Revised

Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-288

CURRYVILLE I 115 KV

12 MW Capacity / 20 MW Energy

February, 2020

Revision 1

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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 Mid-Atlantic Interstate Transmission (MAIT) (Penelec 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 Revision to January 2020 Feasibility Study Report

The January 2020 Feasibility Study report for AF1-288 was revised to be separated from the aggregated report with AF1-289.

4 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Bedford 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 (see chart below). The proposed in-service date for this project is March 1, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AF1-288
Project Name	CURRYVILLE II 115 KV
State	Pennsylvania
County	Bedford
Transmission Owner	PENELEC
MFO	20
MWE	20
MWC	12
Fuel	Solar
Basecase Study Year	2023

5 Point of Interconnection

5.1 Primary POI

The interconnection of the project to the PENELEC system will be accomplished by constructing a new 115 kV four breaker ring bus substation. The new substation will be located at the existing Curryville 115 kV substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection switching station and the associated facilities. The IC will also be responsible for the rough grade of the property and any access roads to the proposed four breaker ring bus site. The project will also require non-direct connection upgrades at Claysburg 115 kV and Saxton 115 kV substations.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF1-288 generation project to connect to the FirstEnergy ("FE") transmission system. IC will be responsible for constructing 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.

5.2 Secondary POI

The interconnection of the project at a Secondary POI can be accomplished by constructing a new 115 kV three (3) breaker ring bus substation and looping the Claysburg – Curryville 115 kV line into the new station. The new substation would be located approximately 2.2 miles from Claysburg 115 kV substation. A full scope of work or estimated cost is not provided for the proposed Secondary POI.

6 Cost Summary

The AF1-288 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$305,400
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$9,617,000
Total Costs	**$9,922,400**

In addition, the AF1-288 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	**$0**

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 AF1-288 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.

7 Transmission Owner Scope of Work

The interconnection of the project to the PENELEC system will be accomplished by constructing a new 115 kV four breaker ring bus substation. The new substation will be located at the existing Curryville 115 kV substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection switching station and the associated facilities. The IC will also be responsible for the rough grade of the property and any access roads to the proposed four breaker ring bus site. The project will also require non-direct connection upgrades at Claysburg 115 kV and Saxton 115 kV substations.

8 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
Expand Curryville 115 kV to a four-breaker ring bus (Line terminal work associated with AF1-288)	$ 242,700
Review nameplates and drawings	$ 62,700
Total Attachment Facility Costs	**$305,400**

9 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
Total Direct Connection Facility Costs	**$0**

10 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
Expand Curryville 115 kV to a four-breaker ring bus	$ 8,210,900
Re-terminate the Claysburg-Saxton 115kV line into Curryville Substation.	$ 259,100
Upgrade Relays & anti-islanding at Claysburg	$ 573,500
Upgrade Relays & anti-islanding at Saxton	$ 573,500
Total Non-Direct Connection Facility Costs	**$9,617,000**

11 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 **24 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 Attachment Facility work. Full initial payment is required for the Don-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 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.

12 Transmission Owner Analysis

12.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AF1-288 project did not contribute to any overloads on the FE transmission <100 kV system.

13 Interconnection Customer Requirements

13.1 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.

The IC has requested a non-standard GSU transformer winding configuration. This transformer is in violation of section 14.2.6 of FE's "Requirements for Transmission Connected Facilities" document and will not be accepted. The GSU transformer must have a grounded wye connection on the high (utility) side and a delta connection on the low (generator) side.

13.2 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 115 kV circuit breaker to protect the AF1-288 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 AF1-288 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.

13.3 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.

14 Revenue Metering and SCADA Requirements

14.1 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.

14.1.1 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

14.2 FE 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

15 Network Impacts – Primary POI

The Queue Project AF1-288 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection at the Curryville 115 kV substation in the PENELEC area. Project AF1-288 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-288 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
8081621 4	20074 6	26ROCKWOO D	115. 0	PENELE C	20265 0	26HIGHPOI NT	115. 0	PENELE C	1	PN-P7-1-PN-230-001	tower	179.0	131.85	133.21	DC	2.42
8081496 4	20265 0	26HIGHPOIN T	115. 0	PENELE C	20074 7	26PENN-MAR	115. 0	PENELE C	1	PN-P2-3-PN-115-35E	breake r	174.0	174.82	175.28	DC	1.76

