Arche Solar Project

Case No. 20-0979-EL-BGN

Exhibit J

PJM Interconnection Studies

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 Arche Energy Project, LLC, 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	Arche Energy Project, LLC
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

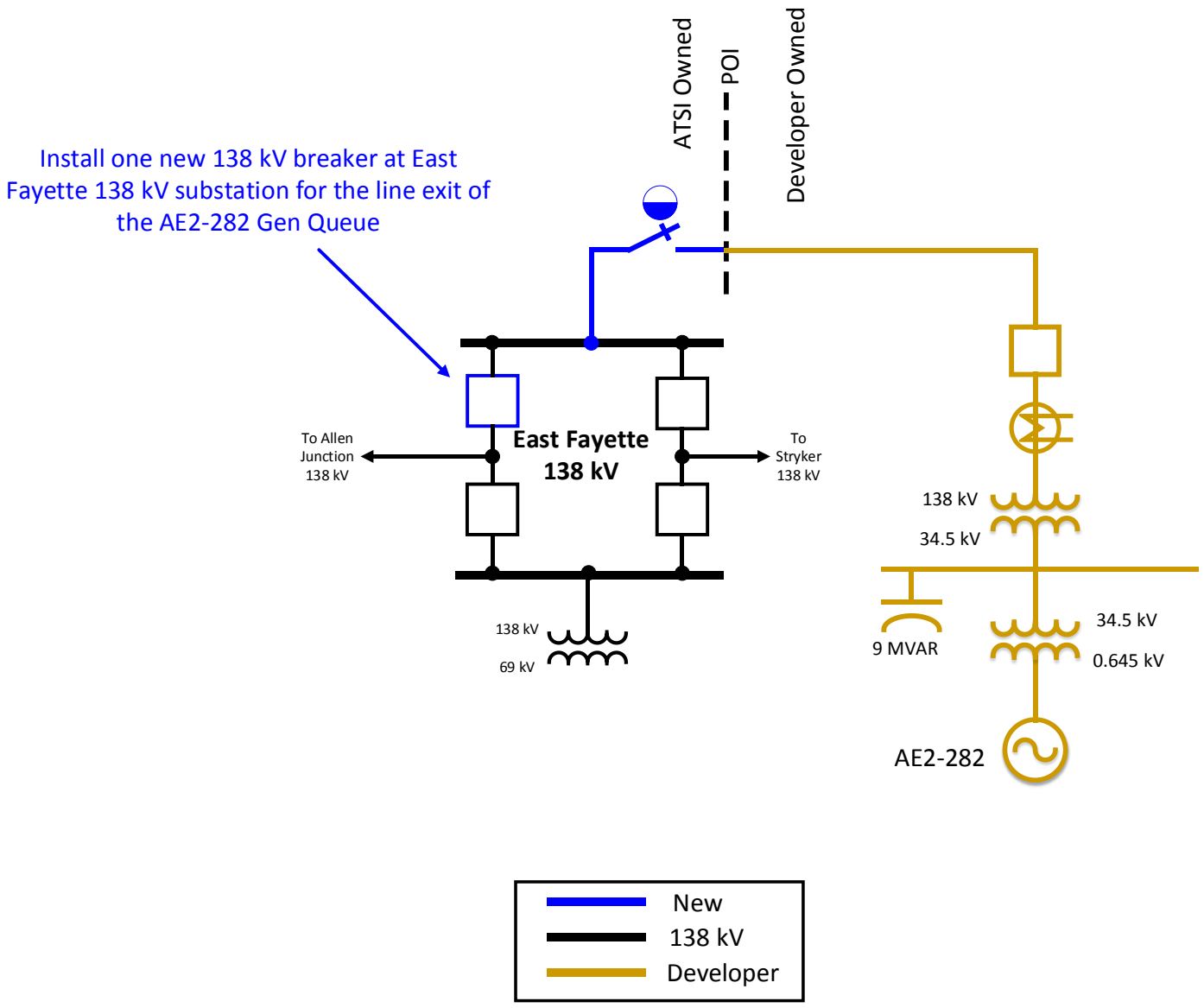
Short Circuit

14.8 Short Circuit

The following Breakers are overduty:

None

Attachment 1 – One Line



Attachment 2 – Project Location

Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-120

EAST FAYETTE 2 138 KV

26.6 MW Capacity / 40 MW Energy

January, 2020

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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-Toledo Edison).

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.

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.

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 an uprate to a planned solar generating facility located in Fulton County, Ohio. This project is an increase to the Interconnection Customer's AE2-282 project, which will share the same property and point of interconnection. The AF1-120 queue position is a 40 MW uprate (26.6 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 107 MW with 70.5 MW of this output being recognized by PJM as Capacity (see table below for clarity). The proposed in-service date for this uprate project is June 30, 2022. This study does not imply a TO commitment to this in-service date.

Queue	Maximum Facility Output (MFO) (MW)	Energy (MW)	Capacity (MW)
AE2-282	67	67	43.9
AF1-120	107	40	26.6
Total	**107**	**107**	**70.5**

Queue Number	**AF1-120**
Project Name	EAST FAYETTE 2 138 KV
State	Ohio
County	Fulton
Transmission Owner	ATSI
MFO	107
MWE	40
MWC	26.6
Fuel	Solar
Basecase Study Year	2023

3.1 Point of Interconnection

The AF1-120 project is an uprate to the AE2-282 project. The interconnection of the AE2-282 project 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/AF1-120 generation project to connect to the FirstEnergy ("FE") transmission system. IC will be responsible for constructing the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system's direct connection facilities.

3.2 Cost Summary

The AF1-120 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$0
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$37,000
Total Costs	$37,000

In addition, the AF1-120 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	**$53,463,100**

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

The Feasibility Study is used to make a preliminary determination of the type and scope of Attachment Facilities, Local Upgrades, and Network Upgrades that will be necessary to accommodate the Interconnection Request and to provide the Interconnection Customer a preliminary estimate of the time that will be required to construct any necessary facilities and upgrades and the Interconnection Customer's cost responsibility. The System Impact Study provides refined and comprehensive estimates of cost responsibility and construction lead times for new facilities and system upgrades. Facilities Studies will include, commensurate with the degree of engineering specificity as provided in the Facilities Study Agreement, good faith estimates of the cost, determined in accordance with Section 217 of the Tariff,

(a) to be charged to each affected New Service Customer for the Facilities and System Upgrades that are necessary to accommodate this queue project;

(b) the time required to complete detailed design and construction of the facilities and upgrades; and

(c) a description of any site-specific environmental issues or requirements that could reasonably be anticipated to affect the cost or time required to complete construction of such facilities and upgrades.

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 AF1-120 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

.

