



Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-206

SNYDER TWP 34.5 KV

6.5 MW Capacity / 10 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 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.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Jefferson County, Pennsylvania. The installed facilities will have a total capability of 10 MW with 6.5 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-206
Project Name	SNYDER TWP 34.5 KV
State	Pennsylvania
County	Jefferson
Transmission Owner	PENELEC (MAIT)
MFO	10
MWE	10
MWC	6.5
Fuel	Solar
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

AG1-206 will interconnect with the PENELEC distribution system via a tap on the Brockway Substation 34.5 kV Sugar Hill ckt#133-23 at/near pole # BWB-10023 (Attachment 1). The IC's proposed generating unit site is located at GPC: 41.24435, -78.88854. Per FirstEnergy EP-02-280 (6/23/20) the maximum allowable single customer owned distributed energy resources (DER) located less than 2 miles from the distribution substation shall be limited to 50% maximum DER capacity for a 34.5kV distribution circuit which is 11MW. Maximum DER at the point of interconnection shall therefore **not exceed 5.5MW for this point of interconnection**. DER greater than 5.5MW will be required to have dedicated facilities from our substation.

The primary reason for this guideline is to maintain the operational flexibility of the distribution system. Large loads and large exports reduce the ability of distribution operations to reconfigure circuits during abnormal conditions, or maintenance scenarios. In addition, large loads and large exports from DER often require modifications to distribution system protection that may compromise system reliability.

4.2 Secondary Point of Interconnection

There is no secondary point of interconnection specified for AG1-206.

5 Cost Summary

The AG1-206 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$188,700
Total System Network Upgrade Costs	\$16,000,000 ¹
Total Costs	\$16,137,000

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

AG1-206 will interconnect with the PENELEC distribution system via a tap on the Brockway Substation 34.5 kV Sugar Hill ckt#133-23 at/near pole # BWB-10023 (Attachment 1). The IC's proposed generating unit site is located at GPC: 41.24435, -78.88854. Per FirstEnergy EP-02-280 (6/23/20) the maximum allowable single customer owned distributed energy resources (DER) located less than 2 miles from the distribution substation shall be limited to 50% maximum DER capacity for a 34.5kV distribution circuit which is 11MW. Maximum DER at the point of interconnection shall therefore **not exceed 5.5MW for this point of interconnection**. DER greater than 5.5MW will be required to have dedicated facilities from our substation.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AG1-206 generation project to connect to the Penelec distribution system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing all the facilities on its side of the POI, including the attachment facilities which connect the generator to the Penelec distribution system's direct connection facilities.

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

Description	Total Cost
Proposed line tap at/near existing pole #BWB-10023 on existing Harvey Run 34.5kV distribution circuit, add new SCADA switch, add new primary metering. The customer is responsible to build their own line from their site to Penelec's existing facilities.	\$137,000
Non-Direct Connection upgrades	\$51,700
Total Physical Interconnection Costs	\$188,700

7 Schedule

Based on the scope of work for the Direct and Non-Direct Connection facilities, it is expected to take a minimum of **14 months** after the signing of an Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the IC to make a preliminary payment that compensates FE for the first three months of the engineering design work that is related to the construction of the interconnection substation. This assumes that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined direct connection and that any distribution system outages will be allowed when requested.

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

Penelec performed an analysis of its distribution system. The AG1-206 project did not contribute to any overloads on the distribution system.

9 Interconnection Customer Requirements

9.1 System Protection

An analysis was conducted to assess the impact of the AG1-206 “Snyder Twp 34.5 kV” Project on the system protection requirements in the area. The results of this review show that the following relay additions will be required:

Proposed single line diagrams show the IC constructing a generation facility tapping the Brockway Substation 34.5 kV Sugar Hill ckt#133-23 at/near pole # BWB-10023.

The 34.5kV interconnection proposal will require Developer to meet applicable "Technical Requirements" as outlined in First Energy's document titled “Technical Requirements for the Interconnection of Customer-Owned Generation to the FirstEnergy Distribution System". Anti-islanding system shall meet IEEE 1547 and UL 1741 Therefore no Direct Transfer Trip (DTT) will be required.

