483 |
| **314589** | 3MURPHYS | 0.0389 | 80/20 | 0.0389 |
| **314623** | 3WITAKRS | 0.0846 | 80/20 | 0.0846 |
| **314704** | 3LAWRENC | 0.7289 | 80/20 | 0.7289 |
| **315115** | 1S HAMPT1 | 0.4811 | 80/20 | 0.4811 |
| **315126** | 1ROARAP2 | 1.1971 | 80/20 | 1.1971 |
| **315128** | 1ROARAP4 | 1.1424 | 80/20 | 1.1424 |
| **315136** | 1ROSEMG1 | 0.9301 | 80/20 | 0.9301 |
| **315137** | 1ROSEMS1 | 0.5767 | 80/20 | 0.5767 |
| **315138** | 1ROSEMG2 | 0.4359 | 80/20 | 0.4359 |
| **315139** | 1GASTONA | 1.4047 | 80/20 | 1.4047 |
| **315141** | 1GASTONB | 1.4047 | 80/20 | 1.4047 |
| **315158** | 1KERR 1 | 0.2620 | 80/20 | 0.2620 |
| **315159** | 1KERR 2 | 0.7337 | 80/20 | 0.7337 |
| **315160** | 1KERR 3 | 0.7337 | 80/20 | 0.7337 |
| **315161** | 1KERR 4 | 0.7337 | 80/20 | 0.7337 |
| **315162** | 1KERR 5 | 0.7337 | 80/20 | 0.7337 |
| **315163** | 1KERR 6 | 0.7337 | 80/20 | 0.7337 |
| **315164** | 1KERR 7 | 0.7337 | 80/20 | 0.7337 |
| **315266** | 1PLYWOOD A | 0.3917 | 80/20 | 0.3917 |
| **315606** | 3AA2-053SOLA | 1.1660 | 80/20 | 1.1660 |
| **315607** | 3AA1-063SOLA | 0.9971 | 80/20 | 0.9971 |
| **315608** | 3AA2-088SOLA | 0.4761 | 80/20 | 0.4761 |
| **316020** | AB2-059 C OP | 0.5459 | 80/20 | 0.5459 |
| **316087** | AB2-174 C | 2.7447 | 80/20 | 2.7447 |
| **316096** | AB2-100 C1 | 0.4277 | 80/20 | 0.4277 |
| **316098** | AB2-100 C2 | 0.4277 | 80/20 | 0.4277 |
| **316103** | AB2-015 C | 2.5605 | 80/20 | 2.5605 |
| **316118** | AC1-105 C | 2.0148 | 80/20 | 2.0148 |
| **316129** | AC1-054 C | 5.7187 | 80/20 | 5.7187 |
| **316131** | AB2-060 C | 1.0922 | 80/20 | 1.0922 |
| **316140** | **AB2-099 C (Suspended)** | **0.2281** | **80/20** | **0.2281** |
| **920591** | AA2-165 C | 0.0699 | 80/20 | 0.0699 |
| **922922** | AB1-081 C OP | 0.4632 | 80/20 | 0.4632 |
| **923991** | AB2-040 C O1 | 16.2549 | 80/20 | 16.2549 |
| **924301** | **AB2-077 C O1 (Suspended)** | **1.5130** | **80/20** | **1.5130** |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| 924311 | AB2-078 C O1 (Suspended) | 1.5130 | 80/20 | 1.5130 |
| 924321 | AB2-079 C O1 (Suspended) | 1.5130 | 80/20 | 1.5130 |
| 925591 | AC1-034 C | 2.2414 | 80/20 | 2.2414 |
| 925611 | AC1-036 C | 0.1376 | 80/20 | 0.1376 |
| 926070 | AC1-086 C | 10.0123 | 80/20 | 10.0123 |
| 926201 | AC1-098 C | 3.1031 | 80/20 | 3.1031 |
| 926211 | AC1-099 C | 1.0399 | 80/20 | 1.0399 |
| 927145 | AC1-208 C | 5.2586 | 80/20 | 5.2586 |
| 932631 | AC2-084 C | 4.4236 | 80/20 | 4.4236 |
| 934331 | AD1-057 C O1 | 3.8417 | 80/20 | 3.8417 |
| 935221 | AD1-157 C | 0.0980 | 80/20 | 0.0980 |
| 936265 | AD2-033 C | 8.3234 | 80/20 | 8.3234 |
| 936361 | AD2-046 C O1 | 6.2368 | 80/20 | 6.2368 |
| 936485 | AD2-063 C | 10.6713 | 80/20 | 10.6713 |
| 938371 | AE1-056 C | 2.6788 | 80/20 | 2.6788 |
| 939181 | AE1-148 C | 6.1781 | 80/20 | 6.1781 |
| 940571 | AE2-044 C | 1.4680 | 80/20 | 1.4680 |
| 940661 | AE2-053 O1 | 2.2882 | 80/20 | 2.2882 |
| 941541 | AE2-151 C (Withdrawn : 01/08/2021) | 0.0630 | 80/20 | 0.0630 |
| 942451 | AE2-258 | 1.8236 | 80/20 | 1.8236 |
| 943171 | AE2-346 C | 0.5473 | 80/20 | 0.5473 |
| 943911 | AF1-059 | 31.0992 | 80/20 | 31.0992 |
| 944141 | AF1-082 | 0.9437 | 80/20 | 0.9437 |
| 946281 | AF1-292 C | 4.8137 | 80/20 | 4.8137 |
| 946301 | AF1-294 C | 1.9760 | 80/20 | 1.9760 |
