Generation Interconnection

System Impact Study Report

for

Queue Project AE2-324

GALION-ROBERTS SOUTH II 138 KV

20.3 MW Capacity / 20.3 MW Energy

February 2020

Table of Contents

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 Marion County Solar 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.

3 General

The Interconnection Customer (IC), has proposed a storage uprate to the proposed Solar generating facility AC2-195 located in city of Marion, Marion County, Ohio. This project requests an increase to the install capability of the AC2-195 project by 20.3 MW with 20.3 MW of this output being recognized by PJM as additional Capacity. AE2-324 will share the same property and connection point as the AC2-195 project. The installed facilities will have a total capability of 120.3 MW with 82.4 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 1, 2022. This study does not imply a Transmission owner (TO) commitment to this in-service date.

Queue Number	AE2-324
Project Name	GALION-ROBERTS SOUTH II 138 KV
Interconnection Customer	Marion County Solar Project, LLC
State	Ohio
County	Marion
Transmission Owner	ATSI
MFO	120.3
MWE	20.3
MWC	20.3
Fuel	Storage
Basecase Study Year	2022

4 Point of Interconnection

AE2-324 will interconnect with the ATSI transmission system. The interconnection of the project at the Point of Interconnection (POI) will be accomplished through the prior queue project AC2-195. Gen Queue AC2-195 is to construct a new 138 kV three (3) breaker ring bus substation, looping the Galion – Roberts South 138 kV line into the new substation, and extending a new line exit to the POI. The new substation will be located approximately 20.4 miles from the FirstEnergy Galion substation. Due to the uprate of 20.3 MW, the project will require non-direct connection upgrades at the FirstEnergy Galion and Roberts substations.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AE2-324 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 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 Cost Summary

The AE2-324 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrade	$ 0
Non Direct Connection Network Upgrades	$41,400
System Upgrades	$0
Total Costs	**$41,400**

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 AE2-324 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.

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.

6 Transmission Owner Scope of Work

AE2-324 will interconnect with the ATSI transmission system. The interconnection of the project at the Primary POI will be accomplished through the prior queue project AC2-195. Gen Queue AC2-195 is to construct a new 138 kV three (3) breaker ring bus substation, looping the Galion – Roberts South 138 kV line into the new substation, and extending a new line exit to the Primary POI. The new substation will be located approximately 20.4 miles from the FirstEnergy Galion substation. Due to the uprate of 20.3 MW, the project will require non-direct connection upgrades at the FirstEnergy Galion and Roberts substations.

7 Attachment Facilities

There is no Attachment Facility scope of work required.

8 Direct Connection Cost Estimate

There is no Direct Connection scope of work required.

9 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
Relay settings changes for Roberts South line due to AE2-324 uprate. @ Galion SS	$20,700
Relay settings changes for Galion South line due to AE2-324 uprate @ Roberts SS	$20,700
Total Non-Direct Connection Facility Costs	**$41,400**

10 Schedule

Based on the scope of work for the Attachment Facilities and the Direct and/or Non-Direct Connection facilities, it is expected to take a minimum of **four months** after the signing of an Interconnection Construction Service Agreement to complete the facility changes. This includes the requirement for the IC to make a preliminary payment that compensates FE for the Non-Direct Connection work identified. This assumes that there will be no environmental issues with any of the new properties associated with this project and that all transmission system outages will be allowed when requested.

11 Transmission Owner Analysis

11.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AE2-324 project did not contribute to any overloads on the FE transmission system

12 Interconnection Customer Requirements

1.1 System Protection

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

1.2 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 AE2-324/AC2-195 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 AE2-324/AC2-195 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.

12.1 Power Factor Requirements

The existing non-synchronous 99.96 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 20.3 MW to the non-synchronous Customer Facility associated with AE2-324 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).

13 Revenue Metering and SCADA Requirements

13.1 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.

13.2 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

14 Network Impacts

The Queue Project AE2-324 was evaluated as a 20.3 MW (Capacity 20.3 MW) injection at the AC2-195 tap (Hamilton to Dual Rail 138kV line) POI in the ATSI area. Project AE2-324 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-324 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Load Flow

15 Generation Deliverability

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

None.

16 Multiple Facility Contingency

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

None.

17 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)

None.

18 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.

