Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-134

PHILIPSBURG-MADERA 34.5 KV

12 MW Capacity / 20 MW Energy

January, 2020

Table of Contents

1 Introduction

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

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 Clearfield 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 April 1, 2022. This study does not imply a TO commitment to this in-service date.

Final attachment facilities and local upgrades (if required) along with terms and conditions to interconnect AF1-022 will be specified in a separate two party Interconnection Agreement (IA) between WPP and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT).

Queue Number	**AF1-134**
Project Name	PHILIPSBURG-MADERA 34.5 KV
State	Pennsylvania
County	Clearfield
Transmission Owner	PENELEC
MFO	20
MWE	20
MWC	12
Fuel	Solar
Basecase Study Year	2023

4 Point of Interconnection

4.1 Primary POI

The interconnection of the project to the PENELEC system will be accomplished by tapping the Phillipsburg to Madera 34.5 kV circuit at pole #FM-67722. The IC's proposed generating unit site is approximately 0.7 miles southeast of Madera, PA., near Vulcan Road (Attachment 2). The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct the associated Attachment facilities.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF1-134 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's direct connection facilities.

4.2 Secondary POI

The interconnection of the project at a Secondary POI can be accomplished via a new line position at the PENELEC's Madera 34.5 kV substation. A full scope of work or estimated cost is not provided for the proposed Secondary POI.

5 Cost Summary

The AF1-134 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$74,700
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$147,700
Total Costs	**$222,400**

In addition, the AF1-134 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	**$16,065,000**

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/or Non-Direct Connection work for the interconnection of the AF1-320 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.

6 Transmission Owner Scope of Work

7 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
Nameplates and customer drawing review @ AF1-134	$74,700
Total Attachment Facility Costs	**$74,700**

8 Direct Connection Cost Estimate

No Direct Connection work has been identified as part of this study.

9 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
Madera 34.5kV SS. Adjust Remote Relay and Metering Settings.	$16,600
Tap the existing Madera-Philipsburg 34.5kV line at an existing pole or interspersed pole on Penelec' s existing distribution circuit (00147-22) near pole NC-962122. Install a new SCADA recloser to interconnect the project. Install 34.5 kV metering in customer's facilities.	$131,100
Total Non-Direct Connection Facility Costs	**$147,700**

10 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 **6 months** after the signing of an Interconnection Construction Service Agreement to complete the installation. 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.

11 Transmission Owner Analysis

11.1 Power Flow Analysis

The AF1-134 project was studied as total injection of 20.0 MW (12 MW of capacity) into the 34.5 kV bus at Madera substation via the Philipsburg circuit. Project AF1-134 was evaluated for compliance with reliability criteria for summer peak conditions in 2023. The IC will be responsible for meeting a power factor between 0.95 leading (absorbing MVARs) and 0.90 lagging (producing MVARs) measured at the Point of Interconnection to assure that voltage deviation will be less than 1.0 volt as measured at the POI under all Generator operating conditions. The results of the FE distribution system load flow analysis determined that the AF1-134 project did not contribute to any overloads.

A power flow study was conducted to determine the reliability impact of the proposed AF1-134 Project on the Transmission System. This included the performance of a contingency analysis to identify any facility overload or voltage condition that violates the FE Planning Criteria. Any such violation that is either directly attributable to this project or for which it will have a shared responsibility is included in this report with a least cost plan identified to mitigate them.

The power flow analysis was performed using a 2023 summer peak load base case provided by the PJM staff. This base case included a detailed representation of the Penelec transmission system in the area of the Madera substation. A simulation of all possible contingencies within the NERC and FE Planning Standards that are impacted by the AF1-134 project was conducted to test for criteria compliance. As shown, the conclusion from this analysis is that the AF1-134 project contributes to overloads on the transmission system and may be assigned cost responsibility for system reinforcement necessary to mitigate the overloads.

11.2 Short Circuit

A circuit breaker analysis was completed for the AF1-134 study. There are no overdutied breakers found to be directly attributable to the AF1-134 project.

11.3 General Concerns

It is to be understood, for abnormal operation of the Penelec system, which could cause the IC's generation facility to be electrically isolated from the Penelec system's synchronous source via the tripping of a interconnecting primary voltage line or device, the IC will, via Penelec's direction, be required to disconnect the generation from Penelec's system and remain disconnected (**units are required to be OFF LINE**), until the Penelec system normal circuitry is restored. These abnormal conditions will be reviewed by Penelec system operators as to the need for the generation facility to be disconnected.

12 Interconnection Customer Requirements

12.1 System Protection

An analysis was conducted to assess the impact of the AF1-134 project on the system protection requirements in the area. The results of this review show that the following relay additions will be required:

> Proposed single line diagrams show IC constructing a generation facility tapping Penelec's Madera - 34.5kV Philipsburg circuit at pole FM-67722.

The 34.5kV interconnection proposal will require the IC to meet applicable "Technical Requirements" as outlined in First Energy's document titled "Technical Requirements for the Interconnection of Customer-Owned Generation to the FirstEnergy Distribution System".

Protection requirements are included in the "Technical Requirements" document.