| 957521 | AF2-046 C | 7.4161 | 80/20 | 7.4161 |
| 958211 | AF2-115 C | 1.1624 | 80/20 | 1.1624 |
| 958801 | AF2-171 C | 7.0200 | 80/20 | 7.0200 |
| 959311 | AF2-222 C | 9.8000 | 80/20 | 9.8000 |
| 960081 | AF2-299 C | 8.1131 | 80/20 | 8.1131 |
| 961091 | AF2-400 C | 0.1383 | 80/20 | 0.1383 |
| 961681 | AG1-008 C | 7.4310 | 80/20 | 7.4310 |
| 961791 | AG1-021 C | 0.9299 | 80/20 | 0.9299 |
| 961891 | AG1-030 C | 7.7229 | 80/20 | 7.7229 |
| 961931 | AG1-036 C | 0.5625 | 80/20 | 0.5625 |
| 961941 | AG1-037 C | 0.1955 | 80/20 | 0.1955 |
| 962041 | AG1-048 C | 5.8118 | 80/20 | 5.8118 |
| 962331 | AG1-082 C | 0.7819 | 80/20 | 0.7819 |
| 962341 | AG1-083 C | 0.7819 | 80/20 | 0.7819 |
| 962351 | AG1-084 C | 0.6452 | 80/20 | 0.6452 |
| 962361 | AG1-085 C | 0.6452 | 80/20 | 0.6452 |
| 962441 | AG1-093 C O1 | 5.3728 | 80/20 | 5.3728 |
| 962571 | AG1-106 C | 2.7843 | 80/20 | 2.7843 |
| 963171 | AG1-166 C | 0.9299 | 80/20 | 0.9299 |
| 963181 | AG1-167 C | 0.9299 | 80/20 | 0.9299 |
| 963191 | AG1-168 C | 0.9299 | 80/20 | 0.9299 |
| 963201 | AG1-169 C | 0.9299 | 80/20 | 0.9299 |
| 963211 | AG1-170 C | 0.9299 | 80/20 | 0.9299 |
| 963301 | AG1-179 C | 12.9655 | 80/20 | 12.9655 |
| 963311 | AG1-180 | 6.3171 | 80/20 | 6.3171 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **963321** | AG1-181 C O1 | 10.6630 | 80/20 | 10.6630 |
| **963361** | AG1-185 O1 | 5.1590 | 80/20 | 5.1590 |
| **963641** | AG1-215 C | 0.4339 | 80/20 | 0.4339 |
| **964111** | AG1-272 C | 1.5637 | 80/20 | 1.5637 |
| **964121** | AG1-273 C | 1.5637 | 80/20 | 1.5637 |
| **964131** | AG1-274 C | 1.5637 | 80/20 | 1.5637 |
| **964241** | AG1-285 C O1 | 9.1275 | 80/20 | 9.1275 |
| **964501** | AG1-313 C O1 | 3.2212 | 80/20 | 3.2212 |
| **964791** | AG1-342 C | 1.9409 | 80/20 | 1.9409 |
| **964801** | AG1-343 C | 2.8707 | 80/20 | 2.8707 |
| **964821** | AG1-345 C | 0.3733 | 80/20 | 0.3733 |
| **965191** | AG1-384 C | 1.5637 | 80/20 | 1.5637 |
| **965281** | AG1-393 C | 0.9299 | 80/20 | 0.9299 |
| **965291** | AG1-394 C | 0.9982 | 80/20 | 0.9982 |
| **965451** | AG1-413 C O1 | 13.0729 | 80/20 | 13.0729 |
| **965591** | AG1-427 C | 8.6159 | 80/20 | 8.6159 |
| **965601** | AG1-428 C O1 | 10.8238 | 80/20 | 10.8238 |
| **965721** | AG1-440 C | 5.2753 | 80/20 | 5.2753 |
| **965731** | AG1-441 C | 5.2753 | 80/20 | 5.2753 |
| **965771** | AG1-445 | 3.0480 | 80/20 | 3.0480 |
| **965781** | AG1-446 | 3.0480 | 80/20 | 3.0480 |
| **966621** | AG1-532 C | 4.3810 | 80/20 | 4.3810 |
| **966751** | AG1-546 C | 12.7746 | 80/20 | 12.7746 |
| **966811** | AG1-552 C | 1.9007 | 80/20 | 1.9007 |
| **WEC** | WEC | 0.1181 | Confirmed LTF | 0.1181 |
| **LGEE** | LGEE | 0.2444 | Confirmed LTF | 0.2444 |
| **CPLE** | CPLE | 1.2353 | Confirmed LTF | 1.2353 |
| **CBM-W2** | CBM-W2 | 4.9818 | Confirmed LTF | 4.9818 |
| **NY** | NY | 0.1526 | Confirmed LTF | 0.1526 |
| **TVA** | TVA | 0.9282 | Confirmed LTF | 0.9282 |
| **SIGE** | SIGE | 0.0771 | Confirmed LTF | 0.0771 |
| **CBM-S2** | CBM-S2 | 13.8539 | Confirmed LTF | 13.8539 |
| **CBM-S1** | CBM-S1 | 0.2329 | Confirmed LTF | 0.2329 |
| **MEC** | MEC | 0.6960 | Confirmed LTF | 0.6960 |
| **LAGN** | LAGN | 1.1515 | Confirmed LTF | 1.1515 |
| **CBM-W1** | CBM-W1 | 4.9631 | Confirmed LTF | 4.9631 |

