Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-282

EAST FAYETTE 138 KV

43.9 MW Capacity / 67 MW Energy

July, 2019

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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 American Transmission Systems Inc. (ATSI).

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.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model.

The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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 Fulton County, Ohio. The installed facilities will have a total capability of 67 MW with 43.9 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is September 15, 2021. This study does not imply a Transmission Owner (TO) commitment to this in-service date.

Queue Number	**AE2-282**
Project Name	EAST FAYETTE 138 KV
Interconnection Customer	
State	Ohio
County	Fulton
Transmission Owner	ATSI
MFO	67
MWE	67
MWC	43.9
Fuel	Solar
Basecase Study Year	2022

3.1 Point of Interconnection

3.1.1 Primary POI

The interconnection of the project at the Primary POI will be accomplished by installing a new 138 kV breaker at the FirstEnergy East Fayette 138 kV substation and connecting the East Fayette 138 kV ring bus substation and a new line exit to the Primary POI. 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 AE2-282 generation project to connect to the FirstEnergy ("FE") transmission system. Attachment 2 provides the proposed location for the point of interconnection. 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's direct connection facilities.

3.1.2 Secondary POI

The interconnection of the project at a Secondary POI can be accomplished by constructing a new 138 kV three (3) breaker ring bus substation and looping the Fayette-Lyons section of the Allen Junction-East Fayette 138 kV line into the new ring bus substation. A 138 kV line exit would then be extended from the new ring bus substation to the Secondary POI. The new substation would be located approximately 0.7 miles from AE2-282 substation. A full scope of work or estimated cost is not provided for the proposed Secondary POI.

3.2 Cost Summary

The AE2-282 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$677,850
Direct Connection Network Upgrade	$677,850
Non Direct Connection Network Upgrades	$0
Total Costs	$1,355,700

In addition, the AE2-282 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$20,152,700

Cost allocations for these upgrades will be provided in the System Impact Study Report.

The costs provided above exclude the Contribution in Aid of Construction ("CIAC") Federal Income Tax Gross Up charge. If, at a future date, it is determined that the CIAC Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

The required Attachment Facilities and Direct and Non-Direct Connection work for the interconnection of the AE2-282 generation project to the FE Transmission System is detailed in the following sections. The associated

one-line with the generation project Attachment Facilities and the Primary Direct and Non-Direct Connection facilities are shown in Attachment 1.

4 Transmission Owner Scope of Work

4.1 Primary POI

The interconnection of the project at the Primary POI will be accomplished by installing a new 138 kV breaker at the FirstEnergy East Fayette 138 kV substation and connecting the East Fayette 138 kV ring bus substation and a new line exit to the Primary POI. 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 AE2-282 generation project to connect to the FirstEnergy ("FE") transmission system. Attachment 2 provides the proposed location for the point of interconnection. 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's direct connection facilities.

4.2 Secondary POI

The interconnection of the project at a Secondary POI can be accomplished by constructing a new 138 kV three (3) breaker ring bus substation and looping the Fayette-Lyons section of Allen Junction-East Fayette 138 kV line into the new ring bus substation. A 138 kV line exit would then be extended from the new ring bus substation to the Secondary POI. The new substation would be located approximately 0.7 miles from AE2-282 substation. A full scope of work or estimated cost is not provided for the proposed Secondary POI.

5 Attachment Facilities

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Install line exit take-off structure, foundations, disconnect switch and associated equipment at ring bus substation	$677,850
Total Attachment Facility Costs	$677,850

6 Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Install one new 138kV breaker for the line exit of AE2-282. @ East Fayette SS	$677,850
Total Direct Connection Facility Costs	$677,850

7 Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
	$0
Total Non-Direct Connection Facility Costs	$0

8 System Reinforcement Cost Estimates

Upgrade Description	Cost
OEC-002A (18) : Build a new 138 kV line from Black River to Astor substation **Project Type : Facility** **Cost : $20,152,700** **Time Estimate : 30.0 Months**	$20,152,700
TOTAL COST	$20,152,700

9 Schedule

Based on the scope of work for the Attachment Facilities and the Direct and Non-Direct Connection facilities, it is expected to take a minimum of 10 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 direct connection work. 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.

