Revised

Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-289

CURRYVILLE II 115 KV

12 MW Capacity / 20 MW Energy

February, 2020

Revision 1

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 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 AF1-289 was revised to be separated from the aggregated report with AF1-288.

4 General

The Interconnection Customer (IC), has proposed an uprate to a planned Solar generating facility located in Bedford County, Pennsylvania. The project is an increase to the Interconnection Customer's AF1-288 project, which will share the same property and point of interconnection. The AF1-289 project is a 20 MW (12 MW Capacity uprate) to the previous project. The total installed facilities will have a total capability of 40 MW with 24 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	MFO	Capacity	Energy
AF1-288	20	12	20
AF1-289	40	12	20
Total	**40**	**24**	**40**

Queue Number	**AF1-289**
Project Name	CURRYVILLE I 115 KV
State	Pennsylvania
County	Bedford
Transmission Owner	PENELEC
MFO	40
MWE	20
MWC	12
Fuel	Solar
Basecase Study Year	2023

5 Point of Interconnection

5.1 Primary POI

AF1-289 will interconnect with the MAIT transmission system as an uprate to the AF1-288 project. The interconnection of the AF1-288 project will be accomplished by constructing a new 115 kV four breaker ring bus substation (located at the existing Curryville 115 kV Substation). It is anticipated that there will be no additional connection costs associated with the AF1-289 project if the projects are completed in the same time period.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF1-288/AF1-289 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

AF1-289 will interconnect with the MAIT transmission system as an uprate to the AF1-288 project. The interconnection of the AF1-288 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[1]

The AF1-289 project will be responsible for the following costs:

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

In addition, the AF1-289 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$0

AF1-289 is an uprate to the AF1-288 project. There is no additional interconnection work expected to accommodate the AF1-289 uprate if the projects are completed at the same time period.

[1] The AF1-289 project is an uprate to the AF1-288 project and it is not expected that there will be additional physical interconnection costs for the uprate project. If either AF1-288 withdraws from the queue, the AF1-289 project would still be responsible for the physical interconnection costs identified in the AF1-288 Feasibility Study Report. The network impacts would need to be re-evaluated if AF1-288 withdraws.

7 Transmission Owner Scope of Work

AF1-289 will interconnect with the MAIT transmission system as an uprate to the AF1-288 project. The interconnection of the AF1-288 project will be accomplished by constructing a new 115 kV four breaker ring bus substation (located at the existing Curryville 115 kV Substation). It is anticipated that there will be no additional connection costs associated with the AF1-289 project if the projects are completed in the same time period.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AF1-288/AF1-289 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.

7.1 Attachment Facilities

There is no Attachment Facility scope of work required.

7.2 Direct Connection Cost Estimate

There is no Direct Connection scope of work required.

7.3 Non-Direct Connection Cost Estimate

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

8 Schedule

AF1-289 is an increase to the AE2-288 project. Therefore, there are no Attachment Facilities, Direct, and Non-Direct Connection facilities work to be completed outside of the scope of the AF1-288 project if both projects are completed in the same time period.

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 AF1-289 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.

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.

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 115 kV circuit breaker to protect the AF1-289/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 AF1-289/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.

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 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

12 Network Impacts – Primary POI

The Queue Project AF1-289 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection at the Curryville 115 kV substation in the PENELEC area (uprate to AF1-288). Project AF1-289 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-289 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

12.1 Generation Deliverability

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

None

12.2 Multiple Facility Contingency

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

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
41064923	200746	26ROCKWOOD	115.0	PENELEC	202650	26HIGHPOINT	115.0	PENELEC	1	PN-P7-1-PN-230-001	tower	179.0	133.21	134.56	DC	2.42
41693996	202650	26HIGHPOINT	115.0	PENELEC	200747	26PENN-MAR	115.0	PENELEC	1	PN-P2-3-PN-115-35E	breaker	174.0	175.28	175.73	DC	1.76

