Revised

Generation Interconnection

System Impact Study Report

for

Queue Project AD2-055

"MOSHANNON-EAST TOWANDA 230 KV"

35 MW Capacity / 44 MW Energy

April 2021

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1 Introduction

This System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 205, as well as the System Impact 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 System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. 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 System Impact Study is performed.

The System Impact 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.

An Interconnection Customer with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

3 General

The Interconnection Customer (IC) has proposed an uprate to a planned/existing Natural Gas generating facility located in Clinton, Pennsylvania. This project is an increase to the Interconnection Customer's AA1-111 and AB1-092 projects, which will share the same point of interconnection. The AD2-055 queue position is a 44 MW uprate (35 MW Capacity uprate) to the previous projects. The total installed facilities will have a capability of 548 MW with 515 MW of this output being recognized by PJM as Capacity. The proposed Commercial Operation Date for this project is June 2024[1]. **This study does not imply a Mid-Atlantic Interstate Transmission (MAIT) commitment to this in-service date.**

Queue Number	**AD2-055**
Project Name	MOSHANNON-EAST TOWANDA 230 KV
State	Pennsylvania
County	Clinton
Transmission Owner	PENELEC
MFO	548
MWE	44
MWC	35
Fuel	Natural Gas
Basecase Study Year	2021

Queue	Maximum Facility Output (MFO) (MW)	Energy (MW)	Capacity (MW)
AA1-111	463	463	463
AB1-092	504	41	17
AD2-055	548	44	35
Total	**548**	**548**	**515**

[1] The AA1-111/AB1-092/AD2-055 Commercial Operation Date will be updated in the Facilities Study to follow.

4 Revisions since December 2019 System Impact Study Report

The AD2-055 System Impact Study results were retooled. With the updated analysis, the following was determined:

1) AD2-055 contributes to an overload of the Karns City-Bulter 138 kV line but does not have cost allocation per the cost allocation rules. Two baseline RTEP upgrades, b2967 and b3083 mitigate the issue. Both of these upgrades are currently on hold in the PJM RTEP until it is determined whether a New Services Customer is eligible to take advantage of the baseline. **Given the timing of when this AD2-055 project entered the queue versus the date when the generator deactivation was announced and rescinded, the AD2-055 project is eligible to take advantage of these baselines when they sign an ISA**.

   The AD2-055 project will need these baseline upgrades in place or an interim analysis to determine if they are deliverable prior to going into Commercial Operation. See the "Network Impacts" and "System Reinforcements" sections below.

2) AD2-055 requires the stability reinforcement (*PJM Network Upgrade Number n5740*) to be in service prior to commercial operation.

See the Network Impacts section of this report for the updated analysis results. The updated interconnection work scope and cost estimates for AA1-111/AB1-092/AD2-055 will be provided in the Facilities Study Report.

5 Point of Interconnection

AD2-055 will interconnect with the PENELEC on as an uprate to the AA2-000 (AA1-111) and AB1-092 projects through a new 230 kV interconnection switchyard along the Moshannon-East Towanda 230kV line.

6 Cost Summary

The AD2-055 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$0
Direct Connection Network Upgrades	$0
Non-Direct Connection Network Upgrades	$0
Allocation for New System Upgrades	$0
Contribution for Previously Identified Upgrades	$0
Total Costs	**$0**[2]

*As your project progresses through the study process and other projects modify their request or withdraw, then your cost allocation could change.

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 88-129. 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.

Note 1: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. The allocation of costs for a network upgrade will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.

Note 2: For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost

[2] Note that the stability reinforcement is included in the updated analysis. The cost responsibility for the stability upgrade is included in the AA1-111 System Impact Study Report. The cost allocation between AA1-111, AB1-092 and the AD2-055 project was not split out as the same customer is responsible. If the AD2-055 project is at any time transferred to another Interconnection Customer, we will determine cost allocation at that time.

allocation to a System Reinforcement is presently $0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

7 Transmission Owner Scope of Work

As this project is an uprate to AA1-111 and AB1-092, no additional work is required for the physical interconnection. However, this project does need the following reinforcement projects addressing transmission system impacts to be in-service prior to Commercial Operation:

1) **B2967**- Convert the existing 6 wire Butler - Shanor Manor - Krendale 138 kV Line into two separate 138 kV lines.
2) **B3083** - Replace substation conductor at Butler (138 kV) Replace substation conductor and line trap at Karns City (138 kV).
3) **N5740** – Stability Reinforcement- New 345/230 kV step-up transformation to NYSEG/NYISO between proposed AA1-111 230 kV interconnection switchyard and the NYSEG Q654 345 kV interconnection switchyard.