The schedule for the required Network Impact Reinforcements will be more clearly identified in future study phases. The estimate elapsed time to complete each of the required reinforcements is identified in the "System Reinforcements" section of the report.

10 Transmission Owner Analysis

10.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AE2-282 project did not contribute to any overloads on the FE transmission system.

11 Interconnection Customer Requirements

11.1 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.

Regarding the Secondary POI, the IC has requested a non-standard GSU transformer winding configuration. This transformer is in violation of section 14.2.6 of FE's "Requirements for Transmission Connected Facilities" document and will not be accepted. The GSU transformer must have a grounded wye connection on the high (utility) side and a delta connection on the low (generator) side.

11.2 Compliance Issues and Interconnection Customer Requirements

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

1. The purchase and installation of a fully rated 138 kV circuit breaker to protect the AE2-282 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 AE2-282 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.

11.3 Power Factor Requirements

The IC shall design its solar 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.

12 Revenue Metering and SCADA Requirements

12.1 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.

12.1.1 Meteorological Data Reporting Requirement

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

- Temperature (degrees Fahrenheit)
- Atmospheric pressure (hectopascals)
- Irradiance
- Forced outage data

12.2 ATSI 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

13 Network Impacts – Primary Point of Interconnection

The Queue Project AE2-282 was evaluated as a 67.0 MW (Capacity 43.9 MW) injection at East Fayette 138kV substation in the ATSI area. Project AE2-282 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-282 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

13.1 Generation Deliverability

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

None

13.2 Multiple Facility Contingency

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

None

13.3 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	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
8937162	238524	02ADQ-2	ATSI	241928	02AVQ2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	332.0	129.52	130.01	DC	3.6
8935882	238890	02LEMOYN	ATSI	239176	02WOOD+	ATSI	1	AEP_P2-2_#517_05FOSTOR 345_1	bus	223.0	143.38	144.61	DC	6.07
8936154	238890	02LEMOYN	ATSI	239176	02WOOD+	ATSI	1	AEP_P4_#517_05FOSTOR 345_A1	breaker	223.0	143.38	144.61	DC	6.07
8937147	238915	02LRNQ2	ATSI	238524	02ADQ-2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	316.0	136.11	136.63	DC	3.6

13.4 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	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
7351371	238889	02LEMOYN	ATSI	242936	05FOSTOR	AEP	1	AEP_P1-2_#768	operation	1409.0	105.97	106.42	DC	14.12

13.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
8937147	3	02LRN Q2 138.0 kV - 02AD Q-2 138.0 kV Ckt 1	OEC-002A (18) : Build a new 138 kV line from Black River to Astor substation Project Type : Facility Cost : $20,152,700 Time Estimate : 30.0 Months	$20,152,700[1]
8937162	1	02AD Q-2 138.0 kV - 02AVQ2 138.0 kV Ckt 1	OEC-002A (18) : Build a new 138 kV line from Black River to Astor substation Project Type : Facility Cost : $20,152,700 Time Estimate : 30.0 Months	$20,152,700[1]
8935882,8936154	2	02LEMOYN 138.0 kV - 02WOOD+ 138.0 kV Ckt 1	No Reinforcement Needed. Not a valid violation[2]	$0
			TOTAL COST	$20,152,700

[1] System reinforcement solution identified resolves both violations.

[2] If "No Reinforcement Needed. Not a valid violation" was provided as the Upgrade Description for a facility in the System Reinforcements table then that facility met one of the following conditions:

a. The loading on the facility at your queue position was less than 100%; therefore, the facility is not yet overloaded, but may be overloaded by end of the AE2 queue.
b. The TO reviewed their ratings on the facility and determined that the current rating was greater than the rating in PJM's model. This new rating was greater than the loading at your queue position making the violation invalid.
c. The TO reviewed the contingency and determined that contingency was not valid; therefore the violation is invalid. Any contingency corrections will be assessed and corrected in the AE2 impact study phase.

