Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-293

KIDDS STORE – FORK UNION 115 KV

108.4 MW Capacity / 127.9 MW Energy

January, 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 Virginia Electric and Power Company (VEPCO).

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.

An Interconnection Customer with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in

order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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 / storage generating facility located in Fluvanna County, Virginia. The installed facilities will have a total capability of 127.9 MW with 108.4 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 6/30/2022. This study does not imply a TO commitment to this in-service date.

Queue Number	**AF1-293**
Project Name	KIDDS STORE – FORK UNION 115 KV
State	Virginia
County	Fluvanna
Transmission Owner	Dominion
MFO	127.9
MWE	127.9
MWC	108.4
Fuel	Solar / Storage
Basecase Study Year	2023

3.1 Primary Point of Interconnection

The AF1-293 project will interconnect with the Dominion's transmission system at a new 115 kV three breaker ring bus tapping the Kidds Store to Fork Union 115 kV line. The IC is responsible for securing right-of-way, permits and constructing the proposed attachment line from the battery energy storage facility site to the existing switching station. Attachment 1 shows a one-line diagram of the proposed interconnection facilities. The IC may not install any facilities on Dominion's right-of-way without first obtaining the necessary approval from Dominion Energy.

3.2 Secondary Point of Interconnection

The AF1-293 project secondary POI is a direct connection at the existing Fork Union 115 kV substation.

This report does not provide costs for the physical interconnection of the secondary point of interconnection. It was just analyzed for network impacts. Results are shown in the Network Impacts – Secondary Point of Interconnection section of this report.

3.3 Cost Summary

The AF1-293 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 1,700,000
Direct Connection Network Upgrade	$ 5,500,000
Non Direct Connection Network Upgrades	$ 1,600,000
Total Costs	**$ 8,800,000**

In addition, the AF1-293 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	**$ 19,050,000**

Cost allocations for these upgrades will be provided in the System Impact Study Report.

The Feasibility Study is used to make a preliminary determination of the type and scope of Attachment Facilities, Local Upgrades, and Network Upgrades that will be necessary to accommodate the Interconnection Request and to provide the Interconnection Customer a preliminary estimate of the time that will be required to construct any necessary facilities and upgrades and the Interconnection Customer's cost responsibility. The System Impact Study provides refined and comprehensive estimates of cost responsibility and construction lead times for new facilities and system upgrades. Facilities Studies will include, commensurate with the degree of engineering specificity as provided in the Facilities Study Agreement, good faith estimates of the cost, determined in accordance with Section 217 of the Tariff,

(a) to be charged to each affected New Service Customer for the Facilities and System Upgrades that are necessary to accommodate this queue project;

(b) the time required to complete detailed design and construction of the facilities and upgrades; and

(c) a description of any site-specific environmental issues or requirements that could reasonably be anticipated to affect the cost or time required to complete construction of such facilities and upgrades.

4 Transmission Owner Scope of Work

Dominion assessed the impact of the proposed Queue Project AF1-293 was evaluated as a 108.4 MW Capacity (127.9 MW Energy) injection on the Kidds Store – Fork Union 115 kV line in the Dominion Transmission System, for compliance with NERC Reliability Criteria on Dominion Transmission System. . The system was assessed using the summer 2023 AF1 case provided to Dominion by PJM. When performing a generation analysis, Dominion's main analysis will be load flow study results under single contingency (both normal and stressed system conditions). Dominion Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. A full listing of Dominion's Planning Criteria and interconnection requirements can be found in the Company's Facility Connection Requirements which are publicly available at: http://www.dominionenergy.com.

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

The required Attachment Facilities, Direct Connection and Non-Direct Connection work for the interconnection of the AF1-293 generation project to the Dominion Transmission System is detailed in the following sections. The associated one-line with the generation project attachment facilities and primary direct and non-direct connection are shown in Attachment 1.