8 Schedule

The AD2-055 project will require the reinforcement projects identified in Section 7 to be complete prior to Commercial Operation. If the customer desires to come into service prior to the baseline projects being completed, they will need an interim deliverability study to confirm if all or a portion of their output can be deliverable. This analysis must be performed each year until the baseline is in-service.

9 Transmission Owner Analysis

9.1 Power Flow Analysis

PJM performed a power flow analysis of the transmission system using a 2021 summer peak load flow model and the results were verified by FE. Additionally, FE performed an analysis of its underlying transmission <100 kV system. At the Primary POI, the AD2-055 project contributes to overloads on the FE transmission system as shown in the Network Impact section of this report. The estimated cost of system reinforcements necessary to mitigate these overloads are included in the System Reinforcements section below.

9.2 Short Circuit Analysis

PJM performed a short circuit analysis and the results were verified by FE. The connection of the AD2-055 project to the system does not result in any newly overdutied circuit breakers on the FE transmission system and does not have a significant fault current contribution to existing overdutied circuit breakers.

9.3 Stability Analysis

A dynamic stability analysis was completed by PJM (results are in this report) and the results were reviewed by FE.

10 Interconnection Customer Requirements

10.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx.
Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

10.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx. In particular, the IC is responsible for the following:

1. The purchase and installation of 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.
2. 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.
3. Compliance with the FE and PJM generator power factor and voltage control requirements.
4. The execution of a back-up service agreement to serve the customer load supplied from the AD2-055 generation project metering point when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

The IC will also be required to meet all PJM, ReliabilityFirst, and NERC reliability criteria and operating procedures for standards compliance. For example, the IC will need to properly locate and report the over and under voltage and over and under frequency system protection elements for its units as well as the

submission of the generator model and protection data required to satisfy the PJM and ReliabilityFirst audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the FE system.

10.3 Power Factor Requirements:

The AA1-111/AB1-092/AD2-055 customer shall design its Customer Facility with the ability to maintain a power factor of at least 0.95 leading to 0.90 lagging measured at the generator's terminals.

11 Revenue Metering and SCADA Requirements

11.1 PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 8 of Attachment O.

11.2 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/

12 Summer Peak Analysis

The Queue Project AD2-055 was evaluated as a 35.0 MW (Capacity 35.0 MW) uprate to the AA2-000 (AA1-111) & AB1-092 which is an injection tapping the Chapman to Lobo 230 kV transmission line in the PENELEC area. Project AD2-055 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-055 was studied with a commercial probability of 100.0 %.

Study Assumptions:

- The model used in this study includes the Stability reinforcement required by AA2-000 (AA1-111).

Potential network impacts were as follows:

12.1 Generation Deliverability

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

None

12.2 Multiple Facility Contingency

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

None

12.3 Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONTNAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
179474927	235197	01KARNSC	138.0	AP	235152	01BUTLER	138.0	AP	1	ATSI-P1-2-CEI-345-700T	single	179.0	110.26	110.86	AC	1.97
179474928	235197	01KARNSC	138.0	AP	235152	01BUTLER	138.0	AP	1	PN-P1-2-PN-345-107T	single	179.0	110.26	110.86	AC	1.97

12.4 Steady-State Voltage Requirements

None

12.5 Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
179474904	200674	26TOWANDA	115.0	PENELEC	200677	26NO MESHO	115.0	PENELEC	1	PN-P1-2-PN-230-013	operation	172.0	117.29	120.15	AC	2.04
179474913	200675	26E.TWANDA	230.0	PENELEC	200924	26CANYON	230.0	PENELEC	1	Base Case	operation	515.0	111.18	113.84	AC	5.74
179474901	200677	26NO MESHO	115.0	PENELEC	200825	26MESH2REA	115.0	PENELEC	3	PN-P1-2-PN-230-013	operation	197.0	128.48	130.17	AC	2.51
179474897	200825	26MESH2REA	115.0	PENELEC	200706	26N.MESHPN	230.0	PENELEC	3	PN-P1-2-PN-230-013	operation	188.0	135.7	137.46	AC	2.51
179474936	200924	26CANYON	230.0	PENELEC	200706	26N.MESHPN	230.0	PENELEC	1	Base Case	operation	546.0	101.94	104.44	AC	5.74