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
41385949	200742	26TOWER 51	115.0	PENELEC	200741	26SEWARD	115.0	PENELEC	1	AP-P1-3-PN-115-010	operation	185.0	116.06	117.57	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
4138565 9	200743	26HOOVERS V	115.0	PENELEC	200742	26TOWER 51	115.0	PENELEC	1	AP-P1-3-PN-115-010	operation	172.0	138.16	139.78	DC	2.78
4138566 4	200743	26HOOVERS V	115.0	PENELEC	200742	26TOWER 51	115.0	PENELEC	1	Base Case	operation	137.0	110.53	112.19	DC	2.28
4138542 9	200745	26ALLEGHEN	115.0	PENELEC	202647	26KIMRUN TAP	115.0	PENELEC	1	Base Case	operation	133.0	158.69	159.36	DC	1.98
4138578 0	200746	26ROCKWOOD	115.0	PENELEC	202650	26HIGHPOINT	115.0	PENELEC	1	Base Case	operation	148.0	137.68	138.13	DC	1.48
4138549 2	200747	26PENN-MAR	115.0	PENELEC	946190	AF1-284 TAP	115.0	PENELEC	1	Base Case	operation	137.0	164.38	164.87	DC	1.48
4138537 5	200762	26GARRETT	115.0	PENELEC	235470	01GARRET	115.0	AP	1	Base Case	operation	133.0	186.9	187.4	DC	1.48
4138543 6	202637	26PRIDE	115.0	PENELEC	200744	26SOMERST	115.0	PENELEC	1	Base Case	operation	133.0	156.28	156.95	DC	1.98
4138542 2	202647	26KIMRUN TAP	115.0	PENELEC	202637	26PRIDE	115.0	PENELEC	1	Base Case	operation	133.0	158.69	159.36	DC	1.98
4138554 3	202650	26HIGHPOINT	115.0	PENELEC	200747	26PENN-MAR	115.0	PENELEC	1	Base Case	operation	137.0	160.36	160.84	DC	1.48
4138544 3	946190	AF1-284 TAP	115.0	PENELEC	200762	26GARRETT	115.0	PENELEC	1	Base Case	operation	137.0	172.94	173.43	DC	1.48

12.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
41064923	1	**26ROCKWOOD 115.0 kV - 26HIGHPOINT 115.0 kV Ckt 1**	**s1770.1_s1770.2_s1770.3 (1843) :** **Rebuild/reconductor approximately 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**	$0
41693996	2	**26HIGHPOINT 115.0 kV - 26PENN-MAR 115.0 kV Ckt 1**	**s1770.1_s1770.2_s1770.3 (182) :** **Rebuild/reconductor approximately 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**	$0
			TOTAL COST	**$0**

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.

12.7 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
41064923	200746	26ROCKWOOD	PENELEC	202650	26HIGHPOINT	PENELEC	1	PN-P7-1-PN-230-001	tower	179.0	133.21	134.56	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

12.8 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
41693996	202650	26HIGHPOINT	PENELEC	200747	26PENN-MAR	PENELEC	1	PN-P2-3-PN-115-35E	breaker	174.0	175.28	175.73	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

12.9 Affected Systems

12.9.1 LG&E

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

12.9.2 MISO

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

12.9.3 TVA

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

12.9.4 Duke Energy Progress

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

12.9.5 NYISO

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

12.10 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

12.11 Short Circuit

The following Breakers are overduty:

None

13 Network Impacts – Secondary POI

The Queue Project AF1-289 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection tapping the Curryville to Claysburg 115 kV line in the PENELEC area (as an uprate to AF1-288). Project AF1-289 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-289 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

13.1 Generation Deliverability

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

None

13.2 Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONTNAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
41694441	200912	26CONEMAGH	230.0	PENELEC	200005	CONEM-GH	500.0	PJM	3	PN-P2_3-PN-230-0252-C	breaker	1066.0	99.46	100.04	DC	6.15
41694442	200912	26CONEMAGH	230.0	PENELEC	200005	CONEM-GH	500.0	PJM	3	PN-P2_3-PN-230-0252-B	breaker	1066.0	99.41	100.0	DC	6.15

13.3 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
41064923	200746	26ROCKWOOD	115.0	PENELEC	202650	26HIGHPOINT	115.0	PENELEC	1	PN-P7-1-PN-230-001	tower	179.0	134.27	135.59	DC	2.38

