Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-188

MANITOU-OYSTER CREEK 34.5 KV

8.316 MW Capacity / 19.8 MW Energy

January 2021

Table of Contents

1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is JCPL.

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 Ocean County, New Jersey. The installed facilities will have a total capability of 19.8 MW with 8.316 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 17, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-188
Project Name	MANITOU-OYSTER CREEK 34.5 KV
State	New Jersey
County	Ocean
Transmission Owner	JCPL
MFO	19.8
MWE	19.8
MWC	8.316
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

AG1-188 will interconnect with the JCPL system by tapping the Oyster Creek - Whitings Q121 34.5 kV line with a three-switch tap and constructing a one span 34.5 kV line extension. The transmission line tap will be located approximately 7.8 miles from Oyster Creek substation and 0.7 miles from Bamber Lake substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection line tap and the associated Attachment facilities.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AG1-188 generation project to connect to the FirstEnergy ("FE") transmission system. IC will be responsible for constructing all of the facilities on its side of the POI, including the Attachment facilities which connect the generator to the FE transmission system.

5 Cost Summary

The AG1-188 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$2,729,000
Total System Network Upgrade Costs	$302,958,272[1]
Total Costs	**$305,687,272**

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

The interconnection of the project at the Primary POI will be accomplished by tapping the Oyster Creek - Whitings Q121 34.5 kV line with a three-switch tap and constructing a one span 34.5 kV line extension. The transmission line tap will be located approximately 7.8 miles from Oyster Creek substation and 0.7 miles from Bamber Lake substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection line tap and the associated Attachment facilities.

The project will also require non-direct connection upgrades at the Oyster Creek - Whitings substations.

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

Description	Total Cost
Construct a 0.2 mile 34.5 kV tap into the interconnection customer's substation.	$1,080,000
Install FE owned 34.5 kV metering in the interconnection customer's substation.	$105,000
Construct a tap and install 2-34.5 kV switches on the Oyster Creek - Whitings Q121 34.5 kV line.	$470,000
Upgrade relaying at Oyster Creek 34.5 kV.	$537,000
Upgrade relaying at Whitings 34.5 kV.	$537,000
Total Physical Interconnection Costs	**$2,729,000**

7 Schedule

Based on the scope of work for the Attachment Facilities and the Direct and/or Non-Direct Connection facilities, it is expected to take a minimum of **24 months** after the signing of an Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the IC to make a preliminary payment that compensates FE for the first three months of the engineering design work that is related to the construction of the 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 network upgrades, and that all transmission 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[1].

8 Transmission Owner Analysis

8.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AG1-188 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.

All new generator only and new generator plus load facilities must be isolated from the FE transmission System by a Power Transformer. Section 14.2.6 of FE's "Requirements for Transmission Connected Facilities" document specifies the winding configurations of the transformer connecting to a non-effectively grounded portion of the FE Transmission system shall be determined by FE on a case-by-case basis.

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 34.5 kV circuit breaker to protect the AG1-188 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 AG1-188 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 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 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 FE revenue metering requirements for generation interconnection customers which can be found in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx

11 Summer Peak - Load Flow Analysis

The Queue Project AG1-188 was evaluated as a 19.8 MW (Capacity 8.3 MW) injection tapping the Bamber Lake to Oyster Creek 34.5 kV line in the JCPL area. Project AG1-188 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-188 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	CONTNAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
164938700	206302	28OYSTER C	230.0	JCP&L	227955	CEDAR	230.0	AE	1	JC-P7-1-JCC-230-13	tower	564.0	258.06	259.65	DC	8.98
164938701	206302	28OYSTER C	230.0	JCP&L	227955	CEDAR	230.0	AE	1	JC-P7-1-JCC-230-10A	tower	564.0	155.85	157.01	DC	6.52
164938753	206319	28WHITINGS	230.0	JCP&L	206720	28MANCHSTR	230.0	JCP&L	1	JC-P7-1-JCC-230-10A	tower	869.0	152.05	153.27	DC	10.6
164938754	206319	28WHITINGS	230.0	JCP&L	206720	28MANCHSTR	230.0	JCP&L	1	JC-P7-1-JCC-230-12	tower	869.0	139.48	140.73	DC	10.84
164938756	206720	28MANCHSTR	230.0	JCP&L	206318	28VANHISVL	230.0	JCP&L	1	JC-P7-1-JCC-230-10A	tower	869.0	149.65	150.87	DC	10.6
164938757	206720	28MANCHSTR	230.0	JCP&L	206318	28VANHISVL	230.0	JCP&L	1	JC-P7-1-JCC-230-12	tower	869.0	137.09	138.34	DC	10.84
165282853	227955	CEDAR	230.0	AE	227900	CARDIFF	230.0	AE	1	JC-P7-1-JCC-230-13	tower	805.0	139.56	140.56	DC	8.05