The AF1-120 project is an uprate to the AE2-282 project. The interconnection of the AE2-282 project 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/AF1-120 generation project to connect to the FirstEnergy ("FE") transmission system. IC will be responsible for constructing the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system's direct connection facilities.

5 Attachment Facilities

There is no Attachment Facility scope of work required.

6 Direct Connection Cost Estimate

There is no Direct Connection scope of work required.

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**
Engineering Review	$ 10,000
Relay settings updates at East Fayette	$ 27,000
Total Non-Direct Connection Facility Costs	**$ 37,000**

8 Schedule

Based on the scope of work for the Non-Direct Connection facilities, it is expected to take a minimum of **6 months** after the signing of an Interconnection Construction Service Agreement to complete the identified work. If this project is done together with AE2-282, the schedule can be improved.

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.

9 Transmission Owner Analysis

9.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AF1-120 project did not contribute to any overloads on the FE transmission system.

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

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 and AF1-120 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 AE2-285 and AF1-120 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 existing proposed AE2-282 Solar-powered 67 MW portion of the Customer Facility shall retain 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. The increase of 40 MW to the Solar-powered Customer Facility associated with AF1-120 project shall be designed with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs).

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.

1.1.1 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

11.2 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

12 Network Impacts

The Queue Project AF1-120 was evaluated as a 40.0 MW (Capacity 26.6 MW) injection at the East Fayette 138 kV substation in the ATSI area. Project AF1-120 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-120 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

13 Generation Deliverability

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

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
43447775	256000	18ARGNTA	345.0	METC	243234	05TWIN B	345.0	AEP	1	AEP_P1-2_#7021	single	956.0	99.86	100.02	DC	1.48

14 Multiple Facility Contingency

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

None

15 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	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
40987391	239070	02RICHLD	138.0	ATSI	239165	02WAUSEO	138.0	ATSI	1	AEP_P7-1_#10983-B	tower	190.0	101.28	103.69	DC	4.57

16 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.

None

17 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
43447775	1	**18ARGNTA 345.0 kV - 05TWIN B 345.0 kV Ckt 1**	**AEPI0013a : Argentum-Twin Branch 345 kV Line: 1)A Sag Study will be required on the 51.4mile section of line to mitigate the overload . Depending on the sag study results, cost for this upgrade is expected to be between $205,600 (no remediations required just sag study) and $102.8 million (complete line reconductor/rebuild required).** **Project Type : FAC** **Cost : $205,600** **Time Estimate : 6-12 Months**	$205,600
40987391	2	**02RICHLD 138.0 kV - 02WAUSEO 138.0 kV Ckt 1**	**TE-011A (1385) : Richland-Wauseon 138 kV Line: Reconductor with 336 ACSS (approx 26.3 miles). This project is dependent on the s1698 project Richland-Wauseon-Midway 138 kV Three-Terminal Elimination project (ISD 12/31/2020)** **Project Type : FAC** **Cost : $53,257,500** **Time Estimate : 36.0 Months**	$53,257,500
			TOTAL COST	**$53,463,100**

18 Flow Gate Details

The following indices contain additional information about each flowgate presented in the body of the report. For each index, 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.

18.1 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
43447775	256000	18ARGNTA	METC	243234	05TWIN B	AEP	1	AEP_P1-2_#7021	single	956.0	99.86	100.02	DC	1.48

Bus #	Bus	MW Impact
238564	02BAYSG1	1.2513
238670	**02DVBSG1 (Deativation : 05/31/20)**	**4.7571**
238885	02LEMOG1	1.2913
238886	02LEMOG2	1.2913
238887	02LEMOG3	1.2913
238888	02LEMOG4	1.2913
238979	02NAPMUN	2.0428
239202	02STRYCT	0.0921
239293	02BS-PKR	0.1092
241902	Y1-069 GE	7.0651
247528	05COVRT1	3.3841
247529	05COVRT2	3.3841
247530	05COVRT3	3.3841
247531	05COVRT4	2.0311
247532	05COVRT5	2.0311
247533	05COVRT6	2.0311
925961	AC1-072	0.3139
931951	AB1-107 1	15.7317
931961	AB1-107 2	35.4908
934891	AD1-118	4.0474
936601	AD2-075	16.3053
938911	AE1-119	31.8010
941781	AE2-181 C	1.5491
942661	AE2-282 C O1	2.4470
943961	AF1-064 C O1	1.8878
944551	AF1-120 C	1.4827
945401	AF1-205 C O1	1.3250
945411	AF1-206 C O1	6.6554
950311	G934 C	3.7995
950351	J466	3.1329
950791	J201 C	0.4444
950871	J246 C	0.1728
951531	J533 C	4.9364
951571	J538 C	3.1212
951941	J602 C	3.5527
952161	J571	1.0017
952201	J589 C	3.8039
952401	J752 C	1.6500
952611	J717 C	3.6497
952761	J728 C	3.3942
952881	J758	29.2420
952971	J793	128.0886

Bus #	Bus	MW Impact
953071	J794 C	0.2331
953271	J701 C	0.8116
953291	J796	27.3583
953321	J799	16.1708
953361	J806	20.1567
953421	J841	80.2667
953771	J832	12.5070
953781	J833	8.4720
953811	J839	9.9020
953941	J857	17.5642
954111	J875	14.9790
954381	J906 C	2.2094
954591	J937	98.3705
955021	J978 C	2.0458
955071	J984 C	3.9515
955121	J989	8.6840
955181	J996	6.8296
955261	J1005	22.8880
955341	J1013	9.4360
955351	J1014 C	5.9140
955591	J1043 C	2.6076
955621	J1046	3.5670
955721	J1056 C	2.4685
955781	J1062	14.2680
955801	J1064 C	4.1755
955811	J1065 C	3.9512
955831	J1068 C	2.7459
955861	J1071	14.0350
955961	J1083	8.9824
956011	J1088	17.4090
956021	J1089	19.5925
956031	J1090	10.9260
956161	J1103	2.1236
956291	J1117	9.9536
956301	J1119	72.8880
956741	J1172	5.5100
956751	J1173	7.7128
956801	J1178	8.3408
DUCKCREEK	DUCKCREEK	2.8960
NEWTON	NEWTON	1.8857
FARMERCITY	FARMERCITY	0.1171
G-007A	G-007A	1.4265
VFT	VFT	3.8571
CBM-W1	CBM-W1	28.3351
PRAIRIE	PRAIRIE	4.4970
COFFEEN	COFFEEN	1.0327
EDWARDS	EDWARDS	0.9149
CHEOAH	CHEOAH	0.3569
TILTON	TILTON	1.2304
GIBSON	GIBSON	0.7759
CALDERWOOD	CALDERWOOD	0.3598
BLUEG	BLUEG	1.8940