12.2 Compliance Issues and Interconnection Customer Requirements

The proposed interconnection Owner's/Developer's facilities must be designed in accordance with the document titled *FirstEnergy Distribution Engineering Practices Interconnection of Customer-Owned Generation to the FirstEnergy Distribution System* dated 11/17/14 located at the following link:

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

The document is referred to as engineering practice EP(# 02-280) with section 4 part C specifically referencing the "interconnection technical requirements". Certain protection requirement are shown.

Additionally, the IC is responsible to provide adequate protection (for their equipment) under any distribution system operating condition' - which includes 'Separation from supply' (i.e. tripping of F.E. circuit breakers) and 'Re-synchronizing the generation after electric restoration of the supply' (i.e. reclosing of F.E. circuit breakers).

The IC's protection must be designed to coordinate with the reclosing practices of FirstEnergy line protective devices. The generator must cease to energize the FirstEnergy circuit to which it is connected prior to reclosing of any (FE) automatic reclosing devices.

The IC's electrical protection and control schematics shall be provided to FE for consideration. FE may request modifications, if required, to meet the technical requirements.

The proposed Customer Facilities must also 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 34.5 kV circuit breaker to protect the AF1-134 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. The establishment of dedicated communication circuits for SCADA report 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 AF1-134 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.

6. The rough grade of the property for the AF1-134 Interconnection 34.5 kV tap pole and an access road for the delivery of equipment to this site. The above requirements are in addition to any metering and telecommunications required by PJM as specified in PJM Manuals M-01 and M-14D

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.

12.3 Power Factor Requirement

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 0.90 lagging (supplying VARs) measured at the Point of Interconnection to assure that voltage deviation will be less than 1.0 volt as measured at the POI under all generator operating conditions.

13 Revenue Metering and SCADA Requirements

13.1 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.

13.1.1 Meteorological Data Reporting Requirements

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

13.2 FE Requirements

Interconnection metering is also required for this generation connection. The 34.5 kV revenue quality metering equipment shall be designed, furnished and installed by FirstEnergy. The Interconnection Customer will be responsible for designing, furnishing and installing a SCADA RTU in their generation substation and obtaining the telecommunication circuits from the RTU to the Penelec Data Center. The connection to the Penelec Data Center will be to provide MW, MVAR and 34.5kV voltage the generator collector substation. Please reference the FirstEnergy Metering Requirements for Interconnection Customers, for more details on the metering requirements for FirstEnergy. This document can be found on the FE website at:

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

14 Network Impacts - Primary POI

The Queue Project AF1-134 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection at the Madera 34.5 kV substation in the PENELEC area tapping the Philipsburg to Madera 34.5 kV circuit. Project AF1-134 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-134 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

14.1 Generation Deliverability

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

None

14.2 Multiple Facility Contingency

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

None

14.3 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
41552590	200713	26ROCKTON	115.0	PENELEC	200712	26DUBOIS	115.0	PENELEC	1	AP-P2-3-WP-230-443T *	breaker	190.0	104.47	105.69	DC	2.31
41552566	200714	26SHAWVL1	115.0	PENELEC	200713	26ROCKTON	115.0	PENELEC	1	AP-P2-3-WP-230-443T *	breaker	190.0	106.15	107.37	DC	2.31
41808041	200714	26SHAWVL1	115.0	PENELEC	999394	STAR599	1.0	PENELEC	1A	PN-P2-2-PN-230-014T	bus	126.0	113.23	116.59	DC	4.24
41552371	200727	26SHAW. 2	115.0	PENELEC	200716	26PHILIPSB	115.0	PENELEC	1	AP-P2-3-WP-230-460T	breaker	185.0	100.8	101.29	DC	1.98
41552330	200904	26EAGLVAL	115.0	PENELEC	200527	26TYRONEN	115.0	PENELEC	1	PN-P2-3-PN-115-28B_A	breaker	191.0	111.12	112.82	DC	3.25
41552331	200904	26EAGLVAL	115.0	PENELEC	200527	26TYRONEN	115.0	PENELEC	1	PN-P2-3-PN-115-59B	breaker	191.0	111.12	112.82	DC	3.25
41808032	200904	26EAGLVAL	115.0	PENELEC	200527	26TYRONEN	115.0	PENELEC	1	AP-P2-2-WP-230-005T	bus	191.0	132.42	132.89	DC	1.98

14.4 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	CONTNAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
41220446	200727	26SHAW. 2	115.0	PENELEC	200716	26PHILIPSB	115.0	PENELEC	1	AP-P1-2-WP-230-323T	operation	185.0	100.46	100.94	DC	1.97
41220330	200755	26WESTOVER	115.0	PENELEC	200801	26GARMAN	115.0	PENELEC	1	AP-P1-2-WP-230-323T	operation	246.0	99.76	103.58	DC	9.4
41220237	200904	26EAGL VAL	115.0	PENELEC	200527	26TYRONEN	115.0	PENELEC	1	PN-P1-2-PN-115-048	operation	191.0	110.96	112.67	DC	3.25
41220240	200904	26EAGL VAL	115.0	PENELEC	200527	26TYRONEN	115.0	PENELEC	1	Base Case	operation	147.0	102.14	102.62	DC	1.59
41220286	944180	AF1-086 TAP	115.0	PENELEC	200755	26WESTOVER	115.0	PENELEC	1	AP-P1-2-WP-230-323T	operation	237.0	104.31	108.28	DC	9.4