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	CKT ID	CONTNAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
167621575	206297	28MANITOU	230.0	JCP&L	206295	28LEISUR D	230.0	JCP&L	1	JC-P1-2-JCC-230-020	operation	817.0	148.37	149.4	DC	8.44
167621526	206323	28LAKEWOOD	230.0	JCP&L	206294	28LARRABEE	230.0	JCP&L	2	JC-P1-2-JCC-230-014	operation	817.0	186.15	187.26	DC	9.01
167621539	206323	28LAKEWOOD	230.0	JCP&L	206294	28LARRABEE	230.0	JCP&L	1	JC-P1-2-JCC-230-013	operation	869.0	175.84	176.88	DC	9.0

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
164938701,164938700	1	28OYSTER C 230.0 kV - CEDAR 230.0 kV Ckt 1	<u>ACE</u> **ACECedar230strandR01 (13) : To mitigate the (ACE) Cedar Oyster Creek 230 kV line (from bus 227955 to bus 206302 ckt 1) overload, it will require a 230 kV strand bus upgrade at Cedar.** **Project Type : FAC** **Cost : $300,000** **Time Estimate : 24-36 Months** **as2318r0001 (79) : To mitigate the (ACE) Cedar Oyster Creek 230 kV line (from bus 227955 to bus 206302 ckt 1) overload, it will require various terminal reinforcements at Cedar.** **Project Type : FAC** **Cost : $700,000** **Time Estimate : 24-48 Months** **at2318r0001 (148) : To mitigate the (ACE) Cedar Oyster Creek 230 kV line (from bus 227955 to bus 206302 ckt 1) overload, it will require increasing the emergency rating of the Cedar to Oyster Creek 230 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. In addition, various terminal reinforcements are required at Cedar.** **Project Type : FAC** **Cost : $63,000,000** **Time Estimate : 36-60 Months** <u>JCPL</u> **JCP&L-AF2-F-0011a (2069) :** **1) Reconductor the Oyster Creek - Cedar 230 kV line (JCP&L portion only ~0.1 miles. AE portion ~14 miles)** **2) Upgrade terminal equipment at Oyster Creek** **Project Type : FAC** **Cost : $3,550,733** **Time Estimate : 24.0 Months**	$67,550,733
164938753,164938754	2	28WHITINGS 230.0 kV - 28MANCHSTR 230.0 kV Ckt 1	<u>JCPL</u> **JCP&L-AF2-F-0019a (2080) :** **1) Reconductor the Manchester - Whitings 230 kV 1590 line (~12.65 miles).** **2) Replace wave trap at Whitings.** **3) Replace substation conductor at Manchester.** **4) Replace circuit breaker at Whitings.** **5) Replace disconnect switches at Manchester and Whitings.** **6) Replace relaying and metering at Whitings.** **Project Type : FAC** **Cost : $62,324,402** **Time Estimate : 54.0 Months** **JCP&L-AF2-F-0019b (2081) : Replace fault switches at Whitings.** **Project Type : FAC** **Cost : $536,990** **Time Estimate : 12.0 Months**	$62,861,392

