Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-112

CENTRE HALL-BOALSBURG 46 KV

12 MW Capacity / 20 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 (APS-WPP zone).

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.

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 generating facility located in Centre County, Pennsylvania. The installed facilities will have a total capability of 20 MW with 12 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 04/03/2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AF1-112
Project Name	CENTRE HALL-BOALSBURG 46 KV
State	Pennsylvania
County	Centre
Transmission Owner	APS
MFO	20
MWE	20
MWC	12
Fuel	Solar
Basecase Study Year	2023

3.1 Point of Interconnection

The interconnection of the project at the Primary POI will be accomplished by tapping the Center Hall - Shingletown 46 kV line and constructing a one span tap. The transmission line tap will be located approximately 0.9 miles from Center Hall substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection line tap and the associated attachment facilities. The project will also require non-direct connection upgrades at Center Hall and Shingletown substations.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF1-112 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 AF1-112 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$99,300
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$151,600
Total Costs	**$250,900**

In addition, the AF1-112 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	**$167,921,000**

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.

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.

The required Attachment Facilities and Direct and Non-Direct Connection work for the interconnection of the AF1-112 generation project to the FE Transmission System is detailed in the following sections. The associated one-line with the generation project Attachment Facilities and the Primary Direct and Non-Direct Connection facilities are shown in Attachment 1.

4 Transmission Owner Scope of Work

The interconnection of the project at the Primary POI will be accomplished by tapping the Center Hall - Shingletown 46 kV line and constructing a one span tap. The transmission line tap will be located approximately 0.9 miles from Center Hall substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection line tap and the associated attachment facilities. The project will also require non-direct connection upgrades at Center Hall and Shingletown substations.

5 Attachment Facilities

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
One 46 kV Tap Switch and single span tap to customer's substation. Install 46 kV metering in customer's substation.	$36,100
Review drawings and provide nameplates for customer substation.	$63,200
Total Attachment Facility Costs	**$99,300**

6 Direct Connection Cost Estimate

Direct Connection scope of work is not required.

7 Non-Direct Connection Cost Estimate

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

Description	Total Cost
Construct 46 kV tap with two line switches.	$72,200
Update relay settings at Centre Hall	$39,700
Update relay settings at Shingletown	$39,700
Total Non-Direct Connection Facility Costs	**$151,600**

8 Schedule

Based on the scope of work for the Attachment Facilities and the Direct and/or Non-Direct Connection facilities, it is expected to take a minimum of **12 months** after the signing of an Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the IC to make a preliminary payment that compensates FE for the first three months of the engineering design work that is related to the Attachment Facilities. Full initial payment is required for Non-Direct Connection work. This assumes that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined interconnection work and network upgrades, and that all transmission system outages will be allowed when requested.

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

FE performed an analysis of its underlying transmission <100 kV system. The AF1-112 project did not contribute to any overloads on the FE transmission <100 kV system.

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 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.

10.2 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 46 kV circuit breaker to protect the AF1-112 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 AF1-112 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.

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 FE 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.

11.1.1 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 APS 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

12 Network Impacts

The Queue Project AF1-112 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection tapping the Center Hall to Boalsburg 46 kV line in the APS area. Project AF1-112 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-112 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
41531009	200727	26SHAW. 2	115.0	PENELEC	200716	26PHILIPSB	115.0	PENELEC	1	AP-P2-3-WP-230-460T	breaker	185.0	99.92	100.36	DC	1.81

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
41530897	200513	26LEWISTWN	230.0	PENELEC	208005	JUNI BU2	230.0	PPL	1	AP-P2-3-WP-230-446T	breaker	624.0	107.0	108.3	DC	8.1
41795175	200513	26LEWISTWN	230.0	PENELEC	208005	JUNI BU2	230.0	PPL	1	PN-P2-2-PN-115-032	bus	624.0	106.69	107.83	DC	7.41
41795162	200904	26EAGL VAL	115.0	PENELEC	200527	26TYRONEN	115.0	PENELEC	1	AP-P2-2-WP-230-005T	bus	191.0	131.52	131.97	DC	1.91
41195181	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	Base Case	single	491.0	111.54	112.72	DC	5.98
41530770	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P2-3-WP-230-446T	breaker	570.0	152.02	154.14	DC	12.11
41530771	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P2-3-WP-230-443T *	breaker	570.0	151.88	154.0	DC	12.11
41530772	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P2-2-WP-230-001T	breaker	570.0	151.88	154.0	DC	12.11

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
41795075	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P2-2-WP-230-001T	bus	570.0	151.88	154.0	DC	12.11
49471026	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	PN-P1-2-PN-230-004	single	570.0	110.38	111.45	DC	6.13
41531270	999393	STAR600	1.0	PENELEC	200727	26SHAW. 2	115.0	PENELEC	2A	AP-P2-3-WP-230-446T	breaker	148.0	108.99	109.48	DC	1.6
41531272	999393	STAR600	1.0	PENELEC	200727	26SHAW. 2	115.0	PENELEC	2A	AP-P2-2-WP-230-001T	breaker	148.0	108.92	109.41	DC	1.6
41795168	999393	STAR600	1.0	PENELEC	200727	26SHAW. 2	115.0	PENELEC	2A	AP-P2-2-WP-230-001T	bus	148.0	108.92	109.41	DC	1.6
41531059	999394	STAR599	1.0	PENELEC	200714	26SHAWVL1	115.0	PENELEC	1A	AP-P2-3-WP-230-446T	breaker	126.0	126.65	127.21	DC	1.58
41531060	999394	STAR599	1.0	PENELEC	200714	26SHAWVL1	115.0	PENELEC	1A	AP-P2-2-WP-230-001T	breaker	126.0	126.49	127.06	DC	1.58
41795267	999394	STAR599	1.0	PENELEC	200714	26SHAWVL1	115.0	PENELEC	1A	AP-P2-2-WP-230-001T	bus	126.0	126.49	127.06	DC	1.58