13.4 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

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
41386090	200740	26BLRSVL E	115.0	PENELEC	200763	26BLAIRSVL	138.0	PENELEC	1	Base Case	operation	291.0	99.84	100.08	DC	1.57
41385949	200742	26TOWER 51	115.0	PENELEC	200741	26SEWARD	115.0	PENELEC	1	AP-P1-3-PN-115-010	operation	185.0	117.07	118.54	DC	2.71
41385659	200743	26HOOVERSV	115.0	PENELEC	200742	26TOWER 51	115.0	PENELEC	1	AP-P1-3-PN-115-010	operation	172.0	139.27	140.84	DC	2.7
41385664	200743	26HOOVERSV	115.0	PENELEC	200742	26TOWER 51	115.0	PENELEC	1	Base Case	operation	137.0	111.55	113.16	DC	2.2
55400754	200747	26PENN-MAR	115.0	PENELEC	200762	26GARRETT	115.0	PENELEC	1	Base Case	operation	137.0	174.17	174.65	DC	1.46
41385375	200762	26GARRETT	115.0	PENELEC	235470	01GARRET	115.0	AP	1	Base Case	operation	133.0	187.94	188.43	DC	1.45
41385436	202637	26PRIDE	115.0	PENELEC	200744	26SOMERST	115.0	PENELEC	1	Base Case	operation	133.0	166.02	166.66	DC	1.91
41385543	202650	26HIGHPOINT	115.0	PENELEC	200747	26PENN-MAR	115.0	PENELEC	1	Base Case	operation	137.0	156.57	157.04	DC	1.46
55401036	945670	AF1-232 TAP	115.0	PENELEC	946080	AF1-273 TAP	115.0	PENELEC	1	Base Case	operation	133.0	114.76	115.41	DC	1.91
55400735	946080	AF1-273 TAP	115.0	PENELEC	202637	26PRIDE	115.0	PENELEC	1	Base Case	operation	133.0	168.42	169.07	DC	1.91

13.5 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.

13.6 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
41694442	200912	26CONEMAGH	PENELEC	200005	CONEM-GH	PJM	3	PN-P2_3-PN-230-0252-B	breaker	1066.0	99.41	100.0	DC	6.15

Bus #	Bus	MW Impact
200503	**26C.SLOPE (Deativation : 06/07/19)**	**30.7476**
200794	26CONEMAGH	0.5306
200805	**26COLVER13 (Deativation : 09/01/20)**	**27.4549**
200809	26SITHE	1.6348
200833	26SEWRDB34	30.3583
200834	26SW_E13_K22	0.0709
200835	26DSGENWIN	0.3478
200837	26HOMER C1	28.1545
200838	26HOMER C2	23.7777
200839	26HOMER C3	25.1718
200846	26FORWARD	0.2526
200864	K-013 E	7.2400
200883	Q-053 E	14.0366
200886	26ARWF_N39	0.6871
200888	26HIGHLAND	0.5841
200889	26STNY CRK	0.4284
200890	26BF_G21_K23	0.1705
200891	26CSLMN_L13	0.2675
200892	26LOOKOUT	0.2541
200894	26K02	5.7572
200898	26AA1-106	2.1269
200915	26CHSTN_FL	0.3102
200925	26R32	0.6740
200945	26CT_V3-030	0.2053
201144	W3-099 C OP1	1.2351
201477	26Y2-055	3.4759
202225	26SCI_S29B	0.1103
203034	26NA_O38_P22	0.6012
203910	26Z1-091	1.8524
203999	P-047 E	9.9155
235003	AC1-025 E	0.1594
236828	01GRAYMONT	0.4308
290086	Q-036 E	7.9043
292350	K-023	7.8819
292542	L-013 1	7.6662
293301	N-039 E	19.6902
293393	V3-030E	7.7542
293432	R-040 E	0.3665
293603	O-018 E	16.7383
293902	O-048 E	6.8996
294515	O38_P22	17.2290