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	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
8081590 6	20074 2	26TOWER 51	115. 0	PENELE C	20074 1	26SEWARD	115. 0	PENELE C	1	AP-P1-3-PN-115-010	operatio n	185.0	114.55	116.06	DC	2.79

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
8081569 2	20074 3	26HOOVERS V	115. 0	PENELE C	20074 2	26TOWER 51	115. 0	PENELE C	1	AP-P1-3-PN-115-010	operatio n	172.0	136.54	138.16	DC	2.78
8081569 7	20074 3	26HOOVERS V	115. 0	PENELE C	20074 2	26TOWER 51	115. 0	PENELE C	1	Base Case	operatio n	137.0	108.86	110.53	DC	2.28
8081552 9	20074 5	26ALLEGHEN	115. 0	PENELE C	20264 7	26KIMRUN TAP	115. 0	PENELE C	1	Base Case	operatio n	133.0	158.02	158.69	DC	1.98
8081574 5	20074 6	26ROCKWO OD	115. 0	PENELE C	20265 0	26HIGHPOI NT	115. 0	PENELE C	1	Base Case	operatio n	148.0	137.23	137.68	DC	1.48
8081557 4	20074 7	26PENN-MAR	115. 0	PENELE C	94619 0	AF1-284 TAP	115. 0	PENELE C	1	Base Case	operatio n	137.0	163.9	164.38	DC	1.48
7944253 9	20076 2	26GARRETT	115. 0	PENELE C	23547 0	01GARRET	115. 0	AP	1	Base Case	operatio n	133.0	186.4	186.9	DC	1.48
8081553 6	20263 7	26PRIDE	115. 0	PENELE C	20074 4	26SOMERST	115. 0	PENELE C	1	Base Case	operatio n	133.0	155.61	156.28	DC	1.98
8081552 2	20264 7	26KIMRUN TAP	115. 0	PENELE C	20263 7	26PRIDE	115. 0	PENELE C	1	Base Case	operatio n	133.0	158.02	158.69	DC	1.98
8081559 5	20265 0	26HIGHPOIN T	115. 0	PENELE C	20074 7	26PENN-MAR	115. 0	PENELE C	1	Base Case	operatio n	137.0	159.87	160.36	DC	1.48
8081554 3	94619 0	AF1-284 TAP	115. 0	PENELE C	20076 2	26GARRETT	115. 0	PENELE C	1	Base Case	operatio n	137.0	172.46	172.94	DC	1.48

15.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
80816214	1	**26ROCKWOOD 115.0 kV - 26HIGHPOINT 115.0 kV Ckt 1**	**s1770.1_s1770.2_s1770.3 (1843) : Rebuild/reconductorapproximately 14.8 miles of wood pole construction (s1770.1) Adjust CT ratios and replace substation conductor and breaker disconnect (s1770.2) Adjust relaying and replace CTs, substation conductor, line drops, circuit breaker and disconnect switches (s1770.3) Project Type : FAC Cost : $29,300,000 Time Estimate : Months**	$29,300,000
80814964	2	**26HIGHPOINT 115.0 kV - 26PENN-MAR 115.0 kV Ckt 1**	**s1770.1_s1770.2_s1770.3 (182) : Rebuild/reconductorapproximately 14.8 miles of wood pole construction (s1770.1) Adjust CT ratios and replace substation conductor and breaker disconnect (s1770.2) Adjust relaying and replace CTs, substation conductor, line drops, circuit breaker and disconnect switches (s1770.3) Project Type : FAC Cost : $29,300,000 Time Estimate : Months**	$29,300,000
			TOTAL COST	**$0**

15.6 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.

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
80816214	200746	26ROCKWOOD	PENELEC	202650	26HIGHPOINT	PENELEC	1	PN-P7-1-PN-230-001	tower	179.0	131.85	133.21	DC	2.42