Note that the ITO findings were made from a conceptual review of this project. A more detailed review of the connection facilities and their cost will be identified in a future study phases. Further note that the cost estimate data contained in this document should be considered high level estimates since it was produced without a detailed engineering review. The applicant will be responsible for the actual cost of construction. ITO herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any reinforcements to the transmission systems.

5 Attachment Facilities

To accommodate the proposed AF1-293 Project, Dominion Energy will install one span of overhead 115 kV line to the point of interconnection ("POI") including 115 kV interconnection metering.

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Substation (Metering)	$ 500,000
Transmission (One span)	$ 1,200,000
Total Attachment Facility Costs	**$ 1,700,000**

It is estimated to take 18-24 months to complete this work upon execution of an Interconnection Construction Service Agreement (ICSA). These preliminary cost estimates are based on typical engineering costs. A more detailed engineering cost estimates are normally done when the IC provides an exact site plan location for the generation substation during the Facility Study phase. See Attachment One.

6 Direct Connection Cost Estimate

To accommodate the proposed AF1-293 Project, Dominion Energy will build a new three breaker 115 kV substation.

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Substation	$ 5,500,000
Total Direct Connection Facility Costs	**$ 5,500,000**

It is estimated to take 24-30 months to complete this work upon execution of an Interconnection Construction Service Agreement (ICSA). These preliminary cost estimates are based on typical engineering costs. A more detailed engineering cost estimates are normally done when the IC provides an exact site plan location for the generation substation during the Facility Study phase. See Attachment One.

7 Non-Direct Connection Cost Estimate

To accommodate the proposed AF1-293 Project, Dominion Energy will re-arrange the existing line between Kidds Store and Fork Union substations.

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Transmission (one span)	$ 1,600,000
Total Direct Connection Facility Costs	**$ 1,600,000**

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.

8 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.

9 Transmission Owner Analysis

9.1 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.

9.2 Short Circuit Analysis

PJM performed a short circuit analysis and the results were verified by Dominion. The connection of AF1-293 project to the system does not result in any newly overdutied circuit breakers on the Dominion transmission system and does not have a significant fault current contribution to existing overdutied circuit breakers

9.3 Stability Analysis

PJM will complete a dynamic stability analysis, if necessary, as part of the System Impact Study. The results of this analysis will be reviewed by Dominion. Should stability concerns be identified in PJM's study, Dominion

will develop appropriate system reinforcement(s) and included the estimated cost of any reinforcement(s) in Dominion's System Impact Study report.

10 Interconnection Customer Requirements

10.1 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.

10.2 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.

10.3 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.

11 Revenue Metering and SCADA Requirements

11.1 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.

1.1.1 Meteorological Data Reporting Requirement

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

- Temperature (degrees Fahrenheit)
- Atmospheric pressure (hectopascals)
- Irradiance
- Forced outage data

11.2 Dominion 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.

12 Network Impacts – Primary Point of Interconnection

The Queue Project AF1-293 was evaluated as a 127.9 MW (Capacity 108.4 MW) injection tapping the Kidds Store to Fork Union 115 kV line in the Dominion area. Project AF1-293 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-293 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

12.1 Generation Deliverability

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

None

12.2 Multiple Facility Contingency

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

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
4325116	941010	AE2-092 TAP	115.0	DVP	314774	3SHERWOD	115.0	DVP	1	DVP_P4-2: YT1030	breaker	208.0	49.86	111.35	DC	127.9

12.3 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
4295861 7	927250	AC1-221 TAP	230.0	DVP	304070	6PERSON230 T	230.0	CPLE	1	DVP_P1-2: LN 556-B	single	718.0	117.89	119.18	DC	9.29
4295861 8	927250	AC1-221 TAP	230.0	DVP	304070	6PERSON230 T	230.0	CPLE	1	DVP_P1-2: LN 556-A	single	718.0	114.92	116.21	DC	9.29

12.4 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
4325159 4	941010	AE2-092 TAP	115.0	DVP	314774	3SHERWOD	115.0	DVP	1	DVP_P1-2: LN 2028	operation	169.2	97.62	116.54	DC	32.02