13.6 Flow Gate Details

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

13.6.1 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
8937162	238524	02AD Q-2	ATSI	241928	02AVQ2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	332.0	129.52	130.01	DC	3.6

Bus #	Bus	MW Impact
238571	02BEAVGA	0.89
238572	02BEAVGB	0.91
238670	02DVBSG1	66.4
238979	02NAPMUN	2.0
239174	02WLORG-5	1.06
239175	02WLORG-6	1.38
240968	02BG2 GEN	0.42
240969	02BG4 G1	0.11
240973	02BG6 AMPO	1.66
240975	02PGE GEN	2.19
241908	02LLF_W4-004	0.3
247548	V4-010 C	1.53
247940	U4-028 E	4.44
247941	U4-029 E	4.44
247947	V4-010 E	10.24
931951	AB1-107 1	16.61
931961	AB1-107 2	36.46
932791	AC2-103 C	3.56
932792	AC2-103 E	23.82
934251	AD1-052 C1	0.85
934261	AD1-052 C2	0.85
934761	AD1-103 C O1	5.98
934762	AD1-103 E O1	40.04
934891	AD1-118	4.16

Bus #	Bus	MW Impact
937021	AD2-136 C O1	2.39
937022	AD2-136 E O1	15.99
937381	AD2-191 C	1.13
937382	AD2-191 E	7.55
938911	AE1-119	32.71
941741	AE2-174 C	2.05
941742	AE2-174 E	9.6
941761	AE2-176 C	6.55
941762	AE2-176 E	4.37
941781	AE2-181 C	1.58
941782	AE2-181 E	1.05
942661	AE2-282 C O1	2.36
942662	AE2-282 E O1	1.24
CARR	CARR	0.55
CBM-S1	CBM-S1	3.73
CBM-S2	CBM-S2	0.85
CBM-W1	CBM-W1	15.2
CBM-W2	CBM-W2	32.82
CIN	CIN	4.0
CPLE	CPLE	0.23
G-007	G-007	1.12
IPL	IPL	2.56
LGEE	LGEE	0.99
MEC	MEC	7.89
MECS	MECS	15.45
O-066	O-066	7.25
RENSSELAER	RENSSELAER	0.43
WEC	WEC	1.27

13.6.2 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
8936154	238890	02LEMOYN	ATSI	239176	02WOOD+	ATSI	1	AEP_P4_#517_05FOSTOR345_A1	breaker	223.0	143.38	144.61	DC	6.07

Bus #	Bus	MW Impact
238670	02DVBSG1	65.84
238887	02LEMOG3	2.17
238888	02LEMOG4	2.17
238979	02NAPMUN	3.84
240968	02BG2 GEN	0.9
240969	02BG4 G1	0.22
240973	02BG6 AMPO	3.46
240975	02PGE GEN	4.66
931951	AB1-107 1	23.58
931961	AB1-107 2	45.94
932791	AC2-103 C	1.96
932792	AC2-103 E	13.13
934761	AD1-103 C O1	3.3
934762	AD1-103 E O1	22.07
934891	AD1-118	7.77
938911	AE1-119	61.08
941781	AE2-181 C	2.66
941782	AE2-181 E	1.78
942661	AE2-282 C O1	3.98
942662	AE2-282 E O1	2.09
950041	J308 C	3.03
950042	J308 E	12.11
950241	J419	6.3
952312	J646 E	0.08
952971	J793	68.96
953321	J799	11.69

Bus #	Bus	MW Impact
953781	J833	6.3
953811	J839	5.07
954111	J875	8.35
BLUEG	BLUEG	1.44
CALDERWOOD	CALDERWOOD	0.14
CANNELTON	CANNELTON	0.06
CARR	CARR	0.0
CATAWBA	CATAWBA	0.1
CBM-W1	CBM-W1	11.77
CHEOAH	CHEOAH	0.13
CHILHOWEE	CHILHOWEE	0.05
COTTONWOOD	COTTONWOOD	0.18
ELMERSMITH	ELMERSMITH	0.1
G-007	G-007	0.09
GIBSON	GIBSON	0.02
HAMLET	HAMLET	0.17
MEC	MEC	1.24
MECS	MECS	19.91
O-066	O-066	0.57
RENSSELAER	RENSSELAER	0.0
SANTEETLA	SANTEETLA	0.04
SMITHLAND	SMITHLAND	0.02
TRIMBLE	TRIMBLE	0.16
TVA	TVA	0.31
UNIONPOWER	UNIONPOWER	0.09
WEC	WEC	0.3