Bus #	Bus	MW Impact
200834	26SW_E13_K22	0.0701
200835	26DSGENWIN	0.5597
200846	26FORWARD	0.1641
200864	K-013 E	4.7029
200883	Q-053 E	3.2881
200888	26HIGHLAND	0.2074
200889	26STNY CRK	0.3411
200890	26BF_G21_K23	0.2745
200891	26CSLMN_L13	0.4306
200892	26LOOKOUT	0.4090
200925	26R32	0.2393
202225	26SCI_S29B	0.1090
292350	K-023	12.6859
292542	L-013 1	12.3389
293432	R-040 E	0.6941
293603	O-018 E	5.9441
293902	O-048 E	11.1050
294903	P-060 E	9.7738
296332	R-032 E	6.8586
917672	Z2-108 E	6.9406
938351	AE1-053	3.8559
938881	AE1-116	1.2553
938991	AE1-128 C	12.5662
938992	AE1-128 E	8.3774
942361	AE2-249 C	1.4137
942362	AE2-249 E	0.9425
944751	AF1-140 C	1.1212
944752	AF1-140 E	0.7475
944781	AF1-143 C	23.1354
944782	AF1-143 E	15.4236
945671	AF1-232 C O1	25.3562
945672	AF1-232 E O1	13.6534
945901	AF1-255 C	0.8591
945902	AF1-255 E	1.1863
946081	AF1-273 C O1	14.6286
946082	AF1-273 E O1	9.7524
946231	AF1-288 C O1	1.4519
946232	AF1-288 E O1	0.9679
946241	AF1-289 C O1	1.4519
946242	AF1-289 E O1	0.9679
946571	AF1-321 C O1	2.5168

Bus #	Bus	MW Impact
946572	AF1-321 E O1	1.6778
DUCKCREEK	DUCKCREEK	0.3155
NEWTON	NEWTON	0.3019
FARMERCITY	FARMERCITY	0.0158
G-007A	G-007A	0.9350
VFT	VFT	2.5671
PRAIRIE	PRAIRIE	0.7362
COFFEEN	COFFEEN	0.1480
EDWARDS	EDWARDS	0.0952
CHEOAH	CHEOAH	0.1577
TILTON	TILTON	0.1732
GIBSON	GIBSON	0.1534
CALDERWOOD	CALDERWOOD	0.1566
BLUEG	BLUEG	0.4930
TRIMBLE	TRIMBLE	0.1580
CATAWBA	CATAWBA	0.1162

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
80814964	202650	26HIGHPOINT	PENELEC	200747	26PENN-MAR	PENELEC	1	PN-P2-3-PN-115-35E	breaker	174.0	174.82	175.28	DC	1.76

Bus #	Bus	MW Impact
200834	26SW_E13_K22	0.1183
200835	26DSGENWIN	0.7970
200864	K-013 E	1.7933
200889	26STNY CRK	0.4819
200890	26BF_G21_K23	0.3908
200891	26CSLMN_L13	0.6131
200892	26LOOKOUT	0.5824
202225	26SCI_S29B	0.1840
202652	26RGH_Y1-033	0.4493
292350	K-023	18.0628
292542	L-013 1	17.5686
293432	R-040 E	0.9882
293902	O-048 E	15.8118
294903	P-060 E	13.8096
913142	Y1-033 E OP1	21.9885
917672	Z2-108 E	9.8824
938351	AE1-053	5.4902
938881	AE1-116	2.1185
938991	AE1-128 C	10.8187
938992	AE1-128 E	7.2125
942361	AE2-249 C	1.2171
942362	AE2-249 E	0.8114
943711	AF1-039 C O1	5.8171
943712	AF1-039 E O1	3.8780
944781	AF1-143 C	32.9412
944782	AF1-143 E	21.9608
945671	AF1-232 C O1	37.7416
945672	AF1-232 E O1	20.3224
945901	AF1-255 C	0.6999
945902	AF1-255 E	0.9665
946081	AF1-273 C O1	21.7740
946082	AF1-273 E O1	14.5160
946231	AF1-288 C O1	0.4751
946232	AF1-288 E O1	0.3168
946241	AF1-289 C O1	0.4751
946242	AF1-289 E O1	0.3168
DUCKCREEK	DUCKCREEK	0.2361
NEWTON	NEWTON	0.2267
FARMERCITY	FARMERCITY	0.0119
G-007A	G-007A	0.6497
VFT	VFT	1.7866
PRAIRIE	PRAIRIE	0.5528

Bus #	Bus	MW Impact
COFFEEN	COFFEEN	0.1110
EDWARDS	EDWARDS	0.0714
CHEOAH	CHEOAH	0.1186
TILTON	TILTON	0.1298
GIBSON	GIBSON	0.1152
CALDERWOOD	CALDERWOOD	0.1178
BLUEG	BLUEG	0.3698
TRIMBLE	TRIMBLE	0.1185
CATAWBA	CATAWBA	0.0875