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
41195299	200513	26LEWISTWN	230.0	PENELEC	208005	JUNI BU2	230.0	PPL	1	Base Case	operation	493.0	110.6	111.91	DC	6.75

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
41195300	200513	26LEWISTWN	230.0	PENELEC	208005	JUNI BU2	230.0	PPL	1	PN-P1-2-PN-115-094-A	operation	624.0	106.64	107.77	DC	7.42
41195378	200522	26SHADEGP	115.0	PENELEC	938380	AE1-071 TAP	115.0	PENELEC	1	PL_P12_100618	operation	160.0	119.42	120.91	DC	2.38
41195471	200714	26SHAWVL1	115.0	PENELEC	200872	26BIOENTP	115.0	PENELEC	1	AP-P1-2-WP-230-323T	operation	185.0	107.75	108.87	DC	2.08
41195175	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	Base Case	operation	491.0	139.98	141.95	DC	9.96
41195178	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	AP-P1-2-WP-230-324T_FSA_B	operation	570.0	131.79	133.63	DC	10.82
49471021	235248	01SHINGL	230.0	AP	200513	26LEWISTWN	230.0	PENELEC	1	200909 26LOBO+ 230 919490 AA2-000 TAP 230 1	operation	570.0	131.79	133.63	DC	10.82
41195704	999394	STAR599	1.0	PENELEC	200714	26SHAWVL1	115.0	PENELEC	1A	PN-P1-3-PN-115-005	operation	126.0	116.88	117.35	DC	1.32

12.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
41531059,41531060, 41795267	6	STAR599 1.0 kV - 26SHAWVL 1 115.0 kV Ckt 1A	PENELEC PN-AF1-F-0081 (963) : Replace Shawville 230/115 kV 1A transformer Project Type : FAC Cost : $4,165,000 Time Estimate : 24.0 Months	$4,165,000

ID	Index	Facility	Upgrade Description	Cost
41530772,41530771, 41530770,41195181, 49471026,41795075	4	01SHINGL 230.0 kV - 26LEWISTWN 230.0 kV Ckt 1	PENELEC PN-AF1-F-0061a (763) : Replace substation conductor at Shingletown Project Type : FAC Cost : $238,000 Time Estimate : 6.0 Months PN-AF1-F-0061b (764) : Replace substation conductor at Shingletown Replace disconnect switches at Shingletown Reconductor Shingletown - Lewistown 115 kV (~26 miles) Project Type : FAC Cost : $46,826,500 Time Estimate : 9.0 Months PN-AF1-F-0061c (765) : Replace disconnect switches at Shingletown Replace substation conductor at Shingletown Replace relays at Lewistown and Shingletown Project Type : FAC Cost : $714,000 Time Estimate : 12.0 Months PN-AF1-F-0061d (766) : Replace 1600 Amp Generic circuit breaker at Shingletown Project Type : FAC Cost : $595,000 Time Estimate : 12.0 Months APS WP-AF1-F-0005a (1951) : Replace substation conductor at Shingletown Project Type : FAC Cost : $126,000 Time Estimate : 6.0 Months WP-AF1-F-0005b (1952) : Replace substation conductor Replace switches at Shingletown Project Type : FAC Cost : $378,000 Time Estimate : 9.0 Months WP-AF1-F-0005c (1953) : Replace substation conductor and relays at Lewistown and Shingletown Project Type : FAC Cost : $441,000 Time Estimate : 12.0 Months WP-AF1-F-0005d (1954) : Replace circuit breaker at Shingletown Project Type : FAC Cost : $630,000 Time Estimate : 12.0 Months	$49,948,500