12.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
43251166	1	AE2-092 TAP 115.0 kV - 3SHERWOD 115.0 kV Ckt 1	DVP dom-096 (613) : Rebuild 6.42 miles of 115 kV Line 91 from AE2-092 Tap to Sherwood with 2-636 ACSR. Project Type : FAC Cost : $16,050,000 Time Estimate : 30-36 Months	$16,050,000
42958617,42958618	2	AC1-221 TAP 230.0 kV - 6PERSON230 T 230.0 kV Ckt 1	DVP dom-006 (558) : For DEV portion, rebuild 2 miles of 230 kV Line 296 from AC1-221 Tap to Persons (Duke Energy/Progress) with 2-636 ACSR. Project Type : FAC Cost : $3,000,000 Time Estimate : 30-36 Months	$3,000,000
			TOTAL COST	**$19,050,000**

12.6 Flow Gate Details

The following indices contain additional information about each flowgate presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

12.6.1 Contingency Descriptions

Contingency Name	Contingency Definition
DVP_P1-2: LN 2028	CONTINGENCY 'DVP_P1-2: LN 2028' OPEN BRANCH FROM BUS 313707 TO BUS 314765 CKT 1 /* 6FORK UNION 230.00 - 6MTEAGLE 230.00 OPEN BRANCH FROM BUS 314749 TO BUS 314765 CKT 1 /* 6CHARLVL 230.00 - 6MTEAGLE 230.00 OPEN BUS 314765 /* ISLAND: 6MTEAGLE 230.00 OPEN BUS 926451 /* ISLAND: AC1-116 C 230.00 OPEN BUS 926452 /* ISLAND: AC1-116 E 230.00 END

Contingency Name	Contingency Definition
DVP_P1-2: LN 556-A	CONTINGENCY 'DVP_P1-2: LN 556-A' OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 1 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 2 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 3 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314906 TO BUS 945810 CKT 1 /* 8CLOVER 500.00 - AF1-246 TAP 500.00 OPEN BUS 314906 /* ISLAND: 8CLOVER 500.00 OPEN BUS 314915 /* ISLAND: 8CLOVER_STC 500.00 END
DVP_P1-2: LN 556-B	CONTINGENCY 'DVP_P1-2: LN 556-B' OPEN BRANCH FROM BUS 945810 TO BUS 314936 CKT 1 /* AF1-246 TAP 500.00 - 8RAWLINGS 500.00 END
DVP_P4-2: YT1030	CONTINGENCY 'DVP_P4-2: YT1030' /* FORK UNION 115 KV OPEN BRANCH FROM BUS 313708 TO BUS 314744 CKT 1 /* 3FORK UNION 115.00 - 3BREMO 115.00 OPEN BRANCH FROM BUS 313707 TO BUS 313708 CKT 1 /* 6FORK UNION 230.00 - 3FORK UNION 115.00 OPEN BUS 313872 /* 3FORK UNIO_1115.00 KV END

12.6.2 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
43251166	941010	AE2-092 TAP	DVP	314774	3SHERWOD	DVP	1	DVP_P4-2: YT1030	breaker	208.0	49.86	111.35	DC	127.9

Bus #	Bus	MW Impact
941011	AE2-092 C	82.8000
941012	AE2-092 E	55.2000
946291	AF1-293 C O1	108.4000
946292	AF1-293 E O1	19.5000

12.6.3 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
42958617	927250	AC1-221 TAP	DVP	304070	6PERSON230 T	CPLE	1	DVP_P1-2: LN 556-B	single	718.0	117.89	119.18	DC	9.29