13.6.3 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
8937147	238915	02LRN Q2	ATSI	238524	02AD Q-2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	316.0	136.11	136.63	DC	3.6

Bus #	Bus	MW Impact
238571	02BEAVGA	0.89
238572	02BEAVGB	0.91
238670	02DVBSG1	66.4
238979	02NAPMUN	2.0
239174	02WLORG-5	1.06
239175	02WLORG-6	1.38
240968	02BG2 GEN	0.42
240969	02BG4 G1	0.11
240973	02BG6 AMPO	1.66
240975	02PGE GEN	2.19
241908	02LLF_W4-004	0.3
247548	V4-010 C	1.53
247940	U4-028 E	4.44
247941	U4-029 E	4.44
247947	V4-010 E	10.24
931951	AB1-107 1	16.61
931961	AB1-107 2	36.46
932791	AC2-103 C	3.56
932792	AC2-103 E	23.82
934251	AD1-052 C1	0.85
934261	AD1-052 C2	0.85
934761	AD1-103 C O1	5.98
934762	AD1-103 E O1	40.04
934891	AD1-118	4.16

Bus #	Bus	MW Impact
937021	AD2-136 C O1	2.39
937022	AD2-136 E O1	15.99
937381	AD2-191 C	1.13
937382	AD2-191 E	7.55
938911	AE1-119	32.71
941741	AE2-174 C	2.05
941742	AE2-174 E	9.6
941761	AE2-176 C	6.55
941762	AE2-176 E	4.37
941781	AE2-181 C	1.58
941782	AE2-181 E	1.05
942661	AE2-282 C O1	2.36
942662	AE2-282 E O1	1.24
CARR	CARR	0.55
CBM-S1	CBM-S1	3.73
CBM-S2	CBM-S2	0.85
CBM-W1	CBM-W1	15.2
CBM-W2	CBM-W2	32.82
CIN	CIN	4.0
CPLE	CPLE	0.23
G-007	G-007	1.12
IPL	IPL	2.56
LGEE	LGEE	0.99
MEC	MEC	7.89
MECS	MECS	15.45
O-066	O-066	7.25
RENSSELAER	RENSSELAER	0.43
WEC	WEC	1.27

Affected Systems

13.7 Affected Systems

13.7.1 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

13.7.2 MISO

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

13.7.3 TVA

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

13.7.4 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

13.7.5 NYISO

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

13.8 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P2-2_#517_05FOSTOR 345_1	CONTINGENCY 'AEP_P2-2_#517_05FOSTOR 345_1' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND

Contingency Name	Contingency Definition
ATSI-P7-1-CEI-345-001-A	CONTINGENCY 'ATSI-P7-1-CEI-345-001-A' /* AVON-BEAVER #1 AND #2 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 1 /* 02AVON 345 02LAKEAVE 345 DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 2 /* 02AVON 345 02LAKEAVE 345 END
AEP_P1-2_#768	CONTINGENCY 'AEP_P1-2_#768' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND
AEP_P4_#517_05FOSTOR 345_A1	CONTINGENCY 'AEP_P4_#517_05FOSTOR 345_A1' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND

Short Circuit

13.9 Short Circuit

The following Breakers are overduty:

None

14 Network Impacts – Secondary POI

The Queue Project AE2-282 was evaluated as a 67.0 MW (Capacity 43.9 MW) injection tapping the Fayette to Lyons 138kV line in the ATSI area. Project AE2-282 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-282 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