Bus #	Bus	MW Impact
TRIMBLE	TRIMBLE	0.6021
CATAWBA	CATAWBA	0.1386

18.2 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
40987391	239070	02RICHLD	ATSI	239165	02WAUSEO	ATSI	1	AEP_P7-1_#10983-B	tower	190.0	101.28	103.69	DC	4.57

Bus #	Bus	MW Impact
238979	02NAPMUN	2.1002
239064	02RICHG1	0.6855
239065	02RICHG2&3	1.3657
239067	02RICHG4	7.3530
239068	02RICHG5	7.3530
239069	02RICHG6	7.3530
239202	02STRYCT	0.2457
926941	AC1-181	0.3116
940841	AE2-072 C	40.0275
940842	AE2-072 E	26.6850
941781	AE2-181 C	3.6253
941782	AE2-181 E	2.4169
942661	AE2-282 C O1	5.0204
942662	AE2-282 E O1	2.6417
944551	AF1-120 C	3.0420
944552	AF1-120 E	1.5324
945401	AF1-205 C O1	0.7220
945402	AF1-205 E O1	0.4814
945411	AF1-206 C O1	13.6546
945412	AF1-206 E O1	9.1031
DUCKCREEK	DUCKCREEK	0.1128
NEWTON	NEWTON	0.1053
FARMERCITY	FARMERCITY	0.0055
NY	NY	0.0531
PRAIRIE	PRAIRIE	0.2531
O-066	O-066	0.6384
COFFEEN	COFFEEN	0.0518
EDWARDS	EDWARDS	0.0343
CHEOAH	CHEOAH	0.0485
TILTON	TILTON	0.0617
G-007	G-007	0.0988
GIBSON	GIBSON	0.0535
CALDERWOOD	CALDERWOOD	0.0482
BLUEG	BLUEG	0.1684
TRIMBLE	TRIMBLE	0.0540
CATAWBA	CATAWBA	0.0336

Affected Systems

19 Affected Systems

19.1 LG&E

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

19.2 MISO

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

19.3 TVA

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

19.4 Duke Energy Progress

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

19.5 NYISO

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

20 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P1-2_#7021	CONTINGENCY 'AEP_P1-2_#7021' OPEN BRANCH FROM BUS 243212 TO BUS 247803 CKT 1 / 243212 05BENTON 345 247803 05SEGRETO 345 1 END
AEP_P7-1_#10983-B	CONTINGENCY 'AEP_P7-1_#10983-B' OPEN BRANCH FROM BUS 239070 TO BUS 243029 CKT 1 / 239070 02RICHLD 138 243029 05LCKWRD 138 1 OPEN BRANCH FROM BUS 940840 TO BUS 242993 CKT 1 / 239269 AE2-072 TAP 138 242993 05E.LPSC 138 1 OPEN BRANCH FROM BUS 242993 TO BUS 893021 CKT 1 / 242993 05E.LPSC 138 893021 V2-006 C 138 1 OPEN BRANCH FROM BUS 242971 TO BUS 243029 CKT 1 / 242971 05BRYAN 138 243029 05LCKWRD 138 1 REMOVE SWSHUNT FROM BUS 243029 / 243029 05LCKWRD 138 END

Short Circuit

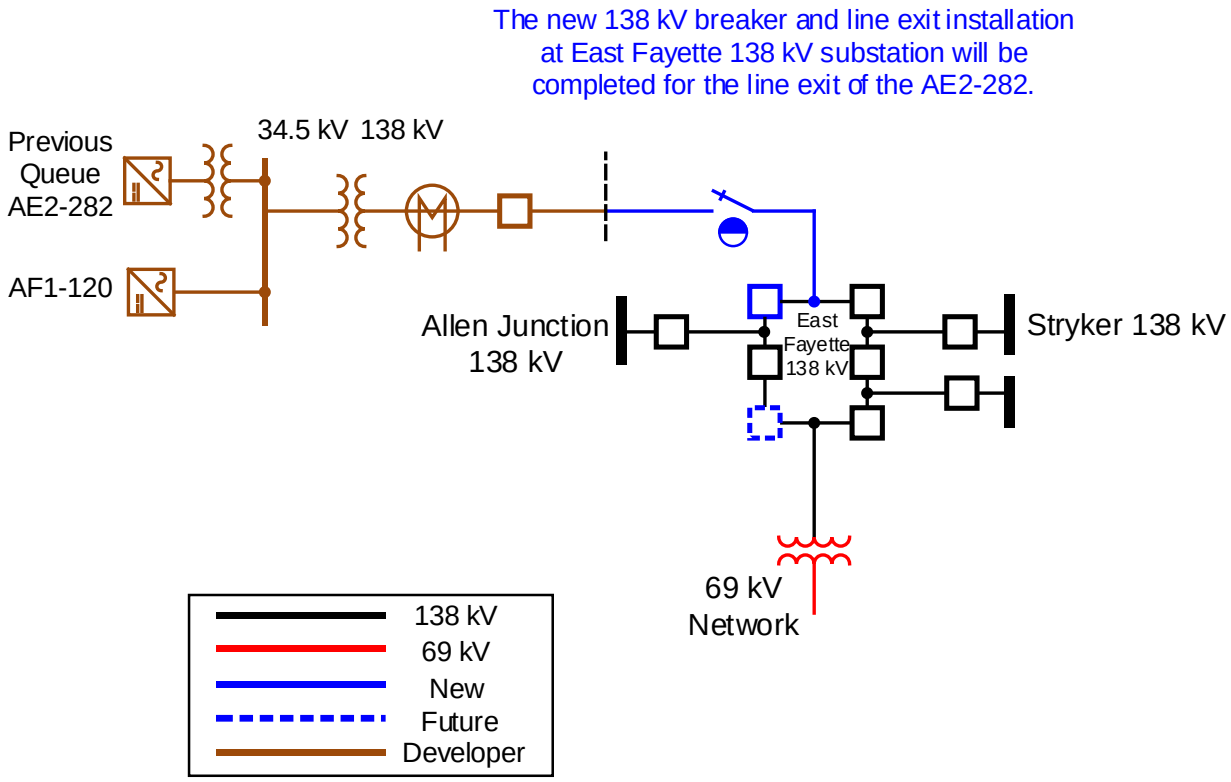
21 Short Circuit

The following Breakers are overduty:

None

22 Attachment One: One Line Diagram

East Fayette 138 kV Substation



Revised

Generation Interconnection

Impact Study Report

for

Queue Project AE2-282

EAST FAYETTE 138 KV

43.9 MW Capacity / 67 MW Energy

March 2020

Revision 1

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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 Arche Energy Project, LLC, 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 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.

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.