14.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
41552590	1	26ROCKTON 115.0 kV - 26DUBOIS 115.0 kV Ckt 1	**PENELEC** **PN-AF1-F-0020a : Replace wave trap at Dubois** **Project Type : FAC** **Cost : $119,000** **Time Estimate : 9.0 Months**	$119,000
41808041	3	26SHAWVL 1 115.0 kV - STAR599 1.0 kV Ckt 1A	**PENELEC** **PN-AF1-F-0024 : Replace relay at Shawville** **Project Type : FAC** **Cost : $297,500** **Time Estimate : 12.0 Months**	$297,500
41808032,41552331, 41552330	5	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
41552566	2	26SHAWVL 1 115.0 kV - 26ROCKTON 115.0 kV Ckt 1	**PENELEC** **PN-AF1-F-0021b : Replace wave trap at Shawville** **Project Type : FAC** **Cost : $119,000** **Time Estimate : 9.0 Months** **PN-AF1-F-0021c : Replace substation conductor at Shawville . Reconductor Rockton - Shawville 115 kV (~9 miles)** **Project Type : FAC** **Cost : $15,529,500** **Time Estimate : 6.0 Months**	$15,648,500

ID	Index	Facility	Upgrade Description	Cost
41552371	4	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	**$16,065,000**

14.6 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.

14.7 Contingency Descriptions

Contingency Name	Contingency Definition
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-115-048	CONTINGENCY 'PN-P1-2-PN-115-048' /* GARMAN - SPANGLER 115KV DISCONNECT BRANCH FROM BUS 200801 TO BUS 200524 CKT 1 /* 26GARMAN 115 26SPANGLER 115 DISCONNECT BRANCH FROM BUS 200524 TO BUS 200533 CKT 2 /* 26SPANGLER 115 26SPANGLER 46 DISCONNECT BRANCH FROM BUS 200801 TO BUS 200755 CKT 1 /* 26GARMAN 115 26WESTOVER 115 DISCONNECT BUS 200524 /* 26SPANGLER 115 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
PN-P2-2-PN-230-014T	CONTINGENCY 'PN-P2-2-PN-230-014T' /* SHAWVILLE #2 230KV BUS DISCONNECT BRANCH FROM BUS 200726 TO BUS 235248 CKT 1 /* 26SHAWVL 2 230 01SHINGL 230 DISCONNECT BRANCH FROM BUS 200726 TO BUS 235175 CKT 1 /* 26SHAWVL 2 230 01ELKO 230 DISCONNECT BRANCH FROM BUS 200726 TO BUS 200666 CKT 1 /* 26SHAWVL 2 230 26SHAWVL 4 22 DISCONNECT BRANCH FROM BUS 200726 TO BUS 200710 CKT ZB /* 26SHAWVL 2 230 26SHAWVL 1 230 END
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
Base Case	

Contingency Name	Contingency Definition
PN-P2-3-PN-115-28B_A	CONTINGENCY 'PN-P2-3-PN-115-28B_A' /* 630 DISCONNECT BRANCH FROM BUS 200755 TO BUS 200801 CKT 1 /* 26WESTOVER 115 26GARMAN 115 DISCONNECT BRANCH FROM BUS 200682 TO BUS 200755 CKT 1 /* 26WEST.SOU 35 26WESTOVER 115 DISCONNECT BRANCH FROM BUS 200524 TO BUS 200801 CKT 1 /* 26SPANGLER 115 26GARMAN 115 DISCONNECT BRANCH FROM BUS 200524 TO BUS 200533 CKT 2 /* 26SPANGLER 115 26SPANGLER 46 END
PN-P2-3-PN-115-59B	CONTINGENCY 'PN-P2-3-PN-115-59B' /* GARMAN 115 KV STUCK CB - CB (SPANGLER - WESTOVER SOUTH) DISCONNECT BRANCH FROM BUS 200755 TO BUS 944180 CKT 1 /* WESTOVER-AF1-086 TAP DISCONNECT BUS 200755 DISCONNECT BRANCH FROM BUS 200801 TO BUS 200524 CKT 1 /* GARMAN-SPANGLER DISCONNECT BRANCH FROM BUS 200524 TO BUS 200533 CKT 2 /* SPANGLER TR2 DISCONNECT BUS 200524 END

14.8 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
41552590	200713	26ROCKTON	PENELEC	200712	26DUBOIS	PENELEC	1	AP-P2-3-WP-230-443T *	breaker	190.0	104.47	105.69	DC	2.31