12.6 System Reinforcements

ID	Idx	Facility	Upgrade Description	Cost	Cost Allocated to AD2-055	Upgrade Number
179474928,179474927	1	01KARNSC 138.0 kV - 01BUTLER 138.0 kV Ckt 1	**APS** **Description :** PJM baseline upgrade b2967: Convert the existing 6 wire Butler - Shanor Manor - Krendale 138 kV Line into two separate 138 kV lines. New lines will be Butler - Keisters and Butler - Shanor Manor - Krendale 138 kV. The baseline project is currently on-hold. **Type :** CON Note 1: Although Queue Project AD2-055 may not have cost responsibility for this upgrade, Queue Project AD2-055 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD2-055 comes into service prior to completion of the upgrade, Queue Project AD2-055 will need an interim study. **Description :** PJM baseline upgrade b3083: Replace substation conductor at Butler (138 kV) Replace substation conductor and line trap at Karns City (138 kV). The baseline project is currently on-hold. **Type :** FAC Note 1: Although Queue Project AD2-055 may not have cost responsibility for this upgrade, Queue Project AD2-055 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD2-055 comes into service prior to completion of the upgrade, Queue Project AD2-055 will need an interim study.	$0	$0	b2967, b3083
N/A	N/A	Stability Reinforcement	**PENELEC** **ProjectId : n5740** **Description :** Stability Reinforcement for AA1-111 • Install a 230-345kV transformer between the proposed AA1-111 interconnection switchyard and the NYSEG Q496 interconnection switchyard. • At AA1-111 interconnection switchyard, install a 345 / 230 kV transformer, 230 kV breaker, and 345 kV breaker. **Cost :** $12,572,600 **Type :** CON **Time Estimate :** 28 Months	$12,572,600	See Note 2	n5740
			TOTAL COST	**$0**	**$0**	

Note 1: For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently $0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

Note 2: The AD2-055 project is an uprate to the AA2-000 (AA1-111) and AB1-092 projects. The AD2-055 project requires this system reinforcement to be deliverable to the PJM system.

12.7 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".

12.7.1 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
179474928	235197	01KARNSC	AP	235152	01BUTLER	AP	1	PN-P1-2-PN-345-107T	single	179.0	110.26	110.86	AC	1.97

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
200608	26PINEY #1	0.9493	80/20	0.9493
200642	26SENECA#1	3.1802	80/20	3.1802
200643	26SENECA#2	3.0035	80/20	3.0035
200644	26SENECA#3	0.4077	80/20	0.4077
200649	26PENNTECH	0.5640	80/20	0.5640
200662	26SCRUB GR	2.0068	80/20	2.0068
200665	26SHAWVL 3	2.0787	80/20	2.0787
200666	26SHAWVL 4	2.0793	80/20	2.0793
200715	26SHAWVL 1	1.4386	80/20	1.4386
200722	26SHAWVL 2	1.4740	80/20	1.4740
200805	**26COLVER13 (Deactivation : 01/09/2020)**	**1.3700**	**80/20**	**1.3700**
200828	26HNSMLK 1	0.9410	80/20	0.9410
200829	26HNSMLK 2	0.9410	80/20	0.9410
200830	26HNSMLK 3	0.9410	80/20	0.9410
200831	26HNSMLK 4	0.9410	80/20	0.9410
200832	26HNSMLK 5	0.9410	80/20	0.9410
200838	26HOMER C2	6.4458	80/20	6.4458
200839	26HOMER C3	6.8238	80/20	6.8238
200849	26LAKVU GN	0.0765	80/20	0.0765
200913	26SHAW-D	0.0690	80/20	0.0690
201201	26WRREN CT	0.8014	80/20	0.8014
235030	01MHNG-T155	0.2082	80/20	0.2082
235134	01AL&D6	0.1817	80/20	0.1817
915951	Y3-092 FTIR	85.7600	80/20	85.7600
916201	Z1-069 C	0.1571	80/20	0.1571
916321	Z1-088	0.0649	80/20	0.0649
916331	Z1-089	0.0649	80/20	0.0649
919491	AA2-000	22.0978	Adder	26.0
930511	AB1-092	0.8114	Adder	0.95
931091	AB1-160 C	0.0406	80/20	0.0406
936421	AD2-055	1.6705	Adder	1.97
936991	AD2-133 C	0.7846	Adder	0.92
CANNELTON	CANNELTON	0.1991	Confirmed LTF	0.1991
BLUEG	BLUEG	1.1626	Confirmed LTF	1.1626
G-007A	G-007A	1.7885	Confirmed LTF	1.7885
VFT	VFT	4.9343	Confirmed LTF	4.9343
NYISO	NYISO	18.3643	Confirmed LTF	18.3643
CHEOAH	CHEOAH	0.2783	Confirmed LTF	0.2783
CBM-N	CBM-N	1.2151	Confirmed LTF	1.2151

