Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-486

ORRTANNA 115 KV

15 MW Capacity / 15 MW Energy

January 2021

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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, LLC (MAIT) (ME 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 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 Storage generating facility located in Adams County, Pennsylvania. The installed facilities will have a total capability of 15 MW with 15 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is June 01, 2024. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-486
Project Name	ORRTANNA 115 KV
State	Pennsylvania
County	Adams
Transmission Owner	MAIT (ME)
MFO	15
MWE	15
MWC	15
Fuel	Storage
Basecase Study Year	2024

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

4.1 Primary POI

The interconnecting customer selected a direct connection to the Orrtanna 115 kV substation as its Primary POI. Upon further evaluating this option, FE determined that adding a new terminal to the substation would not be feasible. A PJM supplemental project (s1725.2) was recently completed to rebuild the substation into a five-breaker ring bus with a position for a future sixth breaker. This does not yet appear to be reflected on any satellite imaging (google earth, bing maps, etc.). The substation was not designed to accommodate future expansion beyond six breakers and the sixth ring bus position is currently set to be occupied by the AE2-192 project.

An alternative would be for the customer to consider connecting to the 115 kV lines near the Orrtanna substation. A future additional line will be created by PJM supplemental project s1725.1. Connecting to the 115 kV transmission line would require building a new ring bus substation.

A change to the Primary POI would have to undergo formal review and approval by PJM.

4.2 Secondary POI

As a secondary POI, the interconnecting customer has selected a connection to the customer side of the existing Orrtanna CT generation tie POI. It is anticipated that there will be no direct connect costs associated with this project.

Attachment 1 shows a one-line diagram of the proposed secondary POI direct connection facilities for the AG1-486 generation project to connect to the FirstEnergy ("FE") transmission system.

5 Cost Summary

The AG1-486 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$0
Total System Network Upgrade Costs	$45,756,080[1]
Total Costs	$45,756,080

[1] This project currently causes and/or contributes to overloads of the Transmission System (see Summer Peak Load Flow Analysis section below) and therefore has potential to have cost allocation for the system reinforcements listed in the report. This will be re-evaluated in the System Impact phase. The results may vary with queue customers withdrawing from the queue and other generators deactivating over time. If a customer is the first to cause the need for a project (causes loading to exceed 100% of rating), then the customer is responsible. If a customer contributes to a facility that is already overloaded by a prior queue, then they may receive cost allocation.

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 2016-36, 2016-25 I.R.B. (6/20/2016). If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

6 Transmission Owner Scope of Work

As a secondary POI, the interconnecting customer has selected a connection to the customer side of the existing Orrtanna CT generation POI. It is anticipated that there will be no direct connect costs associated with this project.

Attachment 1 shows a one-line diagram of the proposed secondary direct connection facilities for the AG1-486 generation project to connect to the FirstEnergy ("FE") transmission system.

The total physical interconnection costs is given in the table below:

Description	Total Cost
Total Physical Interconnection Costs	$0

7 Schedule

The IC selected a Primary POI of a direct connection to the Orrtanna 115 kV substation as its Primary POI. Upon further evaluating this option, FE determined that adding a new terminal to the substation would not be feasible. An alternative would be for the customer to consider connecting to the 115 kV lines near the Orrtanna substation. A future additional line will be created by PJM supplemental project s1725.1. Connecting to the 115 kV transmission line would require building a new ring bus substation. A change to the Primary POI would have to undergo formal review and approval by PJM.

As a Secondary POI, the IC has selected a connection to the customer side of the existing Orrtanna CT generation tie POI. If AG1-486 pursued this option, there would be no Attachment Facilities, Direct, and Non-Direct Connection facilities work to be complete.

If the customer is ultimately responsible for network upgrades, then the schedule for those upgrades will be refined in future study phases. The customer would need to wait for those upgrades to be completed prior to commercial operation unless determined deliverable by an interim deliverability study. The elapsed time to complete any network upgrades is provided in the System Reinforcements table of this report[1].

8 Transmission Owner Analysis

8.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AG1-486 project did not contribute to any overloads on the FE transmission <100 kV system.

9 Interconnection Customer Requirements

9.1 System Protection

The IC must design it's 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.

9.2 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 AG1-486 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 AG1-486 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.

9.3 Power Factor Requirements

The IC shall design its solar-powered 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.

10 Revenue Metering and SCADA Requirements

10.1 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.