Bus #	Bus	MW Impact
200665	26SHAWVL 3	2.7651
200666	26SHAWVL 4	2.7179
200715	26SHAWVL 1	2.4750
200722	26SHAWVL 2	2.5382
200905	26Q36	0.1493
200913	26SHAW-D	0.1506
235003	AC1-025 E	0.0984
236828	01GRAYMONT	0.2698
290086	Q-036 E	4.2796
919491	AA2-000	28.5639
930511	AB1-092	1.0488
936421	AD2-055	2.1593
936991	AD2-133 C	1.9258
936992	AD2-133 E	8.8085
939171	AE1-147 C	0.8128
939172	AE1-147 E	0.5419
940201	AE2-001 C	0.8108
940202	AE2-001 E	0.5405
940681	AE2-055 C	0.7805
940682	AE2-055 E	0.5203
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**2.1564**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.4376**
941261	AE2-120 C	0.8098
941262	AE2-120 E	0.5399
941271	AE2-121 C	0.4340
941272	AE2-121 E	0.2898
941331	AE2-129 C	1.6717
941332	AE2-129 E	1.1145
941351	AE2-131 C	1.6717
941352	AE2-131 E	1.1145
942351	AE2-248 C	0.6345
942352	AE2-248 E	0.4230
942491	AE2-262 C	3.8054
942492	AE2-262 E	2.5573
942501	AE2-263 C	3.5771
942502	AE2-263 E	2.3883
943751	AF1-043	3.4332
944001	AF1-068 C O1	0.4463
944002	AF1-068 E O1	0.2510
944181	AF1-086 C O1	0.6200

Bus #	Bus	MW Impact
944182	AF1-086 E O1	2.6972
944311	AF1-099 C	3.0616
944312	AF1-099 E	2.0411
944321	AF1-100 C O1	17.0805
944322	AF1-100 E O1	11.3870
944382	AF1-103 BAT	1.3802
944471	AF1-112 C	0.4222
944472	AF1-112 E	0.2814
944671	AF1-132 C O1	0.4172
944672	AF1-132 E O1	0.2782
944691	AF1-134 C O1	1.1545
944692	AF1-134 E O1	1.1545
944701	AF1-135 C	1.3854
944702	AF1-135 E	0.9236
944771	AF1-142 C	4.8986
944772	AF1-142 E	3.2657
944841	AF1-149 C	0.8096
944842	AF1-149 E	0.5397
945071	AF1-172 C	5.6006
945072	AF1-172 E	3.7337
945161	AF1-181	0.0910
945171	AF1-182	0.4555
945181	AF1-183	0.1453
945481	AF1-213 C	13.3514
945482	AF1-213 E	8.9009
945491	AF1-214 C	0.4292
945492	AF1-214 E	0.2861
946423	AF1-306 BAT	38.2104
DUCKCREEK	DUCKCREEK	0.3362
NEWTON	NEWTON	0.3030
FARMERCITY	FARMERCITY	0.0155
G-007A	G-007A	1.1196
VFT	VFT	3.0315
NY	NY	0.0481
PRAIRIE	PRAIRIE	0.7052
COFFEEN	COFFEEN	0.1496
EDWARDS	EDWARDS	0.1029
CHEOAH	CHEOAH	0.1086
TILTON	TILTON	0.1833
MADISON	MADISON	0.0181
GIBSON	GIBSON	0.1551
CALDERWOOD	CALDERWOOD	0.1088
BLUEG	BLUEG	0.4878
TRIMBLE	TRIMBLE	0.1564
CATAWBA	CATAWBA	0.0595

14.9 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
41552566	200714	26SHAWVL 1	PENELEC	200713	26ROCKTON	PENELEC	1	AP-P2-3-WP-230-443T *	breaker	190.0	106.15	107.37	DC	2.31

Bus #	Bus	MW Impact
200665	26SHAWVL 3	2.7651
200666	26SHAWVL 4	2.7179
200715	26SHAWVL 1	2.4750
200722	26SHAWVL 2	2.5382
200905	26Q36	0.1493
200913	26SHAW-D	0.1506
235003	AC1-025 E	0.0984
236828	01GRAYMONT	0.2698
290086	Q-036 E	4.2796
919491	AA2-000	28.5639
930511	AB1-092	1.0488
936421	AD2-055	2.1593
936991	AD2-133 C	1.9258
936992	AD2-133 E	8.8085
939171	AE1-147 C	0.8128
939172	AE1-147 E	0.5419
940201	AE2-001 C	0.8108
940202	AE2-001 E	0.5405
940681	AE2-055 C	0.7805
940682	AE2-055 E	0.5203
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**2.1564**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.4376**
941261	AE2-120 C	0.8098
941262	AE2-120 E	0.5399
941271	AE2-121 C	0.4340
941272	AE2-121 E	0.2898
941331	AE2-129 C	1.6717
941332	AE2-129 E	1.1145
941351	AE2-131 C	1.6717
941352	AE2-131 E	1.1145
942351	AE2-248 C	0.6345
942352	AE2-248 E	0.4230
942491	AE2-262 C	3.8054
942492	AE2-262 E	2.5573
942501	AE2-263 C	3.5771
942502	AE2-263 E	2.3883
943751	AF1-043	3.4332
944001	AF1-068 C O1	0.4463
944002	AF1-068 E O1	0.2510
944181	AF1-086 C O1	0.6200