3 Revision from February 25, 2020 Report

The report has been updated to remove an upgrade (*n6185 – Build new 138 kV Line from Black River to Astor*) from the "**System Reinforcements**" table in **Section 16**. The customer does not have cost allocation for the overload of the Lorain to Admiral 138 kV facility per PJM Cost Allocation Rules.

4 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 1, 2021. This study does not imply a TO commitment to this in-service date.

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

5 Point of Interconnection

The interconnection of the AE2-282 project at the Point of Interconnection (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 the new line exit to the 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 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.

6 Cost Summary

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

Description	Total Cost
Attachment Facilities	$291,000
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$1,259,700
System Upgrades	$810,000[1]
Total Costs	**$2,360,700**

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 Up charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Note: 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: 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

[1] See Section 15 "System Reinforcements" for a description of the system upgrades needed.

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.

7 Transmission Owner Scope of Work

The interconnection of the project at the POI will be accomplished by installing a new 138 kV breaker at the FE East Fayette 138 kV substation and connecting the East Fayette 138 kV ring bus substation and the 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 FE transmission system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing all the facilities on its side of the POI, including the Attachment Facilities which connect the generator to the FE transmission system's Direct Connection facilities.

8 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	$291,000
Total Attachment Facility Costs	**$291,000**

9 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
	$0
Total Direct Connection Facility Costs	$0

10 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
Install one new 138 kV breaker for the line exit of AE2-282. at East Fayette substation	$1,259,700
Total Non-Direct Connection Facility Costs	**$1,259,700**

11 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 **15 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.

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.

12 Transmission Owner Analysis

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 <100 kV system.

13 Interconnection Customer Requirements

13.1 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.

13.2 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.

13.3 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.

14 Revenue Metering and SCADA Requirements

14.1 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.

14.1.1 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

14.2 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

15 Network Impacts

The Queue Project AE2-282 was evaluated as a 67.0 MW (Capacity 43.9 MW) injection at the East Fayette 138 kV 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 100%. Potential network impacts were as follows:

Summer Peak Load Flow

15.1 Generation Deliverability

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

None

15.2 Multiple Facility Contingency

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

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
8935882	238890	02LEMOYN	138.0	ATSI	239176	02WOOD+	138.0	ATSI	1	AEP_P2-2_#517_05FOSTOR 345_1	bus	347.0	99.4	100.89	AC	6.05
8936154	238890	02LEMOYN	138.0	ATSI	239176	02WOOD+	138.0	ATSI	1	AEP_P4_#517_05FOSTOR 345_A1	breaker	347.0	99.4	100.89	AC	6.05
3910188 1	242942	05SBERWI	345.0	AEP	238745	02GALION	345.0	ATSI	1	ATSI-P7-1-TE-345-027A	tower	1409.0	99.65	100.2	AC	9.05

15.3 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	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
8937162	238524	02AD Q-2	138.0	ATSI	241928	02AVQ2	138.0	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	332.0	124.41	125.38	AC	3.61
4073350 4	238874	02LAKVEW	138.0	ATSI	238768	02GRNFLD	138.0	ATSI	1	ATSI-P7-1-TE-345-027A	tower	316.0	143.33	144.82	AC	4.75
8937147	238915	02LRNQ2	138.0	ATSI	238524	02AD Q-2	138.0	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	316.0	130.77	131.8	AC	3.61
4073353 3	239030	02OTTAWA	138.0	ATSI	238874	02LAKVEW	138.0	ATSI	1	ATSI-P7-1-TE-345-027A	tower	380.0	132.73	133.97	AC	4.75
3910146 5	239176	02WOOD+	138.0	ATSI	243137	05W.END	138.0	AEP	1	AEP_P2-2_#517_05FOSTOR 345_1	bus	185.0	102.12	104.05	AC	4.19
3910162 3	239176	02WOOD+	138.0	ATSI	243137	05W.END	138.0	AEP	1	AEP_P4_#517_05FOSTOR 345_A1	breaker	185.0	102.12	104.05	AC	4.19

15.4 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.

None

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost	Cost allocated to AE2-282	NUN
8935882, 8936154	1	02LEMOYN 138.0 kV - 02WOOD+ 138.0 kV Ckt 1	Reconductor the Fostoria West End-Lemoyne-West Fremont 138 kV line from Lemoyne to the Woodville Tap with 954 ACSS. Approximately 0.4 miles of line to be reconductored. Project Type : FAC Cost : $810,000 Time Estimate : 18 months New Ratings: Rate A: 296 Rate B: 354 Rate C: 372 AE2-282 is the driver for this upgrade.	$810,000	$810,000	N6480
39101623 ,39101465	7	02WOOD+ 138.0 kV - 05W.END 138.0 kV Ckt 1	ATSI upgrade: The limiting element is AEP owned. Current ATSI end rating is 200 MVA SN, 241 MVA SE, 271 MVA SLD. AEP upgrade: "A Sag Study will be required on the 20 miles section of ACSR ~ 477 ~ 26/7 ~ HAWK conductor section 2 line to mitigate the overload. New Ratings after the sag study S/N : 185MVA S/E: 257MVA.Depending on the sag study results, cost for this upgrade is expected to be between $80,000 (no remediations required just sag study) and $30 million (complete line reconductor/rebuild required)." Project Type : FAC Cost : $80,000 Time Estimate : 6-12 months New Ratings: Rate A: 285 Rate B: 215 Queue Project AE2-282 presently does not receive cost allocation for this upgrade. Note 1: as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AE2-282 could receive cost allocation. Note 2: Although Queue Project AE2-282 may not have cost responsibility for this upgrade, Queue Project AE2-282 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AE2-282 comes into service prior to completion of the upgrade, Queue Project AE2-282 will need an interim study.	$80,000	$0	N6489

ID	Index	Facility	Upgrade Description	Cost	Cost allocated to AE2-282	NUN
40733533	6	02OTTAWA 138.0 kV - 02LAKVEW 138.0 kV Ckt 1	For the Lakeview-Ottawa 138 kV line, reconductor the substation conductor and line drop at Lakeview 138 kV and Ottawa 138 kV with bundled (2 conductor per phase) 1033.5 54/7 ACSR. The Lakeview-Ottawa 138 kV Transmission line has mixed 954 ACSR, 336.4 ACSR bundled (2 conductor per phase), 795 ACSS, and 739.8 ACAR bundled (2 conductor per phase). Reconductor the Lakeview-Ottawa 138 kV line with 795 45/7 ACSR bundled (2 conductor per phase). The sections of transmission line that has 739.8 ACSR 24/13 does not need to be reconductored (approx 2.7 miles). Replace the wave trap at Lakeview 138 kV with a 2000A unit. Project Type : FAC Cost : $5.737 million Time Estimate : 24 months New Ratings Rate A: 489 Rate B: 550 Rate C: 569 Queue Project AE2-282 presently does not receive cost allocation for this upgrade. Note 1: as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AE2-282 could receive cost allocation. Note 2: Although Queue Project AE2-282 may not have cost responsibility for this upgrade, Queue Project AE2-282 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AE2-282 comes into service prior to completion of the upgrade, Queue Project AE2-282 will need an interim study.	$5,737,500	$0	N6486
39101881	2	05SBERWI 345.0 kV - 02GALION 345.0 kV Ckt 1	No ATSI upgrade is required. ATSI SE rating is 1424.	$0	$0	N/A