10.2 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

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

11 Summer Peak - Load Flow Analysis

The Queue Project AG1-486 was evaluated as a 15.0 MW (Capacity 15.0 MW) injection at the Orrtana 115 kV substation in the ME area. Project AG1-486 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-486 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None

11.2 Multiple Facility Contingency

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

None

11.3 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
166065010	200520	26ROXBURY	115.0	PENELEC	961480	AF2-439 TAP	115.0	PENELEC	1	ME-P2-3-ME-230-005A	breaker	159.0	117.46	118.48	DC	1.62
166623607	204539	27HUNTRSTN	115.0	METED	204551	27OXFORD	115.0	METED	1	ME-P7-1-ME-230-003	tower	282.0	115.36	116.64	DC	3.59
166623608	204539	27HUNTRSTN	115.0	METED	204551	27OXFORD	115.0	METED	1	ME-P7-1-ME-230-004	tower	282.0	115.06	116.33	DC	3.59
166623617	204551	27OXFORD	115.0	METED	204548	27N.HANOVR	115.0	METED	1	ME-P7-1-ME-230-003	tower	282.0	108.8	110.08	DC	3.59
166623618	204551	27OXFORD	115.0	METED	204548	27N.HANOVR	115.0	METED	1	ME-P7-1-ME-230-004	tower	282.0	108.5	109.77	DC	3.59
166064984	961480	AF2-439 TAP	115.0	PENELEC	200504	26CARLISLE	115.0	PENELEC	1	ME-P2-3-ME-230-005A	breaker	159.0	126.23	127.24	DC	1.62

11.4 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.

None

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
166623617,166623618	3	27OXFORD 115.0 kV - 27N.HANOVR 115.0 kV Ckt 1	**METED** **ME-AG1-F-0002A (2139) : Reconductor line with larger conductor (5.1 miles).** **Project Type : FAC** **Cost : $12,356,280** **Time Estimate : 36.0 Months** **ME-AG1-F-0002B (2140) : At N. Hanover, upgrade substation conductor** **Project Type : FAC** **Cost : $121,140** **Time Estimate : 12.0 Months**	$12,477,420
166064984	4	AF2-439 TAP 115.0 kV - 26CARLISLE 115.0 kV Ckt 1	**PENELEC** **PN-AG1-F-0020A (2235) : Upgrade relaying at Carlisle Pike** **Project Type : FAC** **Cost : $800,000** **Time Estimate : 12.0 Months** **PN-AG1-F-0020B (2236) : Reconductor 6.82 miles of line. Please line drops at Carlisle Pike substation.** **Project Type : FAC** **Cost : $16,840,000** **Time Estimate : 42.0 Months** **PN-AG1-F-0020C (2237) : Adjust CT ratios.** **Project Type : FAC** **Cost : $900,000** **Time Estimate : 12.0 Months**	$18,540,000
166065010	1	26ROXBURY 115.0 kV - AF2-439 TAP 115.0 kV Ckt 1	**PENELEC** **PN-AG1-F-0026A (2250) : Reconductor 2.59 miles of line.** **Project Type : FAC** **Cost : $6,380,000** **Time Estimate : 30.0 Months**	$6,380,000
166623608,166623607	2	27HUNTRSTN 115.0 kV - 27OXFORD 115.0 kV Ckt 1	**METED** **ME-AG1-F-0004A (2142) : Reconductor line with larger conductor (3.4 miles).** **Project Type : FAC** **Cost : $8,237,520** **Time Estimate : 34.0 Months** **ME-AG1-F-0004B (2143) : At Hunterstown: Upgrade limiting terminal equipment** **Project Type : FAC** **Cost : $121,140** **Time Estimate : 12.0 Months**	$8,358,660
			TOTAL COST	**$45,756,080**[1]

11.6 Flow Gate Details

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

11.6.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
166065010	200520	26ROXBURY	PENELEC	961480	AF2-439 TAP	PENELEC	1	ME-P2-3-ME-230-005A	breaker	159.0	117.46	118.48	DC	1.62