Bus #	Bus	MW Impact
247284	05LEESVG	0.4070
313853	3PONTONDP	0.1046
314333	6POWHATN	0.1036
314429	3JTRSVLE	0.4185
314677	6BUCKING	0.3443
314704	3LAWRENC	0.1486
315153	1CLOVER1	31.9050
315154	1CLOVER2	31.5870
315156	1HALLBR1	0.9143
315158	1KERR 1	0.2958
315159	1KERR 2	0.8281
315160	1KERR 3	0.8281
315161	1KERR 4	0.8281
315162	1KERR 5	0.8281
315163	1KERR 6	0.8281
315164	1KERR 7	0.8281
315191	1BEARGRDN G1	2.3260
315192	1BEARGRDN G2	2.3260
315193	1BEARGRDN S1	4.7871
315266	1PLYWOOD A	2.7045
920291	AA2-127	0.4832
924021	AB2-043 C O1	4.2461
924161	AB2-060 C OP	12.2444
924301	AB2-077 C O1	2.7311
924311	AB2-078 C O1	2.7311
924321	AB2-079 C O1	2.7311
925611	AC1-036 C	1.3096
925661	AC1-042 C	1.6048
925781	AC1-054 C O1	5.0236
925831	AC1-062	0.0621
925991	AC1-075 C	11.9814

Bus #	Bus	MW Impact
926021	AC1-080 C	4.0042
926271	AC1-105 C O1	14.5257
926451	AC1-116 C	0.2761
926641	AC1-145 C	1.9105
927251	AC1-221 C	11.7258
927261	AC1-222 C	10.1401
932511	AC2-071 C	2.4299
932761	AC2-100 C	26.9855
933501	AC2-165 C	3.6001
934311	AD1-055 C	7.0405
934341	AD1-058 C	29.3949
934611	AD1-087 C O1	27.0026
934621	AD1-088 C	24.0140
934991	AD1-131 C	9.6377
935171	AD1-152 C O1	26.8349
935221	AD1-157 C	2.1209
935231	AD1-160 C	1.5554
936261	AD2-033 C	17.8558
936331	**AD2-043 C (Withdrawn : 12/20/2019)**	**13.1391**
936361	AD2-046 C O1	8.4556
936481	AD2-063 C O1	20.3967
937481	AD2-202 C O1	7.1560
938371	AE1-056 C	9.1436
938561	AE1-075 C	0.6505
938821	AE1-108 C	7.3367
939181	AE1-148 C O1	8.5271
939371	AE1-168 C	20.9439
939941	AE1-230 C	0.7240
940241	AE2-006	0.6663
940661	AE2-053 O1	3.1582
941011	AE2-092 C	6.2092
941791	AE2-182 C	4.5741
941801	AE2-185 C	3.6198
941821	AE2-187 C	3.6198
942451	AE2-258	3.1677
942461	AE2-259 C O1	14.3922
942671	AE2-283 C	3.9818
942751	AE2-291 C O1	15.7186
942761	AE2-292 C O1	19.5712
943901	AF1-058 C	5.7505

Bus #	Bus	MW Impact
943911	AF1-059	14.3630
945081	AF1-173	1.4027
945811	AF1-246 C O1	21.7447
946291	AF1-293 C O1	9.2920
946301	AF1-294 C	7.0263
946461	**AF1-310 C O1 (Withdrawn : 11/05/2019)**	**59.0201**
946591	AF1-323 C	2.4440
DUCKCREEK	DUCKCREEK	1.6305
NEWTON	NEWTON	1.6203
FARMERCITY	FARMERCITY	0.0955
G-007A	G-007A	0.3716
VFT	VFT	0.9739
PRAIRIE	PRAIRIE	4.5022
AC1-131	AC1-131	5.1105
COFFEEN	COFFEEN	0.8049
EDWARDS	EDWARDS	0.4830
CHEOAH	CHEOAH	1.4760
TILTON	TILTON	0.8455
GIBSON	GIBSON	0.7699
CALDERWOOD	CALDERWOOD	1.4324
BLUEG	BLUEG	2.3401
TRIMBLE	TRIMBLE	0.7401
CATAWBA	CATAWBA	1.6996

Short Circuit

12.7 Short Circuit

The following Breakers are overdutied:

None

13 Network Impacts – Secondary Point of Interconnection

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Summer Peak Load Flow

13.1 Generation Deliverability

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

None

13.2 Multiple Facility Contingency

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

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4325116	941010	AE2-092 TAP	115.0	DVP	314774	3SHERWOD	115.0	DVP	1	DVP_P4-2: YT1030	breaker	208.0	49.86	111.35	DC	127.9

13.3 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
53040275	927250	AC1-221 TAP	230.0	DVP	304070	6PERSON230 T	230.0	CPLE	1	DVP_P1-2: LN 556	single	718.0	117.95	119.35	DC	10.07
53040276	927250	AC1-221 TAP	230.0	DVP	304070	6PERSON230 T	230.0	CPLE	1	3149068CLOVER 500 3149368RAWLINGS 500 1	single	718.0	117.95	119.35	DC	10.07

13.4 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
4325159 4	941010	AE2-092 TAP	115.0	DVP	314774	3SHERWOD	115.0	DVP	1	DVP_P1-2: LN 2028	operation	169.2	97.62	110.44	DC	21.68

13.5 Flow Gate Details

The following indices contain additional information about each flowgate presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

13.5.1 Contingency Descriptions

Contingency Name	Contingency Definition
DVP_P1-2: LN 2028	CONTINGENCY 'DVP_P1-2: LN 2028' OPEN BRANCH FROM BUS 313707 TO BUS 314765 CKT 1 /* 6FORK UNION 230.00 - 6MTEAGLE 230.00 OPEN BRANCH FROM BUS 314749 TO BUS 314765 CKT 1 /* 6CHARLVL 230.00 - 6MTEAGLE 230.00 OPEN BUS 314765 /* ISLAND: 6MTEAGLE 230.00 OPEN BUS 926451 /* ISLAND: AC1-116 C 230.00 OPEN BUS 926452 /* ISLAND: AC1-116 E 230.00 END
314906 8CLOVER 500 314936 8RAWLINGS 500 1	CONTINGENCY '314906 8CLOVER 500 314936 8RAWLINGS 500 1' OPEN BRANCH FROM BUS 314906 TO BUS 314936 CKT 1 END
DVP_P1-2: LN 556	CONTINGENCY 'DVP_P1-2: LN 556' OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 1 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 2 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 3 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314906 TO BUS 314936 CKT 1 /* 8CLOVER 500.00 - 8RAWLINGS 500.00 OPEN BUS 314906 /* ISLAND: 8CLOVER 500.00 OPEN BUS 314915 /* ISLAND: 8CLOVER_STC 500.00 END
DVP_P4-2: YT1030	CONTINGENCY 'DVP_P4-2: YT1030' /* FORK UNION 115 KV OPEN BRANCH FROM BUS 313708 TO BUS 314744 CKT 1 /* 3FORK UNION 115.00 - 3BREMO 115.00 OPEN BRANCH FROM BUS 313707 TO BUS 313708 CKT 1 /* 6FORK UNION 230.00 - 3FORK UNION 115.00 OPEN BUS 313872 /* 3FORK UNIO_1115.00 KV END

13.5.2 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
43251166	941010	AE2-092 TAP	DVP	314774	3SHERWOD	DVP	1	DVP_P4-2: YT1030	breaker	208.0	49.86	111.35	DC	127.9

Bus #	Bus	MW Impact
941011	AE2-092 C	82.8000
941012	AE2-092 E	55.2000
946291	AF1-293 C O2	108.4000
946292	AF1-293 E O2	19.5000

13.5.3 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
53040276	927250	AC1-221 TAP	DVP	304070	6PERSON230 T	CPLE	1	314906 8CLOVER 500 314936 8RAWLINGS 500 1	single	718.0	117.95	119.35	DC	10.07

