



**Generation Interconnection
Feasibility Study Report
for
Queue Project AG1-561
ROXBURY-GREENE 138 KV II
0 MW Capacity / 0 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) (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 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 an uprate to a planned Storage generating facility located in Franklin, Pennsylvania. This project is an increase to the Interconnection Customer's AD2-062 project, which will share the same point of interconnection. The AG1-561 queue position is a 0 MW uprate (0 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 80.3 MW with 53.5 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is June 01, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-561
Project Name	ROXBURY-GREENE 138 KV II
State	Pennsylvania
County	Franklin
Transmission Owner	PENELEC (MAIT)
MFO	80.3
MWE	0
MWC	0
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 Point of Interconnection

The AG1-561 project was studied as an uprate to the proposed AD2-062 project and the Point of Interconnection will remain unchanged. AG1-561 will add battery storage to the AD2-062 project, but no change to the MFO, capacity, or energy is proposed. The IC will not incur any interconnection facility upgrade costs for this project.

Attachment 1 shows a one-line diagram of the proposed interconnection facilities for the AG1-561 generation project to connect to the FirstEnergy (“FE”) Transmission System. The 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 interconnection facilities.

4.2 Secondary Point of Interconnection

There is no secondary point of interconnection specified for AG1-561.

5 Cost Summary

The AG1-561 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$0
Total System Network Upgrade Costs	\$147,525,000 ¹
Total Costs	\$147,525,000

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.

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.

6 Transmission Owner Scope of Work

There is no interconnection facility scope of work.

7 Schedule

The project is an uprate to the proposed AD2-062 project and the Point of Interconnection will remain unchanged. There is no interconnection facility scope of work.

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.

8 Transmission Owner Analysis

8.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AG1-561 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 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.

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 138 kV circuit breaker to protect the 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 AG1-561 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 Transmission System.

9.3 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.

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 AG1-561 was evaluated as a 0.0 MW (Capacity 0.0 MW) injection and 32 MWs of battery charging as an uprate to AD2-062 which is tapping the Roxbury to Greene 138 kV line in the PENELEC area. Project AG1-561 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-561 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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJE CT LOADIN G %	POST PROJE CT LOADIN G %	AC/D C	MW IMPAC T
165840705	200512	26LEWISTWN	115.0	PENELE C	200519	26REED TAP	115.0	PENELE C	1	PL:10:P24:100548	bus	225.0	142.53	144.95	DC	5.44
166099035	200512	26LEWISTWN	115.0	PENELE C	200519	26REED TAP	115.0	PENELE C	1	PN-P2_3-PN-230-0347-16-DRT-029	breaker	225.0	144.62	147.04	DC	5.44
166099036	200512	26LEWISTWN	115.0	PENELE C	200519	26REED TAP	115.0	PENELE C	1	PL:10:P45:102437	breaker	225.0	142.53	144.95	DC	5.44
165840715	200519	26REED TAP	115.0	PENELE C	200522	26SHADE GP	115.0	PENELE C	1	PL:10:P24:100548	bus	225.0	136.44	138.86	DC	5.44
166099057	200519	26REED TAP	115.0	PENELE C	200522	26SHADE GP	115.0	PENELE C	1	PN-P2_3-PN-230-0347-16-DRT-029	breaker	225.0	138.49	140.9	DC	5.44
166099058	200519	26REED TAP	115.0	PENELE C	200522	26SHADE GP	115.0	PENELE C	1	PL:10:P45:102437	breaker	225.0	136.44	138.86	DC	5.44
165840644	200522	26SHADE GP	115.0	PENELE C	938380	AE1-071-POI	115.0	PENELE C	1	PL:10:P24:100548	bus	160.0	219.51	223.32	DC	6.1
166098943	200522	26SHADE GP	115.0	PENELE C	938380	AE1-071-POI	115.0	PENELE C	1	PL:10:P45:102437	breaker	160.0	219.51	223.32	DC	6.1
166098944	200522	26SHADE GP	115.0	PENELE C	938380	AE1-071-POI	115.0	PENELE C	1	PN-P2_3-PN-230-0347-16-DRT-029	breaker	160.0	214.52	218.33	DC	6.09
165840639	938380	AE1-071-POI	115.0	PENELE C	200520	26ROXBURY	115.0	PENELE C	1	PL:10:P24:100548	bus	160.0	243.62	247.44	DC	6.1
166098933	938380	AE1-071-POI	115.0	PENELE C	200520	26ROXBURY	115.0	PENELE C	1	PN-P2_3-PN-230-0347-16-DRT-029	breaker	160.0	245.91	249.72	DC	6.09
166098934	938380	AE1-071-POI	115.0	PENELE C	200520	26ROXBURY	115.0	PENELE C	1	PL:10:P45:102437	breaker	160.0	243.62	247.44	DC	6.1

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.

ID	FROM BUS#	FROM BUS	KV	FROM BUS AREA	TO BUS#	TO BUS	KV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJE CT LOADIN G %	POST PROJE CT LOADIN G %	ACJD C	MW IMPA CT
166315509	200512	26LEWISTWN	115.0	PENEL EC	200519	26REED TAP	115.0	PENEL EC	1	PL:10:P13:100618	operati on	225.0	141.25	143.67	DC	5.44
166315532	200519	26REED TAP	115.0	PENEL EC	200522	26SHADE GP	115.0	PENEL EC	1	PL:10:P13:100618	operati on	225.0	135.16	137.58	DC	5.44
166315398	200522	26SHADE GP	115.0	PENEL EC	938380	AE1-071-POI	115.0	PENEL EC	1	PL:10:P13:100618	operati on	160.0	213.99	217.79	DC	6.09
166315405	200522	26SHADE GP	115.0	PENEL EC	938380	AE1-071-POI	115.0	PENEL EC	1	Base Case	operati on	131.0	99.49	104.62	DC	6.72
168056717	235189	01GUILFD	138.0	AP	235187	01GRAND P	138.0	AP	1	AP-P1-2-WP-138-109	operati on	228.0	133.46	135.64	DC	4.96
168056719	235189	01GUILFD	138.0	AP	235187	01GRAND P	138.0	AP	1	Base Case	operati on	196.0	108.72	113.78	DC	9.92
166315386	938380	AE1-071-POI	115.0	PENEL EC	200520	26ROXBURY	115.0	PENEL EC	1	PL:10:P13:100618	operati on	160.0	241.58	245.38	DC	6.09
166315393	938380	AE1-071-POI	115.0	PENEL EC	200520	26ROXBURY	115.0	PENEL EC	1	Base Case	operati on	131.0	133.73	138.86	DC	6.72