14.1 Generation Deliverability

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

None

14.2 Multiple Facility Contingency

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

None

14.3 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	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
8937162	238524	02ADQ-2	ATSI	241928	02AVQ2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	332.0	129.52	130.01	DC	3.61
8935882	238890	02LEMOYN	ATSI	239176	02WOOD+	ATSI	1	AEP_P2-2_#517_05FOSTOR 345_1	bus	223.0	143.42	144.66	DC	6.08
8936154	238890	02LEMOYN	ATSI	239176	02WOOD+	ATSI	1	AEP_P4_#517_05FOSTOR 345_A1	breaker	223.0	143.42	144.66	DC	6.08
8937147	238915	02LRNQ2	ATSI	238524	02ADQ-2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	316.0	136.08	136.59	DC	3.61

14.4 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	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
7351371	238889	02LEMOYN	ATSI	242936	05FOSTOR	AEP	1	AEP_P1-2_#768	operation	1409.0	106.05	106.5	DC	14.2

14.5 Flow Gate Details

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

14.5.1 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
8937162	238524	02AD Q-2	ATSI	241928	02AVQ2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	332.0	129.52	130.01	DC	3.61

Bus #	Bus	MW Impact
238571	02BEAVGA	0.89
238572	02BEAVGB	0.91
238670	02DVBSG1	66.4
238979	02NAPMUN	2.0
239174	02WLORG-5	1.06
239175	02WLORG-6	1.38
240968	02BG2 GEN	0.42
240969	02BG4 G1	0.11
240973	02BG6 AMPO	1.66
240975	02PGE GEN	2.19
241908	02LLF_W4-004	0.3
247548	V4-010 C	1.53
247940	U4-028 E	4.44
247941	U4-029 E	4.44
247947	V4-010 E	10.24
931951	AB1-107 1	16.61
931961	AB1-107 2	36.46
932791	AC2-103 C	3.56
932792	AC2-103 E	23.82
934251	AD1-052 C1	0.85
934261	AD1-052 C2	0.85
934761	AD1-103 C O1	5.98
934762	AD1-103 E O1	40.04
934891	AD1-118	4.16

Bus #	Bus	MW Impact
937021	AD2-136 C O1	2.39
937022	AD2-136 E O1	15.99
937381	AD2-191 C	1.13
937382	AD2-191 E	7.55
938911	AE1-119	32.71
941741	AE2-174 C	2.05
941742	AE2-174 E	9.6
941761	AE2-176 C	6.55
941762	AE2-176 E	4.37
941781	AE2-181 C	1.58
941782	AE2-181 E	1.05
942661	AE2-282 C O2	2.37
942662	AE2-282 E O2	1.24
CARR	CARR	0.55
CBM-S1	CBM-S1	3.73
CBM-S2	CBM-S2	0.85
CBM-W1	CBM-W1	15.19
CBM-W2	CBM-W2	32.82
CIN	CIN	4.0
CPLE	CPLE	0.23
G-007	G-007	1.12
IPL	IPL	2.56
LGEE	LGEE	0.99
MEC	MEC	7.89
MECS	MECS	15.45
O-066	O-066	7.25
RENSSELAER	RENSSELAER	0.43
WEC	WEC	1.27

14.5.2 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
8936154	238890	02LEMOYN	ATSI	239176	02WOOD+	ATSI	1	AEP_P4_#517_05FOSTOR345_A1	breaker	223.0	143.42	144.66	DC	6.08

Bus #	Bus	MW Impact
238670	02DVBSG1	65.84
238887	02LEMOG3	2.17
238888	02LEMOG4	2.17
238979	02NAPMUN	3.84
240968	02BG2 GEN	0.9
240969	02BG4 G1	0.22
240973	02BG6 AMPO	3.46
240975	02PGE GEN	4.66
931951	AB1-107 1	23.58
931961	AB1-107 2	45.94
932791	AC2-103 C	1.96
932792	AC2-103 E	13.13
934761	AD1-103 C O1	3.3
934762	AD1-103 E O1	22.07
934891	AD1-118	7.77
938911	AE1-119	61.08
941781	AE2-181 C	2.66
941782	AE2-181 E	1.78
942661	AE2-282 C O2	3.99
942662	AE2-282 E O2	2.1
950041	J308 C	3.03
950042	J308 E	12.11
950241	J419	6.3
952312	J646 E	0.08
952971	J793	68.96
953321	J799	11.69