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
TVA	TVA	0.4577	Confirmed LTF	0.4577
PRAIRIE	PRAIRIE	1.6583	Confirmed LTF	1.6583
NEWTON	NEWTON	0.8784	Confirmed LTF	0.8784
EDWARDS	EDWARDS	0.3528	Confirmed LTF	0.3528
TILTON	TILTON	0.4221	Confirmed LTF	0.4221
SMITHLAND	SMITHLAND	0.1289	Confirmed LTF	0.1289
COTTONWOOD	COTTONWOOD	1.2495	Confirmed LTF	1.2495
HAMLET	HAMLET	0.2518	Confirmed LTF	0.2518
ELMERSMITH	ELMERSMITH	0.5696	Confirmed LTF	0.5696
AMIL	AMIL	0.1900	Confirmed LTF	0.1900
UNIONPOWER	UNIONPOWER	0.4223	Confirmed LTF	0.4223
CLIFTY	CLIFTY	4.8309	Confirmed LTF	4.8309
GIBSON	GIBSON	0.3928	Confirmed LTF	0.3928
CALDERWOOD	CALDERWOOD	0.3052	Confirmed LTF	0.3052
FARMERCITY	FARMERCITY	0.2268	Confirmed LTF	0.2268
TRIMBLE	TRIMBLE	0.2231	Confirmed LTF	0.2231
MORGAN	MORGAN	1.0185	Confirmed LTF	1.0185
CATAWBA	CATAWBA	0.1669	Confirmed LTF	0.1669
TATANKA	TATANKA	0.4139	Confirmed LTF	0.4139

12.8 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
AB1-092	Moshannon-East Towanda 230kV	Active
AB1-160	Gold-Sabinsville 115kV	In Service
AD2-055	Moshannon-East Towanda 230 kV	Active
AD2-133	Eagle Valley 115kV	Active
Y3-092	Erie West 345kV	Engineering and Procurement
Z1-069	Gold-Sabinsville 115kV	In Service
Z1-088	Allegheny Dam 5	In Service
Z1-089	Allegheny Dam 6 138kV	In Service

12.9 Contingency Descriptions

Contingency Name	Contingency Definition
Base Case	
PN-P1-2-PN-230-013	CONTINGENCY 'PN-P1-2-PN-230-013' /* EAST TOWANDA - NORTH MESHOPPEN 230KV DISCONNECT BRANCH FROM BUS 200675 TO BUS 200924 CKT 1 /* 26E.TWANDA 230 26CANYON 230 DISCONNECT BRANCH FROM BUS 200924 TO BUS 200706 CKT 1 /* 26CANYON 230 26N.MESHPN 230 DISCONNECT BRANCH FROM BUS 200706 TO BUS 200677 CKT 4 /* 26N.MESHPN 230 26NO MESHO 115 END
PN-P1-2-PN-345-107T	CONTINGENCY 'PN-P1-2-PN-345-107T' /* ERIE WEST - ASHTABULA - PERRY 345KV DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1 /* 26ERIE W 345 02AT 345 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /* 02AT 345 02S8-ATT 345 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1 /* 02AT 345 02PERRY 345 DISCONNECT BUS 238547 /* 02AT 345 END
ATSI-P1-2-CEI-345-700T	CONTINGENCY 'ATSI-P1-2-CEI-345-700T' /* PN/ATSI ERIE WEST - ASHTABULA - PERRY 345KV DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /* 02PERRY 345 02AT 345 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /* 02AT 345 02S8-ATT 345 DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /* 02S8-ATT 345 02ASH_3 138 DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /* 02AT 345 26ERIE W 345 END