Bus #	Bus	MW Impact
247284	05LEESVG	0.4070
313853	3PONTONDP	0.1046
314333	6POWHATN	0.1036
314429	3JTRSVLE	0.4185
314677	6BUCKING	0.3443
314704	3LAWRENC	0.1486
315153	1CLOVER1	31.9050
315154	1CLOVER2	31.5870
315156	1HALLBR1	0.9143
315158	1KERR 1	0.2958
315159	1KERR 2	0.8281
315160	1KERR 3	0.8281
315161	1KERR 4	0.8281
315162	1KERR 5	0.8281
315163	1KERR 6	0.8281
315164	1KERR 7	0.8281
315191	1BEARGRDN G1	2.3260
315192	1BEARGRDN G2	2.3260
315193	1BEARGRDN S1	4.7871
315266	1PLYWOOD A	2.7045
920291	AA2-127	0.4832
924021	AB2-043 C O1	4.2461
924161	AB2-060 C OP	12.2444
924301	AB2-077 C O1	2.7311
924311	AB2-078 C O1	2.7311
924321	AB2-079 C O1	2.7311
925611	AC1-036 C	1.3096
925661	AC1-042 C	1.6048
925781	AC1-054 C O1	5.0236
925831	AC1-062	0.0621

Bus #	Bus	MW Impact
925991	AC1-075 C	11.9814
926021	AC1-080 C	4.0042
926271	AC1-105 C O1	14.5257
926451	AC1-116 C	0.2761
926641	AC1-145 C	1.9105
927251	AC1-221 C	11.7258
927261	AC1-222 C	10.1401
932511	AC2-071 C	2.4299
932761	AC2-100 C	26.9855
933501	AC2-165 C	3.6001
934311	AD1-055 C	7.0405
934341	AD1-058 C	29.3949
934611	AD1-087 C O1	27.0026
934621	AD1-088 C	24.0140
934991	AD1-131 C	9.6377
935171	AD1-152 C O1	26.8349
935221	AD1-157 C	2.1209
935231	AD1-160 C	1.5554
936261	AD2-033 C	17.8558
936331	**AD2-043 C (Withdrawn : 12/20/2019)**	**13.1391**
936361	AD2-046 C O1	8.4556
936481	AD2-063 C O1	20.3967
937481	AD2-202 C O1	7.1560
938371	AE1-056 C	9.1436
938561	AE1-075 C	0.6505
938821	AE1-108 C	7.3367
939181	AE1-148 C O1	8.5271
939371	AE1-168 C	20.9439
939941	AE1-230 C	0.7240
940241	AE2-006	0.6663
940661	AE2-053 O1	3.1582
941011	AE2-092 C	6.2092
941791	AE2-182 C	4.5741
941801	AE2-185 C	3.6198
941821	AE2-187 C	3.6198
942451	AE2-258	3.1677
942461	AE2-259 C O1	14.3922
942671	AE2-283 C	3.9818
942751	AE2-291 C O1	15.7186
942761	AE2-292 C O1	19.5712

Bus #	Bus	MW Impact
943901	AF1-058 C	5.7505
943911	AF1-059	14.3630
945081	AF1-173	1.4027
945811	AF1-246 C O2	21.7442
946291	AF1-293 C O2	10.0736
946301	AF1-294 C	7.0263
946461	**AF1-310 C O1 (Withdrawn : 11/05/2019)**	**59.0201**
946591	AF1-323 C	2.4440
DUCKCREEK	DUCKCREEK	1.6305
NEWTON	NEWTON	1.6203
FARMERCITY	FARMERCITY	0.0955
G-007A	G-007A	0.3716
VFT	VFT	0.9739
PRAIRIE	PRAIRIE	4.5022
AC1-131	AC1-131	5.1105
COFFEEN	COFFEEN	0.8049
EDWARDS	EDWARDS	0.4830
CHEOAH	CHEOAH	1.4760
TILTON	TILTON	0.8455
GIBSON	GIBSON	0.7699
CALDERWOOD	CALDERWOOD	1.4324
BLUEG	BLUEG	2.3401
TRIMBLE	TRIMBLE	0.7401
CATAWBA	CATAWBA	1.6996

Short Circuit

13.6 Short Circuit

The following Breakers are overdutied:

None

Affected Systems

14 Affected Systems

14.1 Duke Energy Progress

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

Attachment 1

System Configuration