19 System Reinforcements

None.

Affected Systems

20 Affected Systems

None.

Short Circuit

21 Short Circuit

The following Breakers are overduty:

None.

Stability

22 Stability Analysis and Reactive Power Requirement

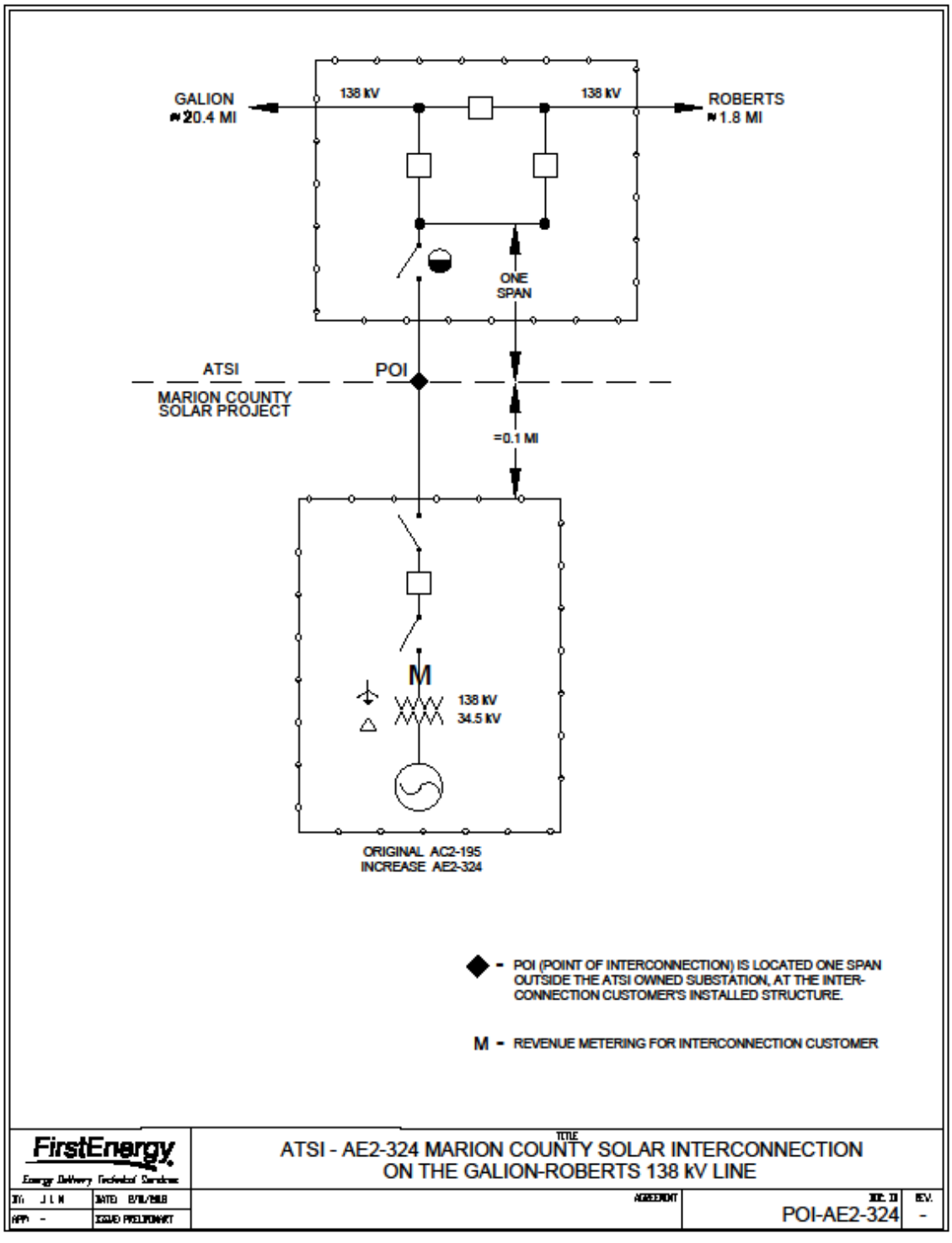
To be finalized in Facilities Study phase.

Light Load

23 Light Load Analysis

No impacts.

24 Attachment 1 – One Line



25 Attachment 2 – Project Location