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
166098944,165 840644,166098 943	3	26SHADE GP 115.0 kV - AE1- 071 TAP 115.0 kV Ckt 1	<p>PENELEC PN-AF2-F-0015A (1424) : Reconductor 6.4 miles of line. Project Type : FAC Cost : \$19,600,000 Time Estimate : 30.0 Months</p> <p>PN-AF2-F-0015B (1425) : Replace line trap at Shade Gap Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months</p> <p>PN-AF2-F-0015C (1426) : Replace transmission line drop at Shade Gap Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months</p> <p>PN-AF2-F-0015D (1427) : Replace adjust CTs at Shade Gap Project Type : FAC Cost : \$800,000 Time Estimate : 12.0 Months</p> <p>PN-AF2-F-0015E (1428) : Replace substation conductor (bus taps) at Shade Gap Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months</p> <p>PN-AG1-F-0016F (1429) : Replace breaker at Shade Gap Project Type : FAC Cost : \$900,000 Time Estimate : 12.0 Months</p> <p>Note: It should be noted that some of the contingencies taken in the analysis may not be valid due to system condition changes that were not captured in the model. This will be re-evaluated for validity in the System Impact phase, though the worst case contingency driving the reinforcements listed above is valid.</p>	\$21,900,000

ID	Idx	Facility	Upgrade Description	Cost
165840639,166 098933,166098 934	4	AE1-071 TAP 115.0 kV - 26ROXBURY 115.0 kV Ckt 1	<p>PN-AF2-F-0014A (1435) : Reconductor 6.4 miles of line. Project Type : FAC Cost : \$15,700,000 Time Estimate : 36.0 Months</p> <p>PN-AF2-F-0014B (1436) : Replace substation conductor (including bus, risers, line trap leads, and breaker leads) at Roxbury Project Type : FAC Cost : \$175,000 Time Estimate : 12.0 Months</p> <p>PN-AF2-F-0014C (1437) : Replace transmission line drop at Roxbury Project Type : FAC Cost : \$175,000 Time Estimate : 12.0 Months</p> <p>PN-AF2-F-0014D (1438) : Replace circuit breaker and CTs at Roxbury Project Type : FAC Cost : \$800,000 Time Estimate : 12.0 Months</p> <p>Note: It should be noted that some of the contingencies taken in the analysis may not be valid due to system condition changes that were not captured in the model. This will be re-evaluated for validity in the System Impact phase.</p>	\$16,850,000

ID	Idx	Facility	Upgrade Description	Cost
166099036,166 099035,165840 705	1	26LEWISTWN 115.0 kV - 26REED TAP 115.0 kV Ckt 1	<p>PENELEC PN-AF2-F-0017A (1446) : Rebuild 11.84 miles of line. Project Type : FAC Cost : \$36,200,000 Time Estimate : 36.0 Months</p> <p>PN-AF2-F-0017B (1447) : Rebuild 0.18 miles of line and replace line drop at Reed Gap Switching Station. Project Type : FAC Cost : \$650,000 Time Estimate : 18.0 Months</p> <p>PN-AF2-F-0017C (1448) : Replace line trap at Lewistown Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months</p> <p>PN-AG1-F-0021D (1449) : Replace the bus conductor at Reeds Gap switching station. Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months</p> <p>PN-AG1-F-0021E (1450) : Adjust relay settings at Lewistown Substation. Project Type : FAC Cost : \$800,000 Time Estimate : 12.0 Months</p> <p>Note: It should be noted that some of the contingencies taken in the analysis may not be valid due to system condition changes that were not captured in the model. This will be re-evaluated for validity in the System Impact phase.</p>	\$38,050,000

ID	Idx	Facility	Upgrade Description	Cost
165840715,166 099057,166099 058	2	26REED TAP 115.0 kV - 26SHADE GP 115.0 kV Ckt 1	<p>PENELEC PN-AF2-F-0016A (1479) : Rebuild 22.36 miles of line. Project Type : FAC Cost : \$67,975,000 Time Estimate : 42.0 Months</p> <p>PN-AF2-F-0016B (1480) : Rebuild 0.3 miles of line and replace line drop at Reed Gap Switching Station Project Type : FAC Cost : \$1,050,000 Time Estimate : 18.0 Months</p> <p>PN-AF2-F-0016C (1481) : Adjust CT ratios at Shade Gap Project Type : FAC Cost : \$800,000 Time Estimate : 12.0 Months</p> <p>PN-AF2-F-0016D (1482) : Replace substation conductor at Shade Gap Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months</p> <p>PN-AG1-0031A (1483) : Replace line trap at Shade Gap Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months</p> <p>PN-AG1-0031B (1484) : Replace disconnect switches at Reeds Gap and Shade Gap Project Type : FAC Cost : \$500,000 Time Estimate : 12.0 Months</p> <p>Note: It should be noted that some of the contingencies taken in the analysis may not be valid due to system condition changes that were not captured in the model. This will be re-evaluated for validity in the System Impact phase.</p>	\$70,725,000
			TOTAL COST	\$147,525,000

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
166099035	200512	26LEWISTWN	PENELEC	200519	26REED TAP	PENELEC	1	PN-P2_3-PN-230-0347-16-DRT-029	breaker	225.0	144.62	147.04	DC	5.44

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
200812	26ALY HYDR	0.3605	50/50	0.3605
200852	26WARR RDG	0.1998	Adder	0.24
235003	AC1-025 E	0.1664	50/50	0.1664
236828	01GRAYMONT	0.4282	50/50	0.4282
290086	Q-036 E	2.0788	Adder	2.45
293301	N-039 E	3.2460	Adder	3.82
294515	O38_P22	2.8403	Adder	3.34
921642	AA2-000	23.0463	Adder	27.11
930511	AB2-092	0.8462	Adder	1.0
936421	AD2-055	1.7422	Adder	2.05
936991	AD2-133 C	0.9354	Adder	1.1
936992	AD2-133 E	4.2786	Adder	5.03
939171	AE1-147 C	1.2773	50/50	1.2773
939172	AE1-147 E	0.8515	50/50	0.8515
939591	AE1-188 C	-0.6130	Adder	-0.72
940201	AE2-001 C	1.2815	50/50	1.2815
940202	AE2-001 E	0.8543	50/50	0.8543
940681	AE2-055 C (Suspended)	1.3447	50/50	1.3447
940682	AE2-055 E (Suspended)	0.8965	50/50	0.8965
941231	AE2-117 C	0.9303	Adder	1.09
941232	AE2-117 E	0.6202	Adder	0.73
941241	AE2-118 C	0.8844	Adder	1.04
941242	AE2-118 E	0.5896	Adder	0.69
941261	AE2-120 C	1.2838	50/50	1.2838
941262	AE2-120 E	0.8558	50/50	0.8558
941271	AE2-121 C	0.6753	50/50	0.6753
941272	AE2-121 E	0.4509	50/50	0.4509
941321	AE2-126 C	0.6212	Adder	0.73
941322	AE2-126 E	0.4141	Adder	0.49
941331	AE2-129 C	0.6514	Adder	0.77
941332	AE2-129 E	0.4342	Adder	0.51
941351	AE2-131 C (Suspended)	0.6514	Adder	0.77
941352	AE2-131 E (Suspended)	0.4342	Adder	0.51
942121	AE2-224 C	2.6464	Adder	3.11
942122	AE2-224 E	1.7643	Adder	2.08
942351	AE2-248 C	1.0547	50/50	1.0547
942352	AE2-248 E	0.7031	50/50	0.7031
942491	AE2-262 C	3.7800	Adder	4.45
942492	AE2-262 E	2.5401	Adder	2.99

