Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-302

BROOKVILLE-SQUAD HOLLOW 134 KV

18 MW Capacity / 42 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 West Penn Power (WPP – APS).

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 an uprate to a planned solar generating facility located in Jefferson County, Pennsylvania. This project is an increase to the Interconnection Customer's AE2-316 project, which will share the same property and point of interconnection. The AF1-302 queue position is a 42 MW uprate (18 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 142 MW with 59.22 MW of this output being recognized by PJM as Capacity (see table below for clarity). The proposed in-service date for this uprate project is December 31, 2021. This study does not imply a TO commitment to this in-service date.

Queue	Maximum Facility Output (MFO) (MW)	Energy (MW)	Capacity (MW)
AE2-316	100	100	41.22
AF1-302	142	42	18
Total	**142**	**142**	**59.22**

Queue Number	**AF1-302**
Project Name	BROOKVILLE-SQUAD HOLLOW 134 KV
State	Pennsylvania
County	Jefferson
Transmission Owner	APS
MFO	142
MWE	42
MWC	18
Fuel	Solar
Basecase Study Year	2023

3.1 Point of Interconnection

The project is an upgrade to the proposed AE2-316 project and the point of interconnection will remain unchanged. The IC will not incur any connection facility upgrade costs for this project.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AE2-316/AF1-302 generation project to connect to the FirstEnergy ("FE") transmission system. IC will be responsible for constructing all of the facilities on its side of the POI, including the Attachment facilities which connect the generator to the FE transmission system.

3.2 Cost Summary

The AF1-302 project will be responsible for the following interconnection costs:

Description	Total Cost
Attachment Facilities	$0
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$0
Total Costs	$0

In addition, the AF1-302 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	**$29,512,000**

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

The costs provided above exclude the Contribution in Aid of Construction ("CIAC") Federal Income Tax Gross Up charge. If, at a future date, it is determined that the CIAC Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

4 Transmission Owner Scope of Work

The project is an upgrade to the proposed AE2-316 project and the point of interconnection will remain unchanged. The IC will not incur any connection facility upgrade costs for this project.

4.1 Attachment Facilities

There is no Attachment Facility scope of work required.

4.2 Direct Connection Cost Estimate

There is no Direct Connection scope of work required.

4.3 Non-Direct Connection Cost Estimate

There is no Non-Direct Connection scope of work required.

5 Schedule

The project is an upgrade to the proposed AE2-316 project and point of interconnection will remain unchanged. There is no Attachment Facilities or Direct and/or Non-Direct Connection facilities scope of work.

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.

6 Transmission Owner Analysis

6.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AE2-316/AF1-302 project did not contribute to any overloads on the FE transmission <100 kV system.

7 Interconnection Customer Requirements

7.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx.

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.

7.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated 138 kV circuit breaker to protect the AE2-316/AF1-302 generator lead line. A single circuit breaker must be used to protect this line; if the project has several GSU transformers, the individual GSU transformer breakers cannot be used to protect this line.

2. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. 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 FE Transmission System Control Center.

4. Compliance with the FE and PJM generator power factor and voltage control requirements.

5. The execution of a back-up service agreement to serve the customer load supplied from the AE2-316/AF1-302 generation project metering point when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

The IC will also be required to meet all PJM, ReliabilityFirst, 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 ReliabilityFirst 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 FE system.

7.3 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 FE transmission system.

8 Revenue Metering and SCADA Requirements

8.1 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.

8.1.1 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

8.2 FirstEnergy Requirements

The IC will be required to comply with all FE revenue metering requirements for generation interconnection customers which can be found in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx

9 Network Impacts

The Queue Project AF1-302 was evaluated as a 42.0 MW (Capacity 18.0 MW) injection tapping the Brookville to Squab Hollow 138 kV line in the APS area. Project AF1-302 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-302 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

10 Generation Deliverability

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
42622459	200769	26HOMER CY	345.0	PENELEC	999391	STAR602	1.0	PENELEC	S	PN-P1-3-PN-230-003A	single	824.0	99.98	100.14	DC	2.88
42622461	999391	STAR602	1.0	PENELEC	200767	26HOMER CT	230.0	PENELEC	S	PN-P1-3-PN-230-003A	single	824.0	99.97	100.13	DC	2.88