ID	Idx	Facility	Upgrade Description	Cost
165282853	4	CEDAR 230.0 kV - CARDIFF 230.0 kV Ckt 1	**ACE** **as2317r0001 (74) : To mitigate the (ACE) AE2-020 TAP Cedar 230 kV line (from bus 940360 to bus 227955 ckt 1) overload, various terminal reinforcements are required at Cedar.** **Project Type : FAC** **Cost : $300,000** **Time Estimate : 24-36 Months** **as2317r0003 (76) : To mitigate the (ACE) AE2-020 TAP Cardiff 230 kV line (from bus 940360 to bus 227955 ckt 1) overload, various terminal reinforcements are required at Cardiff.** **Project Type : FAC** **Cost : $200,000** **Time Estimate : 24-36 Months** **as2317r0005 (78) : To mitigate the (ACE) AE2-020 TAP Cardiff 230 kV line (from bus 940360 to bus 227955 ckt 1) overload, various terminal reinforcements are required at Cardiff.** **Project Type : FAC** **Cost : $1,500,000** **Time Estimate : 24-36 Months** **ACECardiffCedar230r01 (154) : To mitigate the Cardiff-Cedar 230 kV overload the line will be rebuilt with bundled conductor** **Project Type : FAC** **Cost : $135,000,000** **Time Estimate : 60.0 Months**	$137,000,000
164938756,164938757	3	28MANCHSTR 230.0 kV - 28VANHISVL 230.0 kV Ckt 1	**JCPL** **JCP&L-AF2-F-0027a (2090) : Reconductor the Van Hiseville Tap - Manchester 230 kV line (~5.55 miles).** **Project Type : FAC** **Cost : $35,009,147** **Time Estimate : 42.0 Months** **JCP&L-AF2-F-0027b (2091) :** **1) Replace substation conductor at Manchester.** **2) Replace disconnect switches at Manchester.** **Project Type : FAC** **Cost : $537,000** **Time Estimate : 42.0 Months**	$35,546,147
			TOTAL COST	**$302,958,272**

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
164938700	206302	28OYSTER C	JCP&L	227955	CEDAR	AE	1	JC-P7-1-JCC-230-13	tower	564.0	258.06	259.65	DC	8.98

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
206360	28O CRK C1	4.9608	50/50	4.9608
206361	28O CRK C2	3.6410	50/50	3.6410
940161	AE2-000 C O1	212.0589	50/50	212.0589
940162	AE2-000 E O1	542.5860	50/50	542.5860
944331	AF1-101 C O1	207.8973	50/50	207.8973
944332	AF1-101 E O1	531.9507	50/50	531.9507
963391	AG1-188 C	3.7751	50/50	3.7751
963392	AG1-188 E	5.2089	50/50	5.2089
963401	AG1-189 C	3.1780	50/50	3.1780
963402	AG1-189 E	4.2996	50/50	4.2996
G-007A	G-007A	0.9134	Confirmed LTF	0.9134
VFT	VFT	0.7934	Confirmed LTF	0.7934
CALDERWOOD	CALDERWOOD	0.0174	Confirmed LTF	0.0174
PRAIRIE	PRAIRIE	0.0878	Confirmed LTF	0.0878
CHEOAH	CHEOAH	0.0175	Confirmed LTF	0.0175
CBM-N	CBM-N	0.1176	Confirmed LTF	0.1176
COTTONWOOD	COTTONWOOD	0.0735	Confirmed LTF	0.0735
HAMLET	HAMLET	0.0214	Confirmed LTF	0.0214
GIBSON	GIBSON	0.0186	Confirmed LTF	0.0186
BLUEG	BLUEG	0.0590	Confirmed LTF	0.0590
TRIMBLE	TRIMBLE	0.0189	Confirmed LTF	0.0189
CATAWBA	CATAWBA	0.0126	Confirmed LTF	0.0126

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
164938753	206319	28WHITINGS	JCP&L	206720	28MANCHSTR	JCP&L	1	JC-P7-1-JCC-230-10A	tower	869.0	152.05	153.27	DC	10.6