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
942501	AE2-263 C	3.5532	Adder	4.18
942502	AE2-263 E	2.3723	Adder	2.79
942511	AE2-264 C	3.8801	Adder	4.56
942512	AE2-264 E	2.5867	Adder	3.04
943751	AF1-043	5.2265	Adder	6.15
944001	AF1-068 C O1 (Withdrawn : 12/15/2020)	1.4148	50/50	1.4148
944002	AF1-068 E O1 (Withdrawn : 12/15/2020)	0.7958	50/50	0.7958
944311	AF1-099 C	5.7380	Adder	6.75
944312	AF1-099 E	3.8253	Adder	4.5
944321	AF1-100 C	9.7346	Adder	11.45
944322	AF1-100 E	6.4898	Adder	7.64
944471	AF1-112 C	1.3115	50/50	1.3115
944472	AF1-112 E	0.8743	50/50	0.8743
944671	AF1-132 C O1 (Withdrawn : 12/15/2020)	1.3308	50/50	1.3308
944672	AF1-132 E O1 (Withdrawn : 12/15/2020)	0.8872	50/50	0.8872
944691	AF1-134 C	0.5302	Adder	0.62
944692	AF1-134 E	0.3535	Adder	0.42
944771	AF1-142 C	9.1807	Adder	10.8
944772	AF1-142 E	6.1205	Adder	7.2
944881	AF1-153 C O1	0.5901	Adder	0.69
944882	AF1-153 E O1	0.3934	Adder	0.46
944901	AF1-155 C	0.5866	Adder	0.69
944902	AF1-155 E	0.3911	Adder	0.46
945011	AF1-166 C	-0.5009	Adder	-0.59
945491	AF1-214 C (Withdrawn : 12/03/2020)	1.2836	50/50	1.2836
945492	AF1-214 E (Withdrawn : 12/03/2020)	0.8558	50/50	0.8558
945591	AF1-224 C	-0.3844	Adder	-0.45
946421	AF1-306 C	2.5604	Adder	3.01
946422	AF1-306 E	10.2416	Adder	12.05
957451	AF2-039 C	0.4623	Adder	0.54
957452	AF2-039 E	0.3082	Adder	0.36
957561	AF2-050 C	1.3232	Adder	1.56
957562	AF2-050 E	0.8821	Adder	1.04
957931	AF2-087 C (Suspended)	0.1706	Adder	0.2
957932	AF2-087 E (Suspended)	0.2350	Adder	0.28
957941	AF2-088 C	0.2226	Adder	0.26
957942	AF2-088 E	0.1484	Adder	0.17
958071	AF2-101 C	-0.0823	Adder	-0.1
958271	AF2-121 C	0.6514	Adder	0.77
958272	AF2-121 E	0.4342	Adder	0.51
958601	AF2-151 C	-0.0812	Adder	-0.1
959241	AF2-215 C	-0.1404	Adder	-0.17
959802	AF2-271 E	0.2111	Adder	0.25
959843	AF2-275 BAT	0.0921	Merchant Transmission	0.0921
959853	AF2-276 BAT	0.0921	Merchant Transmission	0.0921

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
960022	AF2-293 E	0.1239	50/50	0.1239
960041	AF2-295 C	0.5866	Adder	0.69
960042	AF2-295 E	0.3911	Adder	0.46
960051	AF2-296 C	0.5302	Adder	0.62
960052	AF2-296 E	0.3535	Adder	0.42
962411	AG1-090 C O1	1.7261	Adder	3.83
962412	AG1-090 E O1	1.1508	Adder	2.55
962951	AG1-144 C	0.3452	Adder	0.77
962952	AG1-144 E	0.2302	Adder	0.51
963571	AG1-206 C	0.1737	Adder	0.39
963572	AG1-206 E	0.0935	Adder	0.21
963891	AG1-242 C	0.1522	Adder	0.34
963892	AG1-242 E	0.0820	Adder	0.18
964031	AG1-257 C	0.9032	50/50	0.9032
964032	AG1-257 E	1.2623	50/50	1.2623
964041	AG1-258 C	0.9032	50/50	0.9032
964042	AG1-258 E	1.2623	50/50	1.2623
964191	AG1-280 C	0.2720	Adder	0.6
964192	AG1-280 E	0.1814	Adder	0.4
964201	AG1-281 C	0.2737	Adder	0.61
964202	AG1-281 E	0.1824	Adder	0.4
964391	AG1-301 C	0.5082	Adder	1.13
964392	AG1-301 E	0.3388	Adder	0.75
964451	AG1-308 C O1	0.2426	Adder	0.54
964452	AG1-308 E O1	0.3390	Adder	0.75
965121	AG1-377 C O1	0.3452	Adder	0.77
965122	AG1-377 E O1	0.2302	Adder	0.51
965131	AG1-378 C O1	0.3452	Adder	0.77
965132	AG1-378 E O1	0.2302	Adder	0.51
965201	AG1-385 C	0.4021	Adder	0.89
965202	AG1-385 E	0.1191	Adder	0.26
965301	AG1-395 C	0.4436	Adder	0.98
965302	AG1-395 E	0.1318	Adder	0.29
966041	AG1-473 C	4.4668	50/50	4.4668
966042	AG1-473 E	2.9779	50/50	2.9779
966152	AG1-484 BAT	0.6272	Merchant Transmission	0.6272
966463	AG1-515 BAT	0.3718	Merchant Transmission	0.3718
966891	AG1-560 BAT	12.4896	50/50	12.4896
966901	AG1-561 BAT	5.4371	50/50	5.4371
WEC	WEC	0.0394	Confirmed LTF	0.0394
LGEE	LGEE	0.0647	Confirmed LTF	0.0647
CALDERWOOD	CALDERWOOD	0.0055	Confirmed LTF	0.0055
CBM-W2	CBM-W2	0.5555	Confirmed LTF	0.5555
TVA	TVA	0.0322	Confirmed LTF	0.0322
O-066	O-066	1.7633	Confirmed LTF	1.7633
SIGE	SIGE	0.0381	Confirmed LTF	0.0381
CHEOAH	CHEOAH	0.0070	Confirmed LTF	0.0070
CBM-S1	CBM-S1	0.0144	Confirmed LTF	0.0144
G-007	G-007	0.3034	Confirmed LTF	0.3034
HAMLET	HAMLET	0.0878	Confirmed LTF	0.0878
MEC	MEC	0.1621	Confirmed LTF	0.1621
LAGN	LAGN	0.0543	Confirmed LTF	0.0543

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
CATAWBA	CATAWBA	0.0374	Confirmed LTF	0.0374
CBM-W1	CBM-W1	2.1170	Confirmed LTF	2.1170

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
166099057	200519	26REED TAP	PENELEC	200522	26SHADE GP	PENELEC	1	PN-P2_3-PN-230-0347-16-DRT-029	breaker	225.0	138.49	140.9	DC	5.44