Bus #	Bus	MW Impact
944182	AF1-086 E O1	2.6972
944311	AF1-099 C	3.0616
944312	AF1-099 E	2.0411
944321	AF1-100 C O1	17.0805
944322	AF1-100 E O1	11.3870
944382	AF1-103 BAT	1.3802
944471	AF1-112 C	0.4222
944472	AF1-112 E	0.2814
944671	AF1-132 C O1	0.4172
944672	AF1-132 E O1	0.2782
944691	AF1-134 C O1	1.1545
944692	AF1-134 E O1	1.1545
944701	AF1-135 C	1.3854
944702	AF1-135 E	0.9236
944771	AF1-142 C	4.8986
944772	AF1-142 E	3.2657
944841	AF1-149 C	0.8096
944842	AF1-149 E	0.5397
945071	AF1-172 C	5.6006
945072	AF1-172 E	3.7337
945161	AF1-181	0.0910
945171	AF1-182	0.4555
945181	AF1-183	0.1453
945481	AF1-213 C	13.3514
945482	AF1-213 E	8.9009
945491	AF1-214 C	0.4292
945492	AF1-214 E	0.2861
946423	AF1-306 BAT	38.2104
DUCKCREEK	DUCKCREEK	0.3362
NEWTON	NEWTON	0.3030
FARMERCITY	FARMERCITY	0.0155
G-007A	G-007A	1.1196
VFT	VFT	3.0315
NY	NY	0.0481
PRAIRIE	PRAIRIE	0.7052
COFFEEN	COFFEEN	0.1496
EDWARDS	EDWARDS	0.1029
CHEOAH	CHEOAH	0.1086
TILTON	TILTON	0.1833
MADISON	MADISON	0.0181
GIBSON	GIBSON	0.1551
CALDERWOOD	CALDERWOOD	0.1088
BLUEG	BLUEG	0.4878
TRIMBLE	TRIMBLE	0.1564
CATAWBA	CATAWBA	0.0595

14.10 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
41808041	200714	26SHAWVL 1	PENELEC	999394	STAR599	PENELEC	1A	PN-P2-2-PN-230-014T	bus	126.0	113.23	116.59	DC	4.24

Bus #	Bus	MW Impact
200722	26SHAWVL 2	5.5954
200805	**26COLVER13 (Deativation : 09/01/20)**	**5.3622**
200883	Q-053 E	2.8740
200905	26Q36	0.2661
200913	26SHAW-D	0.2690
235007	AC1-025 BAT	0.0869
236828	01GRAYMONT	-0.2139
290086	Q-036 E	7.6260
293393	V3-030E	1.6446
936991	AD2-133 C	3.4317
936992	AD2-133 E	15.6962
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**3.8524**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**2.5682**
941321	AE2-126 C	2.0305
941322	AE2-126 E	1.3537
941331	AE2-129 C	2.9881
941332	AE2-129 E	1.9921
941351	AE2-131 C	2.9881
941352	AE2-131 E	1.9921
944181	AF1-086 C O1	2.6632
944182	AF1-086 E O1	11.5864
944313	AF1-099 BAT	3.6183
944321	AF1-100 C O1	48.0690
944322	AF1-100 E O1	32.0460
944691	AF1-134 C O1	2.1188
944692	AF1-134 E O1	2.1188
944701	AF1-135 C	2.5426
944702	AF1-135 E	1.6950
944773	AF1-142 BAT	5.7720
944841	AF1-149 C	-0.6423
944842	AF1-149 E	-0.4282
945481	AF1-213 C	24.1098
945482	AF1-213 E	16.0732
945551	AF1-220 C	2.6438
945552	AF1-220 E	1.7635
946091	AF1-274 C	7.0819
946092	AF1-274 E	4.7212
LGEE	LGEE	0.0685
CPLE	CPLE	0.0549
WEC	WEC	0.0381

Bus #	Bus	MW Impact
CBM-W2	CBM-W2	0.9419
NY	NY	0.3069
CBM-W1	CBM-W1	1.5262
TVA	TVA	0.1540
O-066	O-066	2.0429
CBM-S2	CBM-S2	0.5260
CBM-S1	CBM-S1	0.9542
G-007	G-007	0.3026
MEC	MEC	0.1891

14.11 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
41552371	200727	26SHAW. 2	PENELEC	200716	26PHILIPSB	PENELEC	1	AP-P2-3-WP-230-460T	breaker	185.0	100.8	101.29	DC	1.98

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

Bus #	Bus	MW Impact
944472	AF1-112 E	0.3256
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

14.12 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
41808032	200904	26EAGL VAL	PENELEC	200527	26TYRONE N	PENELEC	1	AP-P2-2-WP-230-005T	bus	191.0	132.42	132.89	DC	1.98

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

Affected Systems

14.13 Affected Systems

14.13.1 LG&E

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

14.13.2 MISO

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

14.13.3 TVA

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

14.13.4 Duke Energy Progress

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

14.13.5 NYISO

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

Short Circuit

14.14 Short Circuit

The following Breakers are overduty

None

15 Network Impacts - Secondary POI

The Queue Project AF1-134 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection at the Madera 34.5 kV substation in the PENELEC area via a new line position. Project AF1-134 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-134 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