11 Multiple Facility Contingency

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

None

12 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
41707677	200720	26HARVY.RU	115.0	PENELEC	200712	26DUBOIS	115.0	PENELEC	1	AP-P2-3-WP-230-445	breaker	179.0	111.34	112.29	DC	3.8
41707665	941190	AE2-113 TAP	115.0	PENELEC	200668	26FARMVLY	115.0	PENELEC	1	PN-P2-3-PN-230-8M_SUM_WIN	breaker	160.0	134.67	135.44	DC	2.75

13 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
41401323	200513	26LEWISTWN	230.0	PENELEC	208005	JUNI BU2	230.0	PPL	1	Base Case	operation	493.0	148.87	149.37	DC	5.65
41401344	200726	26SHAWVL2	230.0	PENELEC	235248	01SHINGL	230.0	AP	1	AP-P1-3-WP-230-005	operation	554.0	154.75	155.19	DC	5.63
41401345	200726	26SHAWVL2	230.0	PENELEC	235248	01SHINGL	230.0	AP	1	AP-P1-2-WP-230-005B	operation	554.0	154.75	155.19	DC	5.63
41401199	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	Base Case	operation	491.0	196.51	197.13	DC	6.99
41401202	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P1-2-WP-230-324T_FSA_B	operation	570.0	193.43	194.06	DC	8.14
49691423	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	20090926LOBO+230919490AA2-000 TAP 230 1	operation	570.0	193.43	194.06	DC	8.14
41401631	941190	AE2-113 TAP	115.0	PENELEC	200668	26FARMVLY	115.0	PENELEC	1	PN-P1-2-PN-230-006	operation	160.0	119.27	120.04	DC	2.76

14 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
42622461	2	**STAR602 1.0 kV - 26HOMER CT 230.0 kV Ckt S**	**PENELEC** **PN-AF1-F-0041: Replace the Homer City South 345/230 kV transformer.** **Project Type : FAC** **Cost : $7,140,000** **Time Estimate : 24.0 Months**	$7,140,000
42622459	1	**26HOMER CY 345.0 kV - STAR602 1.0 kV Ckt S**		
41707677	3	**26HARVY.RU 115.0 kV - 26DUBOIS 115.0 kV Ckt 1**	**PENELEC** **s1769.1: Supplemental upgrade s1769.1: Dubois – Harvey Run – Whetstone 115 kV Line, Rehab approximately 14.25 miles of wood pole construction. The supplemental project has a projected in-service date of 12/31/2021.** **Project Type: CON** **Cost : $0** **s1769.2: Supplemental upgrade s1769.2: Dubois 115 kV substation - Replace Line relaying, line trap, substation conductor, line tuner, CCVT, circuit breaker and breaker disconnects (on Dubois – Harvey Run – Whetstone 115 kV Line). The supplemental project has a projected in-service date of 12/31/2021.** **Project Type: FAC** **Cost : $0** **s1769.3: Supplemental upgrade s1769.3: Harvey Run 115 kV substation - Replace Substation conductor, disconnect switches and CVTs (on Dubois – Harvey Run – Whetstone 115 kV Line). The supplemental project has a projected in-service date of 12/31/2021.** **Project Type: CON** **Cost : $0** **s1769.4: Supplemental upgrade s1769.4: Whetstone 115 kV substation - Replace Line relaying, line trap, substation conductor, line tuner, CCVT, circuit breaker and breaker disconnects (on Dubois – Harvey Run – Whetstone 115 kV Line). The supplemental project has a projected in-service date of 12/31/2021.** **Project Type: CON** **Cost : $0**	$0

ID	Index	Facility	Upgrade Description	Cost
41707665	4	**AE2-113 TAP 115.0 kV - 26FARM VLY 115.0 kV Ckt 1**	**PENELEC** **PN-AF1-F-0067a: Replace substation conductor at Farmers Valley. Reconductor AE2-113 - Farmers Valley (~12 miles)** **Project Type : FAC** **Cost : $21,955,500** **Time Estimate : 6.0 Months** **PN-AF1-F-0067b : Replace substation conductor at Farmers Valley** **Replace relay at Farmers Valley** **Project Type : FAC** **Cost : $416,500** **Time Estimate : 12.0 Months**	$22,372,000
			TOTAL COST	**$29,512,000**

15 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.