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
200812	26ALY HYDR	0.3605	50/50	0.3605
200852	26WARR RDG	0.1998	Adder	0.24
235003	AC1-025 E	0.1664	50/50	0.1664
236828	01GRAYMONT	0.4282	50/50	0.4282
290086	Q-036 E	2.0788	Adder	2.45
293301	N-039 E	3.2460	Adder	3.82
294515	O38_P22	2.8403	Adder	3.34
921642	AA2-000	23.0463	Adder	27.11
930511	AB2-092	0.8462	Adder	1.0
936421	AD2-055	1.7422	Adder	2.05
936991	AD2-133 C	0.9354	Adder	1.1
936992	AD2-133 E	4.2786	Adder	5.03
939171	AE1-147 C	1.2773	50/50	1.2773
939172	AE1-147 E	0.8515	50/50	0.8515
939591	AE1-188 C	-0.6130	Adder	-0.72
940201	AE2-001 C	1.2815	50/50	1.2815
940202	AE2-001 E	0.8543	50/50	0.8543
940681	AE2-055 C (Suspended)	1.3447	50/50	1.3447
940682	AE2-055 E (Suspended)	0.8965	50/50	0.8965
941231	AE2-117 C	0.9303	Adder	1.09
941232	AE2-117 E	0.6202	Adder	0.73
941241	AE2-118 C	0.8844	Adder	1.04
941242	AE2-118 E	0.5896	Adder	0.69
941261	AE2-120 C	1.2838	50/50	1.2838
941262	AE2-120 E	0.8558	50/50	0.8558
941271	AE2-121 C	0.6753	50/50	0.6753
941272	AE2-121 E	0.4509	50/50	0.4509
941321	AE2-126 C	0.6212	Adder	0.73
941322	AE2-126 E	0.4141	Adder	0.49
941331	AE2-129 C	0.6514	Adder	0.77
941332	AE2-129 E	0.4342	Adder	0.51
941351	AE2-131 C (Suspended)	0.6514	Adder	0.77
941352	AE2-131 E (Suspended)	0.4342	Adder	0.51
942121	AE2-224 C	2.6464	Adder	3.11
942122	AE2-224 E	1.7643	Adder	2.08
942351	AE2-248 C	1.0547	50/50	1.0547
942352	AE2-248 E	0.7031	50/50	0.7031
942491	AE2-262 C	3.7800	Adder	4.45
942492	AE2-262 E	2.5401	Adder	2.99

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
942501	AE2-263 C	3.5532	Adder	4.18
942502	AE2-263 E	2.3723	Adder	2.79
942511	AE2-264 C	3.8801	Adder	4.56
942512	AE2-264 E	2.5867	Adder	3.04
943751	AF1-043	5.2265	Adder	6.15
944001	AF1-068 C O1 (Withdrawn : 12/15/2020)	1.4148	50/50	1.4148
944002	AF1-068 E O1 (Withdrawn : 12/15/2020)	0.7958	50/50	0.7958
944311	AF1-099 C	5.7380	Adder	6.75
944312	AF1-099 E	3.8253	Adder	4.5
944321	AF1-100 C	9.7346	Adder	11.45
944322	AF1-100 E	6.4898	Adder	7.64
944471	AF1-112 C	1.3115	50/50	1.3115
944472	AF1-112 E	0.8743	50/50	0.8743
944671	AF1-132 C O1 (Withdrawn : 12/15/2020)	1.3308	50/50	1.3308
944672	AF1-132 E O1 (Withdrawn : 12/15/2020)	0.8872	50/50	0.8872
944691	AF1-134 C	0.5302	Adder	0.62
944692	AF1-134 E	0.3535	Adder	0.42
944771	AF1-142 C	9.1807	Adder	10.8
944772	AF1-142 E	6.1205	Adder	7.2
944881	AF1-153 C O1	0.5901	Adder	0.69
944882	AF1-153 E O1	0.3934	Adder	0.46
944901	AF1-155 C	0.5866	Adder	0.69
944902	AF1-155 E	0.3911	Adder	0.46
945011	AF1-166 C	-0.5009	Adder	-0.59
945491	AF1-214 C (Withdrawn : 12/03/2020)	1.2836	50/50	1.2836
945492	AF1-214 E (Withdrawn : 12/03/2020)	0.8558	50/50	0.8558
945591	AF1-224 C	-0.3844	Adder	-0.45
946421	AF1-306 C	2.5604	Adder	3.01
946422	AF1-306 E	10.2416	Adder	12.05
957451	AF2-039 C	0.4623	Adder	0.54
957452	AF2-039 E	0.3082	Adder	0.36
957561	AF2-050 C	1.3232	Adder	1.56
957562	AF2-050 E	0.8821	Adder	1.04
957931	AF2-087 C (Suspended)	0.1706	Adder	0.2
957932	AF2-087 E (Suspended)	0.2350	Adder	0.28
957941	AF2-088 C	0.2226	Adder	0.26
957942	AF2-088 E	0.1484	Adder	0.17
958071	AF2-101 C	-0.0823	Adder	-0.1
958271	AF2-121 C	0.6514	Adder	0.77
958272	AF2-121 E	0.4342	Adder	0.51
958601	AF2-151 C	-0.0812	Adder	-0.1
959241	AF2-215 C	-0.1404	Adder	-0.17
959802	AF2-271 E	0.2111	Adder	0.25
959843	AF2-275 BAT	0.0921	Merchant Transmission	0.0921
959853	AF2-276 BAT	0.0921	Merchant Transmission	0.0921

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
960022	AF2-293 E	0.1239	50/50	0.1239
960041	AF2-295 C	0.5866	Adder	0.69
960042	AF2-295 E	0.3911	Adder	0.46
960051	AF2-296 C	0.5302	Adder	0.62
960052	AF2-296 E	0.3535	Adder	0.42
962411	AG1-090 C O1	1.7261	Adder	3.83
962412	AG1-090 E O1	1.1508	Adder	2.55
962951	AG1-144 C	0.3452	Adder	0.77
962952	AG1-144 E	0.2302	Adder	0.51
963571	AG1-206 C	0.1737	Adder	0.39
963572	AG1-206 E	0.0935	Adder	0.21
963891	AG1-242 C	0.1522	Adder	0.34
963892	AG1-242 E	0.0820	Adder	0.18
964031	AG1-257 C	0.9032	50/50	0.9032
964032	AG1-257 E	1.2623	50/50	1.2623
964041	AG1-258 C	0.9032	50/50	0.9032
964042	AG1-258 E	1.2623	50/50	1.2623
964191	AG1-280 C	0.2720	Adder	0.6
964192	AG1-280 E	0.1814	Adder	0.4
964201	AG1-281 C	0.2737	Adder	0.61
964202	AG1-281 E	0.1824	Adder	0.4
964391	AG1-301 C	0.5082	Adder	1.13
964392	AG1-301 E	0.3388	Adder	0.75
964451	AG1-308 C O1	0.2426	Adder	0.54
964452	AG1-308 E O1	0.3390	Adder	0.75
965121	AG1-377 C O1	0.3452	Adder	0.77
965122	AG1-377 E O1	0.2302	Adder	0.51
965131	AG1-378 C O1	0.3452	Adder	0.77
965132	AG1-378 E O1	0.2302	Adder	0.51
965201	AG1-385 C	0.4021	Adder	0.89
965202	AG1-385 E	0.1191	Adder	0.26
965301	AG1-395 C	0.4436	Adder	0.98
965302	AG1-395 E	0.1318	Adder	0.29
966041	AG1-473 C	4.4668	50/50	4.4668
966042	AG1-473 E	2.9779	50/50	2.9779
966152	AG1-484 BAT	0.6272	Merchant Transmission	0.6272
966463	AG1-515 BAT	0.3718	Merchant Transmission	0.3718
966891	AG1-560 BAT	12.4896	50/50	12.4896
966901	AG1-561 BAT	5.4371	50/50	5.4371
WEC	WEC	0.0394	Confirmed LTF	0.0394
LGEE	LGEE	0.0647	Confirmed LTF	0.0647
CALDERWOOD	CALDERWOOD	0.0055	Confirmed LTF	0.0055
CBM-W2	CBM-W2	0.5555	Confirmed LTF	0.5555
TVA	TVA	0.0322	Confirmed LTF	0.0322
O-066	O-066	1.7633	Confirmed LTF	1.7633
SIGE	SIGE	0.0381	Confirmed LTF	0.0381
CHEOAH	CHEOAH	0.0070	Confirmed LTF	0.0070
CBM-S1	CBM-S1	0.0144	Confirmed LTF	0.0144
G-007	G-007	0.3034	Confirmed LTF	0.3034
HAMLET	HAMLET	0.0878	Confirmed LTF	0.0878
MEC	MEC	0.1621	Confirmed LTF	0.1621
LAGN	LAGN	0.0543	Confirmed LTF	0.0543