ID	Index	Facility	Upgrade Description	Cost
41795162	3	26EAGL VAL 115.0 kV - 26TYRONE N 115.0 kV Ckt 1	**PENELEC** **s1776.1:** Supplemental upgrade s1776.1: Tyrone North - Construct a four breaker 115 kV ring bus. The supplemental project has a projected in-service date of 12/31/2020. **Project Type:** CON **Cost :** $0 **s1776.2:** Supplemental upgrade s1776.2: Replace the Tyrone North #2 115/46 kV 45/60/75 MVA transformer. The supplemental project has a projected in-service date of 12/31/2020. **Project Type:** CON **Cost :** $0 **s1776.3:** Supplemental upgrade s1776.3: Install a 46 kV 1200 A bypass switch between the Tipton and Warrior Ridge 46 kV lines. The supplemental project has a projected in-service date of 12/31/2020. **Project Type:** CON **Cost :** $0	$0
41531270,41795168, 41531272	5	STAR600 1.0 kV - 26SHAW. 2 115.0 kV Ckt 2A	**PN-AF1-F-0080a (961) :** Replace Shawville 230/115 kV 2A transformer **Project Type :** FAC **Cost :** $4,165,000 **Time Estimate :** 24.0 Months	$4,165,000
41530897,41795175	2	26LEWISTWN 230.0 kV - JUNI BU2 230.0 kV Ckt 1	**PPL** **R-PL-0006 (6) :** Rebuild PPL's ~0.9mi LEWI-JUNI 230kV Line and replace terminal equipment at Juniata 230kV **Project Type :** FAC **Cost :** $7,000,000 **Time Estimate :** 24.0 Months **R-PL-0007 (7) :** Replace two (2) CB's MOD switches **Project Type :** FAC **Cost :** $600,000 **Time Estimate :** 24.0 Months **PENELEC** **PN-AF1-F-0003a (674) :** PPL would need to replace their section of the limiting conductor/ equipment and provide estimates for their replacement. Their replacement conductor/ equipment should at least be rated above 660 MVA (Rate B) to not remain as the limiting element. **Project Type :** FAC **Cost :** $0 **Time Estimate :** Months **PN-AF1-F-0003b (675) :** Reconductor Lewistown - Juniata (~24.5 miles). **Project Type :** FAC **Cost :** $102,042,500 **Time Estimate :** 6.0 Months	$109,642,500

ID	Index	Facility	Upgrade Description	Cost
41531009	1	26SHAW. 2 115.0 kV - 26PHILIPSB 115.0 kV Ckt 1	**PENELEC** **s1919: Supplemental upgrade s1919: Construct a 115 kV ring bus at the Philipsburg substation.** • **Build a four breaker 115 kV ring bus at the Philipsburg substation. (s1919.1)** • **Replace limiting CTs, substation conductor / drop, line trap and circuit breakers on Shawville 115 kV line exit at the Philipsburg substation. (s1919.2)** • **Replace limiting CTs, substation conductor / drop, and circuit breakers on Eagle Valley 115 kV line exit at the Philipsburg substation. (s1919.3)** • **Replace line trap on Philipsburg 115 kV line exit at the Shawville substation and adjust line relaying as necessary. (s1919.4)** **The supplemental project has a projected in-service date of 12/01/2023.** **Project Type: CON** **Cost : $0**	$0
			TOTAL COST	**$167,921,000**

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 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
41531009	200727	26SHAW. 2	PENELEC	200716	26PHILIPSB	PENELEC	1	AP-P2-3-WP-230-460T	breaker	185.0	99.92	100.36	DC	1.81

Bus #	Bus	MW Impact
200665	26SHAWVL 3	2.5587
200666	26SHAWVL 4	2.5143
200715	26SHAWVL 1	2.2640
200722	26SHAWVL 2	2.3277
200913	26SHAW-D	0.1367
235003	AC1-025 E	0.1151
236828	01GRAYMONT	0.3073
919491	AA2-000	28.4615
930511	AB1-092	1.0450
936421	AD2-055	2.1515
939171	AE1-147 C	0.9222
939172	AE1-147 E	0.6148
940201	AE2-001 C	0.9221
940202	AE2-001 E	0.6147
940681	AE2-055 C	0.9209
940682	AE2-055 E	0.6139
941191	AE2-113 C	2.9356
941192	AE2-113 E	3.1607
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**1.9622**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.3082**
941261	AE2-120 C	0.9220
941262	AE2-120 E	0.6147
941271	AE2-121 C	0.4903
941272	AE2-121 E	0.3274
941321	AE2-126 C	1.4376
941322	AE2-126 E	0.9584
942351	AE2-248 C	0.7371
942352	AE2-248 E	0.4914
942491	AE2-262 C	3.8594
942492	AE2-262 E	2.5935
942501	AE2-263 C	3.6279
942502	AE2-263 E	2.4222
943751	AF1-043	3.4209
944001	AF1-068 C O1	0.5208
944002	AF1-068 E O1	0.2929
944311	AF1-099 C	3.1051
944312	AF1-099 E	2.0700
944321	AF1-100 C O1	15.8010
944322	AF1-100 E O1	10.5340
944471	AF1-112 C	0.4884
944472	AF1-112 E	0.3256

Bus #	Bus	MW Impact
944671	AF1-132 C O1	0.4882
944672	AF1-132 E O1	0.3254
944691	AF1-134 C O1	0.4457
944692	AF1-134 E O1	0.4457
944701	AF1-135 C	0.5349
944702	AF1-135 E	0.3566
944771	AF1-142 C	4.9681
944772	AF1-142 E	3.3121
944841	AF1-149 C	0.9220
944842	AF1-149 E	0.6147
944881	AF1-153 C O1	0.3830
944882	AF1-153 E O1	0.2553
944901	AF1-155 C	0.3801
944902	AF1-155 E	0.2534
945071	AF1-172 C	5.4202
945072	AF1-172 E	3.6135
945161	AF1-181	0.0842
945171	AF1-182	0.4214
945181	AF1-183	0.1329
945481	AF1-213 C	11.8413
945482	AF1-213 E	7.8942
945491	AF1-214 C	0.4887
945492	AF1-214 E	0.3258
945551	AF1-220 C	3.6843
945552	AF1-220 E	2.4575
945771	AF1-242 C	0.3801
945772	AF1-242 E	0.2534
946091	AF1-274 C	5.6671
946092	AF1-274 E	3.7781
946421	AF1-306 C	2.0140
946422	AF1-306 E	8.0561
DUCKCREEK	DUCKCREEK	0.0046
NEWTON	NEWTON	0.0097
FARMERCITY	FARMERCITY	0.0006
CBM-W1	CBM-W1	0.1126
PRAIRIE	PRAIRIE	0.0310
O-066	O-066	0.3091
COFFEEN	COFFEEN	0.0042
EDWARDS	EDWARDS	0.0010
CHEOAH	CHEOAH	0.0175
TILTON	TILTON	0.0031
G-007	G-007	0.0634
GIBSON	GIBSON	0.0044
CALDERWOOD	CALDERWOOD	0.0169
BLUEG	BLUEG	0.0174
TRIMBLE	TRIMBLE	0.0056
CATAWBA	CATAWBA	0.0182