## 10.7 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 |
|---|---|---|
| **AA1-063** | Huntsville (Cabin Creek) 69kV | Withdrawn |
| **AA2-053** | Carolina-Jackson 115kV | In Service |
| **AA2-088** | Boykins-Handsome 115kV | In Service |
| **AA2-165** | Hornertown-Whitakers 115kV | In Service |
| **AB1-081** | Anaconda-Mayo Dunbar 115kV | In Service |
| **AB1-173** | Brink-Trego 115kV | Engineering and Procurement |
| **AB2-015** | Franklin 115kV | Engineering and Procurement |
| **AB2-040** | Brink 115kV | Engineering and Procurement |
| **AB2-043** | Chase City 115kV | Under Construction |
| **AB2-059** | Benson-Dunbar 115kV | Partially in Service - Under Construction |
| **AB2-060** | Chase City-Lunenburg 115kV | In Service |
| **AB2-077** | Buggs Island-Chase City 115kV | Suspended |
| **AB2-078** | Buggs Island-Chase City 115kV | Suspended |
| **AB2-079** | Buggs Island-Chase City 115kV | Suspended |
| **AB2-099** | Ahoskie 34.5kV | Suspended |
| **AB2-100** | Clubhouse-Lakeview 230kV | Under Construction |
| **AB2-174** | Emporia-Trego 115kV | In Service |
| **AC1-034** | Heartsease DP - Mayo Dunbar 115kV | Engineering and Procurement |
| **AC1-036** | Twittys Creek 34.5kV | Partially in Service - Under Construction |
| **AC1-054** | Kerr Dam–Eatons Ferry 115 kV | Engineering and Procurement |
| **AC1-086** | Thelma 230kV | Active |
| **AC1-098** | Dawson-South Justice 115kV | Engineering and Procurement |
| **AC1-099** | Dawson-South Justice 115kV | Engineering and Procurement |
| **AC1-105** | Halifax-Mt. Laurel 115kV | Engineering and Procurement |
| **AC1-208** | Cox-Whitakers 115kV | Engineering and Procurement |
| **AC2-084** | Dawson-South Justice 115kV | Active |
| **AD1-057** | Hornertown-Hathaway 230 kV | Active |
| **AD1-157** | South Creek 34.5 kV | Engineering and Procurement |
| **AD2-033** | Chase City-Lunenburg 115 kV | Active |
| **AD2-046** | Boydton DP-Kerr Dam 115 kV | Active |
| **AD2-063** | Central-Chase City 115kV | Active |
| **AE1-056** | Red House-South Creek 115 kV | Active |
| **AE1-148** | Kerr Dam-Ridge Rd 115 kV | Active |
| **AE2-033** | Clubhouse-Sappony 230 kV | Active |
| **AE2-044** | Anaconda-Dunbar 115 kV | Active |
| **AE2-053** | Kerr Dam-Ridge Road 115 kV | Active |
| **AE2-151** | Earleys 34.5kV | Withdrawn |
| **AE2-258** | Chase City 115 kV | Active |
| **AE2-260** | Clubhouse 230 kV | Active |
| **AE2-346** | Ahoskie 34.5 kV | Active |
| **AF1-059** | Brodnax-South Hill 115 kV | Active |
| **AF1-082** | Heartsease-Mayo Dunbar DP | Active |
| **AF1-266** | Clubhouse-Sapony 230 kV | Active |