13 Short Circuit Analysis

The following Breakers are overdutied:

None

13.1 System Reinforcements - Short Circuit

None

14 Stability and Reactive Power

(Summary of the VAR requirements based upon the results of the dynamic studies)

14.1 Executive Summary

Generator Interconnection Request AD2-055 is for is for a 44 MW Maximum Facility Output (MFO) uprate to AB1-092. After the uprate, AD2-055 MFO would be 548 MW and consists of a 1 X 559 MW combined cycle turbine unit with a Point of Interconnection (POI) tapped on Marshall – Moshannon 230 kV line in the MAIT transmission system, Clinton County, PA.

This report describes a dynamic simulation analysis of AD2-055 as part of the overall system impact study.

The load flow scenario for the analysis was based on the RTEP 2021 Light Load case, modified to include applicable queue projects. AD2-055 has been dispatched online at maximum power output, with default generator reference voltage specified in PJM Manual 03 Transmission Operations Section 3.3.3.

The AD2-055 queue project was tested for compliance with NERC, PJM and other applicable criteria. The range of contingencies evaluated was limited to that necessary to assess compliance and each was limited to a 15-second simulation time period.

Simulated NERC Standard TPL-001faults include:

1. Three-phase (3ph) fault with normal clearing (Category P1)
2. Operating of a line section w/o a fault, Single-line-to-ground (slg) on Bus Section and Breaker. (Category P2)
3. Single-line-to-ground (slg) with delayed clearing as a result of breaker failure (Category P4)
4. Single-line-to-ground (slg) with delayed clearing as a result of protection failure (Category P5)
5. Single-line-to-ground (slg) with normal clearing for common structure (Category P7)

Note: For generator interconnection studies, Category P3 and P6 faults will be studied on an as needed basis. In this study, P2 contingencies are not applicable.

Other applicable criteria tested include:

1. Transmission Owner (TO) specific criteria
2. Other criteria

The system was tested for a system intact condition and the fault types listed above. Specific fault descriptions and breaker clearing times used for this study are provided in the result table.

No relevant High Speed Reclosing (HSR) contingencies were identified.

For all simulations, the queue project under study along with the rest of the PJM system were required to maintain synchronism and with all states returning to an acceptable new condition following the disturbance.

For the remaining fault contingencies tested on the 2021 Light Load case:

a) Post-contingency oscillations were positively damped with a damping margin of at least 3%.

b) The AD2-055 generator was able to ride through all faults (except for faults where protective action trips a generator(s)).

c) Following fault clearing, all bus voltages recover to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).

d) No transmission element trips, other than those either directly connected or designed to trip as a consequence of that fault.

Mitigation plan for AA1-111 (PJM Network Upgrade Number n5740) was modeled in the case and no further mitigations were found to be required.

14.2 Reactive Power Assessment

AD2-055 was assessed for compliance with reactive power capability requirements. The following applies when increasing the MFO of existing generation:

- The existing MW portion of the existing generation shall retain its existing ability to maintain a power factor of at least 0.95 leading to 0.90 lagging.
- The increase MW portion of the Queue Project shall have the ability to maintain a power factor of at least 1.0 (unity) to 0.90 lagging.
- Since the existing MW portion does not have an ISA as of today, we assessed the reactive capability as all MW portion of the project shall retain its existing ability to maintain a power factor of at least 0.95 leading to 0.90 lagging.

Reactive power assessment for the combustion turbine generator is given in Tables 2. Reactive power assessment has been done for the MFO (Winter, 25 degrees) and CIR (Summer, 40 degrees) capacities as they are air cooled units. Available reactive power capability was determined using the reactive power capability curve[3] of the machine at the machine gross active power output.