15.1 Generation Deliverability

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

None

15.2 Multiple Facility Contingency

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

None

15.3 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
4155259 0	20071 3	26ROCKTO N	115. 0	PENELE C	20071 2	26DUBOIS	115. 0	PENELE C	1	AP-P2-3-WP-230-443T *	breake r	190.0	104.47	105.69	DC	2.31
4155256 6	20071 4	26SHAWVL 1	115. 0	PENELE C	20071 3	26ROCKTO N	115. 0	PENELE C	1	AP-P2-3-WP-230-443T *	breake r	190.0	106.15	107.37	DC	2.31
4180804 1	20071 4	26SHAWVL 1	115. 0	PENELE C	99939 4	STAR599	1.0	PENELE C	1A	PN-P2-2-PN-230-014T	bus	126.0	113.23	116.59	DC	4.24
4155237 1	20072 7	26SHAW. 2	115. 0	PENELE C	20071 6	26PHILIPSB	115. 0	PENELE C	1	AP-P2-3-WP-230-460T	breake r	185.0	100.8	101.29	DC	1.98
4155233 0	20090 4	26EAGL VAL	115. 0	PENELE C	20052 7	26TYRONE N	115. 0	PENELE C	1	PN-P2-3-PN-115-28B_A	breake r	191.0	111.12	112.82	DC	3.25
4155233 1	20090 4	26EAGL VAL	115. 0	PENELE C	20052 7	26TYRONE N	115. 0	PENELE C	1	PN-P2-3-PN-115-59B	breake r	191.0	111.12	112.82	DC	3.25
4180803 2	20090 4	26EAGL VAL	115. 0	PENELE C	20052 7	26TYRONE N	115. 0	PENELE C	1	AP-P2-2-WP-230-005T	bus	191.0	132.42	132.89	DC	1.98

15.4 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	CONTNAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
41220446	200727	26SHAW. 2	115.0	PENELEC	200716	26PHILIPSB	115.0	PENELEC	1	AP-P1-2-WP-230-323T	operation	185.0	100.46	100.94	DC	1.97
41220330	200755	26WESTOVER	115.0	PENELEC	200801	26GARMAN	115.0	PENELEC	1	AP-P1-2-WP-230-323T	operation	246.0	99.76	103.58	DC	9.4
41220237	200904	26EAGL VAL	115.0	PENELEC	200527	26TYRONEN	115.0	PENELEC	1	PN-P1-2-PN-115-048	operation	191.0	110.96	112.67	DC	3.25
41220240	200904	26EAGL VAL	115.0	PENELEC	200527	26TYRONEN	115.0	PENELEC	1	Base Case	operation	147.0	102.14	102.62	DC	1.59
41220286	944180	AF1-086 TAP	115.0	PENELEC	200755	26WESTOVER	115.0	PENELEC	1	AP-P1-2-WP-230-323T	operation	237.0	104.31	108.28	DC	9.4

15.5 Flow Gate Details

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

15.6 Contingency Descriptions

Contingency Name	Contingency Definition
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-115-048	CONTINGENCY 'PN-P1-2-PN-115-048' /* GARMAN - SPANGLER 115KV DISCONNECT BRANCH FROM BUS 200801 TO BUS 200524 CKT 1 /* 26GARMAN 115 26SPANGLER 115 DISCONNECT BRANCH FROM BUS 200524 TO BUS 200533 CKT 2 /* 26SPANGLER 115 26SPANGLER 46 DISCONNECT BRANCH FROM BUS 200801 TO BUS 200755 CKT 1 /* 26GARMAN 115 26WESTOVER 115 DISCONNECT BUS 200524 /* 26SPANGLER 115 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
PN-P2-2-PN-230-014T	CONTINGENCY 'PN-P2-2-PN-230-014T' /* SHAWVILLE #2 230KV BUS DISCONNECT BRANCH FROM BUS 200726 TO BUS 235248 CKT 1 /* 26SHAWVL 2 230 01SHINGL 230 DISCONNECT BRANCH FROM BUS 200726 TO BUS 235175 CKT 1 /* 26SHAWVL 2 230 01ELKO 230 DISCONNECT BRANCH FROM BUS 200726 TO BUS 200666 CKT 1 /* 26SHAWVL 2 230 26SHAWVL 4 22 DISCONNECT BRANCH FROM BUS 200726 TO BUS 200710 CKT ZB /* 26SHAWVL 2 230 26SHAWVL 1 230 END

Contingency Name	Contingency Definition
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
Base Case	
PN-P2-3-PN-115-28B_A	CONTINGENCY 'PN-P2-3-PN-115-28B_A' /* 630 DISCONNECT BRANCH FROM BUS 200755 TO BUS 200801 CKT 1 /* 26WESTOVER 115 26GARMAN 115 DISCONNECT BRANCH FROM BUS 200682 TO BUS 200755 CKT 1 /* 26WEST.SOU 35 26WESTOVER 115 DISCONNECT BRANCH FROM BUS 200524 TO BUS 200801 CKT 1 /* 26SPANGLER 115 26GARMAN 115 DISCONNECT BRANCH FROM BUS 200524 TO BUS 200533 CKT 2 /* 26SPANGLER 115 26SPANGLER 46 END
PN-P2-3-PN-115-59B	CONTINGENCY 'PN-P2-3-PN-115-59B' /* GARMAN 115 KV STUCK CB - CB (SPANGLER - WESTOVER SOUTH) DISCONNECT BRANCH FROM BUS 200755 TO BUS 944180 CKT 1 /* WESTOVER-AF1-086 TAP DISCONNECT BUS 200755 DISCONNECT BRANCH FROM BUS 200801 TO BUS 200524 CKT 1 /* GARMAN-SPANGLER DISCONNECT BRANCH FROM BUS 200524 TO BUS 200533 CKT 2 /* SPANGLER TR2 DISCONNECT BUS 200524 END

