



Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-082

HEARTSEASE-MAYO DUNBAR DP 115kV

18 MW Capacity / 18 MW Energy

January, 2020

Table of Contents

1	Introduction	4
2	Preface	4
3	General	5
3.1	Point of Interconnection	5
3.2	Cost Summary	5
4	Transmission Owner Scope of Work	6
5	Non-Direct Connection Cost Estimate	7
6	Schedule	7
7	Transmission Owner Analysis	7
7.1	Power Flow Analysis	7
7.2	Short Circuit Analysis	7
7.3	Stability Analysis	8
8	Interconnection Customer Requirements	8
8.1	System Protection	8
8.2	Compliance Issues and Interconnection Customer Requirements	8
8.3	Power Factor Requirements	9
9	Revenue Metering and SCADA Requirements	9
9.1	PJM Requirements	9
9.2	Dominion Requirements	9
10	Network Impacts	9
10.1	Generation Deliverability	11
10.2	Multiple Facility Contingency	11
10.3	Contribution to Previously Identified Overloads	11
10.4	Potential Congestion due to Local Energy Deliverability	11
10.5	System Reinforcements	13
10.6	Flow Gate Details	14
10.6.1	Contingency Descriptions	14
10.6.2	Index 1	16

10.6.3 Index 2..... 18

10.6.4 Index 3..... 21

10.7 Short Circuit..... 25

11 Affected Systems 27

11.1 Duke Energy Progress..... 27

Attachment 1 28

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.

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 to add a storage generating facility to a planned solar project, AC1-034. The project requests an increase of 18 MW with 18 MW being recognized by PJM as Capacity. The facility is located in Edgecombe County, North Carolina. The installed facilities will have a total capability of 93 MW with 60.75 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 12/31/2020. This study does not imply a TO commitment to this in-service date.

Queue Number	AF1-082
Project Name	HEARTSEASE-MAYO DUNBAR DP 115KV
State	North Carolina
County	Edgecombe
Transmission Owner	Dominion
MFO	93
MWE	18
MWC	18
Fuel	Storage
Basecase Study Year	2023

3.1 Point of Interconnection

AF1-082 will interconnect with the Dominion transmission system at the new three breaker ring bus AC1-034 substation tapping the Heartsease to Mayo Dunbar DP 115 kV line.

3.2 Cost Summary

The AF1-082 project will utilize the Interconnection Facilities being built for the AC1-034 project.

The AF1-082 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$ 10,425,000

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 AF1-082. The project was evaluated as an 18 MW Capacity (18.0 MW energy) injection at the planned AC1-034 substation 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 AF1-082 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 Non-Direct Connection Cost Estimate

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.

6 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.

7 Transmission Owner Analysis

7.1 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.

7.2 Short Circuit Analysis

PJM performed a short circuit analysis and the results were verified by Dominion. The connection of AF1-082 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

7.3 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.

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 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 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>.

10 Network Impacts

The Queue Project AF1-082 was evaluated as a 18.0 MW (Capacity 18.0 MW) injection as an uprate to AC1-034 tapping the Mayo Dunbar to Heartsease DP 115 kV line in the Dominion area. Project AF1-082 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-082 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

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)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
43051696	313844	3HATHAWAY	115.0	DVP	314554	3BTLEBRO	115.0	DVP	1	DVP_P7-1: LN 2058-2181	tower	301.0	97.53	100.97	DC	10.36

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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
42864092	313845	6HATHAWAY	230.0	DVP	304222	6ROCKYMT230T	230.0	CPL	1	DVP_P1-2: LN 2181	single	478.0	107.73	108.75	DC	4.88
42863883	314554	3BTLEBRO	115.0	DVP	304223	3ROCKYMT115T	115.0	CPL	1	DVP_P4-2: 2058T2167	breaker	93.0	230.65	237.44	DC	6.31
42864014	314554	3BTLEBRO	115.0	DVP	304223	3ROCKYMT115T	115.0	CPL	1	DVP_P1-2: LN 2058	single	93.0	163.75	170.41	DC	6.19
42864015	314554	3BTLEBRO	115.0	DVP	304223	3ROCKYMT115T	115.0	CPL	1	DVP_P1-3: 6HATHAWAY-TX#1	single	93.0	150.05	156.5	DC	6.0
42864018	314554	3BTLEBRO	115.0	DVP	304223	3ROCKYMT115T	115.0	CPL	1	Base Case	single	93.0	120.42	125.06	DC	4.31
42864276	314554	3BTLEBRO	115.0	DVP	304223	3ROCKYMT115T	115.0	CPL	1	DVP_P7-1: LN 2058-2181	tower	93.0	482.15	490.09	DC	7.38