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
237329	01CHBRG_I12	0.4706	50/50	0.4706
901242	W1-045 E OP1	0.3063	Adder	0.36
930822	AB1-127 E	0.3508	Adder	0.41
930832	AB1-128 E	0.3508	Adder	0.41
933977	**AD1-020 EBAT (Suspended)**	**2.1736**	**50/50**	**2.1736**
934371	AD1-061 C	0.3320	Adder	0.39
934372	AD1-061 E	0.2883	Adder	0.34
936061	AD2-009 C	2.2487	Adder	2.65
936062	AD2-009 E	1.0238	Adder	1.2
936471	AD2-062 C O1	9.9066	50/50	9.9066
936472	AD2-062 E O1	4.9626	50/50	4.9626
938384	AE1-071-C	12.4256	50/50	12.4256
938385	AE1-071-E	7.6034	50/50	7.6034
938753	AE1-101 C1	1.7324	Adder	2.04
938754	AE1-101 C2	0.8662	Adder	1.02
938756	AE1-101 E1	3.5765	Adder	4.21
938757	AE1-101 E2	1.7856	Adder	2.1
939033	AE1-132 C	2.3842	Adder	2.8
939034	AE1-132 E	1.5895	Adder	1.87
939591	AE1-188 C	0.6143	Adder	0.72
939592	AE1-188 E	0.3608	Adder	0.42
940671	**AE2-054 C (Suspended)**	**0.5208**	**Adder**	**0.61**
940672	**AE2-054 E (Suspended)**	**0.3472**	**Adder**	**0.41**
945011	AF1-166 C	0.5102	Adder	0.6
945012	AF1-166 E	0.3401	Adder	0.4
945441	AF1-209 C O1	0.5070	Adder	0.6
945442	AF1-209 E O1	0.3380	Adder	0.4
945591	AF1-224 C	0.3852	Adder	0.45
945592	AF1-224 E	0.1950	Adder	0.23
958071	AF2-101 C	-0.2947	Adder	-0.35
958221	AF2-116 C	0.6218	Adder	0.73
958222	AF2-116 E	0.3132	Adder	0.37
958231	AF2-117 C	1.9863	Adder	2.34
958232	AF2-117 E	0.9929	Adder	1.17
958551	AF2-146 C	1.4569	50/50	1.4569
958552	AF2-146 E	0.9713	50/50	0.9713
958571	AF2-148 C	1.2580	50/50	1.2580
958572	AF2-148 E	0.8387	50/50	0.8387
958601	AF2-151 C	-0.2906	Adder	-0.34
958871	AF2-178	0.2673	Adder	0.31

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
958881	AF2-179	0.3083	Adder	0.36
958891	AF2-180	0.3083	Adder	0.36
958931	AF2-184	0.2534	Adder	0.3
959223	AF2-213 BAT	4.9280	Merchant Transmission	4.9280
959241	AF2-215 C	0.1427	Adder	0.17
959242	AF2-215 E	0.0951	Adder	0.11
959381	AF2-229 C	0.7469	Adder	0.88
959382	AF2-229 E	0.6236	Adder	0.73
959773	AF2-268 BAT	0.1617	50/50	0.1617
959842	AF2-275 E	0.1595	Adder	0.19
959852	AF2-276 E	0.1595	Adder	0.19
962082	AG1-052 BAT	0.6605	Merchant Transmission	0.6605
963901	AG1-243 C	0.1817	Adder	0.4
963902	AG1-243 E	0.0978	Adder	0.22
964641	AG1-327 C O1	0.5731	Adder	1.27
964642	AG1-327 E O1	0.2952	Adder	0.66
964693	AG1-332 BAT	0.1533	Merchant Transmission	0.1533
965963	AG1-465 BAT	3.9252	Merchant Transmission	3.9252
966152	AG1-484 BAT	4.2560	50/50	4.2560
966172	AG1-486 BAT	1.6170	50/50	1.6170
966461	AG1-515 C	0.1313	Adder	0.29
966462	AG1-515 E	0.1969	Adder	0.44
WEC	WEC	0.0936	Confirmed LTF	0.0936
LGEE	LGEE	0.1860	Confirmed LTF	0.1860
CPLE	CPLE	0.1870	Confirmed LTF	0.1870
CBM-W2	CBM-W2	2.6253	Confirmed LTF	2.6253
NY	NY	0.1924	Confirmed LTF	0.1924
TVA	TVA	0.4074	Confirmed LTF	0.4074
O-066	O-066	4.4485	Confirmed LTF	4.4485
SIGE	SIGE	0.1005	Confirmed LTF	0.1005
CBM-S2	CBM-S2	2.9232	Confirmed LTF	2.9232
CBM-S1	CBM-S1	0.1110	Confirmed LTF	0.1110
G-007	G-007	0.6919	Confirmed LTF	0.6919
MEC	MEC	0.4688	Confirmed LTF	0.4688
LAGN	LAGN	0.5093	Confirmed LTF	0.5093
CBM-W1	CBM-W1	4.1639	Confirmed LTF	4.1639