15.7 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
41552590	200713	26ROCKTON	PENELEC	200712	26DUBOIS	PENELEC	1	AP-P2-3-WP-230-443T *	breaker	190.0	104.47	105.69	DC	2.31

Bus #	Bus	MW Impact
200665	26SHAWVL 3	2.7651
200666	26SHAWVL 4	2.7179
200715	26SHAWVL 1	2.4750
200722	26SHAWVL 2	2.5382
200905	26Q36	0.1493
200913	26SHAW-D	0.1506
235003	AC1-025 E	0.0984
236828	01GRAYMONT	0.2698
290086	Q-036 E	4.2796
919491	AA2-000	28.5639
930511	AB1-092	1.0488
936421	AD2-055	2.1593
936991	AD2-133 C	1.9258
936992	AD2-133 E	8.8085
939171	AE1-147 C	0.8128
939172	AE1-147 E	0.5419
940201	AE2-001 C	0.8108
940202	AE2-001 E	0.5405
940681	AE2-055 C	0.7805
940682	AE2-055 E	0.5203
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**2.1564**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.4376**
941261	AE2-120 C	0.8098
941262	AE2-120 E	0.5399
941271	AE2-121 C	0.4340
941272	AE2-121 E	0.2898
941331	AE2-129 C	1.6717
941332	AE2-129 E	1.1145
941351	AE2-131 C	1.6717
941352	AE2-131 E	1.1145
942351	AE2-248 C	0.6345
942352	AE2-248 E	0.4230
942491	AE2-262 C	3.8054
942492	AE2-262 E	2.5573
942501	AE2-263 C	3.5771
942502	AE2-263 E	2.3883
943751	AF1-043	3.4332
944001	AF1-068 C O1	0.4463
944002	AF1-068 E O1	0.2510
944181	AF1-086 C O1	0.6200

Bus #	Bus	MW Impact
944182	AF1-086 E O1	2.6972
944311	AF1-099 C	3.0616
944312	AF1-099 E	2.0411
944321	AF1-100 C O1	17.0805
944322	AF1-100 E O1	11.3870
944382	AF1-103 BAT	1.3802
944471	AF1-112 C	0.4222
944472	AF1-112 E	0.2814
944671	AF1-132 C O1	0.4172
944672	AF1-132 E O1	0.2782
944691	AF1-134 C O1	1.1545
944692	AF1-134 E O1	1.1545
944701	AF1-135 C	1.3854
944702	AF1-135 E	0.9236
944771	AF1-142 C	4.8986
944772	AF1-142 E	3.2657
944841	AF1-149 C	0.8096
944842	AF1-149 E	0.5397
945071	AF1-172 C	5.6006
945072	AF1-172 E	3.7337
945161	AF1-181	0.0910
945171	AF1-182	0.4555
945181	AF1-183	0.1453
945481	AF1-213 C	13.3514
945482	AF1-213 E	8.9009
945491	AF1-214 C	0.4292
945492	AF1-214 E	0.2861
946423	AF1-306 BAT	38.2104
DUCKCREEK	DUCKCREEK	0.3362
NEWTON	NEWTON	0.3030
FARMERCITY	FARMERCITY	0.0155
G-007A	G-007A	1.1196
VFT	VFT	3.0315
NY	NY	0.0481
PRAIRIE	PRAIRIE	0.7052
COFFEEN	COFFEEN	0.1496
EDWARDS	EDWARDS	0.1029
CHEOAH	CHEOAH	0.1086
TILTON	TILTON	0.1833
MADISON	MADISON	0.0181
GIBSON	GIBSON	0.1551
CALDERWOOD	CALDERWOOD	0.1088
BLUEG	BLUEG	0.4878
TRIMBLE	TRIMBLE	0.1564
CATAWBA	CATAWBA	0.0595

15.8 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
41552566	200714	26SHAWVL 1	PENELEC	200713	26ROCKTON	PENELEC	1	AP-P2-3-WP-230-443T *	breaker	190.0	106.15	107.37	DC	2.31

Bus #	Bus	MW Impact
200665	26SHAWVL 3	2.7651
200666	26SHAWVL 4	2.7179
200715	26SHAWVL 1	2.4750
200722	26SHAWVL 2	2.5382
200905	26Q36	0.1493
200913	26SHAW-D	0.1506
235003	AC1-025 E	0.0984
236828	01GRAYMONT	0.2698
290086	Q-036 E	4.2796
919491	AA2-000	28.5639
930511	AB1-092	1.0488
936421	AD2-055	2.1593
936991	AD2-133 C	1.9258
936992	AD2-133 E	8.8085
939171	AE1-147 C	0.8128
939172	AE1-147 E	0.5419
940201	AE2-001 C	0.8108
940202	AE2-001 E	0.5405
940681	AE2-055 C	0.7805
940682	AE2-055 E	0.5203
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**2.1564**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.4376**
941261	AE2-120 C	0.8098
941262	AE2-120 E	0.5399
941271	AE2-121 C	0.4340
941272	AE2-121 E	0.2898
941331	AE2-129 C	1.6717
941332	AE2-129 E	1.1145
941351	AE2-131 C	1.6717
941352	AE2-131 E	1.1145
942351	AE2-248 C	0.6345
942352	AE2-248 E	0.4230
942491	AE2-262 C	3.8054
942492	AE2-262 E	2.5573
942501	AE2-263 C	3.5771
942502	AE2-263 E	2.3883
943751	AF1-043	3.4332
944001	AF1-068 C O1	0.4463
944002	AF1-068 E O1	0.2510
944181	AF1-086 C O1	0.6200