Bus #	Bus	MW Impact
294903	P-060 E	12.2766
296332	R-032 E	19.3134
903644	W3-099 E OP1	8.2654
913142	Y1-033 E OP1	5.3945
916202	Z1-069 E	8.0307
917672	Z2-108 E	3.6654
918682	AA1-082 E	5.3411
919201	AA1-144 OP	15.2405
919491	AA2-000	51.9525
920341	AA2-132	2.0682
922932	AB1-082 OP	2.9520
923443	AB1-160 E	2.2945
930511	AB1-092	1.9075
935191	AD1-154	3.3089
936421	AD2-055	3.9273
936991	AD2-133 C	3.5569
936992	AD2-133 E	16.2691
938351	AE1-053	2.0363
938881	AE1-116	1.2699
938951	AE1-123	2.3218
938991	AE1-128 C	21.9607
938992	AE1-128 E	14.6405
939171	AE1-147 C	1.2951
939172	AE1-147 E	0.8634
939291	AE1-160 C	1.4340
939292	AE1-160 E	0.8243
939381	**AE1-169 C O1 (Withdrawn : 01/23/2020)**	**5.8453**
939382	**AE1-169 E O1 (Withdrawn : 01/23/2020)**	**3.8969**
940201	AE2-001 C	1.2936
940202	AE2-001 E	0.8624
940681	AE2-055 C	1.2703
940682	AE2-055 E	0.8469
940861	AE2-074 C	2.2414
940862	AE2-074 E	2.9505
941191	AE2-113 C	9.0452
941192	AE2-113 E	9.7387
941231	AE2-117 C	1.9378
941232	AE2-117 E	1.2919
941241	AE2-118 C	1.9378
941242	AE2-118 E	1.2919
941251	**AE2-119 C (Withdrawn : 12/16/2019)**	**1.7562**
941252	**AE2-119 E (Withdrawn : 12/16/2019)**	**1.1708**
941261	AE2-120 C	1.2927
941262	AE2-120 E	0.8618
941271	AE2-121 C	0.6900
941272	AE2-121 E	0.4607
941321	AE2-126 C	1.6775
941322	AE2-126 E	1.1183
941331	AE2-129 C	2.0951
941332	AE2-129 E	1.3967
941351	AE2-131 C	2.0951
941352	AE2-131 E	1.3967
941421	AE2-139 C	5.8226

Bus #	Bus	MW Impact
941422	AE2-139 E	3.8817
942121	AE2-224 C	21.1416
942122	AE2-224 E	14.0944
942351	AE2-248 C	1.0240
942352	AE2-248 E	0.6827
942361	AE2-249 C	2.4706
942362	AE2-249 E	1.6471
942491	AE2-262 C	5.7175
942492	AE2-262 E	3.8422
942501	AE2-263 C	5.3745
942502	AE2-263 E	3.5883
942511	AE2-264 C	9.4248
942512	AE2-264 E	6.2832
942811	AE2-299 C	3.0638
942812	AE2-299 E	12.2552
942961	AE2-316 C	5.0495
942962	AE2-316 E	7.2007
943151	AE2-344 C	6.5761
943152	AE2-344 E	4.3840
943351	AF1-006 C	0.6052
943352	AF1-006 E	0.3404
943711	AF1-039 C O2	0.6585
943712	AF1-039 E O2	0.4390
943751	AF1-043	6.2444
943871	AF1-055 C O2	2.4871
943872	AF1-055 E O2	1.6580
944001	AF1-068 C O2	0.7215
944002	AF1-068 E O2	0.4059
944181	AF1-086 C O2	2.1438
944182	AF1-086 E O2	9.3267
944261	AF1-094 C	0.6377
944262	AF1-094 E	0.4252
944281	AF1-096 C	0.7181
944282	AF1-096 E	0.4788
944301	AF1-098 C	2.5036
944302	AF1-098 E	1.6691
944311	AF1-099 C	4.6000
944312	AF1-099 E	3.0667
944321	AF1-100 C O2	9.7457
944322	AF1-100 E O2	6.4971
944381	AF1-103 O2	1.2700
944411	AF1-106 O2	1.2052
944471	AF1-112 C	0.6798
944472	AF1-112 E	0.4532
944671	AF1-132 C O2	0.6765
944672	AF1-132 E O2	0.4510
944691	AF1-134 C O1	0.9267
944692	AF1-134 E O1	0.9267
944701	AF1-135 C	1.1121
944702	AF1-135 E	0.7414
944731	AF1-138 C O2	1.0270
944732	AF1-138 E O2	0.6847
944741	AF1-139 C O1	0.6610

