Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-242

WILCOX-PAPER CITY 46 KV

12 MW Capacity / 20 MW Energy

January, 2020

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1 Introduction

This Combined Feasibility/System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is West Penn Power (WPP – APS).

2 Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

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 Elk 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 08/01/2022. 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 AF1-242 will be specified in a separate two party Interconnection Agreement (IA) between the ITO and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT).

Queue Number	AF1-242
Project Name	WILCOX-PAPER CITY 46 KV
State	Pennsylvania
County	Elk
Transmission Owner	APS
MFO	20
MWE	20
MWC	12
Fuel	Solar
Basecase Study Year	2023

3.1 Point of Interconnection

A The interconnection of the project at the Primary POI will be accomplished by tapping the Wilcox – Paper City 46 kV line and constructing a one span tap. The transmission line tap will be located approximately 5.3 miles from Paper City substation and 2.0 miles from Wilcox 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 Paper City and Wilcox substations.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF1-242 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 AF1-242 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$36,100
Direct Connection Network Upgrade	$72,200
Non Direct Connection Network Upgrades	$140,600
Total Costs	$248,900

In addition, the AF1-242 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	**$ 42,661,500**

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

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

The required Attachment Facilities and Direct and/or Non-Direct Connection work for the interconnection of the AF1-242 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 Wilcox – Paper City 46 kV line and constructing a one span tap. The transmission line tap will be located approximately 5.3 miles from Paper City substation and 2.0 miles from Wilcox 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 Paper City and Wilcox 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
Install one 46 kV tap switch and construct single span tap to customer's substation. Install 46 kV metering in customer's substation.	$ 36,100
Total Attachment Facility Costs	**$ 36,100**

6 Direct Connection Cost Estimate

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

Description	Total Cost
Construct 46 kV tap with 2-46 kV line switches.	$ 72,200
Total Direct Connection Facility Costs	**$ 72,200**

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
Update relay settings at Paper City	$ 38,700
Update relay settings at Wilcox	$ 38,700
Review drawings and provide nameplates for customer substation.	$ 63,200
Total Non-Direct Connection Facility Costs	**$ 140,600**

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 construction of the interconnection substation. 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 direct connection 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

9.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AF1-242 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 AF1-242 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 AF1-242 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 FirstEnergy Requirements

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

12 Network Impacts

The Queue Project AF1-242 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection tapping the Paper City to Wilcox 46 kV line in the APS area. Project AF1-242 was evaluated for compliance with applicable reliability

planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-242 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)

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
4256277 0	20081 1	26WARRE N	230. 0	PENELE C	20091 8	26ERI E S TIE	230. 0	PENELE C	1	PN-P1-2-PN-115-100-A	singl e	621.0	99.91	100.13	DC	1.4

12.2 Multiple Facility Contingency

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

None

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
4165231 8	94119 0	AE2-113 TAP	115. 0	PENELE C	20066 8	26FAR M VLY	115. 0	PENELE C	1	PN-P2-3-PN-230-8M_SUM_WIN	breake r	160.0	124.71	125.25	DC	1.9

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
4133710 7	94119 0	AE2-113 TAP	115. 0	PENELE C	20066 8	26FAR M VLY	115. 0	PENELE C	1	PN-P1-2-PN-230-006	operatio n	160.0	109.3	109.84	DC	1.91

12.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
42562770	1	26WARREN 230.0 kV - 26ERIE S TIE 230.0 kV Ckt 1	**PENELEC** **PN-AF1-F-0011a : Replace substation conductor at Glade and Warren. Reconductor Glade - Warren 230 kV (~11.5 miles).** **Project Type : FAC** **Cost : $20,706,000** **Time Estimate : 12 Months** **Note: AF1-242 currently has a cost responsibility for the above upgrade. The following baseline project is "on-hold"; if the following baseline project is approved for construction, then AF1-242 will not have a cost responsibility and can take advantage of the following baseline project.** **b3017 : PJM Baseline Upgrade b3017:** • **Rebuild Glade to Warren 230 kV line with hi-temp conductor 11.53 miles. New conductor will be 1033 ACSS. Existing conductor is 1033 ACSR. (b3017.1)** • **Glade substation terminal upgrades. Replace bus conductor, wave traps, and relaying. (b3017.2)** • **Warren substation terminal upgrades. Replace bus conductor, wave traps, and relaying. (b3017.3)** **The baseline project has a projected in-service date of 06/01/2021.**	$20,706,000
41652318	2	AE2-113 TAP 115.0 kV - 26FARM VLY 115.0 kV Ckt 1	**PENELEC** **PN-AF1-F-0067a : Replace substation conductor at Farmers Valley. Reconductor AE2-113 - Farmers Valley (~12 miles)** **Project Type : FAC** **Cost : $21,955,500** **Time Estimate : 12.0 Months**	$21,955,500
			TOTAL COST	**$42,661,500**