9.2 General Concerns

It is to be understood, for abnormal operation of the Penelec system, which could cause Developer’s generation facility to be electrically isolated from the Penelec system synchronous source via the tripping of a interconnecting primary voltage line or device, Developer will, via Penelec’s direction, be required to disconnect the generation from Penelec’s system and remain disconnected (**units are required to be OFF LINE**), until the Penelec system normal circuitry is restored. These abnormal conditions will be reviewed by Penelec system operators as to the need for the generation facility to be disconnected.

9.3 Requirements for Owner’s/Developer’s Generation IPP Facility

The proposed interconnection Owner’s/Developer’s facilities must be designed in accordance with the document titled *FirstEnergy Distribution Engineering Practices Interconnection of Customer-Owned Generation to the FirstEnergy Distribution System* dated 11/17/14 located at the following link:

<http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>

The document is referred to as engineering practice EP (# 02-280) with section 4, part C specifically referencing the “interconnection technical requirements”. Certain protection requirements are shown.

Additionally, Owner/Developer is responsible to provide adequate protection (for their equipment) under any distribution system operating condition' - which includes 'Separation from supply' (i.e. tripping of F.E. circuit breakers) and 'resynchronizing the generation after electric restoration of the supply' (i.e. reclosing of F.E. circuit breakers).

Owner’s/Developer’s protection must be designed to coordinate with the reclosing practices of FirstEnergy line protective devices. The generator must cease to energize the FirstEnergy circuit to which it is connected prior to reclosing of any (FE) automatic reclosing devices.

Owners/Developer's electrical protection and control schematics shall be provided to FE for consideration. FE may request modifications, if required, to meet the technical requirements.

9.4 Compliance Issues

Interconnection Customer (IC) will be responsible for meeting a power factor between 0.90 lagging (producing MVARs) to 0.95 leading (absorbing MVARs) and assure that voltage deviation will be less than 1.0 volt as measured at the POI under all Solar Gen operating conditions due to the inherent dynamic reactive power capability of this solar facility.

Generators with no inherent VAR (reactive power) control capability, or those that have a restricted VAR capability less than the defined requirements, must provide dynamic supplementary reactive support located at the generation facility with electrical characteristics equivalent to that provided by a similar sized synchronous generator. A Dynamic Reactive Compensation (either Static VAR Compensator (SVC) or STATCOM) or other method be applied in order to maintain the required specifications at the POI. Interconnection Customer (IC) is responsible for the installation of equipment on its side of the POI in order to adhere to the criteria stated above by FirstEnergy.

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 Meteorological Data Reporting Requirements

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Back Panel temperature (Fahrenheit) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Irradiance (Watts/meter²) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Ambient air temperature (Fahrenheit) - (Accepted, not required)
- Wind speed (meters/second) - (Accepted, not required)
- Wind direction (decimal degrees from true north) - (Accepted, not required)

10.3 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 AG1-206 was evaluated as a 10.0 MW (Capacity 6.5 MW) injection at the Harvey Run 34.5 kV substation in the PENELEC area. Project AG1-206 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-206 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 PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
165936001	200582	26RIDGWAY	115.0	PENELEC	200647	26FOREST	115.0	PENELEC	1	PN-P2_1-PN-345-997-DRT-051	breaker	277.0	104.52	106.33	DC	5.02
165935975	941190	AE2-113 TAP	115.0	PENELEC	200668	26FARMVLY	115.0	PENELEC	1	PN-P2-3-PN-230-8M_SUM_WIN	breaker	160.0	122.46	123.59	DC	1.81

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 PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPACT
166179478	941190	AE2-113 TAP	115.0	PENELEC	200668	26FARMVLY	115.0	PENELEC	1	PN-P1-2-PN-230-006	operation	160.0	107.23	108.36	DC	1.81