11.6.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
166623608	204539	27HUNTRSTN	METED	204551	27OXFORD	METED	1	ME-P7-1-ME-230-004	tower	282.0	115.06	116.33	DC	3.59

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
204647	27HUNTR CT	2.3416	50/50	2.3416
204648	27MOUNT CT	0.6777	50/50	0.6777
204649	27ORTAN CT	0.7370	50/50	0.7370
205907	**AC1-048 C (Suspended)**	**2.3815**	**50/50**	**2.3815**
205908	**AC1-048 E (Suspended)**	**3.8856**	**50/50**	**3.8856**
205909	**AC2-053 C (Suspended)**	**1.3609**	**50/50**	**1.3609**
205910	**AC2-053 E (Suspended)**	**2.2203**	**50/50**	**2.2203**
901242	W1-045 E OP1	0.1959	Adder	0.23
923202	**AB1-124 C (Suspended)**	**0.3433**	**Adder**	**0.4**
923203	**AB1-124 E (Suspended)**	**0.5602**	**Adder**	**0.66**
923212	**AB1-125 C OP (Suspended)**	**0.2575**	**Adder**	**0.3**
923213	**AB1-125 E OP (Suspended)**	**0.4202**	**Adder**	**0.49**
930522	AB1-096 E	0.2747	Adder	0.32
933974	**AD1-020 C (Suspended)**	**12.9331**	**50/50**	**12.9331**
933975	**AD1-020 BAT (Suspended)**	**4.8258**	**50/50**	**4.8258**
933976	**AD1-020 E (Suspended)**	**6.3701**	**50/50**	**6.3701**
938041	**AE1-006 C (Suspended)**	**1.3609**	**50/50**	**1.3609**
938042	**AE1-006 E (Suspended)**	**2.2203**	**50/50**	**2.2203**
939021	AE1-131 C O1	7.4950	50/50	7.4950
939022	AE1-131 E O1	4.9967	50/50	4.9967
939101	AE1-139 C O1	9.1662	50/50	9.1662
939102	AE1-139 E O1	6.1108	50/50	6.1108
941871	AE2-192 C	9.3424	50/50	9.3424
941872	AE2-192 E	6.2283	50/50	6.2283
943161	AE2-345 C	12.1335	50/50	12.1335
943162	AE2-345 E	8.0890	50/50	8.0890
945231	AF1-188	0.0378	50/50	0.0378
945271	AF1-192	0.0172	50/50	0.0172
945281	AF1-193	0.1561	50/50	0.1561
958071	AF2-101 C	0.1337	Adder	0.16
958072	AF2-101 E	0.0891	Adder	0.1
958081	AF2-102 C	0.3223	50/50	0.3223
958082	AF2-102 E	0.2149	50/50	0.2149
958601	AF2-151 C	0.1293	Adder	0.15
958602	AF2-151 E	0.0862	Adder	0.1
958841	AF2-175 C	0.3943	50/50	0.3943
958842	AF2-175 E	0.2629	50/50	0.2629
958871	AF2-178	0.1709	Adder	0.2

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
959223	AF2-213 BAT	5.3389	Merchant Transmission	5.3389
959381	AF2-229 C	0.4776	Adder	0.56
959382	AF2-229 E	0.3987	Adder	0.47
959772	AF2-268 E	0.4791	50/50	0.4791
960922	AF2-383 BAT	2.1604	50/50	2.1604
961481	AF2-439 C	1.1865	Adder	1.4
961482	AF2-439 E	1.0953	Adder	1.29
962082	AG1-052 BAT	0.6126	Merchant Transmission	0.6126
962092	AG1-053 BAT	0.8145	Merchant Transmission	0.8145
963953	AG1-248 BAT	8.4450	Merchant Transmission	8.4450
964693	AG1-332 BAT	1.7375	50/50	1.7375
965963	AG1-465 BAT	37.2750	50/50	37.2750
966151	AG1-484	2.1748	50/50	2.1748
966171	AG1-486	3.5933	50/50	3.5933
WEC	WEC	0.1414	Confirmed LTF	0.1414
LGEE	LGEE	0.2859	Confirmed LTF	0.2859
CPLE	CPLE	0.3638	Confirmed LTF	0.3638
CBM-W2	CBM-W2	4.1754	Confirmed LTF	4.1754
NY	NY	0.4983	Confirmed LTF	0.4983
TVA	TVA	0.6678	Confirmed LTF	0.6678
O-066	O-066	8.0693	Confirmed LTF	8.0693
SIGE	SIGE	0.1737	Confirmed LTF	0.1737
CBM-S2	CBM-S2	5.3870	Confirmed LTF	5.3870
CBM-S1	CBM-S1	0.1797	Confirmed LTF	0.1797
G-007	G-007	1.2232	Confirmed LTF	1.2232
MEC	MEC	0.7230	Confirmed LTF	0.7230
LAGN	LAGN	0.8312	Confirmed LTF	0.8312
CBM-W1	CBM-W1	6.2109	Confirmed LTF	6.2109