15.1 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
42622459	200769	26HOMER CY	PENELEC	999391	STAR602	PENELEC	S	PN-P1-3-PN-230-003A	single	824.0	99.98	100.14	DC	2.88

Bus #	Bus	MW Impact
200642	26SENECA#1	6.7245
200643	26SENECA#2	6.3509
200644	26SENECA#3	0.6349
200828	26HNSMLK 1	1.8724
200829	26HNSMLK 2	1.8724
200830	26HNSMLK 3	1.8724
200831	26HNSMLK 4	1.8724
200832	26HNSMLK 5	1.8724
200838	26HOMER C2	44.9371
200839	26HOMER C3	47.5719
200887	26ARMNA MT	0.6656
200898	26AA1-106	3.0340
201144	W3-099 C OP1	1.8314
201201	26WRREN CT	1.5386
201477	26Y2-055	5.6098
203261	26BLOSSBCT	0.6075
203349	26Z1-069 C	0.4973
203350	26MILZ1-092	0.6063
203907	26Y2-042	1.4874
203909	26Z1-038	2.2404
203910	26Z1-091	3.5776
915951	Y3-092 FTIR	140.0300
919201	AA1-144 OP	23.0963
919491	AA2-000	46.8561
920341	AA2-132	4.0202
922932	AB1-082 OP	5.4186
923442	AB1-160 C	0.1421
930511	AB1-092	1.7204
935061	AD1-142	0.0335
936421	AD2-055	3.5420
938951	AE1-123	1.9619
939291	AE1-160 C	1.6601
939381	AE1-169 C O1	6.6482
940861	AE2-074 C	4.1143
941191	AE2-113 C	13.7977
941321	AE2-126 C	1.1364
941421	AE2-139 C	8.2234
942491	AE2-262 C	3.4782
942501	AE2-263 C	3.2695
942811	AE2-299 C	4.5557

Bus #	Bus	MW Impact
942961	AE2-316 C	5.6150
943151	AE2-344 C	9.6193
943351	AF1-006 C	0.8873
943751	AF1-043	5.6318
943871	AF1-055 C O1	8.0519
944261	AF1-094 C	0.8480
944281	AF1-096 C	0.8313
944301	AF1-098 C	3.5963
944311	AF1-099 C	2.7984
944321	AF1-100 C O1	6.1243
944381	AF1-103 O1	3.8676
944391	AF1-104 O1	1.3174
944411	AF1-106 O1	4.3654
944741	AF1-139 C O1	2.4242
944771	AF1-142 C	4.4774
944881	AF1-153 C O1	0.7115
944901	AF1-155 C	0.7136
945021	AF1-167 C	0.6323
945051	AF1-170 C	3.2241
945071	AF1-172 C	7.4846
945121	AF1-177	0.9669
945161	AF1-181	0.0327
945171	AF1-182	0.1633
945331	AF1-198	0.5726
945451	AF1-210 C	0.6039
945551	AF1-220 C	5.8865
945771	AF1-242 C	0.7136
946091	AF1-274 C	2.7741
946131	AF1-278	51.4788
946211	AF1-286 C O1	1.7680
946221	AF1-287 C	0.8793
946381	AF1-302 C	1.2995
946401	AF1-304 C	4.1391
946421	AF1-306 C	3.4741
946771	AF1-217 C O1	0.8793
LGEE	LGEE	0.0747
WEC	WEC	0.0747
CBM-W2	CBM-W2	0.4914
CBM-W1	CBM-W1	4.8163
CHEOAH	CHEOAH	0.0741
MEC	MEC	0.2685
CALDERWOOD	CALDERWOOD	0.0701
CATAWBA	CATAWBA	0.1218

15.2 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
42622461	999391	STAR602	PENELEC	200767	26HOMER CT	PENELEC	S	PN-P1-3-PN-230-003A	single	824.0	99.97	100.13	DC	2.88

Bus #	Bus	MW Impact
200642	26SENECA#1	6.7245
200643	26SENECA#2	6.3509
200644	26SENECA#3	0.6349
200828	26HNSMLK 1	1.8724
200829	26HNSMLK 2	1.8724
200830	26HNSMLK 3	1.8724
200831	26HNSMLK 4	1.8724
200832	26HNSMLK 5	1.8724
200838	26HOMER C2	44.9371
200839	26HOMER C3	47.5719
200887	26ARMNA MT	0.6656
200898	26AA1-106	3.0340
201144	W3-099 C OP1	1.8314
201201	26WRREN CT	1.5386
201477	26Y2-055	5.6098
203261	26BLOSSBCT	0.6075
203349	26Z1-069 C	0.4973
203350	26MILZ1-092	0.6063
203907	26Y2-042	1.4874
203909	26Z1-038	2.2404
203910	26Z1-091	3.5776
915951	Y3-092 FTIR	140.0300
919201	AA1-144 OP	23.0963
919491	AA2-000	46.8561
920341	AA2-132	4.0202
922932	AB1-082 OP	5.4186
923442	AB1-160 C	0.1421
930511	AB1-092	1.7204
935061	AD1-142	0.0335
936421	AD2-055	3.5420
938951	AE1-123	1.9619
939291	AE1-160 C	1.6601
939381	AE1-169 C O1	6.6482
940861	AE2-074 C	4.1143
941191	AE2-113 C	13.7977
941321	AE2-126 C	1.1364
941421	AE2-139 C	8.2234
942491	AE2-262 C	3.4782
942501	AE2-263 C	3.2695
942811	AE2-299 C	4.5557