ID	Index	Facility	Upgrade Description	Cost	Cost allocated to AE2-282	NUN
40733504	4	02LAKVEW 138.0 kV - 02GRNFLD 138.0 kV Ckt 1	Reconductor roughly 13.1 miles of the Greenfield-Lakeview 138 kV Line (currently bundled 336 ACSR) with 795 ACSS conductor. Replace two 1200A line switches with 2000A line switches. Upgrade 500 CU substation conductor at Greenfield to exceed line ratings of 795 ACSS. Upgrade RT for B-242 to exceed line ratings of 795 ACSS. Project Type : FAC Cost : $23.58 million Time Estimate : 24 months New Ratings: Rate A: 448 Rate B: 516 Rate C: 516 Queue Project AE2-282 presently does not receive cost allocation for this upgrade. Note 1: as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AE2-282 could receive cost allocation. Note 2: Although Queue Project AE2-282 may not have cost responsibility for this upgrade, Queue Project AE2-282 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AE2-282 comes into service prior to completion of the upgrade, Queue Project AE2-282 will need an interim study.	$23,580,000	$0	N6481
			TOTAL COST	**$30,207,500**	**$810,000**	

17 Flow Gate Details

The following indices 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.

17.1 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
8936154	238890	02LEMOYN	ATSI	239176	02WOOD+	ATSI	1	AEP_P4_#517_05FOSTOR 345_A1	breaker	347.0	99.4	100.89	AC	6.05

Bus #	Bus	MW Impact
238885	02LEMOG1	2.3171
238886	02LEMOG2	2.3171
238887	02LEMOG3	2.3171
238888	02LEMOG4	2.3171
238979	02NAPMUN	3.8395
247551	U4-028 C	-1.1534
247552	U4-029 C	-1.1534
900041	V4-011	-0.3342
931951	AB1-107 1	20.2546
931961	AB1-107 2	37.9834
934251	AD1-052 C1	-0.7445
934261	AD1-052 C2	-0.7445
934891	AD1-118	7.6545
938911	AE1-119	60.1425
941781	AE2-181 C	2.2583
941782	AE2-181 E	1.5056
942661	AE2-282 C	3.3722
942662	AE2-282 E	1.7744
950241	J419	6.2250
952312	J646 E	0.0824
952971	J793	60.4068
953321	J799	11.5422
953781	J833	6.2250
954111	J875	8.2575
965151	J996	5.1256
965591	J1046	3.8260
965691	J1056 C	2.0751
965692	J1056 E	11.2269
965751	J1062	15.3040
965801	J1068 C	1.8558
965802	J1068 E	10.0402
966721	J1173	4.5648
CHILHOWEE	CHILHOWEE	0.0527
G-007	G-007	0.1575
CBM-W1	CBM-W1	11.4410
MECS	MECS	19.5300
AB2-013	AB2-013	0.0000
TVA	TVA	0.3658
WEC	WEC	0.2800
O-066	O-066	0.9960
CARR	CARR	0.0265
CHEOAH	CHEOAH	0.1481

Bus #	Bus	MW Impact
SANTEETLA	SANTEETLA	0.0437
SMITHLAND	SMITHLAND	0.0223
COTTONWOOD	COTTONWOOD	0.2457
HAMLET	HAMLET	0.1880
BLUEG	BLUEG	1.5681
UNIONPOWER	UNIONPOWER	0.1163
MEC	MEC	1.0903
CANNELTON	CANNELTON	0.0646
GIBSON	GIBSON	0.0230
CALDERWOOD	CALDERWOOD	0.1611
TRIMBLE	TRIMBLE	0.1786
RENSSELAER	RENSSELAER	0.0215
CATAWBA	CATAWBA	0.1162

17.2 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
39101881	242942	05SBERWI	AEP	238745	02GALION	ATSI	1	ATSI-P7-1-TE-345-027A	tower	1409.0	99.65	100.2	AC	9.05

Bus #	Bus	MW Impact
238564	02BAYSG1	2.9597
238670	**02DVBSG1 (Deativation : 05/31/20)**	**15.0039**
238885	02LEMOG1	3.4723
238886	02LEMOG2	3.4723
238887	02LEMOG3	3.4723
238888	02LEMOG4	3.4723
238979	02NAPMUN	4.2847
239293	02BS-PKR	0.2642
241902	Y1-069 GE	18.0260
247506	**U2-041 C (Withdrawn : 12/05/2019)**	**1.7636**
247548	V4-010 C	2.2359
247549	V3-028 C	0.3437
247551	U4-028 C	1.1002
247552	U4-029 C	1.1002
247567	V2-006 C	1.5271
247908	05BLCK-1 E	5.0791
247909	05BLCK-2 E	5.0791
247910	05BLCK-3 E	5.1667
247911	05TIMB G E	5.3876
247919	**U2-041 E (Withdrawn : 12/05/2019)**	**11.8024**
247926	U1-059 E	3.2471
247940	U4-028 E	7.3632
247941	U4-029 E	7.3632
247942	W1-056 E	1.1944
247947	V4-010 E	14.9630
247948	V3-028 E	0.5607
247959	V1-011 E	4.3231
247961	V2-006 E	10.2195
900041	V4-011	0.4390
925131	AB2-170 C O1	2.2339
925132	AB2-170 E O1	3.6447
925751	AC1-051 C	0.3506
925752	AC1-051 E	2.3463
926811	AC1-167 C O1	1.7359
926812	AC1-167 E O1	0.8421
926901	AC1-176 C	0.3390
926902	AC1-176 E	2.2790
931951	AB1-107 1	38.9239
931961	AB1-107 2	95.4399
932051	AC2-015 C	2.3492