11.6.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
166623617	204551	27OXFORD	METED	204548	27N.HANOVR	METED	1	ME-P7-1-ME-230-003	tower	282.0	108.8	110.08	DC	3.59

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
204646	27HAM CT	0.7646	50/50	0.7646
204647	27HUNTR CT	2.3413	50/50	2.3413
204648	27MOUNT CT	0.6773	50/50	0.6773
204649	27ORTAN CT	0.7369	50/50	0.7369
205907	**AC1-048 C (Suspended)**	**2.3810**	**50/50**	**2.3810**
205908	**AC1-048 E (Suspended)**	**3.8847**	**50/50**	**3.8847**
205909	**AC2-053 C (Suspended)**	**1.3606**	**50/50**	**1.3606**
205910	**AC2-053 E (Suspended)**	**2.2198**	**50/50**	**2.2198**
901242	W1-045 E OP1	0.1957	Adder	0.23
923202	**AB1-124 C (Suspended)**	**0.3431**	**Adder**	**0.4**
923203	**AB1-124 E (Suspended)**	**0.5598**	**Adder**	**0.66**
923212	**AB1-125 C OP (Suspended)**	**0.2573**	**Adder**	**0.3**
923213	**AB1-125 E OP (Suspended)**	**0.4198**	**Adder**	**0.49**
930522	AB1-096 E	0.2745	Adder	0.32
933974	**AD1-020 C (Suspended)**	**12.9305**	**50/50**	**12.9305**
933975	**AD1-020 BAT (Suspended)**	**4.8248**	**50/50**	**4.8248**
933976	**AD1-020 E (Suspended)**	**6.3687**	**50/50**	**6.3687**
938041	**AE1-006 C (Suspended)**	**1.3606**	**50/50**	**1.3606**
938042	**AE1-006 E (Suspended)**	**2.2198**	**50/50**	**2.2198**
939021	AE1-131 C O1	7.4935	50/50	7.4935
939022	AE1-131 E O1	4.9956	50/50	4.9956
939091	AE1-138 C	3.2640	50/50	3.2640
939092	AE1-138 E	2.1760	50/50	2.1760
939101	AE1-139 C O1	9.1642	50/50	9.1642
939102	AE1-139 E O1	6.1095	50/50	6.1095
941871	AE2-192 C	9.3409	50/50	9.3409
941872	AE2-192 E	6.2273	50/50	6.2273
943161	AE2-345 C	12.1306	50/50	12.1306
943162	AE2-345 E	8.0870	50/50	8.0870
945231	AF1-188	0.0378	50/50	0.0378
945271	AF1-192	0.0172	50/50	0.0172
945281	AF1-193	0.1561	50/50	0.1561
945291	AF1-194	0.0390	50/50	0.0390
958071	AF2-101 C	0.1336	Adder	0.16
958072	AF2-101 E	0.0891	Adder	0.1
958081	AF2-102 C	0.3222	50/50	0.3222
958082	AF2-102 E	0.2148	50/50	0.2148
958601	AF2-151 C	0.1293	Adder	0.15