Bus #	Bus	MW Impact
944742	AF1-139 E O1	0.4407
944751	AF1-140 C	3.0100
944752	AF1-140 E	2.0067
944771	AF1-142 C	7.3600
944772	AF1-142 E	4.9066
944781	AF1-143 C	14.3742
944782	AF1-143 E	9.5828
944841	AF1-149 C	1.2926
944842	AF1-149 E	0.8618
944881	AF1-153 C O2	0.7832
944882	AF1-153 E O2	0.5221
944901	AF1-155 C	0.7830
944902	AF1-155 E	0.5220
945021	AF1-167 C	0.5693
945022	AF1-167 E	0.3796
945051	AF1-170 C	2.1816
945052	AF1-170 E	1.4544
945071	AF1-172 C	9.1571
945072	AF1-172 E	6.1047
945121	AF1-177	0.3175
945161	AF1-181	0.0524
945171	AF1-182	0.2622
945181	AF1-183	0.0713
945331	AF1-198	0.1635
945451	AF1-210 C	0.5334
945452	AF1-210 E	0.3556
945481	AF1-213 C	7.7751
945482	AF1-213 E	5.1834
945491	AF1-214 C	0.6852
945492	AF1-214 E	0.4568
945521	AF1-217 C O2	0.6013
945522	AF1-217 E O2	0.4009
945551	AF1-220 C	6.5248
945552	AF1-220 E	4.3523
945671	AF1-232 C O2	30.0290
945672	AF1-232 E O2	16.1694
945751	AF1-240 C O2	1.0522
945752	AF1-240 E O2	0.7015
945771	AF1-242 C	0.7830
945772	AF1-242 E	0.5220
945901	AF1-255 C	1.7354
945902	AF1-255 E	2.3965
946081	AF1-273 C O2	17.2344
946082	AF1-273 E O2	11.4896
946091	AF1-274 C	3.7434
946092	AF1-274 E	2.4956
946131	AF1-278	15.0426
946191	AF1-284 C O2	0.9146
946192	AF1-284 E O2	0.5487
946211	AF1-286 C O2	0.4881
946212	AF1-286 E O2	0.3314
946221	AF1-287 C	0.6013
946222	AF1-287 E	0.4009

Bus #	Bus	MW Impact
946231	AF1-288 C O2	3.6908
946232	AF1-288 E O2	2.4606
946241	AF1-289 C O2	3.6908
946242	AF1-289 E O2	2.4606
946381	AF1-302 C	1.1687
946382	AF1-302 E	1.5582
946401	AF1-304 C	3.6755
946402	AF1-304 E	2.4504
946421	AF1-306 C	3.8383
946422	AF1-306 E	15.3534
946431	AF1-307 C O2	14.3772
946432	AF1-307 E O2	9.5848
946571	AF1-321 C O2	3.8318
946572	AF1-321 E O2	2.5546
LGEE	LGEE	0.0667
WEC	WEC	0.0599
CBM-W2	CBM-W2	0.4259
CBM-W1	CBM-W1	3.6404
O-066	O-066	7.8019
CHEOAH	CHEOAH	0.0581
G-007	G-007	1.2979
MEC	MEC	0.2177
CALDERWOOD	CALDERWOOD	0.0547
CATAWBA	CATAWBA	0.1019

13.7 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
41064923	200746	26ROCKWOOD	PENELEC	202650	26HIGHPOINT	PENELEC	1	PN-P7-1-PN-230-001	tower	179.0	134.27	135.59	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

13.8 Affected Systems

13.8.1 LG&E

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

13.8.2 MISO

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

13.8.3 TVA

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

13.8.4 Duke Energy Progress

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

13.8.5 NYISO

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

13.9 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-230-0252-B	CONTINGENCY 'PN-P2_3-PN-230-0252-B' /* SHELOCTA 230 KV STUCK BREAKER (KEYSTONE/HOMER CITY) OPEN BRANCH FROM BUS 200795 TO BUS 200810 CKT 1 /* 26SHELOCTA 230.00 26KEYSTONE 230.00 OPEN BRANCH FROM BUS 200795 TO BUS 200767 CKT 1 /* 26SHELOCTA 230.00 26HOMER CT 230.00 END
PN-P2_3-PN-230-0252-C	CONTINGENCY 'PN-P2_3-PN-230-0252-C' /* SHELOCTA 230 KV STUCK BREAKER (HOMER CITY/XFMR) OPEN BRANCH FROM BUS 200795 TO BUS 200767 CKT 1 /* 26SHELOCTA 230.00 26HOMER CT 230.00 OPEN BRANCH FROM BUS 200795 TO BUS 200739 CKT 2 /* 26SHELOCTA 230.00 26SHELOCTA 115.00 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

13.10 Short Circuit

The following Breakers are overduty:

None

14 Attachment One: One Line Diagram