Bus #	Bus	MW Impact
932052	AC2-015 E	2.7835
932301	AC2-044 C	0.4160
932302	AC2-044 E	0.6787
934251	AD1-052 C1	0.9841
934261	AD1-052 C2	0.9841
934461	AD1-070 C O1	5.6200
934462	AD1-070 E O1	26.3826
934741	AD1-101 C O1	1.1297
934742	AD1-101 E O1	1.8436
934891	AD1-118	11.4709
934901	AD1-119 C O1	0.9494
934902	AD1-119 E O1	1.5493
934981	AD1-130 C	5.2003
934982	AD1-130 E	2.4871
936601	AD2-075	6.8737
936671	AD2-086 C	6.2404
936672	AD2-086 E	4.1602
936721	AD2-091 C	2.6600
937021	AD2-136 C O1	3.9609
937022	AD2-136 E O1	26.5075
937381	AD2-191 C	1.8704
937382	AD2-191 E	12.5174
938681	AE1-090 C	0.9749
938682	AE1-090 E	1.2861
938691	AE1-091 C	2.7560
938692	AE1-091 E	3.7039
938761	AE1-102 C	0.8538
938762	AE1-102 E	0.5692
938911	AE1-119	90.1285
939161	AE1-146 C O1	11.6287
939162	AE1-146 E O1	5.4305
940031	AE1-245 C	0.9690
940032	AE1-245 E	6.4847
940841	AE2-072 C	7.5100
940842	AE2-072 E	5.0067
941741	AE2-174 C	2.9969
941742	AE2-174 E	14.0300
941781	AE2-181 C	3.3737
941782	AE2-181 E	2.2491
942041	AE2-216	2.4871
942661	AE2-282 C	5.0375
942662	AE2-282 E	2.6507
942801	AE2-298 C O1	1.5099
942802	AE2-298 E O1	1.0066
943012	AE2-324 BAT	4.0990
943181	AE2-322 C	2.0820
943182	AE2-322 E	1.0178
950031	J301 C	1.5164
950032	J301 E	6.0657
950041	J308 C	4.6860
950042	J308 E	18.7439
950241	J419	9.1750

Bus #	Bus	MW Impact
950351	J466	2.1933
950361	J469	0.1042
950791	J201 C	0.2666
950792	J201 E	1.0662
950871	J246 C	0.0879
950872	J246 E	0.3515
950942	J325 E	0.3005
950951	J327 C	2.2539
950952	J327 E	6.7617
951011	J340 C	1.5022
951012	J340 E	4.5066
951051	J354 C	0.7807
951052	J354 E	2.3422
951531	J533 C	2.1092
951532	J533 E	8.4368
951571	J538 C	2.0538
951572	J538 E	8.2152
951941	J602 C	1.9937
951942	J602 E	10.7863
952201	J589 C	1.7659
952202	J589 E	9.5541
952312	J646 E	0.1293
952401	J752 C	1.1195
952402	J752 E	6.0565
952611	J717 C	1.8998
952612	J717 E	10.2783
952761	J728 C	1.7688
952762	J728 E	9.5695
952971	J793	94.7638
953071	J794 C	0.1144
953072	J794 E	0.6189
953271	J701 C	0.5419
953272	J701 E	2.9317
953291	J796	15.0020
953321	J799	17.2368
953361	J806	8.0549
953421	J841	44.2962
953771	J832	5.3170
953781	J833	9.1750
953811	J839	7.8450
954111	J875	11.9865
965091	J989	5.6016
965151	J996	7.1432
965231	J1005	12.5740
965321	J1014 C	3.4015
965322	J1014 E	2.0409
965591	J1046	5.2560
965691	J1056 C	2.9793
965692	J1056 E	16.1187
965751	J1062	21.0240
965781	J1065 C	1.6389
965782	J1065 E	8.8671

Bus #	Bus	MW Impact
965801	J1068 C	2.7902
965802	J1068 E	15.0958
965931	J1083	4.2539
965981	J1088	9.4335
965991	J1089	10.7865
966001	J1090	5.9301
966131	J1103	1.4178
966261	J1117	4.9848
966271	J1119	40.3140
966711	J1172	3.3855
966721	J1173	6.5840
966771	J1178	3.9501
LGEE	LGEE	0.5697
CIN	CIN	4.0327
IPL	IPL	2.5184
G-007	G-007	1.2191
CBM-W2	CBM-W2	29.6165
CBM-W1	CBM-W1	28.8284
MECS	MECS	37.4535
AB2-013	AB2-013	0.0000
WEC	WEC	1.7849
O-066	O-066	7.8203
CARR	CARR	0.4201
CBM-S1	CBM-S1	1.9867
HAMLET	HAMLET	0.2375
MEC	MEC	9.7944
RENSSELAER	RENSSELAER	0.3323
CATAWBA	CATAWBA	0.1117

17.3 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
8937162	238524	02AD Q-2	ATSI	241928	02AVQ2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	332.0	124.41	125.38	AC	3.61

Bus #	Bus	MW Impact
238571	02BEAVGA	0.9712
238572	02BEAVGB	0.9905
238979	02NAPMUN	1.7046
239174	02WLORG-5	1.1494
239175	02WLORG-6	1.5040
239276	02COLLW 11	-1.4990
239297	02CPPW41	-1.7700
241908	02LLF_W4-004	0.3246
247548	V4-010 C	1.3024
247551	U4-028 C	0.5652
247552	U4-029 C	0.5652
247940	U4-028 E	3.7825
247941	U4-029 E	3.7825
247947	V4-010 E	8.7157
931951	AB1-107 1	14.1405
931961	AB1-107 2	31.0283
932791	AC2-103 C	3.0272
932792	AC2-103 E	20.2625
934251	AD1-052 C1	0.7258
934261	AD1-052 C2	0.7258
934761	AD1-103 C O1	5.0898
934762	AD1-103 E O1	34.0627
934891	AD1-118	3.5438
937021	AD2-136 C O1	2.0347
937022	AD2-136 E O1	13.6172
937381	AD2-191 C	0.9609
937382	AD2-191 E	6.4303
938911	AE1-119	27.8443
941741	AE2-174 C	1.7457
941742	AE2-174 E	8.1723
941761	AE2-176 C	5.5775
941762	AE2-176 E	3.7183
941781	AE2-181 C	1.3455
941782	AE2-181 E	0.8970
942661	AE2-282 C	2.0090
942662	AE2-282 E	1.0571
LGEE	LGEE	0.9975
CIN	CIN	4.0180
CPLE	CPLE	0.2362
IPL	IPL	2.5767

Bus #	Bus	MW Impact
G-007	G-007	1.1109
CBM-W2	CBM-W2	33.0356
CBM-W1	CBM-W1	15.2451
MECS	MECS	15.4840
AB2-013	AB2-013	0.0000
WEC	WEC	1.2795
O-066	O-066	7.2011
CBM-S2	CBM-S2	0.8676
CARR	CARR	0.5424
CBM-S1	CBM-S1	3.7610
MEC	MEC	7.9325
RENSSELAER	RENSSELAER	0.4265

17.4 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
40733504	238874	02LAKVEW	ATSI	238768	02GRNFLD	ATSI	1	ATSI-P7-1-TE-345-027A	tower	316.0	143.33	144.82	AC	4.75