12.6 Flow Gate Details

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

12.6.1 Contingency Descriptions

Contingency Name	Contingency Definition
PN-P1-2-PN-115-100-A	CONTINGENCY 'PN-P1-2-PN-115-100-A' /* CORRY EAST - FOUR MILE JCT. 115KV LINE DISCONNECT BRANCH FROM BUS 200927 TO BUS 944300 CKT 1 /* 26FOURMILE 115 AF1-098 TAP 115 END
PN-P2-3-PN-230-8M_SUM_WIN	CONTINGENCY 'PN-P2-3-PN-230-8M_SUM_WIN' /* GLADE STUCK BREAKER B42 (FOREST/SENECA) DISCONNECT BRANCH FROM BUS 200581 TO BUS 200593 CKT 1 /* 26FOREST 230 26GLADE 230 DISCONNECT BRANCH FROM BUS 200593 TO BUS 200594 CKT 1 /* 26GLADE 230 26SENECA 230 DISCONNECT BRANCH FROM BUS 200594 TO BUS 200642 CKT 1 /* 26SENECA 230 26SENECA#1 14 DISCONNECT BRANCH FROM BUS 200594 TO BUS 200643 CKT 1 /* 26SENECA 230 26SENECA#2 14 DISCONNECT BRANCH FROM BUS 200594 TO BUS 200644 CKT 1 /* 26SENECA 230 26SENECA#3 14 REMOVE MACHINE 1G FROM BUS 200642 /* 26SENECA#1 14 REMOVE MACHINE 2G FROM BUS 200643 /* 26SENECA#2 14 REMOVE MACHINE 3 FROM BUS 200644 /* 26SENECA#3 14 END
PN-P1-2-PN-230-006	CONTINGENCY 'PN-P1-2-PN-230-006' /* GLADE - FOREST 230KV DISCONNECT BRANCH FROM BUS 200593 TO BUS 200581 CKT 1 /* 26GLADE 230 26FOREST 230 END

12.6.2 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
42562770	200811	26WARREN	PENELEC	200918	26ERIE S TIE	PENELEC	1	PN-P1-2-PN-115-100-A	single	621.0	99.91	100.13	DC	1.4

Bus #	Bus	MW Impact
200642	26SENECA#1	10.3403
200643	26SENECA#2	9.7658
200644	26SENECA#3	0.9763
200649	26PENNTECH	0.9513
200665	26SHAWVL 3	2.5760
200666	26SHAWVL 4	2.5303
200715	26SHAWVL 1	1.7341
200722	26SHAWVL 2	1.7765
200887	26ARMNA MT	0.1572
200898	26AA1-106	1.2191
200905	26Q36	0.0917
200913	26SHAW-D	0.0815
201201	26WRREN CT	3.2446
201477	26Y2-055	11.8268
203261	26BLOSSBCT	0.1671
203349	26Z1-069 C	0.1801
203351	26GROZ1-110	0.1702
203352	26CANZ2-011	0.1702
919201	AA1-144 OP	8.2348
919491	AA2-000	41.9339
922932	AB1-082 OP	2.5741
923442	AB1-160 C	0.0515
923821	AB2-019 FTWR	2.6762
930511	AB1-092	1.5397
934801	AD1-108	0.0128
934811	AD1-109	0.0094
936421	AD2-055	3.1700
936991	AD2-133 C	1.1830
939171	AE1-147 C	1.0069
940201	AE2-001 C	1.0039
940681	AE2-055 C	0.9580
940861	AE2-074 C	1.9545
941191	AE2-113 C	9.8313
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**1.1677**
941261	AE2-120 C	1.0022
941271	AE2-121 C	0.5382
941321	AE2-126 C	1.5512
941331	AE2-129 C	0.9587
941351	AE2-131 C	0.9587
941421	AE2-139 C	3.4057
942351	AE2-248 C	0.7816

Bus #	Bus	MW Impact
942491	AE2-262 C	4.8310
942501	AE2-263 C	4.5411
942961	AE2-316 C	3.3504
943751	AF1-043	9.5098
944001	AF1-068 C O1	1.0360
944301	AF1-098 C	19.3589
944311	AF1-099 C	7.3335
944321	AF1-100 C O1	15.9015
944381	AF1-103 O1	8.1562
944471	AF1-112 C	0.9821
944671	AF1-132 C O1	0.9680
944691	AF1-134 C O1	0.6721
944701	AF1-135 C	0.8065
944771	AF1-142 C	11.7335
944841	AF1-149 C	1.0020
944881	AF1-153 C O1	1.4146
944901	AF1-155 C	1.4046
945071	AF1-172 C	14.5845
945121	AF1-177	2.0391
945161	AF1-181	0.0848
945171	AF1-182	0.4240
945181	AF1-183	0.1018
945331	AF1-198	0.1575
945481	AF1-213 C	7.4476
945491	AF1-214 C	1.0024
945551	AF1-220 C	13.7674
945771	AF1-242 C	1.4046
946091	AF1-274 C	6.9181
946131	AF1-278	37.8642
946381	AF1-302 C	1.4630
946421	AF1-306 C	8.3375
DUCKCREEK	DUCKCREEK	1.1780
NEWTON	NEWTON	1.0605
FARMERCITY	FARMERCITY	0.0545
G-007A	G-007A	2.6372
VFT	VFT	7.2111
PRAIRIE	PRAIRIE	2.4745
COFFEEN	COFFEEN	0.5243
EDWARDS	EDWARDS	0.3608
CHEOAH	CHEOAH	0.3884
TILTON	TILTON	0.6420
MADISON	MADISON	0.0343
GIBSON	GIBSON	0.5405
CALDERWOOD	CALDERWOOD	0.3882
BLUEG	BLUEG	1.6961
TRIMBLE	TRIMBLE	0.5443
CATAWBA	CATAWBA	0.2209

12.6.3 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
41652318	941190	AE2-113 TAP	PENELEC	200668	26FARM VLY	PENELEC	1	PN-P2-3-PN-230-8M_SUM_WIN	breaker	160.0	124.71	125.25	DC	1.9

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

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

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

Short Circuit

12.7 Short Circuit

The following Breakers are overdutied:

None

Affected Systems

13 Affected Systems

13.1 LG&E

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

13.2 MISO

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

13.3 TVA

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

13.4 Duke Energy Progress

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

13.5 NYISO

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

Attachment 1

System Configuration