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
206280	28LAKEHURS	0.7676	50/50	0.7676
206306	28LKWD G1	7.7182	50/50	7.7182
206308	28LKWD G2	7.7094	50/50	7.7094
206312	28LKWD G3	6.2059	50/50	6.2059
206360	28O CRK C1	2.7304	50/50	2.7304
206361	28O CRK C2	2.0039	50/50	2.0039
206366	28LKWD CT1	14.6767	50/50	14.6767
206367	28LKWD CT2	14.6767	50/50	14.6767
227801	ONTC&DCT	4.4021	Adder	5.18
227842	MARINGEN	0.8901	Adder	1.05
227927	V4-067C	0.0214	50/50	0.0214
227928	V4-067E	0.2210	50/50	0.2210
228014	PVILLEG	0.2579	50/50	0.2579
228102	**BLE#2 ST (Deactivation : 30/04/2019)**	**14.1123**	**Adder**	**16.6**
228754	AB1-001 C	0.0276	50/50	0.0276
901982	W1-119 E	0.4749	Adder	0.56
901992	W1-120E	0.4749	Adder	0.56
902432	W2-030 E	0.6702	Adder	0.79
917612	Z2-102 E	0.6877	Adder	0.81
923292	AB1-138 C	0.2002	50/50	0.2002
923293	AB1-138 E	2.1152	50/50	2.1152
923463	AB1-163 E	0.7132	50/50	0.7132
924701	**AB2-122 C (Withdrawn : 05/05/2020)**	**0.0153**	**50/50**	**0.0153**
924702	**AB2-122 E (Withdrawn : 05/05/2020)**	**0.1657**	**50/50**	**0.1657**
930002	AB1-001 E	0.2874	50/50	0.2874
933962	AD1-019 E	0.8667	Adder	1.02
938781	AE1-104 C O1	13.0801	Adder	15.39
938782	AE1-104 E O1	33.4603	Adder	39.37
939121	AE1-142 C O1	0.6995	50/50	0.6995
939122	AE1-142 E O1	6.3798	50/50	6.3798
940161	AE2-000 C O1	116.7137	50/50	116.7137
940162	AE2-000 E O1	298.6303	50/50	298.6303
940361	AE2-020 C	15.7329	50/50	15.7329
940362	AE2-020 E	73.6626	50/50	73.6626
940371	AE2-021 C	15.7329	50/50	15.7329
940372	AE2-021 E	73.6626	50/50	73.6626
940381	AE2-022 C	9.1775	50/50	9.1775
940382	AE2-022 E	42.9698	50/50	42.9698

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
942101	AE2-222 C	9.6190	Adder	11.32
942102	AE2-222 E	24.6122	Adder	28.96
942381	AE2-251 C	49.8415	50/50	49.8415
942382	AE2-251 E	127.5305	50/50	127.5305
943732	AF1-041 E	0.3269	50/50	0.3269
944331	AF1-101 C O1	114.4232	50/50	114.4232
944332	AF1-101 E O1	292.7768	50/50	292.7768
957221	AF2-016 C	13.1957	Adder	15.52
957222	AF2-016 E	19.7936	Adder	23.29
957251	AF2-019 C	0.6510	Adder	0.77
957252	AF2-019 E	0.9765	Adder	1.15
957271	AF2-021 C	3.0338	50/50	3.0338
957272	AF2-021 E	4.5508	50/50	4.5508
957311	AF2-025 C	0.9122	Adder	1.07
957312	AF2-025 E	1.3683	Adder	1.61
963391	AG1-188 C	4.4529	50/50	4.4529
963392	AG1-188 E	6.1441	50/50	6.1441
963401	AG1-189 C	2.6815	50/50	2.6815
963402	AG1-189 E	3.6279	50/50	3.6279
CALDERWOOD	CALDERWOOD	0.1044	Confirmed LTF	0.1044
NY	NY	0.4651	Confirmed LTF	0.4651
PRAIRIE	PRAIRIE	0.5605	Confirmed LTF	0.5605
O-066	O-066	8.1568	Confirmed LTF	8.1568
SIGE	SIGE	0.1044	Confirmed LTF	0.1044
CHEOAH	CHEOAH	0.1051	Confirmed LTF	0.1051
COTTONWOOD	COTTONWOOD	0.4473	Confirmed LTF	0.4473
G-007	G-007	2.8560	Confirmed LTF	2.8560
HAMLET	HAMLET	0.1149	Confirmed LTF	0.1149
GIBSON	GIBSON	0.1196	Confirmed LTF	0.1196
BLUEG	BLUEG	0.3802	Confirmed LTF	0.3802
TRIMBLE	TRIMBLE	0.1219	Confirmed LTF	0.1219
CATAWBA	CATAWBA	0.0711	Confirmed LTF	0.0711