Bus #	Bus	MW Impact
942961	AE2-316 C	5.6150
943151	AE2-344 C	9.6193
943351	AF1-006 C	0.8873
943751	AF1-043	5.6318
943871	AF1-055 C O1	8.0519
944261	AF1-094 C	0.8480
944281	AF1-096 C	0.8313
944301	AF1-098 C	3.5963
944311	AF1-099 C	2.7984
944321	AF1-100 C O1	6.1243
944381	AF1-103 O1	3.8676
944391	AF1-104 O1	1.3174
944411	AF1-106 O1	4.3654
944741	AF1-139 C O1	2.4242
944771	AF1-142 C	4.4774
944881	AF1-153 C O1	0.7115
944901	AF1-155 C	0.7136
945021	AF1-167 C	0.6323
945051	AF1-170 C	3.2241
945071	AF1-172 C	7.4846
945121	AF1-177	0.9669
945161	AF1-181	0.0327
945171	AF1-182	0.1633
945331	AF1-198	0.5726
945451	AF1-210 C	0.6039
945551	AF1-220 C	5.8865
945771	AF1-242 C	0.7136
946091	AF1-274 C	2.7741
946131	AF1-278	51.4788
946211	AF1-286 C O1	1.7680
946221	AF1-287 C	0.8793
946381	AF1-302 C	1.2995
946401	AF1-304 C	4.1391
946421	AF1-306 C	3.4741
946771	AF1-217 C O1	0.8793
LGEE	LGEE	0.0747
WEC	WEC	0.0747
CBM-W2	CBM-W2	0.4914
CBM-W1	CBM-W1	4.8163
CHEOAH	CHEOAH	0.0741
MEC	MEC	0.2685
CALDERWOOD	CALDERWOOD	0.0701
CATAWBA	CATAWBA	0.1218

15.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
41707677	200720	26HARVY.RU	PENELEC	200712	26DUBOIS	PENELEC	1	AP-P2-3-WP-230-445	breaker	179.0	111.34	112.29	DC	3.8

Bus #	Bus	MW Impact
200649	26PENNTECH	1.4479
201477	26Y2-055	1.9010
235007	AC1-025 BAT	0.0986
236828	01GRAYMONT	-0.2298
922932	AB1-082 OP	1.1551
940861	AE2-074 C	0.8771
940862	AE2-074 E	1.1545
941191	AE2-113 C	9.9547
941192	AE2-113 E	10.7179
942961	AE2-316 C	3.1680
942962	AE2-316 E	4.5177
944313	AF1-099 BAT	3.2033
944323	AF1-100 BAT	8.0327
944381	AF1-103 O1	0.6940
944773	AF1-142 BAT	5.1101
944841	AF1-149 C	-0.6897
944842	AF1-149 E	-0.4598
945121	AF1-177	0.1735
945483	AF1-213 BAT	6.9421
945551	AF1-220 C	28.9653
945552	AF1-220 E	19.3208
946091	AF1-274 C	23.8532
946092	AF1-274 E	15.9021
946131	AF1-278	6.2170
946381	AF1-302 C	0.7332
946382	AF1-302 E	0.9776
946421	AF1-306 C	9.0289
946422	AF1-306 E	36.1154
LGEE	LGEE	0.1295
CPLE	CPLE	0.0648
WEC	WEC	0.0765
CBM-W2	CBM-W2	1.7281
CBM-W1	CBM-W1	3.3026
TVA	TVA	0.2660
O-066	O-066	2.6410
CBM-S2	CBM-S2	0.7225
CBM-S1	CBM-S1	1.6784
G-007	G-007	0.4066
MEC	MEC	0.3671