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 LOADIN G %	POST PROJECT LOADIN G %	AC DC	MW IMPACT
43051377	313719	3CHESTNUT	115.0	DVP	314623	3WITAKRS	115.0	DVP	1	DVP_P1-2: LN 2056-A	operation	165.44	139.47	141.19	DC	2.85
46053065	313719	3CHESTNUT	115.0	DVP	314623	3WITAKRS	115.0	DVP	1	Base Case	operation	165.44	106.02	107.41	DC	2.3
42864091	313845	6HATHAWAY	230.0	DVP	304222	6ROCKYMT230T	230.0	CPL	1	DVP_P1-2: LN 2181	operation	478.0	136.62	137.64	DC	4.88
46053081	313854	3CONSLDL	115.0	DVP	314554	3BTLEBRO	115.0	DVP	1	DVP_P1-2: LN 126	operation	165.44	139.33	140.46	DC	1.88
46053087	313854	3CONSLDL	115.0	DVP	314554	3BTLEBRO	115.0	DVP	1	Base Case	operation	165.44	111.93	113.32	DC	2.3
43051511	313858	3SO JUSTICE	115.0	DVP	314577	3COX DP	115.0	DVP	1	DVP_P1-2: LN 2056-A	operation	165.44	111.44	113.16	DC	2.84
42864009	314554	3BTLEBRO	115.0	DVP	304223	3ROCKYMT115T	115.0	CPL	1	DVP_P1-2: LN 2058	operation	93.0	226.15	232.81	DC	6.19
42864013	314554	3BTLEBRO	115.0	DVP	304223	3ROCKYMT115T	115.0	CPL	1	Base Case	operation	93.0	165.55	170.19	DC	4.31
43051450	314556	3BENSON	115.0	DVP	313844	3HATHAWAY	115.0	DVP	1	Base Case	operation	246.28	113.73	121.04	DC	18.0
43051526	314577	3COX DP	115.0	DVP	313719	3CHESTNUT	115.0	DVP	1	DVP_P1-2: LN 2056-A	operation	165.44	104.67	106.39	DC	2.84
46053254	314603	3SCOT NK	115.0	DVP	314602	3SAMS HD	115.0	DVP	1	314628 3DARLINGT DP 115 927140 AC1-208 TAP 115 1	operation	134.42	99.7	100.13	DC	1.28
46053073	314623	3WITAKRS	115.0	DVP	313854	3CONSLDL	115.0	DVP	1	DVP_P1-2: LN 126	operation	165.44	139.39	140.52	DC	1.88
46053079	314623	3WITAKRS	115.0	DVP	313854	3CONSLDL	115.0	DVP	1	Base Case	operation	165.44	111.99	113.38	DC	2.3
43051427	924150	AB2-059 TAP	115.0	DVP	314556	3BENSON	115.0	DVP	1	Base Case	operation	246.28	116.57	123.88	DC	18.0

10.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
42864276,42863883, 42864014,42864015, 42864018	3	3BTLEBRO 115.0 kV - 3ROCKYMT115T 115.0 kV Ckt 1	n6118 : Upgrading the breaker leads at DVPs terminal will bring the rating to 239/239/239 MVA (Limited by terminal equipment at Rocky Mount) . Project Type : FAC Cost : \$100,000 Time Estimate : 18 Months <u>Duke Energy / Progress</u> The external (i.e. Non-PJM) Transmission Owner, Duke Energy / Progress, will not evaluate this violation until the Impact Study phase.	\$100,000
43051696	1	3HATHAWAY 115.0 kV - 3BTLEBRO 115.0 kV Ckt 1		
42864092	2	6HATHAWAY 230.0 kV - 6ROCKYMT230T 230.0 kV Ckt 1	DVP dom-003 : For DEV portion, rebuild 4.13 miles of 230 kV Line 2058 from Hathaway to Rocky Mountain with 2-636 ACSR. Project Type : FAC Cost : \$10,325,000 Time Estimate : 30-36 Months <u>Duke Energy / Progress</u> No Violation. Duke Energy / Progress portion is already rated at 542 MVA	\$10,325,000
			TOTAL COST	\$10,425,000

10.6 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.