| Queue Number | Project Name | Status |
|---|---|---|
| **AF1-292** | Fields 34.5kV | Active |
| **AF1-294** | Jetersville-Ponton 115 kV | Active |
| **AF2-046** | Tunis-Mapleton 115 kV | Active |
| **AF2-115** | Jetersville-Ponton 115 kV | Active |
| **AF2-171** | Madisonville 115 kV | Active |
| **AF2-222** | Madisonville DP-Twitty's Creek 115 kV | Active |
| **AF2-299** | Fields 34.5 kV | Active |
| **AF2-400** | Franklin 13.2 kV | Engineering and Procurement |
| **AG1-008** | Tunis-Mapleton 115 kV | Active |
| **AG1-021** | Jetersville-Ponton 115 kV | Active |
| **AG1-030** | Victoria DP-Martin DP 115 kV | Active |
| **AG1-036** | Tunis 34.5 kV | Active |
| **AG1-037** | Earlys 34.5 kV | Active |
| **AG1-048** | Jetersville-Ponton 115 kV | Active |
| **AG1-082** | Ahoskie 34.5 kV | Active |
| **AG1-083** | Ahoskie 34.5 kV | Active |
| **AG1-084** | Earlys 34.5 kV | Active |
| **AG1-085** | Earlys 34.5 | Active |
| **AG1-093** | Halifax-Chase City 115 kV | Active |
| **AG1-106** | Thelma 230 kV | Active |
| **AG1-166** | Lone Pine 115 kV | Active |
| **AG1-167** | Lone Pine 115 kV | Active |
| **AG1-168** | Lone Pine 115 kV | Active |
| **AG1-169** | Lone Pine 115 kV | Active |
| **AG1-170** | Lone Pine 115 kV | Active |
| **AG1-179** | Brunswick 69 kV | Active |
| **AG1-180** | Brunswick 69 kV | Active |
| **AG1-181** | Pamplin-Chase City 115 kV | Active |
| **AG1-185** | Pamplin-Chase City 115 kV | Active |
| **AG1-215** | Fort Pickett 13.2 kV | Active |
| **AG1-272** | Twitty's Creek 115 kV | Active |
| **AG1-273** | Twitty's Creek 115 kV | Active |
| **AG1-274** | Twitty's Creek 115 kV | Active |
| **AG1-285** | Chase City-Central 115 kV | Active |
| **AG1-313** | Jackson DP-Occoneechee 115 kV | Active |
| **AG1-342** | Dryburg 115 kV | Active |
| **AG1-343** | Boykins-Murphy 115 kV | Active |
| **AG1-345** | Crewe 12.5 kV | Active |
| **AG1-384** | Twitty's Creek 115 kV | Active |
| **AG1-393** | Fort Pickett DP 34.5 kV | Active |
| **AG1-394** | Boykins 34.5 kV | Active |
| **AG1-413** | South Hill-Bordnax 115 kV | Active |
| **AG1-427** | Chase City-Drakes Branch 115 kV | Active |
| **AG1-428** | Danieltown 69 kV | Active |
| **AG1-440** | Palmer Springs 115 kV | Active |
| **AG1-441** | Palmer Springs 115 kV | Active |
| **AG1-445** | Palmer Spring 115 kV | Active |
| **AG1-446** | Palmer Springs 115 kV | Active |
| **AG1-532** | Fields 34.5 kV | Active |
| **AG1-546** | Ebony-Elams Road 115 kV | Active |
| **AG1-552** | Carolina 13.2 kV | Active |