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
165936001	1	26RIDGWAY 115.0 kV - 26FOREST 115.0 kV Ckt 1	<p>PENELEC PN-AF2-F-0063A (2266) : Replace line traps at Forest and Ridgway substations. Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months</p> <p>PN-AF2-F-0063B (2267) : Adjust relay settings at Forest. Project Type : FAC Cost : \$450,000 Time Estimate : 12.0 Months</p> <p>PN-AF2-F-0063C (2268) : Replace line relays. Project Type : FAC Cost : \$450,000 Time Estimate : 12.0 Months</p> <p>PN-AF2-F-0063D (2269) : Replace bus conductor at Ridgway. Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months</p>	\$1,300,000
165935975	2	AE2-113 TAP 115.0 kV - 26FARM VLY 115.0 kV Ckt 1	<p>PENELEC PN-AG1-F-0012A (2197) : Reconductor 5.6 miles of line. Project Type : FAC Cost : \$13,700,000 Time Estimate : 36.0 Months</p> <p>PN-AG1-F-0012B (2198) : Replace substation conductor at Farmers Valley Project Type : FAC Cost : \$200,000 Time Estimate : 12.0 Months</p> <p>PN-AG1-F-0012C (2199) : Adjust line relaying at Farmers Valley Project Type : FAC Cost : \$800,000 Time Estimate : 12.0 Months</p>	\$14,700,000
			TOTAL COST	\$16,000,000

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
165936001	200582	26RIDGWAY	PENELEC	200647	26FOREST	PENELEC	1	PN-P2_1-PN-345-997-DRT-051	breaker	277.0	104.52	106.33	DC	5.02

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
200649	26PENNTech	4.8519	50/50	4.8519
203349	26Z1-069 C	0.5876	50/50	0.5876
916202	Z1-069 E	15.8783	50/50	15.8783
931091	AB1-160 C	0.1679	50/50	0.1679
931092	AB1-160 E	4.5366	50/50	4.5366
940861	AE2-074 C	6.0265	50/50	6.0265
940862	AE2-074 E	7.9329	50/50	7.9329
941191	AE2-113 C	38.4652	50/50	38.4652
941192	AE2-113 E	41.4146	50/50	41.4146
941321	AE2-126 C	5.0311	50/50	5.0311
941322	AE2-126 E	3.3541	50/50	3.3541
941331	AE2-129 C	0.6977	Adder	0.82
941332	AE2-129 E	0.4651	Adder	0.55
941351	AE2-131 C (Suspended)	0.6977	Adder	0.82
941352	AE2-131 E (Suspended)	0.4651	Adder	0.55
946111	AF1-276 C	34.7402	50/50	34.7402
946112	AF1-276 E	17.1108	50/50	17.1108
946121	AF1-277 C	34.7402	50/50	34.7402
946122	AF1-277 E	17.1108	50/50	17.1108
946131	AF1-278 C	27.7092	50/50	27.7092
946132	AF1-278 E	13.7716	50/50	13.7716
946423	AF1-306 BAT	18.4505	Merchant Transmission	18.4505
957451	AF2-039 C	0.6261	Adder	0.74
957452	AF2-039 E	0.4174	Adder	0.49
957941	AF2-088 C	0.3015	Adder	0.35
957942	AF2-088 E	0.2010	Adder	0.24
958271	AF2-121 C	0.6977	Adder	0.82
958272	AF2-121 E	0.4651	Adder	0.55
961211	AF2-412	8.1350	Adder	9.57
962411	AG1-090 C O1	1.8489	Adder	4.1
962412	AG1-090 E O1	1.2326	Adder	2.74
962951	AG1-144 C	0.3698	Adder	0.82
962952	AG1-144 E	0.2465	Adder	0.55
963571	AG1-206 C	3.2639	50/50	3.2639
963572	AG1-206 E	1.7575	50/50	1.7575
964451	AG1-308 C O1	0.2805	Adder	0.62
964452	AG1-308 E O1	0.3920	Adder	0.87
965121	AG1-377 C O1	0.3698	Adder	0.82
965122	AG1-377 E O1	0.2465	Adder	0.55