10.6.1 Contingency Descriptions

Contingency Name	Contingency Definition
DVP_P1-2: LN 2056-A	CONTINGENCY 'DVP_P1-2: LN 2056-A' OPEN BRANCH FROM BUS 313845 TO BUS 934330 CKT 1 /* 6HATHAWAY 230.00 - AD1-057 TAP 230.00 END
314628 3DARLINGT DP 115 927140 AC1-208 TAP 115 1	CONTINGENCY '314628 3DARLINGT DP 115 927140 AC1-208 TAP 115 1' OPEN BRANCH FROM BUS 314628 TO BUS 927140 CKT 1 END
DVP_P1-2: LN 2181	CONTINGENCY 'DVP_P1-2: LN 2181' OPEN BUS 304226 /* ISLAND: 6PA-RMOUNT#4115.00 OPEN BRANCH FROM BUS 304226 TO BUS 314591 CKT 1 /* 6PA-RMOUNT#4230.00 - 6NASH 230.00 OPEN BRANCH FROM BUS 313845 TO BUS 314591 CKT 1 /* 6HATHAWAY 230.00 - 6NASH 230.00 OPEN BUS 314591 /* ISLAND: 6NASH 230.00 END
DVP_P1-2: LN 2058	CONTINGENCY 'DVP_P1-2: LN 2058' OPEN BRANCH FROM BUS 304222 TO BUS 313845 CKT 1 /* 6ROCKYMT230T230.00 - 6HATHAWAY 230.00 OPEN BRANCH FROM BUS 313844 TO BUS 313845 CKT 2 /* 3HATHAWAY 115.00 - 6HATHAWAY 230.00 END
DVP_P1-2: LN 126	CONTINGENCY 'DVP_P1-2: LN 126' OPEN BRANCH FROM BUS 314568 TO BUS 314582 CKT 1 /* 3EARLEYS 115.00 - 3KELFORD 115.00 OPEN BRANCH FROM BUS 314582 TO BUS 314602 CKT 1 /* 3KELFORD 115.00 - 3SAMS HD 115.00 OPEN BRANCH FROM BUS 314602 TO BUS 314603 CKT 1 /* 3SAMS HD 115.00 - 3SCOT NK 115.00 OPEN BUS 314582 /* ISLAND: 3KELFORD 115.00 OPEN BUS 917332 /* ISLAND: Z2-043 E 115.00 OPEN BUS 314602 /* ISLAND: 3SAMS HD 115.00 END

Contingency Name	Contingency Definition
DVP_P1-3: 6HATHAWAY-TX#1	CONTINGENCY 'DVP_P1-3: 6HATHAWAY-TX#1' OPEN BRANCH FROM BUS 313844 TO BUS 313845 CKT 1 /* 3HATHAWAY 115.00 - 6HATHAWAY 230.00 END
Base Case	
DVP_P4-2: 2058T2167	CONTINGENCY 'DVP_P4-2: 2058T2167' /* HATHAWAY 230 KV OPEN BRANCH FROM BUS 304222 TO BUS 313845 CKT 1 /* 6ROCKYMT230T230.00 - 6HATHAWAY 230.00 OPEN BRANCH FROM BUS 313844 TO BUS 313845 CKT 2 /* 3HATHAWAY 115.00 - 6HATHAWAY 230.00 OPEN BRANCH FROM BUS 313845 TO BUS 314564 CKT 1 /* 6HATHAWAY 230.00 - 6EDGEKOM 230.00 END
DVP_P7-1: LN 2058-2181	CONTINGENCY 'DVP_P7-1: LN 2058-2181' /* . OPEN BRANCH FROM BUS 304222 TO BUS 313845 CKT 1 /* 6ROCKYMT230T230.00 - 6HATHAWAY 230.00 OPEN BRANCH FROM BUS 313844 TO BUS 313845 CKT 2 /* 3HATHAWAY 115.00 - 6HATHAWAY 230.00 OPEN BUS 304226 /* ISLAND: 6PA-RMOUNT#4115.00 OPEN BRANCH FROM BUS 304226 TO BUS 314591 CKT 1 /* 6PA-RMOUNT#4230.00 - 6NASH 230.00 OPEN BRANCH FROM BUS 313845 TO BUS 314591 CKT 1 /* 6HATHAWAY 230.00 - 6NASH 230.00 OPEN BUS 314591 /* ISLAND: 6NASH 230.00 END