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
958602	AF2-151 E	0.0862	Adder	0.1
958841	AF2-175 C	0.3942	50/50	0.3942
958842	AF2-175 E	0.2628	50/50	0.2628
958871	AF2-178	0.1708	Adder	0.2
959223	AF2-213 BAT	5.3421	Merchant Transmission	5.3421
959381	AF2-229 C	0.4772	Adder	0.56
959382	AF2-229 E	0.3984	Adder	0.47
959772	AF2-268 E	0.4790	50/50	0.4790
960922	AF2-383 BAT	2.1612	50/50	2.1612
961481	AF2-439 C	1.1857	Adder	1.39
961482	AF2-439 E	1.0945	Adder	1.29
962082	AG1-052 BAT	0.6130	Merchant Transmission	0.6130
962092	AG1-053 BAT	0.8149	Merchant Transmission	0.8149
963953	AG1-248 BAT	8.4493	Merchant Transmission	8.4493
964691	AG1-332 C	1.6589	50/50	1.6589
964692	AG1-332 E	0.5829	50/50	0.5829
965963	AG1-465 BAT	37.2790	50/50	37.2790
966151	AG1-484	2.1738	50/50	2.1738
966171	AG1-486	3.5927	50/50	3.5927
WEC	WEC	0.1399	Confirmed LTF	0.1399
LGEE	LGEE	0.2827	Confirmed LTF	0.2827
CPLE	CPLE	0.3604	Confirmed LTF	0.3604
CBM-W2	CBM-W2	4.1306	Confirmed LTF	4.1306
NY	NY	0.5010	Confirmed LTF	0.5010
TVA	TVA	0.6608	Confirmed LTF	0.6608
O-066	O-066	8.1029	Confirmed LTF	8.1029
SIGE	SIGE	0.1737	Confirmed LTF	0.1737
CBM-S2	CBM-S2	5.3348	Confirmed LTF	5.3348
CBM-S1	CBM-S1	0.1778	Confirmed LTF	0.1778
G-007	G-007	1.2285	Confirmed LTF	1.2285
MEC	MEC	0.7150	Confirmed LTF	0.7150
LAGN	LAGN	0.8225	Confirmed LTF	0.8225
CBM-W1	CBM-W1	6.1408	Confirmed LTF	6.1408

11.6.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
166064984	961480	AF2-439 TAP	PENELEC	200504	26CARLISLE	PENELEC	1	ME-P2-3-ME-230-005A	breaker	159.0	126.23	127.24	DC	1.62

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
237329	01CHBRG_I12	0.4706	50/50	0.4706
901242	W1-045 E OP1	0.3063	Adder	0.36
930822	AB1-127 E	0.3508	Adder	0.41
930832	AB1-128 E	0.3508	Adder	0.41
933977	**AD1-020 EBAT (Suspended)**	**2.1736**	**50/50**	**2.1736**
934371	AD1-061 C	0.3320	Adder	0.39
934372	AD1-061 E	0.2883	Adder	0.34
936061	AD2-009 C	2.2487	Adder	2.65
936062	AD2-009 E	1.0238	Adder	1.2
936471	AD2-062 C O1	9.9066	50/50	9.9066
936472	AD2-062 E O1	4.9626	50/50	4.9626
938384	AE1-071-C	12.4256	50/50	12.4256
938385	AE1-071-E	7.6034	50/50	7.6034
938753	AE1-101 C1	1.7324	Adder	2.04
938754	AE1-101 C2	0.8662	Adder	1.02
938756	AE1-101 E1	3.5765	Adder	4.21
938757	AE1-101 E2	1.7856	Adder	2.1
939033	AE1-132 C	2.3842	Adder	2.8
939034	AE1-132 E	1.5895	Adder	1.87
939591	AE1-188 C	0.6143	Adder	0.72
939592	AE1-188 E	0.3608	Adder	0.42
940671	**AE2-054 C (Suspended)**	**0.5208**	**Adder**	**0.61**
940672	**AE2-054 E (Suspended)**	**0.3472**	**Adder**	**0.41**
945011	AF1-166 C	0.5102	Adder	0.6
945012	AF1-166 E	0.3401	Adder	0.4
945441	AF1-209 C O1	0.5070	Adder	0.6
945442	AF1-209 E O1	0.3380	Adder	0.4
945591	AF1-224 C	0.3852	Adder	0.45
945592	AF1-224 E	0.1950	Adder	0.23
958071	AF2-101 C	-0.2947	Adder	-0.35
958221	AF2-116 C	0.6218	Adder	0.73
958222	AF2-116 E	0.3132	Adder	0.37
958231	AF2-117 C	1.9863	Adder	2.34
958232	AF2-117 E	0.9929	Adder	1.17
958551	AF2-146 C	1.4569	50/50	1.4569
958552	AF2-146 E	0.9713	50/50	0.9713
958571	AF2-148 C	1.2580	50/50	1.2580
958572	AF2-148 E	0.8387	50/50	0.8387
958601	AF2-151 C	-0.2906	Adder	-0.34
958871	AF2-178	0.2673	Adder	0.31

