

***Generation Interconnection
Combined Feasibility/System
Impact Study Report***

For

***PJM Generation Interconnection Request
Queue Position AB1-015***

Evergreen 138kV

February 2016

Preface

The intent of the Combined Feasibility/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, if any, is included in the System Impact Study.

The 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 associated with them will be addressed when seeking an Interconnection Agreement as outlined below. . Developer will also be responsible for providing and installing metering equipment in compliance with applicable PJM and Transmission Owner standards.

General

ArcelorMittal Cleveland LLC DBA ArcelorMittal Warren, the Interconnection Customer (IC), has proposed a natural gas generating facility located at 2234 Main Ave, Warren, Trumbull County, OH 44481. The installed facilities will have a total capability of 16.50 MW with 0.00 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is October 1, 2016. **This study does not imply an Ohio Edison Company commitment to this in-service date.**

Point of Interconnection

AB1-015 will interconnect with the Ohio Edison Company transmission system at the Evergreen 138 kV substation.

Project Costs

The AB1-078 project will be responsible for the following costs (These costs do not include CIAC Tax Gross-up):

Project Costs Description	Amount
Attachment Facilities <u>Metering</u> None. <u>TO side of the POI to TO Facilities</u> None.	\$ 0.0
Direct Connection Network Upgrades Install two 34.5 kV manual line switches.	\$ 0.0
Non-Direct Connection Network Upgrades Remote end relay, protection and metering settings adjustments.	\$ 13,300
Allocation for New System Upgrades None.	\$ 0.0
Contributions for Previously Identified Upgrades None.	\$ 0.0
Total Costs	\$ 13,300

Transmission Owner Scope of Work

The Transmission Owner will be responsible for remote end relaying and protection work.

Interconnection Customer Requirements

The Interconnection Customer will be responsible for meeting all criteria as specified in the applicable sections of the FE "Requirements for Transmission Connected Facilities" document including:

1. The purchase and installation of fully rated 138 kV circuit breakers on the high side of the AB1-015 generator step-up (GSU) transformer.
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.
4. The establishment of dedicated communication circuits for SCADA to the FE Transmission System Control Center.
5. A compliance with the FE and PJM generator power factor and voltage control requirements.

6. The execution of a back-up service agreement to serve the customer load supplied from the AB1-015 generation project metering point when the units are out-of-service. This assumes the intent of the Interconnection Customer is to net the generation with the load.

The above requirements are in addition to any metering or other requirements imposed by PJM.

Revenue Metering and SCADA Requirements

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 Sections 24.1 and 24.2.

PE Requirements

The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "FirstEnergy Requirements for Transmission Connected Facilities" document located at the following links:

<http://www.firstenergycorp.com/feconnect>

<http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx>

Network Impacts

Generator Deliverability

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

None.

Light Load Analysis

Light Load Studies to be conducted during later study phases (applicable to wind, coal, nuclear, and pumped storage projects).

None.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

None.

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None.

Please see Attachment 3 for Short Circuit analysis conducted by Interconnected Transmission Owner.

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.

Steady-State Voltage Requirements

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

None.

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

None.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None.

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

None.

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.