10.6.2 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
43051696	313844	3HATHAWAY	DVP	314554	3BTLEBRO	DVP	1	DVP_P7-1: LN 2058-2181	tower	301.0	97.53	100.97	DC	10.36

Bus #	Bus	MW Impact
315131	1EDGECSMA (Deactivation : 04/22/19)	15.5138
315132	1EDGECSMB (Deactivation : 04/22/19)	15.5138
315136	1ROSEMG1	1.2033
315137	1ROSEMS1	0.7462
315138	1ROSEMG2	0.5639
315601	1CONETOE2SOL	1.3358
917512	Z2-088 E OP1	4.1014
918532	AA1-067 E	0.2788
922922	AB1-081 C OP	32.2263
922923	AB1-081 E OP	13.8113
923262	AB1-132 C OP	6.4667
923263	AB1-132 E OP	2.7714
924151	AB2-059 C OP	37.9810
924152	AB2-059 E OP	19.5660
925591	AC1-034 C	24.6013
925592	AC1-034 E	18.5589
926071	AC1-086 C	9.5230
926072	AC1-086 E	4.3342
927021	AC1-189 C	7.4205
927022	AC1-189 E	3.6963
934331	AD1-057 C O1	11.7396
934332	AD1-057 E O1	6.2624
936701	AD2-089 C (Withdrawn : 12/09/2019)	8.8115
936702	AD2-089 E (Withdrawn : 12/09/2019)	5.8743
940571	AE2-044 C	16.1132
940572	AE2-044 E	6.9056
944141	AF1-082	10.3585
DUCKCREEK	DUCKCREEK	0.5297
NEWTON	NEWTON	0.5244
FARMERCITY	FARMERCITY	0.0301
G-007A	G-007A	0.3356
VFT	VFT	0.8901

Bus #	Bus	MW Impact
PRAIRIE	PRAIRIE	1.4181
COFFEEN	COFFEEN	0.2595
EDWARDS	EDWARDS	0.1578
CHEOAH	CHEOAH	0.4324
TILTON	TILTON	0.2791
GIBSON	GIBSON	0.2528
CALDERWOOD	CALDERWOOD	0.4215
BLUEG	BLUEG	0.7812
TRIMBLE	TRIMBLE	0.2476
CATAWBA	CATAWBA	0.4581

10.6.3 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
42864092	313845	6HATHAWAY	DVP	304222	6ROCKYMT230T	CPL	1	DVP_P1-2: LN 2181	single	478.0	107.73	108.75	DC	4.88

Bus #	Bus	MW Impact
314435	6SAPONY	0.1427
314572	3EMPORIA	0.0402
314574	6EVERETS	0.1811
314582	3KELFORD	0.3088
314589	3MURPHYS	0.0492
314623	3WITAKRS	0.2540
314704	3LAWRENC	0.1369
315115	1S HAMPT1	0.6342
315126	1ROARAP2	0.9589
315128	1ROARAP4	0.9150
315131	1EDGECSMA (Deactivation : 04/22/19)	25.0572
315132	1EDGECSMB (Deactivation : 04/22/19)	25.0572
315136	1ROSEMG1	2.3478
315137	1ROSEMS1	1.4559
315138	1ROSEMG2	1.1003
315139	1GASTONA	2.9075
315141	1GASTONB	2.9075
315292	1DOMTR78	0.6926
315294	1DOMTR10	6.4308
315601	1CONETOE2SOL	2.1801
315602	1HOLLOMANSOL	0.8466
315605	6W1-029WIND	0.2837
315606	3AA2-053SOLA	0.9775
315607	3AA1-063SOLA	0.8796
315608	3AA2-088SOLA	0.5384
315611	6Z1-036WIND	0.3395
315612	3AA2-057SOLA	1.2559
315614	AA2-178 C	0.6337
920591	AA2-165 C	0.1489
920671	AA2-174 C OP	0.0448
922922	AB1-081 C OP	15.1676
923262	AB1-132 C OP	15.9062