12.6.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
41530897	200513	26LEWISTWN	PENELEC	208005	JUNI BU2	PPL	1	AP-P2-3-WP-230-446T	breaker	624.0	107.0	108.3	DC	8.1

Bus #	Bus	MW Impact
200665	26SHAWVL 3	7.7967
200666	26SHAWVL 4	7.6716
200715	26SHAWVL 1	4.9146
200722	26SHAWVL 2	5.0397
200812	26ALY HYDR	1.1301
200852	26WARR RDG	0.3229
200883	Q-053 E	6.8957
200886	26ARWF_N39	0.4288
200894	26K02	9.1554
200898	26AA1-106	1.9579
200905	26Q36	0.2813
200913	26SHAW-D	0.2124
200915	26CHSTN_FL	0.1524
203034	26NA_O38_P22	0.3752
203905	26W1-045 C	0.6853
235003	AC1-025 E	0.6133
236828	01GRAYMONT	1.5971
290086	Q-036 E	8.0600
293301	N-039 E	12.2874
293393	V3-030E	2.7472
294515	O38_P22	10.7514
901242	W1-045 E OP1	1.1181
919491	AA2-000	117.3103
930511	AB1-092	4.3073
936421	AD2-055	8.8679
936471	AD2-062 C O1	5.0032
936472	AD2-062 E O1	2.5063
936991	AD2-133 C	3.6270
936992	AD2-133 E	16.5895
938381	AE1-071 C	13.1348
938382	AE1-071 E	8.0374
939171	AE1-147 C	4.7732
939172	AE1-147 E	3.1822
940201	AE2-001 C	4.7834
940202	AE2-001 E	3.1890
940681	AE2-055 C	4.9397
940682	AE2-055 E	3.2931
941231	AE2-117 C	4.6266
941232	AE2-117 E	3.0844
941241	AE2-118 C	4.6266
941242	AE2-118 E	3.0844

Bus #	Bus	MW Impact
941251	AE2-119 C (Withdrawn : 12/16/2019)	3.0438
941252	AE2-119 E (Withdrawn : 12/16/2019)	2.0292
941261	AE2-120 C	4.7891
941262	AE2-120 E	3.1927
941271	AE2-121 C	2.5283
941272	AE2-121 E	1.6882
941321	AE2-126 C	2.1067
941322	AE2-126 E	1.4045
941331	AE2-129 C	2.7008
941332	AE2-129 E	1.8006
941351	AE2-131 C	2.7008
941352	AE2-131 E	1.8006
941421	AE2-139 C	5.5361
941422	AE2-139 E	3.6907
942031	AE2-215 C	14.8871
942032	AE2-215 E	9.9247
942121	AE2-224 C	7.2840
942122	AE2-224 E	4.8560
942351	AE2-248 C	3.8996
942352	AE2-248 E	2.5997
942491	AE2-262 C	17.7280
942492	AE2-262 E	11.9132
942501	AE2-263 C	16.6643
942502	AE2-263 E	11.1261
942511	AE2-264 C	15.1296
942512	AE2-264 E	10.0864
943751	AF1-043	26.6038
944001	AF1-068 C O1	5.2205
944002	AF1-068 E O1	2.9365
944181	AF1-086 C O1	2.8312
944182	AF1-086 E O1	12.3174
944311	AF1-099 C	26.9111
944312	AF1-099 E	17.9407
944321	AF1-100 C O1	48.2115
944322	AF1-100 E O1	32.1410
944471	AF1-112 C	4.8575
944472	AF1-112 E	3.2383
944671	AF1-132 C O1	4.9052
944672	AF1-132 E O1	3.2702
944691	AF1-134 C O1	1.8754
944692	AF1-134 E O1	1.8754
944701	AF1-135 C	2.2505
944702	AF1-135 E	1.5003
944731	AF1-138 C O1	4.6266
944732	AF1-138 E O1	3.0844
944751	AF1-140 C	1.1435
944752	AF1-140 E	0.7623
944771	AF1-142 C	43.0578
944772	AF1-142 E	28.7052
944841	AF1-149 C	4.7897
944842	AF1-149 E	3.1931
945071	AF1-172 C	42.2760