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
965131	AG1-378 C O1	0.3698	Adder	0.82
965132	AG1-378 E O1	0.2465	Adder	0.55
965241	AG1-389 C O1	3.6982	50/50	3.6982
965242	AG1-389 E O1	2.4654	50/50	2.4654
965251	AG1-390 C O1	3.6982	50/50	3.6982
965252	AG1-390 E O1	2.4654	50/50	2.4654
965261	AG1-391 C O1	3.6982	50/50	3.6982
965262	AG1-391 E O1	2.4654	50/50	2.4654
965271	AG1-392 C O1	7.3963	50/50	7.3963
965272	AG1-392 E O1	4.9309	50/50	4.9309
965301	AG1-395 C	0.4752	Adder	1.05
965302	AG1-395 E	0.1411	Adder	0.31
G-007A	G-007A	0.5778	Confirmed LTF	0.5778
VFT	VFT	1.6125	Confirmed LTF	1.6125
CALDERWOOD	CALDERWOOD	0.0631	Confirmed LTF	0.0631
PRAIRIE	PRAIRIE	0.3978	Confirmed LTF	0.3978
CHEOAH	CHEOAH	0.0636	Confirmed LTF	0.0636
CBM-N	CBM-N	0.3300	Confirmed LTF	0.3300
COTTONWOOD	COTTONWOOD	0.2919	Confirmed LTF	0.2919
HAMLET	HAMLET	0.0537	Confirmed LTF	0.0537
GIBSON	GIBSON	0.0874	Confirmed LTF	0.0874
BLUEG	BLUEG	0.2743	Confirmed LTF	0.2743
TRIMBLE	TRIMBLE	0.0879	Confirmed LTF	0.0879
CATAWBA	CATAWBA	0.0364	Confirmed LTF	0.0364

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
165935975	941190	AE2-113 TAP	PENELEC	200668	26FARM VLY	PENELEC	1	PN-P2-3-PN-230-8M_SUM_WIN	breaker	160.0	122.46	123.59	DC	1.81

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
200649	26PENNTech	1.5387	50/50	1.5387
235003	AC1-025 E	0.0786	Adder	0.09
236828	01GRAYMONT	0.2175	Adder	0.26
290086	Q-036 E	1.7241	Adder	2.03
921642	AA2-000	20.9211	Adder	24.61
930511	AB2-092	0.7682	Adder	0.9
936421	AD2-055	1.5815	Adder	1.86
936991	AD2-133 C	0.7759	Adder	0.91
936992	AD2-133 E	3.5487	Adder	4.17
939171	AE1-147 C	0.6562	Adder	0.77
939172	AE1-147 E	0.4374	Adder	0.51
940201	AE2-001 C	0.6541	Adder	0.77
940202	AE2-001 E	0.4361	Adder	0.51
940681	AE2-055 C (Suspended)	0.6221	Adder	0.73
940682	AE2-055 E (Suspended)	0.4147	Adder	0.49
941191	AE2-113 C	33.8240	50/50	33.8240
941192	AE2-113 E	36.4176	50/50	36.4176
941261	AE2-120 C	0.6530	Adder	0.77
941262	AE2-120 E	0.4353	Adder	0.51
941271	AE2-121 C	0.3508	Adder	0.41
941272	AE2-121 E	0.2342	Adder	0.28
941321	AE2-126 C	1.9456	50/50	1.9456
941322	AE2-126 E	1.2970	50/50	1.2970
941331	AE2-129 C	0.6925	Adder	0.81
941332	AE2-129 E	0.4617	Adder	0.54
941351	AE2-131 C (Suspended)	0.6925	Adder	0.81
941352	AE2-131 E (Suspended)	0.4617	Adder	0.54
942351	AE2-248 C	0.5084	Adder	0.6
942352	AE2-248 E	0.3389	Adder	0.4
942491	AE2-262 C	3.1765	Adder	3.74
942492	AE2-262 E	2.1346	Adder	2.51
942501	AE2-263 C	2.9859	Adder	3.51
942502	AE2-263 E	1.9935	Adder	2.35
942961	AE2-316 C	2.2774	Adder	2.68
942962	AE2-316 E	3.2476	Adder	3.82
943751	AF1-043	4.7445	Adder	5.58
944001	AF1-068 C O1 (Withdrawn : 12/15/2020)	0.6736	Adder	0.79
944002	AF1-068 E O1 (Withdrawn : 12/15/2020)	0.3789	Adder	0.45
944311	AF1-099 C	4.8219	Adder	5.67