Table 1: Reactive Power Assessment of CTG (MFO)

		Required PF range		**Required MVAr**	
CTG	MW (Gross)	Lagging	Leading	Maximum	Minimum
AD2-055	559.4	0.9	0.95	271	-184
Total Required				271	-184
Total Available at 559.4 MW				300	-225
Total surplus/deficiency in MVAR				29	-41

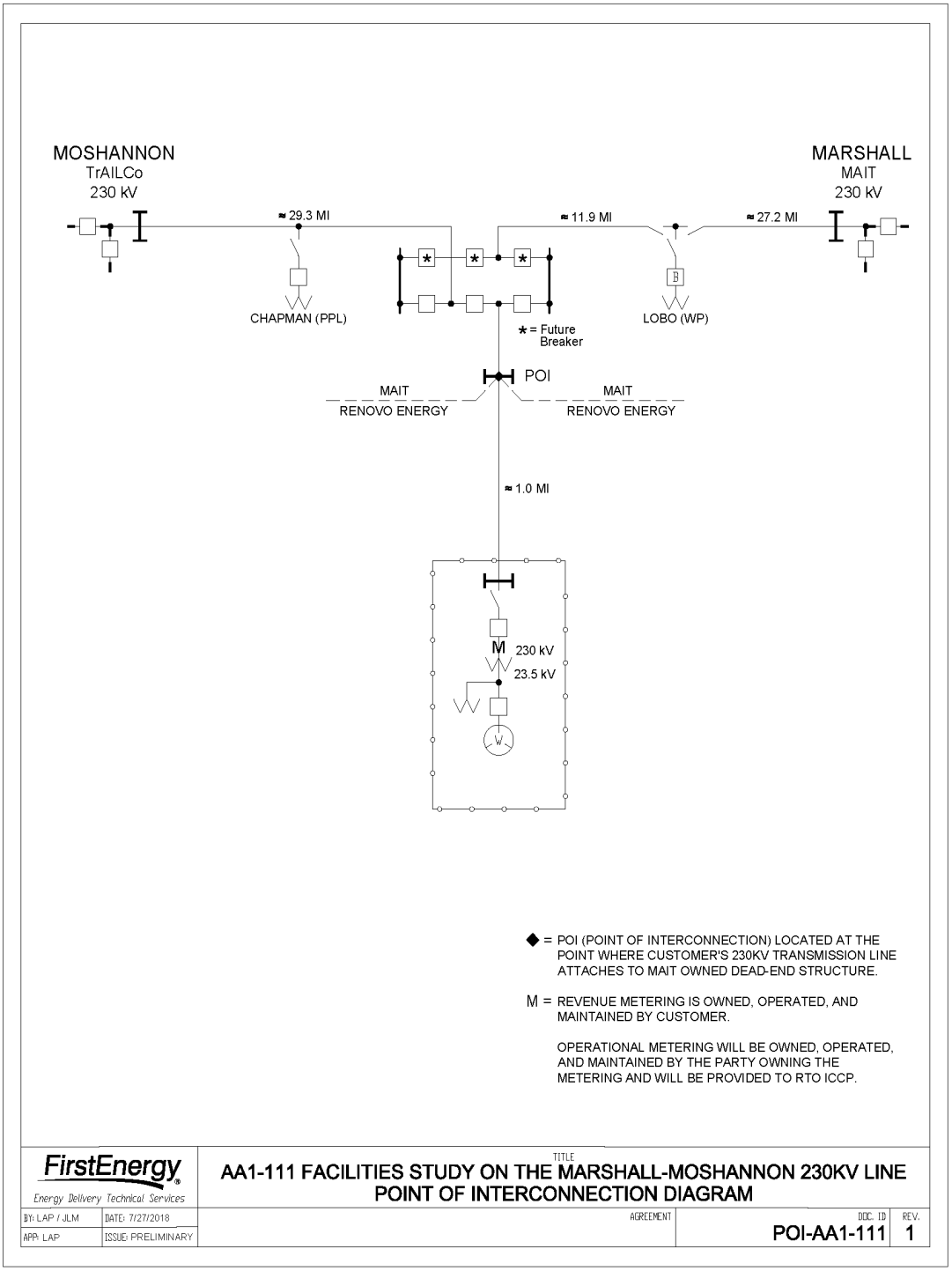
[3] The reactive power capability curve is attached under 'DynMdl' folder, [*AD2-055 D-curve.pdf*].

15 Affected Systems

15.1 NYISO

None

16 Attachment 1: One Line Diagram[4]



[4] Note this one line does not include the stability reinforcement. The one line in the Facilities Study will be updated to include the tie between the FE's 230 kV interconnection switchyard and NYSEG's 345 kV switchyard.