Bus #	Bus	MW Impact
945072	AF1-172 E	28.1840
945161	AF1-181	0.2565
945171	AF1-182	1.2856
945181	AF1-183	0.2886
945481	AF1-213 C	19.9893
945482	AF1-213 E	13.3262
945491	AF1-214 C	4.7887
945492	AF1-214 E	3.1925
945551	AF1-220 C	11.0811
945552	AF1-220 E	7.3914
945901	AF1-255 C	0.2695
945902	AF1-255 E	0.3722
946091	AF1-274 C	8.1585
946092	AF1-274 E	5.4390
946241	AF1-289 C O1	1.2428
946242	AF1-289 E O1	0.8286
946311	AF1-295	4.9624
LGEE	LGEE	0.5465
CPLE	CPLE	0.3744
WEC	WEC	0.3115
CBM-W2	CBM-W2	7.4120
CBM-W1	CBM-W1	12.8478
TVA	TVA	1.1872
O-066	O-066	18.8832
CBM-S2	CBM-S2	3.7743
CBM-S1	CBM-S1	7.3954
G-007	G-007	2.9432
MEC	MEC	1.5207

12.6.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
41795162	200904	26EAGL VAL	PENELEC	200527	26TYRONE N	PENELEC	1	AP-P2-2-WP-230-005T	bus	191.0	131.52	131.97	DC	1.91

Bus #	Bus	MW Impact
200665	26SHAWVL 3	2.5507
200666	26SHAWVL 4	2.5057
200715	26SHAWVL 1	2.2589
200722	26SHAWVL 2	2.3221
200905	26Q36	0.7172
200913	26SHAW-D	0.1365
235003	AC1-025 E	0.1219
236828	01GRAYMONT	0.3194
290086	Q-036 E	20.5528
919491	AA2-000	28.5206
930511	AB1-092	1.0472
936421	AD2-055	2.1560
936991	AD2-133 C	9.2488
936992	AD2-133 E	42.3028
939171	AE1-147 C	0.9548
939172	AE1-147 E	0.6365
940201	AE2-001 C	0.9570
940202	AE2-001 E	0.6380
940681	AE2-055 C	0.9910
940682	AE2-055 E	0.6607
941191	AE2-113 C	2.9319
941192	AE2-113 E	3.1567
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**1.9591**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.3061**
941261	AE2-120 C	0.9578
941262	AE2-120 E	0.6385
941271	AE2-121 C	0.5067
941272	AE2-121 E	0.3383
941321	AE2-126 C	1.4356
941322	AE2-126 E	0.9570
941331	AE2-129 C	4.2805
941332	AE2-129 E	2.8537
941351	AE2-131 C	4.2805
941352	AE2-131 E	2.8537
942351	AE2-248 C	0.7794
942352	AE2-248 E	0.5196
942491	AE2-262 C	3.9032
942492	AE2-262 E	2.6230
942501	AE2-263 C	3.6690
942502	AE2-263 E	2.4496
943751	AF1-043	3.4280

Bus #	Bus	MW Impact
944001	AF1-068 C O1	0.5542
944002	AF1-068 E O1	0.3117
944181	AF1-086 C O1	0.4667
944182	AF1-086 E O1	2.0305
944311	AF1-099 C	3.1403
944312	AF1-099 E	2.0935
944321	AF1-100 C O1	15.7470
944322	AF1-100 E O1	10.4980
944471	AF1-112 C	0.5150
944472	AF1-112 E	0.3433
944671	AF1-132 C O1	0.5210
944672	AF1-132 E O1	0.3473
944691	AF1-134 C O1	0.4449
944692	AF1-134 E O1	0.4449
944701	AF1-135 C	0.5338
944702	AF1-135 E	0.3559
944771	AF1-142 C	5.0244
944772	AF1-142 E	3.3496
944841	AF1-149 C	0.9578
944842	AF1-149 E	0.6385
944881	AF1-153 C O1	0.3827
944882	AF1-153 E O1	0.2552
944901	AF1-155 C	0.3798
944902	AF1-155 E	0.2532
945071	AF1-172 C	5.4317
945072	AF1-172 E	3.6211
945161	AF1-181	0.0839
945171	AF1-182	0.4199
945181	AF1-183	0.1327
945481	AF1-213 C	11.8213
945482	AF1-213 E	7.8808
945491	AF1-214 C	0.5076
945492	AF1-214 E	0.3384
945551	AF1-220 C	3.6798
945552	AF1-220 E	2.4545
945771	AF1-242 C	0.3798
945772	AF1-242 E	0.2532
946091	AF1-274 C	5.6595
946092	AF1-274 E	3.7730
946421	AF1-306 C	2.0125
946422	AF1-306 E	8.0498
DUCKCREEK	DUCKCREEK	0.0115
NEWTON	NEWTON	0.0161
FARMERCITY	FARMERCITY	0.0009
CBM-W1	CBM-W1	0.0375
PRAIRIE	PRAIRIE	0.0465
O-066	O-066	0.3494
COFFEEN	COFFEEN	0.0074
EDWARDS	EDWARDS	0.0032
CHEOAH	CHEOAH	0.0205
TILTON	TILTON	0.0069
G-007	G-007	0.0686

Bus #	Bus	MW Impact
GIBSON	GIBSON	0.0082
CALDERWOOD	CALDERWOOD	0.0199
BLUEG	BLUEG	0.0278
TRIMBLE	TRIMBLE	0.0089
CATAWBA	CATAWBA	0.0203