15.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
41707665	941190	AE2-113 TAP	PENELEC	200668	26FARM VLY	PENELEC	1	PN-P2-3-PN-230-8M_SUM_WIN	breaker	160.0	134.67	135.44	DC	2.75

Bus #	Bus	MW Impact
200649	26PENNTECH	1.3795
235003	AC1-025 E	0.0787
236828	01GRAYMONT	0.2178
290086	Q-036 E	1.8098
919491	AA2-000	22.9558
930511	AB1-092	0.8429
936421	AD2-055	1.7353
936991	AD2-133 C	0.8144
936992	AD2-133 E	3.7251
939171	AE1-147 C	0.6573
939172	AE1-147 E	0.4382
940201	AE2-001 C	0.6551
940202	AE2-001 E	0.4368
940681	AE2-055 C	0.6228
940682	AE2-055 E	0.4152
941191	AE2-113 C	33.8453
941192	AE2-113 E	36.4405
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**0.9191**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**0.6127**
941261	AE2-120 C	0.6539
941262	AE2-120 E	0.4359
941271	AE2-121 C	0.3514
941272	AE2-121 E	0.2346
941321	AE2-126 C	1.9535
941322	AE2-126 E	1.3023
941331	AE2-129 C	0.7112
941332	AE2-129 E	0.4742
941351	AE2-131 C	0.7112
941352	AE2-131 E	0.4742
942351	AE2-248 C	0.5090
942352	AE2-248 E	0.3393
942491	AE2-262 C	3.1858
942492	AE2-262 E	2.1409
942501	AE2-263 C	2.9947
942502	AE2-263 E	1.9994
942961	AE2-316 C	2.2928
942962	AE2-316 E	3.2696
943751	AF1-043	2.7592
944001	AF1-068 C O1	0.3574
944002	AF1-068 E O1	0.2010
944311	AF1-099 C	2.5631

Bus #	Bus	MW Impact
944312	AF1-099 E	1.7087
944321	AF1-100 C O1	5.8202
944322	AF1-100 E O1	3.8802
944382	AF1-103 BAT	1.1864
944471	AF1-112 C	0.3391
944472	AF1-112 E	0.2261
944671	AF1-132 C O1	0.3339
944672	AF1-132 E O1	0.2226
944691	AF1-134 C O1	0.2654
944692	AF1-134 E O1	0.2654
944701	AF1-135 C	0.3185
944702	AF1-135 E	0.2123
944771	AF1-142 C	4.1010
944772	AF1-142 E	2.7340
944841	AF1-149 C	0.6538
944842	AF1-149 E	0.4359
944881	AF1-153 C O1	0.5178
944882	AF1-153 E O1	0.3452
944901	AF1-155 C	0.5143
944902	AF1-155 E	0.3429
945071	AF1-172 C	4.6431
945072	AF1-172 E	3.0954
945161	AF1-181	0.0310
945171	AF1-182	0.1552
945181	AF1-183	0.0396
945481	AF1-213 C	3.0372
945482	AF1-213 E	2.0248
945491	AF1-214 C	0.3466
945492	AF1-214 E	0.2311
945551	AF1-220 C	19.3684
945552	AF1-220 E	12.9194
945771	AF1-242 C	0.5143
945772	AF1-242 E	0.3429
946091	AF1-274 C	9.0418
946092	AF1-274 E	6.0279
946381	AF1-302 C	0.5307
946382	AF1-302 E	0.7075
946421	AF1-306 C	6.7576
946422	AF1-306 E	27.0303
DUCKCREEK	DUCKCREEK	0.1842
NEWTON	NEWTON	0.1655
FARMERCITY	FARMERCITY	0.0085
G-007A	G-007A	0.5131
VFT	VFT	1.3674
NY	NY	0.4911
PRAIRIE	PRAIRIE	0.3823
COFFEEN	COFFEEN	0.0819
EDWARDS	EDWARDS	0.0564
CHEOAH	CHEOAH	0.0576
TILTON	TILTON	0.1002
MADISON	MADISON	0.0081
GIBSON	GIBSON	0.0841