Bus #	Bus	MW Impact
238564	02BAYSG1	2.0434
238601	02FRMENG 1	2.7792
238602	02FRMENG 2	2.7792
238603	02FRMENG 3	5.0192
238979	02NAPMUN	2.2160
239293	02BS-PKR	0.1824
247548	V4-010 C	1.8758
247551	U4-028 C	0.7090
247552	U4-029 C	0.7090
247940	U4-028 E	4.7446
247941	U4-029 E	4.7446
247947	V4-010 E	12.5538
900041	V4-011	0.1407
931951	AB1-107 1	22.5215
931961	AB1-107 2	37.0668
934251	AD1-052 C1	1.4105
934261	AD1-052 C2	1.4105
934461	AD1-070 C O1	1.7656
934462	AD1-070 E O1	8.2886
934891	AD1-118	4.0781
937021	AD2-136 C O1	2.5523
937022	AD2-136 E O1	17.0807
937381	AD2-191 C	1.2052
937382	AD2-191 E	8.0659
938911	AE1-119	32.0424
939161	AE1-146 C O1	3.7053
939162	AE1-146 E O1	1.7303
941741	AE2-174 C	2.5144
941742	AE2-174 E	11.7709
941781	AE2-181 C	1.7703
941782	AE2-181 E	1.1802
942661	AE2-282 C	2.6434
942662	AE2-282 E	1.3909
LGEE	LGEE	1.0024
CIN	CIN	4.1821
CPLE	CPLE	0.1773
IPL	IPL	2.6759
G-007	G-007	1.1403
CBM-W2	CBM-W2	33.9316
CBM-W1	CBM-W1	17.2253

Bus #	Bus	MW Impact
MECS	MECS	18.3680
AB2-013	AB2-013	0.0000
WEC	WEC	1.3759
O-066	O-066	7.3761
CBM-S2	CBM-S2	0.7396
CARR	CARR	0.5005
CBM-S1	CBM-S1	3.7288
MEC	MEC	8.4084
RENSSELAER	RENSSELAER	0.3942

17.5 Index 5

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	130.77	131.8	AC	3.61

Bus #	Bus	MW Impact
238571	02BEAVGA	0.9712
238572	02BEAVGB	0.9905
238979	02NAPMUN	1.7046
239174	02WLORG-5	1.1494
239175	02WLORG-6	1.5040
239276	02COLLW 11	-1.4990
239297	02CPPW41	-1.7700
241908	02LLF_W4-004	0.3246
247548	V4-010 C	1.3024
247551	U4-028 C	0.5652
247552	U4-029 C	0.5652
247940	U4-028 E	3.7825
247941	U4-029 E	3.7825
247947	V4-010 E	8.7157
931951	AB1-107 1	14.1405
931961	AB1-107 2	31.0283
932791	AC2-103 C	3.0272
932792	AC2-103 E	20.2625
934251	AD1-052 C1	0.7258
934261	AD1-052 C2	0.7258
934761	AD1-103 C O1	5.0898
934762	AD1-103 E O1	34.0627
934891	AD1-118	3.5438
937021	AD2-136 C O1	2.0347
937022	AD2-136 E O1	13.6172
937381	AD2-191 C	0.9609
937382	AD2-191 E	6.4303
938911	AE1-119	27.8443
941741	AE2-174 C	1.7457
941742	AE2-174 E	8.1723
941761	AE2-176 C	5.5775
941762	AE2-176 E	3.7183
941781	AE2-181 C	1.3455
941782	AE2-181 E	0.8970
942661	AE2-282 C	2.0090
942662	AE2-282 E	1.0571
LGEE	LGEE	0.9975
CIN	CIN	4.0180
CPLE	CPLE	0.2362
IPL	IPL	2.5767

Bus #	Bus	MW Impact
G-007	G-007	1.1109
CBM-W2	CBM-W2	33.0356
CBM-W1	CBM-W1	15.2451
MECS	MECS	15.4840
AB2-013	AB2-013	0.0000
WEC	WEC	1.2795
O-066	O-066	7.2011
CBM-S2	CBM-S2	0.8676
CARR	CARR	0.5424
CBM-S1	CBM-S1	3.7610
MEC	MEC	7.9325
RENSSELAER	RENSSELAER	0.4265

17.6 Index 6

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
40733533	239030	02OTTAWA	ATSI	238874	02LAKVEW	ATSI	1	ATSI-P7-1-TE-345-027A	tower	380.0	132.73	133.97	AC	4.75

Bus #	Bus	MW Impact
238564	02BAYSG1	2.0434
238601	02FRMENG 1	2.7792
238602	02FRMENG 2	2.7792
238603	02FRMENG 3	5.0192
238979	02NAPMUN	2.2160
239293	02BS-PKR	0.1824
247548	V4-010 C	1.8758
247551	U4-028 C	0.7090
247552	U4-029 C	0.7090
247940	U4-028 E	4.7446
247941	U4-029 E	4.7446
247947	V4-010 E	12.5538
900041	V4-011	0.1407
931951	AB1-107 1	22.5215
931961	AB1-107 2	37.0668
934251	AD1-052 C1	1.4105
934261	AD1-052 C2	1.4105
934461	AD1-070 C O1	1.7656
934462	AD1-070 E O1	8.2886
934891	AD1-118	4.0781
937021	AD2-136 C O1	2.5523
937022	AD2-136 E O1	17.0807
937381	AD2-191 C	1.2052
937382	AD2-191 E	8.0659
938911	AE1-119	32.0424
939161	AE1-146 C O1	3.7053
939162	AE1-146 E O1	1.7303
941741	AE2-174 C	2.5144
941742	AE2-174 E	11.7709
941781	AE2-181 C	1.7703
941782	AE2-181 E	1.1802
942661	AE2-282 C	2.6434
942662	AE2-282 E	1.3909
LGEE	LGEE	1.0024
CIN	CIN	4.1821
CPLE	CPLE	0.1773
IPL	IPL	2.6759
G-007	G-007	1.1403
CBM-W2	CBM-W2	33.9316
CBM-W1	CBM-W1	17.2253

Bus #	Bus	MW Impact
MECS	MECS	18.3680
AB2-013	AB2-013	0.0000
WEC	WEC	1.3759
O-066	O-066	7.3761
CBM-S2	CBM-S2	0.7396
CARR	CARR	0.5005
CBM-S1	CBM-S1	3.7288
MEC	MEC	8.4084
RENSSELAER	RENSSELAER	0.3942

17.7 Index 7

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
3910162 3	239176	02WOOD +	ATSI	243137	05W.END	AEP	1	AEP_P4_#517_05FOSTOR 345_A1	breaker	185.0	102.12	104.05	AC	4.19