12.6.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
41795075	235248	01SHINGL	AP	200513	26LEWISTWN	PENELEC	1	AP-P2-2-WP-230-001T	bus	570.0	151.88	154.0	DC	12.11

Bus #	Bus	MW Impact
200665	26SHAWVL 3	11.2213
200666	26SHAWVL 4	11.0429
200715	26SHAWVL 1	6.8508
200722	26SHAWVL 2	7.0237
200894	26K02	13.1208
200898	26AA1-106	2.6976
200905	26Q36	0.2708
200913	26SHAW-D	0.2828
203352	26CANZ2-011	0.4430
235003	AC1-025 E	0.9180
236828	01GRAYMONT	2.3847
290086	Q-036 E	7.7608
919491	AA2-000	169.8793
930511	AB1-092	6.2375
936421	AD2-055	12.8419
936991	AD2-133 C	3.4924
936992	AD2-133 E	15.9737
939171	AE1-147 C	7.1243
939172	AE1-147 E	4.7495
940201	AE2-001 C	7.1412
940202	AE2-001 E	4.7608
940681	AE2-055 C	7.3998
940682	AE2-055 E	4.9332
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**4.0520**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**2.7014**
941261	AE2-120 C	7.1504
941262	AE2-120 E	4.7670
941271	AE2-121 C	3.7720
941272	AE2-121 E	2.5186
941321	AE2-126 C	2.6525
941322	AE2-126 E	1.7683
941331	AE2-129 C	3.1049
941332	AE2-129 E	2.0699
941351	AE2-131 C	3.1049
941352	AE2-131 E	2.0699
941421	AE2-139 C	7.8236
941422	AE2-139 E	5.2157
942351	AE2-248 C	5.8335
942352	AE2-248 E	3.8890
942491	AE2-262 C	26.1095
942492	AE2-262 E	17.5456

Bus #	Bus	MW Impact
942501	AE2-263 C	24.5429
942502	AE2-263 E	16.3863
943751	AF1-043	38.5255
944001	AF1-068 C O1	7.8127
944002	AF1-068 E O1	4.3947
944181	AF1-086 C O1	1.2931
944182	AF1-086 E O1	5.6255
944311	AF1-099 C	39.6342
944312	AF1-099 E	26.4228
944321	AF1-100 C O1	69.3975
944322	AF1-100 E O1	46.2650
944471	AF1-112 C	7.2636
944472	AF1-112 E	4.8424
944671	AF1-132 C O1	7.3427
944672	AF1-132 E O1	4.8951
944691	AF1-134 C O1	2.2470
944692	AF1-134 E O1	2.2470
944701	AF1-135 C	2.6964
944702	AF1-135 E	1.7976
944771	AF1-142 C	63.4148
944772	AF1-142 E	42.2765
944841	AF1-149 C	7.1515
944842	AF1-149 E	4.7677
945071	AF1-172 C	61.3380
945072	AF1-172 E	40.8920
945161	AF1-181	0.3692
945171	AF1-182	1.8506
945181	AF1-183	0.4023
945481	AF1-213 C	25.4386
945482	AF1-213 E	16.9591
945491	AF1-214 C	7.1500
945492	AF1-214 E	4.7666
945551	AF1-220 C	5.7668
945552	AF1-220 E	3.8467
946091	AF1-274 C	10.0853
946092	AF1-274 E	6.7235
946312	AF1-295 BAT	1.5296
LGEE	LGEE	0.0673
WEC	WEC	0.0444
CBM-W2	CBM-W2	0.6962
CBM-W1	CBM-W1	2.1267
TVA	TVA	0.0672
O-066	O-066	5.0266
CBM-S1	CBM-S1	0.5197
G-007	G-007	0.8403
MEC	MEC	0.1907
CATAWBA	CATAWBA	0.0231

12.6.5 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
41795168	999393	STAR600	PENELEC	200727	26SHAW. 2	PENELEC	2A	AP-P2-2-WP-230-001T	bus	148.0	108.92	109.41	DC	1.6

Bus #	Bus	MW Impact
200665	26SHAWVL 3	2.8447
200666	26SHAWVL 4	2.9005
235003	AC1-025 E	0.1005
236828	01GRAYMONT	0.2760
919491	AA2-000	30.5395
930511	AB1-092	1.1213
936421	AD2-055	2.3086
939171	AE1-147 C	0.8319
939172	AE1-147 E	0.5546
940201	AE2-001 C	0.8298
940202	AE2-001 E	0.5532
940681	AE2-055 C	0.7967
940682	AE2-055 E	0.5311
941261	AE2-120 C	0.8285
941262	AE2-120 E	0.5524
941271	AE2-121 C	0.4443
941272	AE2-121 E	0.2967
942351	AE2-248 C	0.6484
942352	AE2-248 E	0.4323
942491	AE2-262 C	3.9236
942492	AE2-262 E	2.6367
942501	AE2-263 C	3.6882
942502	AE2-263 E	2.4625
943751	AF1-043	3.6707
944001	AF1-068 C O1	0.4558
944002	AF1-068 E O1	0.2564
944311	AF1-099 C	3.1567
944312	AF1-099 E	2.1045
944321	AF1-100 C O1	18.2280
944322	AF1-100 E O1	12.1520
944471	AF1-112 C	0.4315
944472	AF1-112 E	0.2876
944671	AF1-132 C O1	0.4261
944672	AF1-132 E O1	0.2841
944771	AF1-142 C	5.0507
944772	AF1-142 E	3.3671
944841	AF1-149 C	0.8284
944842	AF1-149 E	0.5523
945071	AF1-172 C	5.8966
945072	AF1-172 E	3.9311
945161	AF1-181	0.0936