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
CATAWBA	CATAWBA	0.0374	Confirmed LTF	0.0374
CBM-W1	CBM-W1	2.1170	Confirmed LTF	2.1170

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
166098943	200522	26SHADE GP	PENELEC	938380	AE1-071-POI	PENELEC	1	PL:10:P45:102437	breaker	160.0	219.51	223.32	DC	6.1

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
200812	26ALY HYDR	0.4042	50/50	0.4042
200852	26WARR RDG	0.2636	50/50	0.2636
200883	Q-053 E	2.1510	Adder	2.53
235003	AC1-025 E	0.1866	50/50	0.1866
236828	01GRAYMONT	0.4801	50/50	0.4801
290086	Q-036 E	2.3338	Adder	2.75
293301	N-039 E	3.6448	Adder	4.29
294515	O38_P22	3.1892	Adder	3.75
921642	AA2-000	25.8759	Adder	30.44
930511	AB2-092	0.9501	Adder	1.12
936421	AD2-055	1.9561	Adder	2.3
936991	AD2-133 C	1.0502	Adder	1.24
936992	AD2-133 E	4.8035	Adder	5.65
939171	AE1-147 C	1.4321	50/50	1.4321
939172	AE1-147 E	0.9547	50/50	0.9547
939591	AE1-188 C	-0.6881	Adder	-0.81
940201	AE2-001 C	1.4368	50/50	1.4368
940202	AE2-001 E	0.9578	50/50	0.9578
940681	AE2-055 C (Suspended)	1.5077	50/50	1.5077
940682	AE2-055 E (Suspended)	1.0051	50/50	1.0051
941191	AE2-113 C	2.6637	Adder	3.13
941192	AE2-113 E	2.8679	Adder	3.37
941231	AE2-117 C	1.2276	50/50	1.2276
941232	AE2-117 E	0.8184	50/50	0.8184
941241	AE2-118 C	0.9922	Adder	1.17
941242	AE2-118 E	0.6614	Adder	0.78
941261	AE2-120 C	1.4393	50/50	1.4393
941262	AE2-120 E	0.9595	50/50	0.9595
941271	AE2-121 C	0.7571	50/50	0.7571
941272	AE2-121 E	0.5055	50/50	0.5055
941321	AE2-126 C	0.6973	Adder	0.82
941322	AE2-126 E	0.4648	Adder	0.55
941331	AE2-129 C	0.7311	Adder	0.86
941332	AE2-129 E	0.4874	Adder	0.57
941351	AE2-131 C (Suspended)	0.7311	Adder	0.86
941352	AE2-131 E (Suspended)	0.4874	Adder	0.57
942121	AE2-224 C	2.9733	Adder	3.5
942122	AE2-224 E	1.9822	Adder	2.33
942351	AE2-248 C	1.1824	50/50	1.1824
942352	AE2-248 E	0.7883	50/50	0.7883
942491	AE2-262 C	4.2394	Adder	4.99

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
942492	AE2-262 E	2.8489	Adder	3.35
942501	AE2-263 C	3.9850	Adder	4.69
942502	AE2-263 E	2.6606	Adder	3.13
942511	AE2-264 C	5.1197	50/50	5.1197
942512	AE2-264 E	3.4131	50/50	3.4131
942961	AE2-316 C	1.7575	Adder	2.07
942962	AE2-316 E	2.5061	Adder	2.95
943751	AF1-043	5.8682	Adder	6.9
944001	AF1-068 C O1 (Withdrawn : 12/15/2020)	1.5860	50/50	1.5860
944002	AF1-068 E O1 (Withdrawn : 12/15/2020)	0.8922	50/50	0.8922
944311	AF1-099 C	6.4354	Adder	7.57
944312	AF1-099 E	4.2902	Adder	5.05
944321	AF1-100 C	10.9204	Adder	12.85
944322	AF1-100 E	7.2802	Adder	8.56
944471	AF1-112 C	1.4704	50/50	1.4704
944472	AF1-112 E	0.9802	50/50	0.9802
944671	AF1-132 C O1 (Withdrawn : 12/15/2020)	1.4920	50/50	1.4920
944672	AF1-132 E O1 (Withdrawn : 12/15/2020)	0.9946	50/50	0.9946
944691	AF1-134 C	0.5955	Adder	0.7
944692	AF1-134 E	0.3970	Adder	0.47
944771	AF1-142 C	10.2966	Adder	12.11
944772	AF1-142 E	6.8644	Adder	8.08
944881	AF1-153 C O1	0.6625	Adder	0.78
944882	AF1-153 E O1	0.4417	Adder	0.52
944901	AF1-155 C	0.6586	Adder	0.77
944902	AF1-155 E	0.4391	Adder	0.52
945011	AF1-166 C	-0.5622	Adder	-0.66
945491	AF1-214 C (Withdrawn : 12/03/2020)	1.4392	50/50	1.4392
945492	AF1-214 E (Withdrawn : 12/03/2020)	0.9594	50/50	0.9594
945591	AF1-224 C	-0.4314	Adder	-0.51
946381	AF1-302 C	0.7674	Adder	0.9
946382	AF1-302 E	1.0233	Adder	1.2
946421	AF1-306 C	2.8738	Adder	3.38
946422	AF1-306 E	11.4954	Adder	13.52
957451	AF2-039 C	0.5188	Adder	0.61
957452	AF2-039 E	0.3459	Adder	0.41
957561	AF2-050 C	1.4867	Adder	1.75
957562	AF2-050 E	0.9911	Adder	1.17
957931	AF2-087 C (Suspended)	0.1915	Adder	0.23
957932	AF2-087 E (Suspended)	0.2638	Adder	0.31
957941	AF2-088 C	0.2498	Adder	0.29
957942	AF2-088 E	0.1665	Adder	0.2
958071	AF2-101 C	-0.0937	Adder	-0.11
958271	AF2-121 C	0.7311	Adder	0.86
958272	AF2-121 E	0.4874	Adder	0.57