Bus #	Bus	MW Impact
923263	AB1-132 E OP	6.8170
923572	AB1-173 C OP	1.6592
923582	AB1-173AC OP	1.6592
923801	AB2-015 C OP	4.0535
923911	AB2-031 C O1	1.6469
923991	AB2-040 C O1	5.4076
924151	AB2-059 C OP	17.8761
924501	AB2-099 C	0.4112
924511	AB2-100 C	8.4949
925121	AB2-169 C	4.1734
925171	AB2-174 C O1	5.0379
925591	AC1-034 C	11.5788
925781	AC1-054 C O1	2.9281
926071	AC1-086 C	23.4238
926201	AC1-098 C	6.2957
926211	AC1-099 C	2.1097
927021	AC1-189 C	12.1912
927141	AC1-208 C	9.6989
932631	AC2-084 C	8.9748
933991	AD1-023 C	7.5866
934201	AD1-047 C	5.8992
934331	AD1-057 C O1	20.1168
934521	AD1-076 C	29.5525
936401	AD2-051 C O1	6.0354
936701	AD2-089 C (Withdrawn : 12/09/2019)	14.3289
936711	AD2-090 C O1	3.8426
937571	AD2-169 C	7.5666
938171	AE1-026 C O1	19.1419
938221	AE1-035 C	1.5163
938661	AE1-088	2.1402
938771	AE1-103 C O1	1.6046
940481	AE2-033 C	7.1805
940491	AE2-034 C	3.9724
940521	AE2-037 C	5.5122
940541	AE2-040 O1	1.3064
940571	AE2-044 C	7.5838
941501	AE2-147 C	4.6899
941541	AE2-151 C	0.7816
942471	AE2-260 C O1	9.8388
942851	AE2-304 C	0.2061

Bus #	Bus	MW Impact
943171	AE2-346 C	0.9870
943911	AF1-059	6.8860
944051	AF1-073 C O1	11.0580
944141	AF1-082	4.8753
944871	AF1-152 C	1.5633
945711	AF1-236 C O1	37.2760
946011	AF1-266	6.0107
946281	AF1-292 C	0.9984
DUCKCREEK	DUCKCREEK	1.3668
NEWTON	NEWTON	1.3485
FARMERCITY	FARMERCITY	0.0773
G-007A	G-007A	0.7576
VFT	VFT	2.0124
PRAIRIE	PRAIRIE	3.6420
COFFEEN	COFFEEN	0.6675
EDWARDS	EDWARDS	0.4067
CHEOAH	CHEOAH	1.1016
TILTON	TILTON	0.7195
GIBSON	GIBSON	0.6514
CALDERWOOD	CALDERWOOD	1.0740
BLUEG	BLUEG	2.0120
TRIMBLE	TRIMBLE	0.6383
CATAWBA	CATAWBA	1.1606

10.6.4 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
42864276	314554	3BTLBRO	DVP	304223	3ROCKYMT115T	CPL	1	DVP_P7-1: LN 2058-2181	tower	93.0	482.15	490.09	DC	7.38