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
958881	AF2-179	0.3083	Adder	0.36
958891	AF2-180	0.3083	Adder	0.36
958931	AF2-184	0.2534	Adder	0.3
959223	AF2-213 BAT	4.9280	Merchant Transmission	4.9280
959241	AF2-215 C	0.1427	Adder	0.17
959242	AF2-215 E	0.0951	Adder	0.11
959381	AF2-229 C	0.7469	Adder	0.88
959382	AF2-229 E	0.6236	Adder	0.73
959773	AF2-268 BAT	0.1617	50/50	0.1617
959842	AF2-275 E	0.1595	Adder	0.19
959852	AF2-276 E	0.1595	Adder	0.19
961481	AF2-439 C	7.5080	50/50	7.5080
961482	AF2-439 E	6.9305	50/50	6.9305
962082	AG1-052 BAT	0.6605	Merchant Transmission	0.6605
963901	AG1-243 C	0.1817	Adder	0.4
963902	AG1-243 E	0.0978	Adder	0.22
964641	AG1-327 C O1	0.5731	Adder	1.27
964642	AG1-327 E O1	0.2952	Adder	0.66
964693	AG1-332 BAT	0.1533	Merchant Transmission	0.1533
965963	AG1-465 BAT	3.9252	Merchant Transmission	3.9252
966152	AG1-484 BAT	4.2560	50/50	4.2560
966172	AG1-486 BAT	1.6170	50/50	1.6170
966461	AG1-515 C	0.1313	Adder	0.29
966462	AG1-515 E	0.1969	Adder	0.44
WEC	WEC	0.0936	Confirmed LTF	0.0936
LGEE	LGEE	0.1860	Confirmed LTF	0.1860
CPLE	CPLE	0.1870	Confirmed LTF	0.1870
CBM-W2	CBM-W2	2.6253	Confirmed LTF	2.6253
NY	NY	0.1924	Confirmed LTF	0.1924
TVA	TVA	0.4074	Confirmed LTF	0.4074
O-066	O-066	4.4485	Confirmed LTF	4.4485
SIGE	SIGE	0.1005	Confirmed LTF	0.1005
CBM-S2	CBM-S2	2.9232	Confirmed LTF	2.9232
CBM-S1	CBM-S1	0.1110	Confirmed LTF	0.1110
G-007	G-007	0.6919	Confirmed LTF	0.6919
MEC	MEC	0.4688	Confirmed LTF	0.4688
LAGN	LAGN	0.5093	Confirmed LTF	0.5093
CBM-W1	CBM-W1	4.1639	Confirmed LTF	4.1639

11.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AB1-096	Carroll-Mt. Airy 34.5kV	Engineering and Procurement
AB1-124	Carroll-Monocacy 34.5kV	Suspended
AB1-125	Carroll-Monocacy 34.5kV	Suspended
AB1-127	St. Thomas-Guilford 34.5kV	In Service
AB1-128	St. Thomas-Mercersburg 34.5kV	In Service
AC1-048	Germantown 115kV	Suspended
AC2-053	Germantown 115kV	Suspended
AD1-020	Hunterstown-Lincoln 115 kV	Suspended
AD1-061	McConnelsburg-Mercersburg 34 kV	Active
AD2-009	McConnellsburg 138 kV	Active
AD2-062	Roxbury-Greene 138 kV	Active
AE1-006	Germantown 115 kV	Suspended
AE1-071	Shade Gap-Roxbury 115 kV	Active
AE1-101	McConnellsburg-Texas Eastern 138 kV	Active
AE1-131	Gardners-Hunterstown 115 kV	Active
AE1-132	McConnellsburg 138 kV	Active
AE1-138	Hamilton 115 kV	Active
AE1-139	Hunterstown 115 kV	Active
AE1-188	Fayetteville 34.5 kV	Engineering and Procurement
AE2-054	Warfordsburg 34 kV	Suspended
AE2-192	Orrtanna 115 kV	Active
AE2-345	Hunterstown-Texas Eastern Tap 115 kV	Active
AF1-166	Target-Chambers No.5 34.5 kV	Engineering and Procurement
AF1-188	Orrtanna 115 kV	Partially in Service - Under Construction
AF1-192	Mountain 2 115 kV	Partially in Service - Under Construction
AF1-193	Hunterstown 115 kV	Partially in Service - Under Construction
AF1-194	Hamilton CT1 115 kV	Partially in Service - Under Construction
AF1-209	Guilford 34.5 kV	Active
AF1-224	Fayetteville 34.5 kV	Engineering and Procurement
AF2-101	Allen 13.2 kV	Engineering and Procurement
AF2-102	Germantown 13.2 kV	Active
AF2-116	McConnellsburg 138 kV	Active
AF2-117	Warfordsburg-McConnellsburg 138 kV	Active
AF2-146	Hill Valley-Valley REC 46 kV	Active
AF2-148	Shade Gap-Three Springs KTS 23 kV	Active
AF2-151	Dillsburg 13.2 kV	Engineering and Procurement
AF2-175	Straban 13.2 kV	Active
AF2-178	Roxbury 23 kV II	In Service
AF2-179	St. Thomas-Mercersburg 34.5 kV II	In Service
AF2-180	St. Thomas-Guilford 34.5 kV II	In Service
AF2-184	McConnelsburg-Mercersburg 34 kV II	Active
AF2-213	Zions View-Smith Street 115 kV	Active
AF2-215	Saint Thomas-LeMasters Junction 34.5 kV	Engineering and Procurement