Affected Systems

15.9 Affected Systems

15.9.1 LG&E

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

15.9.2 MISO

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

15.9.3 TVA

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

15.9.4 Duke Energy Progress

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

15.9.5 NYISO

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

15.10 Contingency Descriptions

Contingency Name	Contingency Definition
Base Case	
PN-P7-1-PN-230-001	CONTINGENCY 'PN-P7-1-PN-230-001' /* HOMER CITY - HOOVERSVILLE 230KV & SEWARD - TOWER 51 115KV DISCONNECT BRANCH FROM BUS 200767 TO BUS 200768 CKT 1 /* 26HOMER CT 230 26QUEMAHON 230 DISCONNECT BRANCH FROM BUS 200768 TO BUS 200796 CKT 1 /* 26QUEMAHON 230 26HOOVRSVL 230 DISCONNECT BRANCH FROM BUS 200796 TO BUS 200743 CKT 3 /* 26HOOVRSVL 230 26HOOVERSV 115 DISCONNECT BRANCH FROM BUS 200741 TO BUS 200742 CKT 1 /* 26SEWARD 115 26TOWER 51 115 END
PN-P2-3-PN-115-35E	CONTINGENCY 'PN-P2-3-PN-115-35E' /* #14 STUCK TIE BREAKER BETWEEN BUSES 1 AND 2 DISCONNECT BRANCH FROM BUS 200734 TO BUS 200743 CKT 1 /* 26SCALP L. 115 26HOOVERSV 115 DISCONNECT BRANCH FROM BUS 200743 TO BUS 200802 CKT 1 /* 26HOOVERSV 115 26RALPHTON 115 DISCONNECT BRANCH FROM BUS 200743 TO BUS 200776 CKT 1 /* 26HOOVERSV 115 26HOOVER#1 23 DISCONNECT BRANCH FROM BUS 200743 TO BUS 200744 CKT 1 /* 26HOOVERSV 115 26SOMERST 115 DISCONNECT BRANCH FROM BUS 200742 TO BUS 200743 CKT 1 /* 26TOWER 51 115 26HOOVERSV 115 DISCONNECT BRANCH FROM BUS 200743 TO BUS 200789 CKT 2 /* 26HOOVERSV 115 26HOOVER#2 23 END
AP-P1-3-PN-115-010	CONTINGENCY 'AP-P1-3-PN-115-010' /* GARRETT 138/115KV XFMR FAULT OPEN BRANCH FROM BUS 235469 TO BUS 235470 CKT 1 /* 01GARRET 138.00 01GARRET 115.00 END

Short Circuit

15.11 Short Circuit

The following Breakers are overduty:

None

16 Network Impacts – Secondary POI

The Queue Project AF1-288 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection tapping the Curryville to Claysburg 115 kV line in the PENELEC area. Project AF1-288 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-288 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

16.1 Generation Deliverability

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

None

16.2 Multiple Facility Contingency

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

None

16.3 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	CONTNAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
8081621 4	20074 6	26ROCKWOO D	115. 0	PENELE C	20265 0	26HIGHPOIN T	115. 0	PENELE C	1	PN-P7-1-PN-230-001	towe r	179.0	132.94	134.27	DC	2.38

16.4 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
8081590 6	20074 2	26TOWER 51	115. 0	PENELE C	20074 1	26SEWAR D	115. 0	PENELE C	1	AP-P1-3-PN-115-010	operatio n	185.0	115.6	117.07	DC	2.71
8081569 2	20074 3	26HOOVERS V	115. 0	PENELE C	20074 2	26TOWER 51	115. 0	PENELE C	1	AP-P1-3-PN-115-010	operatio n	172.0	137.7	139.27	DC	2.7
8081569 7	20074 3	26HOOVERS V	115. 0	PENELE C	20074 2	26TOWER 51	115. 0	PENELE C	1	Base Case	operatio n	137.0	109.94	111.55	DC	2.2
8372875 4	20074 7	26PENN-MAR	115. 0	PENELE C	20076 2	26GARRET T	115. 0	PENELE C	1	Base Case	operatio n	137.0	173.69	174.17	DC	1.46

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
79442539	200762	26GARRETT	115.0	PENELEC	235470	01GARRET	115.0	AP	1	Base Case	operation	133.0	187.45	187.94	DC	1.45
80815536	202637	26PRIDE	115.0	PENELEC	200744	26SOMERST	115.0	PENELEC	1	Base Case	operation	133.0	165.37	166.02	DC	1.91
80815595	202650	26HIGHPOINT	115.0	PENELEC	200747	26PENN-MAR	115.0	PENELEC	1	Base Case	operation	137.0	156.09	156.57	DC	1.46
83729036	945670	AF1-232 TAP	115.0	PENELEC	946080	AF1-273 TAP	115.0	PENELEC	1	Base Case	operation	133.0	114.11	114.76	DC	1.91
83728727	946080	AF1-273 TAP	115.0	PENELEC	202637	26PRIDE	115.0	PENELEC	1	Base Case	operation	133.0	167.78	168.42	DC	1.91

16.5 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.