Bus #	Bus	MW Impact
314582	3KELFORD	0.3143
314623	3WITAKRS	0.4481
315131	1EDGECSMA (Deactivation : 04/22/19)	12.1498
315132	1EDGECSMB (Deactivation : 04/22/19)	12.1498
315136	1ROSEMG1	1.2901
315137	1ROSEMS1	0.8000
315138	1ROSEMG2	0.6046
315139	1GASTONA	1.6581
315141	1GASTONB	1.6581
315601	1CONETOE2SOL	1.0750
315612	3AA2-057SOLA	2.0693
900672	V4-068 E	0.1239
917332	Z2-043 E	0.9790
917342	Z2-044 E	1.3758
917512	Z2-088 E OP1	3.3007
918492	AA1-063AE OP	1.9453
918512	AA1-065 E OP	1.4321
918532	AA1-067 E	0.2468
919692	AA2-053 E OP	1.9802
919702	AA2-057 E OP	6.9980
920042	AA2-088 E OP	4.0205
920591	AA2-165 C	0.2454
920592	AA2-165 E	0.9618
920672	AA2-174 E OP	0.2288
922922	AB1-081 C OP	22.9734
922923	AB1-081 E OP	9.8458
923262	AB1-132 C OP	9.0712
923263	AB1-132 E OP	3.8876
923572	AB1-173 C OP	1.0087
923573	AB1-173 E OP	0.4707
923582	AB1-173AC OP	1.0087

Bus #	Bus	MW Impact
923583	AB1-173AE OP	0.4707
923911	AB2-031 C O1	1.0012
923912	AB2-031 E O1	0.4931
923991	AB2-040 C O1	3.2875
923992	AB2-040 E O1	2.6897
924151	AB2-059 C OP	27.0758
924152	AB2-059 E OP	13.9482
924501	AB2-099 C	0.2639
924502	AB2-099 E	0.1131
924511	AB2-100 C	4.2530
924512	AB2-100 E	2.0948
925171	AB2-174 C O1	2.9963
925172	AB2-174 E O1	2.7109
925591	AC1-034 C	17.5378
925592	AC1-034 E	13.2302
926071	AC1-086 C	13.3584
926072	AC1-086 E	6.0798
926201	AC1-098 C	8.4863
926202	AC1-098 E	5.0557
926211	AC1-099 C	2.8438
926212	AC1-099 E	1.6702
927021	AC1-189 C	6.0737
927022	AC1-189 E	3.0255
927141	AC1-208 C	13.5259
927142	AC1-208 E	6.0061
932631	AC2-084 C	12.0975
932632	AC2-084 E	5.9585
934201	AD1-047 C	3.5863
934202	AD1-047 E	2.3909
934331	AD1-057 C O1	10.1868
934332	AD1-057 E O1	5.4341
936401	AD2-051 C O1	3.1730
936402	AD2-051 E O1	1.3625
936701	AD2-089 C (Withdrawn : 12/09/2019)	7.0241
936702	AD2-089 E (Withdrawn : 12/09/2019)	4.6827
936711	AD2-090 C O1	2.4240
936712	AD2-090 E O1	1.6160
937571	AD2-169 C	4.7032
937572	AD2-169 E	3.1355
938221	AE1-035 C	0.7996

Bus #	Bus	MW Impact
938222	AE1-035 E	0.3938
940521	AE2-037 C	2.8495
940522	AE2-037 E	1.3774
940571	AE2-044 C	11.4867
940572	AE2-044 E	4.9229
941541	AE2-151 C	0.5015
941542	AE2-151 E	0.2700
942471	AE2-260 C O1	4.9572
942472	AE2-260 E O1	7.0312
943171	AE2-346 C	0.3356
943172	AE2-346 E	0.1438
944141	AF1-082	7.3843
946281	AF1-292 C	0.2945
946282	AF1-292 E	0.1986
DUCKCREEK	DUCKCREEK	0.8625
NEWTON	NEWTON	0.8510
FARMERCITY	FARMERCITY	0.0489
G-007A	G-007A	0.4531
VFT	VFT	1.1997
PRAIRIE	PRAIRIE	2.3015
COFFEEN	COFFEEN	0.4212
EDWARDS	EDWARDS	0.2565
CHEOAH	CHEOAH	0.6977
TILTON	TILTON	0.4536
GIBSON	GIBSON	0.4106
CALDERWOOD	CALDERWOOD	0.6799
BLUEG	BLUEG	1.2673
TRIMBLE	TRIMBLE	0.4018
CATAWBA	CATAWBA	0.7364

Short Circuit

10.7 Short Circuit

The following Breakers are overdutied:

None

Affected Systems

11 Affected Systems

11.1 Duke Energy Progress

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

Attachment 1

System Configuration