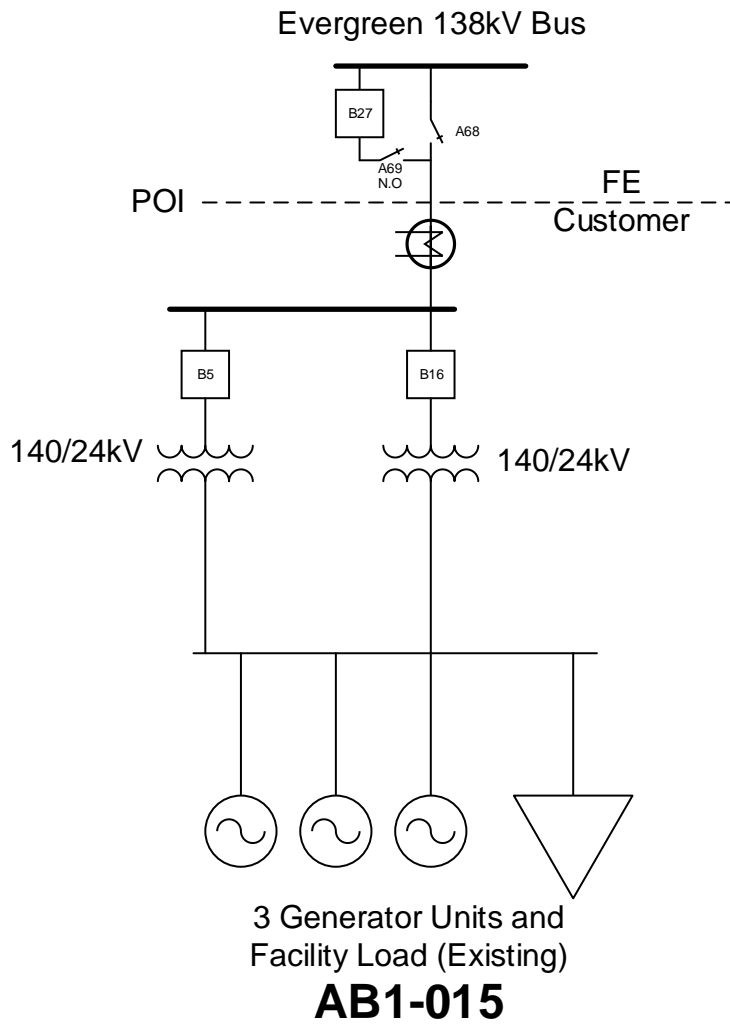
None.

Attachment 1
Project Location



Attachment 2

Interconnection Project AB1-015 Single Line Diagram



Attachment 3

Preliminary Short Circuit Duties & Protection Requirements

Short Circuit Analysis

Short Circuit Values

The preliminary fault values (100 MVA, 138kV base) for the Evergreen 138kV bus with maximum back-feed of AB1-015 generation (7 MW) in service are:

Three phase = 41.9kA
Single line to ground = 30.8kA
 $Z1 = (0.163 + j 0.985)\%$
 $Z0 = (0.549 + j 2.010)\%$

Protection Requirements

AB1-015 Generation 138kV (Arcelor Mittal)

The following protection will be required for the customer to run their generation equipment:

- Phase fault detection utilizing 51V or 21 functions. See Figure 6 in the “Requirements for Transmission Connected Facilities” document.
- Ground fault detection utilizing a 59G function on the high side neutral of the unit GSU or a 51G function on the high side bus. See Figure 6 in the “Requirements for Transmission Connected Facilities” document.

In addition, the Arcelor Mittal facilities should not be fed by the normally-open 23kV breaker B33 at Evergreen while the Arcelor Mittal facility is generating power. This may result in unexpected power flows and misoperation of protective devices.

Arcelor Mittal shall provide utility-grade relays for protection of the FE Transmission System. FE shall approve all relays specified for the protection of the FE Transmission System, including time delay and auxiliary relays. Relay operation for any of the listed functions that are required shall initiate immediate separation of the parallel generation from the FE Transmission System.

Relay Function	Description
Frequency	To detect underfrequency and overfrequency operation.
Overvoltage	To detect overvoltage operation.
Undervoltage	To detect undervoltage operation.
Ground Fault Detector	To detect a circuit ground on the FE Transmission System.
Phase Fault Detector	To detect phase to phase faults on the FE Transmission System.
Directional Power	To detect, under all system conditions, a loss of FE primary source. The relay shall be sensitive enough to detect transformer magnetizing current supplied by the generation
Breaker Failure	To detect a stuck breaker condition at the generation substation and 1- send a trip signal to the remote ends of the connected line via transfer trip or 2-to trip a high speed ground switch.

Based on analysis of the existing generating capabilities and protective relay schemes performed in conjunction with FirstEnergy Load Study Application 1363 for Arcelor Mittal, it is not anticipated that relay upgrades will be required at this time.