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
164938756	206720	28MANCHSTR	JCP&L	206318	28VANHISVL	JCP&L	1	JC-P7-1-JCC-230-10A	tower	869.0	149.65	150.87	DC	10.6

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
206280	28LAKEHURS	0.7676	50/50	0.7676
206306	28LKWD G1	7.7182	50/50	7.7182
206308	28LKWD G2	7.7094	50/50	7.7094
206312	28LKWD G3	6.2059	50/50	6.2059
206360	28O CRK C1	2.7304	50/50	2.7304
206361	28O CRK C2	2.0039	50/50	2.0039
206366	28LKWD CT1	14.6767	50/50	14.6767
206367	28LKWD CT2	14.6767	50/50	14.6767
227801	ONTC&DCT	4.4021	Adder	5.18
227842	MARINGEN	0.8901	Adder	1.05
227927	V4-067C	0.0214	50/50	0.0214
227928	V4-067E	0.2210	50/50	0.2210
228014	PVILLEG	0.2579	50/50	0.2579
228102	**BLE#2 ST (Deactivation : 30/04/2019)**	**14.1123**	**Adder**	**16.6**
228754	AB1-001 C	0.0276	50/50	0.0276
901982	W1-119 E	0.4749	Adder	0.56
901992	W1-120E	0.4749	Adder	0.56
902432	W2-030 E	0.6702	Adder	0.79
917612	Z2-102 E	0.6877	Adder	0.81
923292	AB1-138 C	0.2002	50/50	0.2002
923293	AB1-138 E	2.1152	50/50	2.1152
923463	AB1-163 E	0.7132	50/50	0.7132
924701	**AB2-122 C (Withdrawn : 05/05/2020)**	**0.0153**	**50/50**	**0.0153**
924702	**AB2-122 E (Withdrawn : 05/05/2020)**	**0.1657**	**50/50**	**0.1657**
930002	AB1-001 E	0.2874	50/50	0.2874
933962	AD1-019 E	0.8667	Adder	1.02
938781	AE1-104 C O1	13.0801	Adder	15.39
938782	AE1-104 E O1	33.4603	Adder	39.37
939121	AE1-142 C O1	0.6995	50/50	0.6995
939122	AE1-142 E O1	6.3798	50/50	6.3798
940161	AE2-000 C O1	116.7137	50/50	116.7137
940162	AE2-000 E O1	298.6303	50/50	298.6303
940361	AE2-020 C	15.7329	50/50	15.7329
940362	AE2-020 E	73.6626	50/50	73.6626
940371	AE2-021 C	15.7329	50/50	15.7329
940372	AE2-021 E	73.6626	50/50	73.6626
940381	AE2-022 C	9.1775	50/50	9.1775
940382	AE2-022 E	42.9698	50/50	42.9698