16.6 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
80816214	200746	26ROCKWOOD	PENELEC	202650	26HIGHPOINT	PENELEC	1	PN-P7-1-PN-230-001	tower	179.0	132.94	134.27	DC	2.38

Bus #	Bus	MW Impact
200834	26SW_E13_K22	0.0701
200835	26DSGENWIN	0.5597
200846	26FORWARD	0.1641
200864	K-013 E	4.7029
200883	Q-053 E	3.2881
200888	26HIGHLAND	0.2074
200889	26STNY CRK	0.3411
200890	26BF_G21_K23	0.2745
200891	26CSLMN_L13	0.4306
200892	26LOOKOUT	0.4090
200925	26R32	0.2393
202225	26SCI_S29B	0.1090
292350	K-023	12.6859
292542	L-013 1	12.3389
293432	R-040 E	0.6941
293603	O-018 E	5.9441
293902	O-048 E	11.1050
294903	P-060 E	9.7738
296332	R-032 E	6.8586
917672	Z2-108 E	6.9406
938351	AE1-053	3.8559
938881	AE1-116	1.2553
938991	AE1-128 C	12.5662
938992	AE1-128 E	8.3774
942361	AE2-249 C	1.4137
942362	AE2-249 E	0.9425
944751	AF1-140 C	1.1212
944752	AF1-140 E	0.7475
944781	AF1-143 C	23.1354
944782	AF1-143 E	15.4236
945671	AF1-232 C O2	25.8970
945672	AF1-232 E O2	13.9446
945901	AF1-255 C	0.8591
945902	AF1-255 E	1.1863
946081	AF1-273 C O2	15.3522
946082	AF1-273 E O2	10.2348
946231	AF1-288 C O2	1.4264
946232	AF1-288 E O2	0.9510
946241	AF1-289 C O2	1.4264
946242	AF1-289 E O2	0.9510
DUCKCREEK	DUCKCREEK	0.3155

Bus #	Bus	MW Impact
NEWTON	NEWTON	0.3019
FARMERCITY	FARMERCITY	0.0158
G-007A	G-007A	0.9350
VFT	VFT	2.5671
PRAIRIE	PRAIRIE	0.7362
COFFEEN	COFFEEN	0.1480
EDWARDS	EDWARDS	0.0952
CHEOAH	CHEOAH	0.1577
TILTON	TILTON	0.1732
GIBSON	GIBSON	0.1534
CALDERWOOD	CALDERWOOD	0.1566
BLUEG	BLUEG	0.4930
TRIMBLE	TRIMBLE	0.1580
CATAWBA	CATAWBA	0.1162

Affected Systems

16.7 Affected Systems

16.7.1 LG&E

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

16.7.2 MISO

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

16.7.3 TVA

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

16.7.4 Duke Energy Progress

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

16.7.5 NYISO

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

16.8 Contingency Descriptions

Contingency Name	Contingency Definition
Base Case	
PN-P7-1-PN-230-001	CONTINGENCY 'PN-P7-1-PN-230-001' /* HOMER CITY - HOOVERSVILLE 230KV & SEWARD - TOWER 51 115KV DISCONNECT BRANCH FROM BUS 200767 TO BUS 200768 CKT 1 /* 26HOMER CT 230 26QUEMAHON 230 DISCONNECT BRANCH FROM BUS 200768 TO BUS 200796 CKT 1 /* 26QUEMAHON 230 26HOOVRSVL 230 DISCONNECT BRANCH FROM BUS 200796 TO BUS 200743 CKT 3 /* 26HOOVRSVL 230 26HOOVERSV 115 DISCONNECT BRANCH FROM BUS 200741 TO BUS 200742 CKT 1 /* 26SEWARD 115 26TOWER 51 115 END
AP-P1-3-PN-115-010	CONTINGENCY 'AP-P1-3-PN-115-010' /* GARRETT 138/115KV XFMR FAULT OPEN BRANCH FROM BUS 235469 TO BUS 235470 CKT 1 /* 01GARRET 138.00 01GARRET 115.00 END

Short Circuit

16.9 Short Circuit

The following Breakers are overduty:

None

17 Attachment One: One Line Diagram