Bus #	Bus	MW Impact
944182	AF1-086 E O1	2.6972
944311	AF1-099 C	3.0616
944312	AF1-099 E	2.0411
944321	AF1-100 C O1	17.0805
944322	AF1-100 E O1	11.3870
944382	AF1-103 BAT	1.3802
944471	AF1-112 C	0.4222
944472	AF1-112 E	0.2814
944671	AF1-132 C O1	0.4172
944672	AF1-132 E O1	0.2782
944691	AF1-134 C O1	1.1545
944692	AF1-134 E O1	1.1545
944701	AF1-135 C	1.3854
944702	AF1-135 E	0.9236
944771	AF1-142 C	4.8986
944772	AF1-142 E	3.2657
944841	AF1-149 C	0.8096
944842	AF1-149 E	0.5397
945071	AF1-172 C	5.6006
945072	AF1-172 E	3.7337
945161	AF1-181	0.0910
945171	AF1-182	0.4555
945181	AF1-183	0.1453
945481	AF1-213 C	13.3514
945482	AF1-213 E	8.9009
945491	AF1-214 C	0.4292
945492	AF1-214 E	0.2861
946423	AF1-306 BAT	38.2104
DUCKCREEK	DUCKCREEK	0.3362
NEWTON	NEWTON	0.3030
FARMERCITY	FARMERCITY	0.0155
G-007A	G-007A	1.1196
VFT	VFT	3.0315
NY	NY	0.0481
PRAIRIE	PRAIRIE	0.7052
COFFEEN	COFFEEN	0.1496
EDWARDS	EDWARDS	0.1029
CHEOAH	CHEOAH	0.1086
TILTON	TILTON	0.1833
MADISON	MADISON	0.0181
GIBSON	GIBSON	0.1551
CALDERWOOD	CALDERWOOD	0.1088
BLUEG	BLUEG	0.4878
TRIMBLE	TRIMBLE	0.1564
CATAWBA	CATAWBA	0.0595

15.9 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
41808041	200714	26SHAWVL 1	PENELEC	999394	STAR599	PENELEC	1A	PN-P2-2-PN-230-014T	bus	126.0	113.23	116.59	DC	4.24

Bus #	Bus	MW Impact
200722	26SHAWVL 2	5.5954
200805	**26COLVER13 (Deativation : 09/01/20)**	**5.3622**
200883	Q-053 E	2.8740
200905	26Q36	0.2661
200913	26SHAW-D	0.2690
235007	AC1-025 BAT	0.0869
236828	01GRAYMONT	-0.2139
290086	Q-036 E	7.6260
293393	V3-030E	1.6446
936991	AD2-133 C	3.4317
936992	AD2-133 E	15.6962
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**3.8524**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**2.5682**
941321	AE2-126 C	2.0305
941322	AE2-126 E	1.3537
941331	AE2-129 C	2.9881
941332	AE2-129 E	1.9921
941351	AE2-131 C	2.9881
941352	AE2-131 E	1.9921
944181	AF1-086 C O1	2.6632
944182	AF1-086 E O1	11.5864
944313	AF1-099 BAT	3.6183
944321	AF1-100 C O1	48.0690
944322	AF1-100 E O1	32.0460
944691	AF1-134 C O1	2.1188
944692	AF1-134 E O1	2.1188
944701	AF1-135 C	2.5426
944702	AF1-135 E	1.6950
944773	AF1-142 BAT	5.7720
944841	AF1-149 C	-0.6423
944842	AF1-149 E	-0.4282
945481	AF1-213 C	24.1098
945482	AF1-213 E	16.0732
945551	AF1-220 C	2.6438
945552	AF1-220 E	1.7635
946091	AF1-274 C	7.0819
946092	AF1-274 E	4.7212
LGEE	LGEE	0.0685
CPLE	CPLE	0.0549
WEC	WEC	0.0381

Bus #	Bus	MW Impact
CBM-W2	CBM-W2	0.9419
NY	NY	0.3069
CBM-W1	CBM-W1	1.5262
TVA	TVA	0.1540
O-066	O-066	2.0429
CBM-S2	CBM-S2	0.5260
CBM-S1	CBM-S1	0.9542
G-007	G-007	0.3026
MEC	MEC	0.1891

15.10 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
41552371	200727	26SHAW. 2	PENELEC	200716	26PHILIPSB	PENELEC	1	AP-P2-3-WP-230-460T	breaker	185.0	100.8	101.29	DC	1.98

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

Bus #	Bus	MW Impact
944472	AF1-112 E	0.3256
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

15.11 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
41808032	200904	26EAGL VAL	PENELEC	200527	26TYRONE N	PENELEC	1	AP-P2-2-WP-230-005T	bus	191.0	132.42	132.89	DC	1.98

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

Affected Systems

15.12 Affected Systems

15.12.1 LG&E

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

15.12.2 MISO

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

15.12.3 TVA

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

15.12.4 Duke Energy Progress

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

15.12.5 NYISO

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

Short Circuit

15.13 Short Circuit

The following Breakers are overduty

None