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
942101	AE2-222 C	9.6190	Adder	11.32
942102	AE2-222 E	24.6122	Adder	28.96
942381	AE2-251 C	49.8415	50/50	49.8415
942382	AE2-251 E	127.5305	50/50	127.5305
943732	AF1-041 E	0.3269	50/50	0.3269
944331	AF1-101 C O1	114.4232	50/50	114.4232
944332	AF1-101 E O1	292.7768	50/50	292.7768
957221	AF2-016 C	13.1957	Adder	15.52
957222	AF2-016 E	19.7936	Adder	23.29
957251	AF2-019 C	0.6510	Adder	0.77
957252	AF2-019 E	0.9765	Adder	1.15
957271	AF2-021 C	3.0338	50/50	3.0338
957272	AF2-021 E	4.5508	50/50	4.5508
957311	AF2-025 C	0.9122	Adder	1.07
957312	AF2-025 E	1.3683	Adder	1.61
963391	AG1-188 C	4.4529	50/50	4.4529
963392	AG1-188 E	6.1441	50/50	6.1441
963401	AG1-189 C	2.6815	50/50	2.6815
963402	AG1-189 E	3.6279	50/50	3.6279
CALDERWOOD	CALDERWOOD	0.1044	Confirmed LTF	0.1044
NY	NY	0.4651	Confirmed LTF	0.4651
PRAIRIE	PRAIRIE	0.5605	Confirmed LTF	0.5605
O-066	O-066	8.1568	Confirmed LTF	8.1568
SIGE	SIGE	0.1044	Confirmed LTF	0.1044
CHEOAH	CHEOAH	0.1051	Confirmed LTF	0.1051
COTTONWOOD	COTTONWOOD	0.4473	Confirmed LTF	0.4473
G-007	G-007	2.8560	Confirmed LTF	2.8560
HAMLET	HAMLET	0.1149	Confirmed LTF	0.1149
GIBSON	GIBSON	0.1196	Confirmed LTF	0.1196
BLUEG	BLUEG	0.3802	Confirmed LTF	0.3802
TRIMBLE	TRIMBLE	0.1219	Confirmed LTF	0.1219
CATAWBA	CATAWBA	0.0711	Confirmed LTF	0.0711

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
165282853	227955	CEDAR	AE	227900	CARDIFF	AE	1	JC-P7-1-JCC-230-13	tower	805.0	139.56	140.56	DC	8.05

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
206360	28O CRK C1	4.4467	50/50	4.4467
206361	28O CRK C2	3.2637	50/50	3.2637
228754	AB1-001 C	0.0314	50/50	0.0314
930002	AB1-001 E	0.3267	50/50	0.3267
940161	AE2-000 C O1	190.0828	50/50	190.0828
940162	AE2-000 E O1	486.3567	50/50	486.3567
944331	AF1-101 C O1	186.3525	50/50	186.3525
944332	AF1-101 E O1	476.8236	50/50	476.8236
957271	AF2-021 C	6.3395	50/50	6.3395
957272	AF2-021 E	9.5093	50/50	9.5093
963391	AG1-188 C	3.3837	50/50	3.3837
963392	AG1-188 E	4.6688	50/50	4.6688
963401	AG1-189 C	2.8486	50/50	2.8486
963402	AG1-189 E	3.8539	50/50	3.8539
G-007A	G-007A	0.8104	Confirmed LTF	0.8104
VFT	VFT	0.6966	Confirmed LTF	0.6966
CALDERWOOD	CALDERWOOD	0.0164	Confirmed LTF	0.0164
PRAIRIE	PRAIRIE	0.0827	Confirmed LTF	0.0827
CHEOAH	CHEOAH	0.0165	Confirmed LTF	0.0165
CBM-N	CBM-N	0.1020	Confirmed LTF	0.1020
COTTONWOOD	COTTONWOOD	0.0693	Confirmed LTF	0.0693
HAMLET	HAMLET	0.0202	Confirmed LTF	0.0202
GIBSON	GIBSON	0.0175	Confirmed LTF	0.0175
BLUEG	BLUEG	0.0556	Confirmed LTF	0.0556
TRIMBLE	TRIMBLE	0.0178	Confirmed LTF	0.0178
CATAWBA	CATAWBA	0.0119	Confirmed LTF	0.0119