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
944312	AF1-099 E	3.2146	Adder	3.78
944321	AF1-100 C	10.8235	Adder	12.73
944322	AF1-100 E	7.2157	Adder	8.49
944382	AF1-103 BAT	1.1770	Merchant Transmission	1.1770
944471	AF1-112 C	0.6389	Adder	0.75
944472	AF1-112 E	0.4260	Adder	0.5
944671	AF1-132 C O1 (Withdrawn : 12/15/2020)	0.6292	Adder	0.74
944672	AF1-132 E O1 (Withdrawn : 12/15/2020)	0.4195	Adder	0.49
944691	AF1-134 C	0.5831	Adder	0.69
944692	AF1-134 E	0.3888	Adder	0.46
944771	AF1-142 C	7.7150	Adder	9.08
944772	AF1-142 E	5.1433	Adder	6.05
944881	AF1-153 C O1	0.9734	Adder	1.15
944882	AF1-153 E O1	0.6489	Adder	0.76
944901	AF1-155 C	0.9669	Adder	1.14
944902	AF1-155 E	0.6446	Adder	0.76
945491	AF1-214 C (Withdrawn : 12/03/2020)	0.6530	Adder	0.77
945492	AF1-214 E (Withdrawn : 12/03/2020)	0.4353	Adder	0.51
946381	AF1-302 C	0.9945	Adder	1.17
946382	AF1-302 E	1.3260	Adder	1.56
946421	AF1-306 C	5.7301	50/50	5.7301
946422	AF1-306 E	22.9206	50/50	22.9206
957451	AF2-039 C	0.6136	Adder	0.72
957452	AF2-039 E	0.4091	Adder	0.48
957941	AF2-088 C	0.2954	Adder	0.35
957942	AF2-088 E	0.1970	Adder	0.23
958271	AF2-121 C	0.6925	Adder	0.81
958272	AF2-121 E	0.4617	Adder	0.54
960022	AF2-293 E	0.0639	Adder	0.08
960041	AF2-295 C	0.9669	Adder	1.14
960042	AF2-295 E	0.6446	Adder	0.76
960051	AF2-296 C	0.5831	Adder	0.69
960052	AF2-296 E	0.3888	Adder	0.46
962411	AG1-090 C O1	1.8351	Adder	4.07
962412	AG1-090 E O1	1.2234	Adder	2.72
962951	AG1-144 C	0.3670	Adder	0.81
962952	AG1-144 E	0.2447	Adder	0.54
963571	AG1-206 C	1.1736	50/50	1.1736
963572	AG1-206 E	0.6320	50/50	0.6320
963891	AG1-242 C	0.1674	Adder	0.37
963892	AG1-242 E	0.0901	Adder	0.2
964031	AG1-257 C	0.2353	Adder	0.52
964032	AG1-257 E	0.3288	Adder	0.73
964041	AG1-258 C	0.2353	Adder	0.52
964042	AG1-258 E	0.3288	Adder	0.73
964341	AG1-296 C	0.1602	Adder	0.36
964342	AG1-296 E	0.0863	Adder	0.19
964451	AG1-308 C O1	0.2778	Adder	0.62

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
964452	AG1-308 E O1	0.3883	Adder	0.86
965121	AG1-377 C O1	0.3670	Adder	0.81
965122	AG1-377 E O1	0.2447	Adder	0.54
965131	AG1-378 C O1	0.3670	Adder	0.81
965132	AG1-378 E O1	0.2447	Adder	0.54
965201	AG1-385 C	0.6634	Adder	1.47
965202	AG1-385 E	0.1965	Adder	0.44
965301	AG1-395 C	0.4716	Adder	1.05
965302	AG1-395 E	0.1401	Adder	0.31
966122	AG1-481 BAT	0.4772	Merchant Transmission	0.4772
G-007A	G-007A	0.5922	Confirmed LTF	0.5922
VFT	VFT	1.5803	Confirmed LTF	1.5803
CALDERWOOD	CALDERWOOD	0.0601	Confirmed LTF	0.0601
NY	NY	0.4761	Confirmed LTF	0.4761
PRAIRIE	PRAIRIE	0.4004	Confirmed LTF	0.4004
CHEOAH	CHEOAH	0.0601	Confirmed LTF	0.0601
CBM-N	CBM-N	0.2820	Confirmed LTF	0.2820
COTTONWOOD	COTTONWOOD	0.2856	Confirmed LTF	0.2856
HAMLET	HAMLET	0.0445	Confirmed LTF	0.0445
GIBSON	GIBSON	0.0890	Confirmed LTF	0.0890
BLUEG	BLUEG	0.2778	Confirmed LTF	0.2778
TRIMBLE	TRIMBLE	0.0896	Confirmed LTF	0.0896
CATAWBA	CATAWBA	0.0319	Confirmed LTF	0.0319