Bus #	Bus	MW Impact
945171	AF1-182	0.4861
945483	AF1-213 BAT	7.7918
945491	AF1-214 C	0.4392
945492	AF1-214 E	0.2928
DUCKCREEK	DUCKCREEK	0.2602
NEWTON	NEWTON	0.2385
FARMERCITY	FARMERCITY	0.0122
G-007A	G-007A	0.9590
VFT	VFT	2.6251
PRAIRIE	PRAIRIE	0.5579
COFFEEN	COFFEEN	0.1173
EDWARDS	EDWARDS	0.0798
CHEOAH	CHEOAH	0.0921
TILTON	TILTON	0.1430
MADISON	MADISON	0.0161
GIBSON	GIBSON	0.1218
CALDERWOOD	CALDERWOOD	0.0924
BLUEG	BLUEG	0.3854
TRIMBLE	TRIMBLE	0.1235
CATAWBA	CATAWBA	0.0546

12.6.6 Index 6

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
41795267	999394	STAR599	PENELEC	200714	26SHAWVL 1	PENELEC	1A	AP-P2-2-WP-230-001T	bus	126.0	126.49	127.06	DC	1.58

Bus #	Bus	MW Impact
200665	26SHAWVL 3	2.9147
200666	26SHAWVL 4	2.7597
235003	AC1-025 E	0.0991
236828	01GRAYMONT	0.2735
919491	AA2-000	31.0983
930511	AB1-092	1.1418
936421	AD2-055	2.3508
939171	AE1-147 C	0.8250
939172	AE1-147 E	0.5500
940201	AE2-001 C	0.8225
940202	AE2-001 E	0.5484
940681	AE2-055 C	0.7851
940682	AE2-055 E	0.5234
941261	AE2-120 C	0.8212
941262	AE2-120 E	0.5475
941271	AE2-121 C	0.4409
941272	AE2-121 E	0.2944
942351	AE2-248 C	0.6406
942352	AE2-248 E	0.4270
942491	AE2-262 C	3.9546
942492	AE2-262 E	2.6575
942501	AE2-263 C	3.7173
942502	AE2-263 E	2.4819
943751	AF1-043	3.7378
944001	AF1-068 C O1	0.4500
944002	AF1-068 E O1	0.2531
944311	AF1-099 C	3.1817
944312	AF1-099 E	2.1211
944321	AF1-100 C O1	17.3430
944322	AF1-100 E O1	11.5620
944471	AF1-112 C	0.4265
944472	AF1-112 E	0.2844
944671	AF1-132 C O1	0.4205
944672	AF1-132 E O1	0.2803
944771	AF1-142 C	5.0906
944772	AF1-142 E	3.3938
944841	AF1-149 C	0.8210
944842	AF1-149 E	0.5473
945071	AF1-172 C	6.0034
945072	AF1-172 E	4.0022
945161	AF1-181	0.0959

Bus #	Bus	MW Impact
945171	AF1-182	0.4625
945181	AF1-183	0.0432
945483	AF1-213 BAT	7.8550
945491	AF1-214 C	0.4352
945492	AF1-214 E	0.2902
DUCKCREEK	DUCKCREEK	0.2591
NEWTON	NEWTON	0.2364
FARMERCITY	FARMERCITY	0.0122
G-007A	G-007A	0.9566
VFT	VFT	2.6187
PRAIRIE	PRAIRIE	0.5553
COFFEEN	COFFEEN	0.1168
EDWARDS	EDWARDS	0.0791
CHEOAH	CHEOAH	0.0921
TILTON	TILTON	0.1424
MADISON	MADISON	0.0141
GIBSON	GIBSON	0.1212
CALDERWOOD	CALDERWOOD	0.0919
BLUEG	BLUEG	0.3837
TRIMBLE	TRIMBLE	0.1230
CATAWBA	CATAWBA	0.0543