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
AB1-001	Absecon 12 kV	In Service
AB1-138	Navy 34.5kV	In Service
AB1-163	Glidden-Van Hiseville 34.5 kV	Engineering and Procurement
AB2-122	Egg Harbor 12kV	Withdrawn
AD1-019	Ontario 23 kV	Active
AE1-104	BL England 138 kV	Active
AE1-142	Manitou-Pleasant Plains 34.5 kV	Under Construction
AE2-000	N/A	N/A
AE2-020	Cardiff 230 kV I	Active
AE2-021	Cardiff 230 kV II	Active
AE2-022	Cardiff 230 kV III	Active
AE2-222	Higbee 69 kV	Active
AE2-251	Cardiff 230 kV	Active
AF1-041	Absecon 12.47 kV	In Service
AF1-101	Oyster Creek 230 kV III	Active
AF2-016	Lewis 138 kV	Active
AF2-019	Middle 69 kV	Active
AF2-021	Cedar 69 kV	Active
AF2-025	Missouri Ave 69 kV	Active
AG1-188	Manitou-Oyster Creek 34.5 kV	Active
AG1-189	Oyster Creek-Bamber Lake 34.5	Active
V4-067	Cates Road Egg Harbor Township 12kV	In Service
W1-119	Pemberton Township 1 34.5 kV	In Service
W1-120	Pemberton Township 2 34.5 kV	In Service
W2-030	Egg Harbor Township	In Service
Z2-102	Argonne-New Lisbon 34.5kV	In Service

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
JC-P7-1-JCC-230-12	CONTINGENCY 'JC-P7-1-JCC-230-12' /* LEISURE VILLAGE-MANITOU A2027 & C2029 DISCONNECT BRANCH FROM BUS 206295 TO BUS 206297 CKT 1 DISCONNECT BRANCH FROM BUS 206297 TO BUS 206277 CKT 7 DISCONNECT BRANCH FROM BUS 206296 TO BUS 206297 CKT 1 DISCONNECT BRANCH FROM BUS 206296 TO BUS 206276 CKT 3 SET BUS 206296 LOAD TO 0 MW END
JC-P7-1-JCC-230-13	CONTINGENCY 'JC-P7-1-JCC-230-13' /* MANITOU-OYSTER CREEK 230 LINES & OYSTER GEN DISCONNECT BRANCH FROM BUS 206297 TO BUS 206302 CKT 1 DISCONNECT BRANCH FROM BUS 206297 TO BUS 206302 CKT 2 END
JC-P7-1-JCC-230-10A	CONTINGENCY 'JC-P7-1-JCC-230-10A' /* LAKEWOOD - LARRABEE 230 KV LINES DISCONNECT BRANCH FROM BUS 206323 TO BUS 206294 CKT 2 DISCONNECT BRANCH FROM BUS 206323 TO BUS 206294 CKT 1 DISCONNECT BRANCH FROM BUS 206294 TO BUS 206274 CKT 3 DISCONNECT BRANCH FROM BUS 206294 TO BUS 206275 CKT 12 /* LARRABEE 12 FUTURE BREAKER AND A HALF SET BUS 206294 LOAD TO 38 MW /* LARRABEE 8 FUTURE BREAKER AND A HALF END
JC-P1-2-JCC-230-020	CONTINGENCY 'JC-P1-2-JCC-230-020' /* LEISURE VILLAGE - MANITOU (C2029) 230 KV DISCONNECT BRANCH FROM BUS 206296 TO BUS 206297 CKT 1 DISCONNECT BRANCH FROM BUS 206296 TO BUS 206276 CKT 3 END
JC-P1-2-JCC-230-014	CONTINGENCY 'JC-P1-2-JCC-230-014' /* FUTURE BREAKERS LAKEWOOD - LARRABEE (Z2026) 230 KV & LAR BK 8 & 12 DISCONNECT BRANCH FROM BUS 206323 TO BUS 206294 CKT 1 DISCONNECT BRANCH FROM BUS 206294 TO BUS 206275 CKT 12 END
JC-P1-2-JCC-230-013	CONTINGENCY 'JC-P1-2-JCC-230-013' /* LAKEWOOD - LARRABEE (K2011) 230 KV DISCONNECT BRANCH FROM BUS 206323 TO BUS 206294 CKT 2 END

12 Short Circuit Analysis

The following Breakers are overdutied:

None.

12.1 System Reinforcements - Short Circuit

No short circuit impacts were identified for this project.

13 Affected Systems

13.1 NYISO

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

14 Attachment 1: One Line Diagram