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
AB1-160	Gold-Sabinsville 115kV	In Service
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
AE1-147	Bellefonte 46 kV	Engineering and Procurement
AE2-001	Nittany-Zion 46 kV	Active
AE2-055	Shingletown-Boalsburg 46 kV	Suspended
AE2-074	Potter 46 kV	Active
AE2-113	Farmers Valley-Ridgeway 115 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
AE2-248	Fillmore-Thompson Farm 46 kV	Active
AE2-262	Moshannon-Milesburg 230 kV	Active
AE2-263	Moshannon-Milesburg 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
AF1-103	Warren 34.5 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
AF1-214	Nittany-Zion 46 kV	Withdrawn
AF1-276	Lewis Run-Pierce Brook 230 kV	Active
AF1-277	Lewis Run-Pierce Brook 2 230 kV	Active
AF1-278	Lewis Run-Pierce Brook 3 230 kV	Active
AF1-302	Brookville-Squab Hollow 138 kV	Active
AF1-306	Squab Hollow 230 kV	Active
AF2-039	Shawville-Clearfield 34.5 kV	Active
AF2-088	Shawville-Clearfield 34.5 kV II	Active

Queue Number	Project Name	Status
AF2-121	Philipsburg-Shawville 34.5 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
AF2-412	Mainesburg 115 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
AG1-296	Snyder Township 34.5 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
AG1-389	Gold 115 kV I	Active
AG1-390	Gold 115 kV II	Active
AG1-391	Gold 115 kV III	Active
AG1-392	Gold 115 kV IV	Active
AG1-395	Philipsburg-Karthaus 34.5 kV 2	Active
AG1-481	Warren 34.5 kV	Active
Z1-069	Gold-Sabinsville 115kV	In Service

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
PN-P2_1-PN-345-997-DRT-051	CONTINGENCY 'PN-P2_1-PN-345-997-DRT-051' /* B8 INTERNAL FAULT DISCONNECT BRANCH FROM BUS 946110 TO BUS 200704 CKT 1 /* AF1-276 TAP - PIERCEBRK 345 DISCONNECT BRANCH FROM BUS 200942 TO BUS 200943 CKT 1 /* 26PIERCEBRK XFMR BK_1 END
PN-P2-3-PN-230-8M_SUM_WIN	CONTINGENCY 'PN-P2-3-PN-230-8M_SUM_WIN' /* GLADE STUCK BREAKER B42 (FOREST/SENECA) DISCONNECT BRANCH FROM BUS 200581 TO BUS 200593 CKT 1 /* 26FOREST 230 26GLADE 230 DISCONNECT BRANCH FROM BUS 200593 TO BUS 200594 CKT 1 /* 26GLADE 230 26SENECA 230 DISCONNECT BRANCH FROM BUS 200594 TO BUS 200642 CKT 1 /* 26SENECA 230 26SENECA#1 14 DISCONNECT BRANCH FROM BUS 200594 TO BUS 200643 CKT 1 /* 26SENECA 230 26SENECA#2 14 DISCONNECT BRANCH FROM BUS 200594 TO BUS 200644 CKT 1 /* 26SENECA 230 26SENECA#3 14 REMOVE MACHINE 1G FROM BUS 200642 /* 26SENECA#1 14 REMOVE MACHINE 2G FROM BUS 200643 /* 26SENECA#2 14 REMOVE MACHINE 3 FROM BUS 200644 /* 26SENECA#3 14 END
PN-P1-2-PN-230-006	CONTINGENCY 'PN-P1-2-PN-230-006' /* GLADE - FOREST 230KV DISCONNECT BRANCH FROM BUS 200593 TO BUS 200581 CKT 1 /* 26GLADE 230 26FOREST 230 END

12 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).

14 Attachment 1: One Line Diagram