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
958551	AF2-146 C	5.3006	50/50	5.3006
958552	AF2-146 E	3.5338	50/50	3.5338
958571	AF2-148 C	4.3049	50/50	4.3049
958572	AF2-148 E	2.8699	50/50	2.8699
958601	AF2-151 C	-0.0925	Adder	-0.11
959241	AF2-215 C	-0.1576	Adder	-0.19
959802	AF2-271 E	0.2368	Adder	0.28
959843	AF2-275 BAT	0.1034	Merchant Transmission	0.1034
959853	AF2-276 BAT	0.1034	Merchant Transmission	0.1034
960022	AF2-293 E	0.1389	50/50	0.1389
960041	AF2-295 C	0.6586	Adder	0.77
960042	AF2-295 E	0.4391	Adder	0.52
960051	AF2-296 C	0.5955	Adder	0.7
960052	AF2-296 E	0.3970	Adder	0.47
962411	AG1-090 C O1	1.9375	Adder	4.3
962412	AG1-090 E O1	1.2917	Adder	2.87
962951	AG1-144 C	0.3875	Adder	0.86
962952	AG1-144 E	0.2583	Adder	0.57
963571	AG1-206 C	0.1950	Adder	0.43
963572	AG1-206 E	0.1050	Adder	0.23
963891	AG1-242 C	0.1710	Adder	0.38
963892	AG1-242 E	0.0921	Adder	0.2
964031	AG1-257 C	1.0126	50/50	1.0126
964032	AG1-257 E	1.4152	50/50	1.4152
964041	AG1-258 C	1.0126	50/50	1.0126
964042	AG1-258 E	1.4152	50/50	1.4152
964191	AG1-280 C	0.3056	Adder	0.68
964192	AG1-280 E	0.2037	Adder	0.45
964201	AG1-281 C	0.3074	Adder	0.68
964202	AG1-281 E	0.2049	Adder	0.45
964391	AG1-301 C	1.2653	50/50	1.2653
964392	AG1-301 E	0.8435	50/50	0.8435
964451	AG1-308 C O1	0.2722	Adder	0.6
964452	AG1-308 E O1	0.3805	Adder	0.84
965121	AG1-377 C O1	0.3875	Adder	0.86
965122	AG1-377 E O1	0.2583	Adder	0.57
965131	AG1-378 C O1	0.3875	Adder	0.86
965132	AG1-378 E O1	0.2583	Adder	0.57
965201	AG1-385 C	0.4515	Adder	1.0
965202	AG1-385 E	0.1337	Adder	0.3
965301	AG1-395 C	0.4979	Adder	1.11
965302	AG1-395 E	0.1479	Adder	0.33
966041	AG1-473 C	5.0062	50/50	5.0062
966042	AG1-473 E	3.3375	50/50	3.3375
966152	AG1-484 BAT	0.7123	Merchant Transmission	0.7123
966463	AG1-515 BAT	0.4172	Merchant Transmission	0.4172
966891	AG1-560 BAT	13.9988	50/50	13.9988
966901	AG1-561 BAT	6.0982	50/50	6.0982
WEC	WEC	0.0460	Confirmed LTF	0.0460
LGEE	LGEE	0.0767	Confirmed LTF	0.0767
CALDERWOOD	CALDERWOOD	0.0045	Confirmed LTF	0.0045
CBM-W2	CBM-W2	0.6630	Confirmed LTF	0.6630

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
TVA	TVA	0.0420	Confirmed LTF	0.0420
O-066	O-066	1.9786	Confirmed LTF	1.9786
SIGE	SIGE	0.0434	Confirmed LTF	0.0434
CHEOAH	CHEOAH	0.0060	Confirmed LTF	0.0060
CBM-S1	CBM-S1	0.0179	Confirmed LTF	0.0179
G-007	G-007	0.3423	Confirmed LTF	0.3423
HAMLET	HAMLET	0.0982	Confirmed LTF	0.0982
MEC	MEC	0.1907	Confirmed LTF	0.1907
LAGN	LAGN	0.0683	Confirmed LTF	0.0683
CATAWBA	CATAWBA	0.0413	Confirmed LTF	0.0413
CBM-W1	CBM-W1	2.4535	Confirmed LTF	2.4535

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
166098933	938380	AE1-071-POI	PENELEC	200520	26ROXBURY	PENELEC	1	PN-P2_3-PN-230-0347-16-DRT-029	breaker	160.0	245.91	249.72	DC	6.09

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
200812	26ALY HYDR	0.4036	50/50	0.4036
200852	26WARR RDG	0.2631	50/50	0.2631
200883	Q-053 E	2.1432	Adder	2.52
235003	AC1-025 E	0.1863	50/50	0.1863
236828	01GRAYMONT	0.4794	50/50	0.4794
290086	Q-036 E	2.3276	Adder	2.74
293301	N-039 E	3.6339	Adder	4.28
294515	O38_P22	3.1797	Adder	3.74
921642	AA2-000	25.8051	Adder	30.36
930511	AB2-092	0.9475	Adder	1.11
936421	AD2-055	1.9507	Adder	2.29
936991	AD2-133 C	1.0474	Adder	1.23
936992	AD2-133 E	4.7909	Adder	5.64
938384	AE1-071-C	40.3905	50/50	40.3905
938385	AE1-071-E	24.7156	50/50	24.7156
939171	AE1-147 C	1.4302	50/50	1.4302
939172	AE1-147 E	0.9534	50/50	0.9534
939591	AE1-188 C	-0.6863	Adder	-0.81
940201	AE2-001 C	1.4348	50/50	1.4348
940202	AE2-001 E	0.9566	50/50	0.9566
940681	AE2-055 C (Suspended)	1.5056	50/50	1.5056
940682	AE2-055 E (Suspended)	1.0038	50/50	1.0038
941231	AE2-117 C	1.2254	50/50	1.2254
941232	AE2-117 E	0.8170	50/50	0.8170
941241	AE2-118 C	0.9903	Adder	1.17
941242	AE2-118 E	0.6602	Adder	0.78
941261	AE2-120 C	1.4374	50/50	1.4374
941262	AE2-120 E	0.9582	50/50	0.9582
941271	AE2-121 C	0.7560	50/50	0.7560
941272	AE2-121 E	0.5048	50/50	0.5048
941321	AE2-126 C	0.6954	Adder	0.82
941322	AE2-126 E	0.4636	Adder	0.55
941331	AE2-129 C	0.7293	Adder	0.86
941332	AE2-129 E	0.4862	Adder	0.57
941351	AE2-131 C (Suspended)	0.7293	Adder	0.86
941352	AE2-131 E (Suspended)	0.4862	Adder	0.57
942121	AE2-224 C	2.9631	Adder	3.49
942122	AE2-224 E	1.9754	Adder	2.32
942351	AE2-248 C	1.1809	50/50	1.1809