Bus #	Bus	MW Impact
CALDERWOOD	CALDERWOOD	0.0577
BLUEG	BLUEG	0.2639
TRIMBLE	TRIMBLE	0.0851
CATAWBA	CATAWBA	0.0308

Affected Systems

16 Affected Systems

16.1 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

16.2 MISO

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

16.3 TVA

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

16.4 Duke Energy Progress

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

16.5 NYISO

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

17 Contingency Definitions

Contingency Name	Contingency Definition
PN-P1-3-PN-230-003A	CONTINGENCY 'PN-P1-3-PN-230-003A' /* HOMER CITY NORTH 345/230KV XFMR DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 TO BUS 202640 CKT N/* 26HOMER CY 345 26HOMER CT 230 26HOMERCITYN 23.00 END
PN-P2-3-PN-230-8M_SUM_WIN	CONTINGENCY 'PN-P2-3-PN-230-8M_SUM_WIN' /* GLADE STUCK BREAKER B42 (FOREST/SENECA) DISCONNECT BRANCH FROM BUS 200581 TO BUS 200593 CKT 1 /* 26FOREST 230 26GLADE 230 DISCONNECT BRANCH FROM BUS 200593 TO BUS 200594 CKT 1 /* 26GLADE 230 26SENECA 230 DISCONNECT BRANCH FROM BUS 200594 TO BUS 200642 CKT 1 /* 26SENECA 230 26SENECA#1 14 DISCONNECT BRANCH FROM BUS 200594 TO BUS 200643 CKT 1 /* 26SENECA 230 26SENECA#2 14 DISCONNECT BRANCH FROM BUS 200594 TO BUS 200644 CKT 1 /* 26SENECA 230 26SENECA#3 14 REMOVE MACHINE 1G FROM BUS 200642 /* 26SENECA#1 14 REMOVE MACHINE 2G FROM BUS 200643 /* 26SENECA#2 14 REMOVE MACHINE 3 FROM BUS 200644 /* 26SENECA#3 14 END
AP-P1-3-WP-230-005	CONTINGENCY 'AP-P1-3-WP-230-005' /* MILESBURG #82 230/46KV XFMR DISCONNECT BRANCH FROM BUS 235219 TO BUS 236745 CKT 82 /* 01MILESB 230 01MILESBG 46 DISCONNECT BRANCH FROM BUS 942490 TO BUS 235219 CKT 1 /* AE2-262 TAP 230 01MILESB 230 END
PN-P1-2-PN-230-006	CONTINGENCY 'PN-P1-2-PN-230-006' /* GLADE - FOREST 230KV DISCONNECT BRANCH FROM BUS 200593 TO BUS 200581 CKT 1 /* 26GLADE 230 26FOREST 230 END
AP-P1-2-WP-230-324T_FSA_B	CONTINGENCY 'AP-P1-2-WP-230-324T_FSA_B' /* MOSHANNON-MARSHALL 230KV APS-PN TIE DISCONNECT BRANCH FROM BUS 919490 TO BUS 200909 CKT 1 /* AA2-000 TAP 230 26LOBO+ 230 DISCONNECT BRANCH FROM BUS 200857 TO BUS 200909 CKT 1 /* 26MARSHALL 230 26LOBO+ 230 DISCONNECT BRANCH FROM BUS 236829 TO BUS 200909 CKT 81 /* 01LOBO 46 46 26LOBO+ 230 REMOVE LOAD 1 FROM BUS 236829 /* 01LOBO 46 46 END

Contingency Name	Contingency Definition
AP-P1-2-WP-230-005B	CONTINGENCY 'AP-P1-2-WP-230-005B' /* QUEUE AE2-262 - MOSHANNON 230KV DISCONNECT BRANCH FROM BUS 942490 TO BUS 235219 CKT 1 /* AE2-262 TAP 230 01MILESB 230 END
Base Case	
200909 26LOBO+ 230 919490 AA2-000 TAP 230 1	CONTINGENCY '200909 26LOBO+ 230 919490 AA2-000 TAP 230 1' OPEN BRANCH FROM BUS 200909 TO BUS 919490 CKT 1 END
AP-P2-3-WP-230-445	CONTINGENCY 'AP-P2-3-WP-230-445' /* 454 DISCONNECT BRANCH FROM BUS 235174 TO BUS 235175 CKT 1 /* 01ELKO 138 01ELKO 230 DISCONNECT BRANCH FROM BUS 235971 TO BUS 235175 CKT 1 /* 01SQUABHLLW 230 01ELKO 230 DISCONNECT BRANCH FROM BUS 235174 TO BUS 235237 CKT 1 /* 01ELKO 138 01RIDGWY 138 DISCONNECT BRANCH FROM BUS 235159 TO BUS 235174 CKT 1 /* 01CARB J 138 01ELKO 138 END

Short Circuit

18 Short Circuit

The following Breakers are overduty:

None

19 Attachment One: One Line Diagram