Bus #	Bus	MW Impact
238979	02NAPMUN	2.1713
247551	U4-028 C	-0.7569
247552	U4-029 C	-0.7569
900041	V4-011	-0.3377
931951	AB1-107 1	16.5211
931961	AB1-107 2	30.8722
934891	AD1-118	4.5018
938911	AE1-119	35.3710
941781	AE2-181 C	1.5636
941782	AE2-181 E	1.0424
942661	AE2-282 C	2.3348
942662	AE2-282 E	1.2286
965591	J1046	2.8065
965691	J1056 C	1.5753
965692	J1056 E	8.5227
965751	J1062	11.2260
DUCKCREEK	DUCKCREEK	0.1140
NEWTON	NEWTON	0.4037
CHILHOWEE	CHILHOWEE	0.0796
G-007	G-007	0.0084
CBM-W1	CBM-W1	6.8785
MECS	MECS	13.9685
AB2-013	AB2-013	0.0000
TVA	TVA	0.7193
PRAIRIE	PRAIRIE	0.7232
O-066	O-066	0.0336
COFFEEN	COFFEEN	0.1263
EDWARDS	EDWARDS	0.0394
CHEOAH	CHEOAH	0.2222
TILTON	TILTON	0.1455
SANTEETLA	SANTEETLA	0.0653
SMITHLAND	SMITHLAND	0.0774
CBM-N	CBM-N	0.0760
COTTONWOOD	COTTONWOOD	0.7455
HAMLET	HAMLET	0.2237
BLUEG	BLUEG	2.8206
UNIONPOWER	UNIONPOWER	0.2833
CANNELTON	CANNELTON	0.1459
GIBSON	GIBSON	0.0874
CALDERWOOD	CALDERWOOD	0.2435
FARMERCITY	FARMERCITY	0.0661
TRIMBLE	TRIMBLE	0.3166

Bus #	Bus	MW Impact
CATAWBA	CATAWBA	0.1449
NYISO	NYISO	0.3330

18 Contingency Details

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
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
ATSI-P7-1-TE-345-027A	CONTINGENCY 'ATSI-P7-1-TE-345-027A' /* DB - X1-027A & DB - HAYES 345 DISCONNECT BRANCH FROM BUS 238654 TO BUS 907060 CKT 1 /* 02DAV-BE 345 X1-027A_AT12 345 DISCONNECT BRANCH FROM BUS 238654 TO BUS 239289 CKT 1 /* 02DAV-BE 345 02HAYES 345 END
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

Affected Systems

19 Affected Systems

19.1 NYISO

NYISO Impacts to be determined during Facilities phase (as applicable).

19.2 MISO

MISO Impacts to be determined during Facilities phase (as applicable).

Short Circuit

20 Short Circuit

The following Breakers are overdutied:

None.

Stability

21 Stability Analysis and Reactive Power Requirement

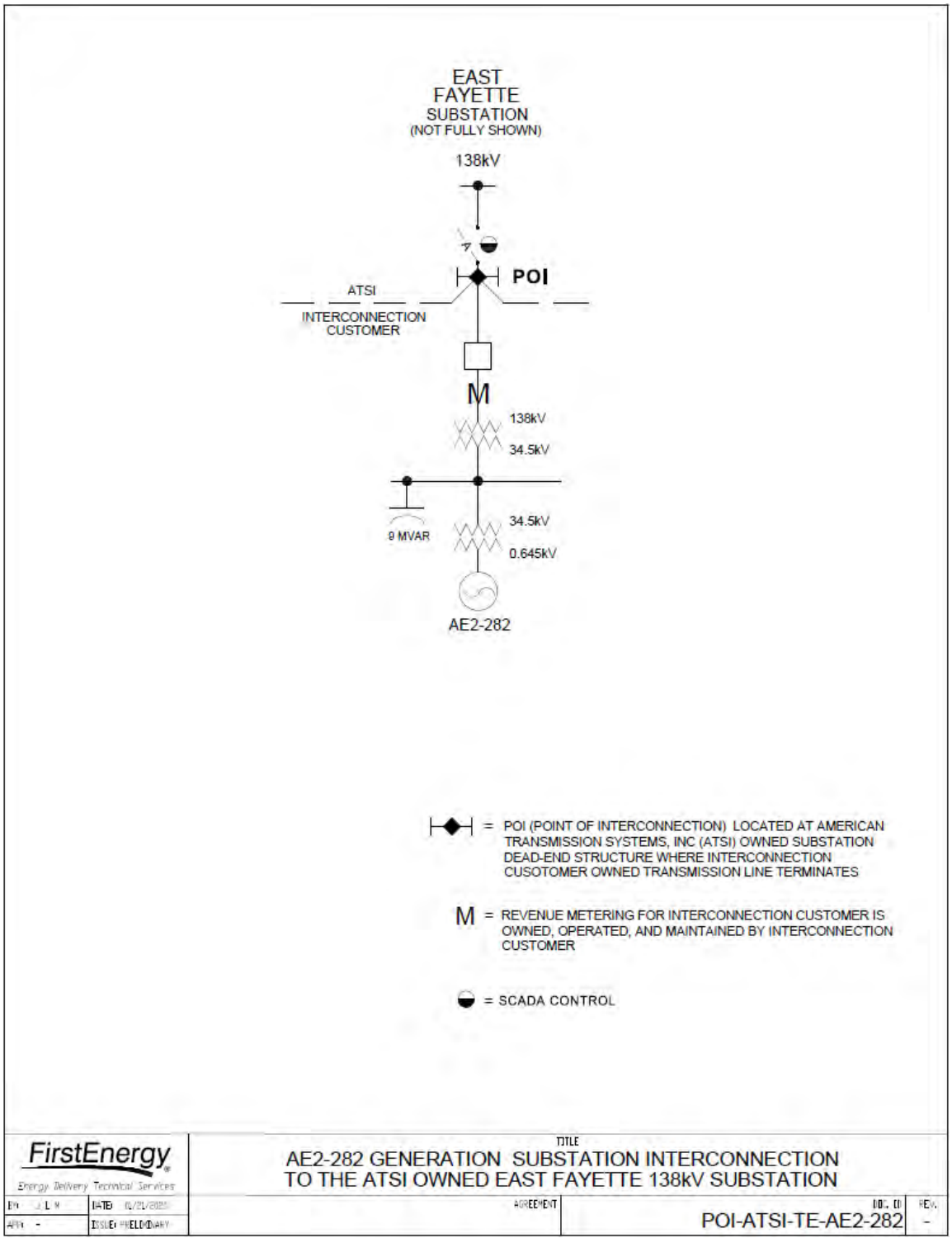
To be finalized in Facilities Study phase.

Light Load

22 Light Load Analysis

Light Load analysis not required for solar projects.

23 Attachment 1 – One Line



24 Attachment 2 – Project Location