Queue Number	Project Name	Status
AF2-229	Roxbury 23 kV	Active
AF2-268	Orrtanna 13.2 kV	Engineering and Procurement
AF2-275	Guilford 12.47 kV	Active
AF2-276	Guilford 12.47 kV	Active
AF2-383	Tolna 115 kV	Active
AF2-439	Roxbury-Carlisle 115 kV	Active
AG1-052	Zionsview-Middletown 115 kV II	Active
AG1-053	Jackson-Three Mile Island 230 kV III	Active
AG1-243	Guilford-Fayetteville 34.5 kV	Active
AG1-248	York Storage 115 kV	Active
AG1-327	West Waynesboro-East Waynesboro 138 kV	Active
AG1-332	Oxford 13.2 kV	Active
AG1-465	North Hanover-Gitts Run 115 kV	Active
AG1-484	Mountain 115 kV	Active
AG1-486	Orrtanna 115 kV	Active
AG1-515	Guilford 138 kV	Active
W1-045	Roxbury 23 kV	In Service

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
ME-P2-3-ME-230-005A	CONTINGENCY 'ME-P2-3-ME-230-005A' /* HUNTRSTOWN-JACKSON_ HUNTRSTWN BK1 (HUNTRSTWN-105392) DISCONNECT BRANCH FROM BUS 204575 TO BUS 204502 CKT 1 /* 27HUNTRST1 230 27JACKSON 230 DISCONNECT BRANCH FROM BUS 204575 TO BUS 204501 CKT 1 /* 27HUNTRST1 230 27HUNTRSTN 230 DISCONNECT BRANCH FROM BUS 200026 TO BUS 204501 CKT 1 /* HUNTERTN 500 27HUNTRSTN 230 DISCONNECT BUS 204501 /* 27HUNTRSTN 230 END
ME-P7-1-ME-230-003	CONTINGENCY 'ME-P7-1-ME-230-003' /* HUNTERSTOWN-JACKSON 230 KV & HAMILTON-JACKSON 115 KV DISCONNECT BRANCH FROM BUS 204575 TO BUS 204502 CKT 1 /* 27HUNTRST1 230 27JACKSON 230 DISCONNECT BRANCH FROM BUS 204535 TO BUS 204700 CKT 1 /* 27HAMILTON 115 27JACKSON6 115 END
ME-P7-1-ME-230-004	CONTINGENCY 'ME-P7-1-ME-230-004' /* HUNTRSTWN-JACKSN 230 KV & HUNTRSTWN-HAMILTON 115 KV DISCONNECT BRANCH FROM BUS 204575 TO BUS 204502 CKT 1 /* 27HUNTRST1 230 27JACKSON 230 DISCONNECT BRANCH FROM BUS 204535 TO BUS 204539 CKT 1 /* 27HAMILTON 115 27HUNTRSTN 115 END

12 Short Circuit Analysis

The following Breakers are overdutied:

None

13 Affected Systems

1.1 NYISO

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

1.2 MISO

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

14 Attachment 1: One Line Diagram