Bus #	Bus	MW Impact
953781	J833	6.3
953811	J839	5.07
954111	J875	8.35
BLUEG	BLUEG	1.44
CALDERWOOD	CALDERWOOD	0.14
CANNELTON	CANNELTON	0.06
CARR	CARR	0.0
CATAWBA	CATAWBA	0.1
CBM-W1	CBM-W1	11.77
CHEOAH	CHEOAH	0.13
CHILHOWEE	CHILHOWEE	0.05
COTTONWOOD	COTTONWOOD	0.18
ELMERSMITH	ELMERSMITH	0.1
G-007	G-007	0.09
GIBSON	GIBSON	0.02
HAMLET	HAMLET	0.17
MEC	MEC	1.24
MECS	MECS	19.91
O-066	O-066	0.57
RENSSELAER	RENSSELAER	0.0
SANTEETLA	SANTEETLA	0.04
SMITHLAND	SMITHLAND	0.02
TRIMBLE	TRIMBLE	0.16
TVA	TVA	0.31
UNIONPOWER	UNIONPOWER	0.09
WEC	WEC	0.3

14.5.3 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
8937147	238915	02LRN Q2	ATSI	238524	02AD Q-2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	316.0	136.08	136.59	DC	3.61

Bus #	Bus	MW Impact
238571	02BEAVGA	0.89
238572	02BEAVGB	0.91
238670	02DVBSG1	66.4
238979	02NAPMUN	2.0
239174	02WLORG-5	1.06
239175	02WLORG-6	1.38
240968	02BG2 GEN	0.42
240969	02BG4 G1	0.11
240973	02BG6 AMPO	1.66
240975	02PGE GEN	2.19
241908	02LLF_W4-004	0.3
247548	V4-010 C	1.53
247940	U4-028 E	4.44
247941	U4-029 E	4.44
247947	V4-010 E	10.24
931951	AB1-107 1	16.61
931961	AB1-107 2	36.46
932791	AC2-103 C	3.56
932792	AC2-103 E	23.82
934251	AD1-052 C1	0.85
934261	AD1-052 C2	0.85
934761	AD1-103 C O1	5.98
934762	AD1-103 E O1	40.04
934891	AD1-118	4.16

Bus #	Bus	MW Impact
937021	AD2-136 C O1	2.39
937022	AD2-136 E O1	15.99
937381	AD2-191 C	1.13
937382	AD2-191 E	7.55
938911	AE1-119	32.71
941741	AE2-174 C	2.05
941742	AE2-174 E	9.6
941761	AE2-176 C	6.55
941762	AE2-176 E	4.37
941781	AE2-181 C	1.58
941782	AE2-181 E	1.05
942661	AE2-282 C O2	2.37
942662	AE2-282 E O2	1.24
CARR	CARR	0.55
CBM-S1	CBM-S1	3.73
CBM-S2	CBM-S2	0.85
CBM-W1	CBM-W1	15.19
CBM-W2	CBM-W2	32.82
CIN	CIN	4.0
CPLE	CPLE	0.23
G-007	G-007	1.12
IPL	IPL	2.56
LGEE	LGEE	0.99
MEC	MEC	7.89
MECS	MECS	15.45
O-066	O-066	7.25
RENSSELAER	RENSSELAER	0.43
WEC	WEC	1.27

Affected Systems

14.6 Affected Systems

14.6.1 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

14.6.2 MISO

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

14.6.3 TVA

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

14.6.4 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

14.6.5 NYISO

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

14.7 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P2-2_#517_05FOSTOR 345_1	CONTINGENCY 'AEP_P2-2_#517_05FOSTOR 345_1' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND

Contingency Name	Contingency Definition
ATSI-P7-1-CEI-345-001-A	CONTINGENCY 'ATSI-P7-1-CEI-345-001-A' /* AVON-BEAVER #1 AND #2 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 1 /* 02AVON 345 02LAKEAVE 345 DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 2 /* 02AVON 345 02LAKEAVE 345 END
AEP_P1-2_#768	CONTINGENCY 'AEP_P1-2_#768' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND
AEP_P4_#517_05FOSTOR 345_A1	CONTINGENCY 'AEP_P4_#517_05FOSTOR 345_A1' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND