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
942352	AE2-248 E	0.7873	50/50	0.7873
942491	AE2-262 C	4.2321	Adder	4.98
942492	AE2-262 E	2.8440	Adder	3.35
942501	AE2-263 C	3.9782	Adder	4.68
942502	AE2-263 E	2.6561	Adder	3.12
942511	AE2-264 C	5.1106	50/50	5.1106
942512	AE2-264 E	3.4070	50/50	3.4070
943751	AF1-043	5.8521	Adder	6.88
944001	AF1-068 C O1 (Withdrawn : 12/15/2020)	1.5840	50/50	1.5840
944002	AF1-068 E O1 (Withdrawn : 12/15/2020)	0.8910	50/50	0.8910
944311	AF1-099 C	6.4244	Adder	7.56
944312	AF1-099 E	4.2829	Adder	5.04
944321	AF1-100 C	10.8987	Adder	12.82
944322	AF1-100 E	7.2658	Adder	8.55
944471	AF1-112 C	1.4683	50/50	1.4683
944472	AF1-112 E	0.9789	50/50	0.9789
944671	AF1-132 C O1 (Withdrawn : 12/15/2020)	1.4900	50/50	1.4900
944672	AF1-132 E O1 (Withdrawn : 12/15/2020)	0.9934	50/50	0.9934
944691	AF1-134 C	0.5935	Adder	0.7
944692	AF1-134 E	0.3957	Adder	0.47
944771	AF1-142 C	10.2790	Adder	12.09
944772	AF1-142 E	6.8527	Adder	8.06
944881	AF1-153 C O1	0.6607	Adder	0.78
944882	AF1-153 E O1	0.4404	Adder	0.52
944901	AF1-155 C	0.6569	Adder	0.77
944902	AF1-155 E	0.4379	Adder	0.52
945011	AF1-166 C	-0.5608	Adder	-0.66
945491	AF1-214 C (Withdrawn : 12/03/2020)	1.4371	50/50	1.4371
945492	AF1-214 E (Withdrawn : 12/03/2020)	0.9581	50/50	0.9581
945591	AF1-224 C	-0.4303	Adder	-0.51
946421	AF1-306 C	2.8667	Adder	3.37
946422	AF1-306 E	11.4669	Adder	13.49
957451	AF2-039 C	0.5175	Adder	0.61
957452	AF2-039 E	0.3450	Adder	0.41
957561	AF2-050 C	1.4816	Adder	1.74
957562	AF2-050 E	0.9877	Adder	1.16
957931	AF2-087 C (Suspended)	0.1910	Adder	0.22
957932	AF2-087 E (Suspended)	0.2631	Adder	0.31
957941	AF2-088 C	0.2492	Adder	0.29
957942	AF2-088 E	0.1661	Adder	0.2
958071	AF2-101 C	-0.0921	Adder	-0.11
958271	AF2-121 C	0.7293	Adder	0.86
958272	AF2-121 E	0.4862	Adder	0.57
958551	AF2-146 C	5.3162	50/50	5.3162
958552	AF2-146 E	3.5442	50/50	3.5442

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
958571	AF2-148 C	4.3078	50/50	4.3078
958572	AF2-148 E	2.8719	50/50	2.8719
958601	AF2-151 C	-0.0909	Adder	-0.11
959241	AF2-215 C	-0.1572	Adder	-0.18
959802	AF2-271 E	0.2363	Adder	0.28
959843	AF2-275 BAT	0.1031	Merchant Transmission	0.1031
959853	AF2-276 BAT	0.1031	Merchant Transmission	0.1031
960022	AF2-293 E	0.1387	50/50	0.1387
960041	AF2-295 C	0.6569	Adder	0.77
960042	AF2-295 E	0.4379	Adder	0.52
960051	AF2-296 C	0.5935	Adder	0.7
960052	AF2-296 E	0.3957	Adder	0.47
962411	AG1-090 C O1	1.9326	Adder	4.29
962412	AG1-090 E O1	1.2884	Adder	2.86
962951	AG1-144 C	0.3865	Adder	0.86
962952	AG1-144 E	0.2577	Adder	0.57
963571	AG1-206 C	0.1945	Adder	0.43
963572	AG1-206 E	0.1047	Adder	0.23
963891	AG1-242 C	0.1704	Adder	0.38
963892	AG1-242 E	0.0918	Adder	0.2
964031	AG1-257 C	1.0113	50/50	1.0113
964032	AG1-257 E	1.4133	50/50	1.4133
964041	AG1-258 C	1.0113	50/50	1.0113
964042	AG1-258 E	1.4133	50/50	1.4133
964191	AG1-280 C	0.3046	Adder	0.68
964192	AG1-280 E	0.2030	Adder	0.45
964201	AG1-281 C	0.3064	Adder	0.68
964202	AG1-281 E	0.2042	Adder	0.45
964391	AG1-301 C	1.2631	50/50	1.2631
964392	AG1-301 E	0.8421	50/50	0.8421
964451	AG1-308 C O1	0.2716	Adder	0.6
964452	AG1-308 E O1	0.3795	Adder	0.84
965121	AG1-377 C O1	0.3865	Adder	0.86
965122	AG1-377 E O1	0.2577	Adder	0.57
965131	AG1-378 C O1	0.3865	Adder	0.86
965132	AG1-378 E O1	0.2577	Adder	0.57
965201	AG1-385 C	0.4502	Adder	1.0
965202	AG1-385 E	0.1333	Adder	0.3
965301	AG1-395 C	0.4967	Adder	1.1
965302	AG1-395 E	0.1475	Adder	0.33
966041	AG1-473 C	5.0011	50/50	5.0011
966042	AG1-473 E	3.3340	50/50	3.3340
966152	AG1-484 BAT	0.7022	Merchant Transmission	0.7022
966463	AG1-515 BAT	0.4163	Merchant Transmission	0.4163
966901	AG1-561 BAT	6.0877	50/50	6.0877
WEC	WEC	0.0441	Confirmed LTF	0.0441
LGEE	LGEE	0.0729	Confirmed LTF	0.0729
CALDERWOOD	CALDERWOOD	0.0060	Confirmed LTF	0.0060
CBM-W2	CBM-W2	0.6182	Confirmed LTF	0.6182
TVA	TVA	0.0364	Confirmed LTF	0.0364
O-066	O-066	1.9719	Confirmed LTF	1.9719
SIGE	SIGE	0.0427	Confirmed LTF	0.0427

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
CHEOAH	CHEOAH	0.0080	Confirmed LTF	0.0080
CBM-S1	CBM-S1	0.0163	Confirmed LTF	0.0163
G-007	G-007	0.3402	Confirmed LTF	0.3402
HAMLET	HAMLET	0.0982	Confirmed LTF	0.0982
MEC	MEC	0.1827	Confirmed LTF	0.1827
LAGN	LAGN	0.0595	Confirmed LTF	0.0595
CATAWBA	CATAWBA	0.0416	Confirmed LTF	0.0416
CBM-W1	CBM-W1	2.3694	Confirmed LTF	2.3694