Affected Systems

12.7 Affected Systems

12.7.1 LG&E

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

12.7.2 MISO

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

12.7.3 TVA

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

12.7.4 Duke Energy Progress

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

12.7.5 NYISO

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

12.8 Contingency Definitions

Contingency Name	Contingency Definition
PN-P1-2-PN-115-094-A	CONTINGENCY 'PN-P1-2-PN-115-094-A' /* ROXBURY - SHADE GAP 115KV DISCONNECT BRANCH FROM BUS 200520 TO BUS 938380 CKT 1 /* 26ROXBURY 115 AE1-071 TAP 115 END
AP-P2-3-WP-230-443T *	CONTINGENCY 'AP-P2-3-WP-230-443T *' / UPDATED CON AJK 3-31-16 DISCONNECT BRANCH FROM BUS 200726 TO BUS 235175 CKT 1 DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1 DISCONNECT BUS 235158 END
AP-P2-2-WP-230-005T	CONTINGENCY 'AP-P2-2-WP-230-005T' /* SHINGLETOWN #2 230KV BUS DISCONNECT BRANCH FROM BUS 235248 TO BUS 235970 CKT 1 /* 01SHINGL 230 01DALE 230 DISCONNECT BRANCH FROM BUS 235248 TO BUS 200513 CKT 1 /* 01SHINGL 230 26LEWISTWN 230 DISCONNECT BRANCH FROM BUS 235248 TO BUS 236711 CKT 82 /* 01SHINGL 230 01SHINGLTN 46 DISCONNECT BUS 237058 /*SHINGLETOWN 230 KV CAPACITOR END
PN-P1-2-PN-230-004	CONTINGENCY 'PN-P1-2-PN-230-004' /* GLADE - WARREN 230KV DISCONNECT BRANCH FROM BUS 200811 TO BUS 200593 CKT 1 /* 26WARREN 230 26GLADE 230 END
PN-P1-3-PN-115-005	CONTINGENCY 'PN-P1-3-PN-115-005' /* SHAWVILLE 2A 230/115KV XFMR FAULT DISCONNECT BRANCH FROM BUS 200726 TO BUS 200727 TO BUS 200722 CKT 2A/* 26SHAWVL 2 230 26SHAW. 2 115 26SHAWVL 2 18.00 DISCONNECT BRANCH FROM BUS 200714 TO BUS 200722 CKT 2B /* 26SHAWVL 1 115 26SHAWVL 2 18 DISCONNECT BUS 200722 /* 26SHAWVL 2 18 END
AP-P2-3-WP-230-446T	CONTINGENCY 'AP-P2-3-WP-230-446T' /* ELKO-MOSHANNON STK BKR AT ELKO DISCONNECT BRANCH FROM BUS 200726 TO BUS 235175 CKT 1 /* 26SHAWVL 2 230 01ELKO 230 DISCONNECT BRANCH FROM BUS 235158 TO BUS 235175 CKT 1 /* 01CARB 230 01ELKO 230 DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1 /* 01ELKO 230 01QUEHAN 230 DISCONNECT BRANCH FROM BUS 235220 TO BUS 235236 CKT 1 /* 01MOSHAN 230 01QUEHAN 230 DISCONNECT BRANCH FROM BUS 235236 TO BUS 236732 CKT 81 /* 01QUEHAN 230 01QUEHANNA 46 END
AP-P2-3-WP-230-460T	CONTINGENCY 'AP-P2-3-WP-230-460T' /* 467 DISCONNECT BRANCH FROM BUS 200513 TO BUS 235248 CKT 1 /* 26LEWISTWN 230 01SHINGL 230 DISCONNECT BRANCH FROM BUS 200726 TO BUS 235248 CKT 1 /* 26SHAWVL 2 230 01SHINGL 230 DISCONNECT BRANCH FROM BUS 235248 TO BUS 235970 CKT 1 /* 01SHINGL 230 01DALE 230 DISCONNECT BRANCH FROM BUS 236711 TO BUS 235248 CKT 81 /* 01SHINGLTN 46 01SHINGL 230 DISCONNECT BRANCH FROM BUS 236711 TO BUS 235248 CKT 82 /* 01SHINGLTN 46 01SHINGL 230 END

Contingency Name	Contingency Definition
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
PL_P12_100618	CONTINGENCY 'PL_P12_100618' /* JUNIATA 230/69KV TR4 OUT" DISCONNECT BRANCH FROM BUS 208005 TO BUS 209997 CKT 4 /* DISCONNECT BRANCH FROM BUS 208005 TO BUS 207955 CKT 1 /* DISCONNECT BRANCH FROM BUS 208005 TO BUS 200009 CKT 2 /* DISCONNECT BRANCH FROM BUS 208005 TO BUS 208006 CKT 1 /* DISCONNECT BRANCH FROM BUS 208005 TO BUS 208004 CKT 1 /* DISCONNECT BRANCH FROM BUS 208005 TO BUS 200513 CKT 1 /* END
Base Case	
AP-P1-2-WP-230-323T	CONTINGENCY 'AP-P1-2-WP-230-323T' /* SHINGLETOWN-LEWISTOWN 230KV APS-PN TIE DISCONNECT BRANCH FROM BUS 235248 TO BUS 200513 CKT 1 /* 01SHINGL 230 26LEWISTWN 230 END
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-P2-2-WP-230-001T	CONTINGENCY 'AP-P2-2-WP-230-001T' /* ELKO #2 230KV BUS DISCONNECT BRANCH FROM BUS 235175 TO BUS 235158 CKT 1 /* 01ELKO 230 01CARB 230 DISCONNECT BRANCH FROM BUS 235175 TO BUS 235236 CKT 1 /* 01ELKO 230 01QUEHAN 230 DISCONNECT BRANCH FROM BUS 235175 TO BUS 200726 CKT 1 /* 01ELKO 230 26SHAWVL 2 230 REDUCE BUS 237007 SHUNT BY 100 PERCENT /* 01ELKO CAP 138 DISCONNECT BUS 237007 /* 01ELKO CAP 138 END
PN-P2-2-PN-115-032	CONTINGENCY 'PN-P2-2-PN-115-032' /* ROXBURY 115KV BUS FAULT DISCONNECT BUS 200520 /* 26ROXBURY 115 END

Short Circuit

12.9 Short Circuit

The following Breakers are overduty:

None.

13 Attachment 1 – One Line