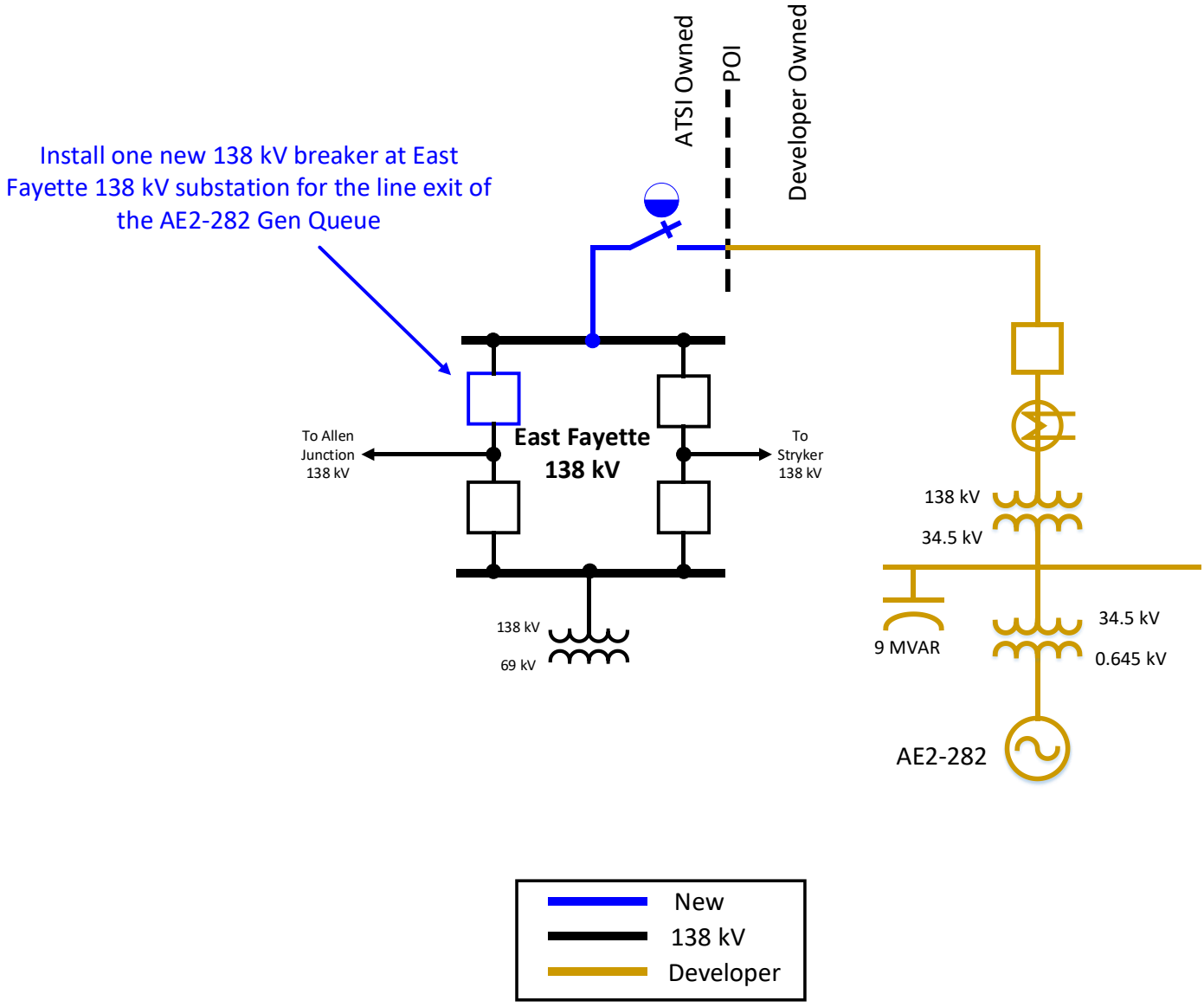
Short Circuit

14.8 Short Circuit

The following Breakers are overduty:

None

Attachment 1 – One Line



Attachment 2 – Project Location