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
AA2-000	N/A	N/A
AB2-092	Bergen 138kV	Partially in Service - Under Construction
AC1-025	Dale Summit	In Service
AD2-055	Moshannon-East Towanda 230 kV	Active
AD2-133	Eagle Valley 115kV	Active
AE1-071	Shade Gap-Roxbury 115 kV	Active
AE1-147	Bellefonte 46 kV	Engineering and Procurement
AE1-188	Fayetteville 34.5 kV	Engineering and Procurement
AE2-001	Nittany-Zion 46 kV	Active
AE2-055	Shingletown-Boalsburg 46 kV	Suspended
AE2-113	Farmers Valley-Ridgeway 115 kV	Active
AE2-117	ABW Tap-Alexandria 46 kV	Active
AE2-118	ABW Tap-Williamsburg 46 kV	Active
AE2-120	Graymont-Zion 46 kV	Active
AE2-121	Milesburg-Tanney Junction 46 kV	Active
AE2-126	Dubois-Curwensville 34.5 kV	Engineering and Procurement
AE2-129	Philipsburg-Clarence 34.5 kV	Engineering and Procurement
AE2-131	Philipsburg-Karthus 34.5	Suspended
AE2-224	Bearrock-Johnstown 230 kV	Active
AE2-248	Fillmore-Thompson Farm 46 kV	Active
AE2-262	Moshannon-Milesburg 230 kV	Active
AE2-263	Moshannon-Milesburg 230 kV	Active
AE2-264	Altoona-Raystown 230 kV	Active
AE2-316	Brookville-Squab Hollow 138 kV	Active
AF1-043	Moshannon-East Towanda 230 kV	Active
AF1-068	Boalsburg-Centre Hall 46 kV	Withdrawn
AF1-099	Moshannon-Milesburg 230 kV	Active
AF1-100	Shawville-Moshannon 230 kV	Active
AF1-112	Centre Hall-Boalsburg 46 kV	Active
AF1-132	Shingletown-Boalsburg 46 kV	Withdrawn
AF1-134	Philipsburg-Madera 34.5 kV	Active
AF1-142	Moshannon-Milesburg 230 kV	Active
AF1-153	Motion-Ridgeway 46 kV	Active
AF1-155	Paper City-Wilcox 46 kV	Engineering and Procurement
AF1-166	Target-Chambers No.5 34.5 kV	Engineering and Procurement
AF1-214	Nittany-Zion 46 kV	Withdrawn
AF1-224	Fayetteville 34.5 kV	Engineering and Procurement
AF1-302	Brookville-Squab Hollow 138 kV	Active
AF1-306	Squab Hollow 230 kV	Active

Queue Number	Project Name	Status
AF2-039	Shawville-Clearfield 34.5 kV	Active
AF2-050	Bearrock-Johnstown 230 kV	Active
AF2-087	East Altoona-Pinecroft 12.47 kV	Suspended
AF2-088	Shawville-Clearfield 34.5 kV II	Active
AF2-101	Allen 13.2 kV	Engineering and Procurement
AF2-121	Philipsburg-Shawville 34.5 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
AF2-215	Saint Thomas-LeMasters Junction 34.5 kV	Engineering and Procurement
AF2-271	Pemberton-Sinking Valley 12.47 kV	Engineering and Procurement
AF2-275	Guilford 12.47 kV	Active
AF2-276	Guilford 12.47 kV	Active
AF2-293	Beech Creek 12.47 kV	Active
AF2-295	Wilcox-Paper City 46 kV	Active
AF2-296	Madera 34.5 kV	Active
AG1-090	Philipsburg 115 kV	Active
AG1-144	Phillipsburg 34.5 kV	Active
AG1-206	Snyder Twp 34.5 kV	Active
AG1-242	Beccaria 34.5 kV	Active
AG1-257	Madisonburg Jct-Millheim 46 kV	Active
AG1-258	Madisonburg Jct-Millheim 46 kV	Active
AG1-280	Claysburg-Puzzletown 46 kV	Active
AG1-281	Claysburg-HCR Tap 46 kV	Active
AG1-301	Miller REC-Warrior Ridge 46 kV	Active
AG1-308	Shawville-Philipsburg 115 kV	Active
AG1-377	Philipsburg 115 kV	Active
AG1-378	Philipsburg 115 kV	Active
AG1-385	Motion-Ridgeway 46 kV	Active
AG1-395	Philipsburg-Karthaus 34.5 kV 2	Active
AG1-473	Shinglestown-Lewistown 230 kV	Active
AG1-484	Mountain 115 kV	Active
AG1-515	Guilford 138 kV	Active
AG1-560	Shade Gap-Roxbury 115 kV II	Active
AG1-561	Roxbury-Greene 138 kV II	Active

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
PN-P2_3-PN-230-0347-16-DRT-029	CONTINGENCY 'PN-P2_3-PN-230-0347-16-DRT-029' /* 26LEWISTOWN- 26RAYSTOWN 230 AND B5 FAULT DISCONNECT BRANCH FROM BUS 200513 TO BUS 208005 CKT 1 /* 26LEWISTOWN- 08JUNITA 230 AND B89 FAULT OPEN BUS 200531 /* 26LEWISTOWN 230 BUS 2 END
PL:10:P45:102437	CONTINGENCY 'PL:10:P45:102437' /* JUNI BU2 230KV BUS; BUS_SEC_1-2 CB @ JUNI 230KV DISCONNECT BUS 208004 /* JUNI BU1 230 DISCONNECT BUS 208005 /* JUNI BU2 230 END
PL:10:P13:100618	CONTINGENCY 'PL:10:P13:100618' /* JUNIATA 230/69KV TR4 OUT" DISCONNECT BRANCH FROM BUS 208005 TO BUS 209997 CKT 4 /* DISCONNECT BRANCH FROM BUS 208005 TO BUS 207955 CKT 1 /* DISCONNECT BRANCH FROM BUS 208005 TO BUS 200009 CKT 2 /* REMOVE SHUNT 1 FROM BUS 208004 /* DISCONNECT BRANCH FROM BUS 208005 TO BUS 208004 CKT 1 /* DISCONNECT BRANCH FROM BUS 208005 TO BUS 200513 CKT 1 /* END
PL:10:P24:100548	CONTINGENCY 'PL:10:P24:100548' /* JUNI 230KV BUS_SEC_1-2 CB DISCONNECT BUS 208005 /* JUNI BU2 230 DISCONNECT BUS 208004 /* JUNI BU1 230 /* JUNI BU1 230 END
AP-P1-2-WP-138-109	CONTINGENCY 'AP-P1-2-WP-138-109' /* GUILFORD - REID 138KV DISCONNECT BRANCH FROM BUS 235189 TO BUS 235136 CKT 1 /* 01GUILFD 138 01ANTRIM 138 DISCONNECT BRANCH FROM BUS 235136 TO BUS 235503 CKT 1 /* 01ANTRIM 138 01REID 138 REMOVE LOAD 1 FROM BUS 235136 /* 01ANTRIM 138 END
Base Case	

12 Short Circuit Analysis

The following Breakers are overdutied:

None.

12.1 System Reinforcements - Short Circuit

None.

13 Affected Systems

13.1 NYISO

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