## 10.8 Contingency Descriptions

| Contingency Name | Contingency Definition |
|---|---|
| **Base Case** | |
| **DVP_P1-2: LN 130** | CONTINGENCY 'DVP_P1-2: LN 130'<br>OPEN BRANCH FROM BUS 314559 TO BUS 314600 CKT 1 /* 3CAROLNA 115.00 - 3PLHITP 115.00<br>OPEN BRANCH FROM BUS 314595 TO BUS 314600 CKT 1 /* 3PL HILL 115.00 - 3PLHITP 115.00<br>OPEN BRANCH FROM BUS 314600 TO BUS 314615 CKT 1 /* 3PLHITP 115.00 - 3SKIPPERS 115.00<br>OPEN BUS 314595 /* ISLAND: 3PL HILL 115.00<br>OPEN BUS 314600 /* ISLAND: 3PLHITP 115.00<br>END |
| **DVP_P1-2: LN 2201** | CONTINGENCY 'DVP_P1-2: LN 2201'<br>OPEN BRANCH FROM BUS 313725 TO BUS 314563 CKT 1 /* 6DRY BREAD 230.00 - 6CLUBHSE 230.00<br>END |
| **DVP_P1-2: LN 238-A** | CONTINGENCY 'DVP_P1-2: LN 238-A'<br>OPEN BRANCH FROM BUS 314282 TO BUS 314435 CKT 1 /* 6CARSON 230.00 - 6SAPONY 230.00<br>OPEN BRANCH FROM BUS 314435 TO BUS 940480 CKT 1 /* 6SAPONY 230.00 - AE2-033 TAP 230.00<br>OPEN BUS 314435 /* ISLAND: 6SAPONY 230.00<br>OPEN BUS 923852 /* ISLAND: AB2-025 E 230.00<br>END |
| **314435 6SAPONY 230 940480 AE2-033 TAP 230 1** | CONTINGENCY '314435 6SAPONY 230 940480 AE2-033 TAP 230 1'<br>OPEN BRANCH FROM BUS 314435 TO BUS 940480 CKT 1<br>END |

## 11 Short Circuit Analysis

The following Breakers are overdutied:

None

# 12 Affected Systems

## 12.1 TVA

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

## 12.2 Duke Energy Progress

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

# 13 Attachment 1: One Line Diagram