Revised

Generation Interconnection

Impact Study Report

for

Queue Project AE1-105

NORTH LONGVIEW 500 KV

1235 MW Capacity / 1270 MW Energy

May 2022

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 **Longview Power II, LLC**, the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Monongahela Power Company (MonPower).

2 Preface

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

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the Feasibility Study, but the actual allocation will be deferred until the System Impact Study is performed.

The System Impact Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

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

3 Revisions

The AE1-105 System Impact Study report has been updated to reflect retooled short circuit analysis. The physical connection costs have not been modified in this revision. Final scope, cost and schedule for the physical interconnection will be provided in the Facilities Study Report.

- **Short Circuit:** Retooled analysis shows that no network upgrades are required for this project.

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4 General

The Interconnection Customer (IC), has proposed a Natural Gas generating facility located in Monongalia County, West Virginia. The installed facilities will have a total capability of 1270 MW with 1235 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 06/01/2022. This study does not imply a TO commitment to this in-service date.

Queue Number	**AE1-105**
Project Name	NORTH LONGVIEW 500 KV
Interconnection Customer	Longview Power II, LLC
State	West Virginia
County	Monongalia
Transmission Owner	APS (MonPower)
MFO	1270
MWE	1270
MWC	1235
Fuel	Natural Gas
Basecase Study Year	2022

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5 Point of Interconnection

AE1-105 will interconnect to the MonPower transmission system through the North Longview 500 kV Substation. This will be accomplished by installing a new 500 kV breaker at North Longview substation to create a four breaker ring bus**. Attachment 1** shows a one-line diagram of the proposed facilities for the AE1-105 generation project to connect to the FirstEnergy ("FE") transmission system. **Attachment 2** provides the plan view for the project.

The 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.

6 Cost Summary

The AE1-105 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$296,400
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$4,720,400
New System Upgrades	$0
Contribution to Previously Identified System Upgrades	$0
Total Costs	**$5,016,800**

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 AE1-105 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 Direct and Non-Direct Connection facilities are shown in Attachment 1.

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7 Transmission Owner Scope of Work

AE1-105 will interconnect to the MonPower transmission system through the North Longview 500 kV Substation. This will be accomplished by installing a new 500 kV breaker at North Longview substation to create a four breaker ring bus**. Attachment 1** shows a one-line diagram of the proposed facilities for the AE1-105 generation project to connect to the FirstEnergy ("FE") transmission system. **Attachment 2** provides the plan view for the project.

The 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.

7.1 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
At North Longview Substation: Add 500 kV disconnect switch and pulloff structure	$296,400
Total Attachment Facility Costs	$296,400

7.2 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.

None.

7.3 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
Add 500 kV terminal for AE1-105 at North Longview substation	$3,706,500
Estimated SCADA work at North Longview to support breaker, MOAB, and relay installations. Estimated in-sub fiber run from North Longview control house to developer ran OPGW outside substation.	$55,900
Project Management, Commissioning, Environmental, and Real Estate.	$958,000
Total Non-Direct Connection Facility Costs	$4,720,400

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8 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 **18 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 Attachment Facilities and full payment for Non-Direct Connection work. This assumes that there will be no environmental issues, that there will be no delays in acquiring any necessary permits, and that all transmission system outages will be allowed when requested.

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9 Transmission Owner Analysis

9.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AE1-105 project did not contribute to any overloads on the FE transmission <100 kV system.

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10 Interconnection Customer Requirements

10.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx.

Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

10.2 Compliance Issues and Interconnection Customer Requirements

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

1. The purchase and installation of a fully rated 500 kV circuit breaker to protect the AE1-105 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 AE1-105 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 IC shall design its Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.90 lagging (supplying VARs) measured at the generator's terminals of each unit.

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11 Revenue Metering and SCADA Requirements

11.1 PJM Requirements

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

11.2 FirstEnergy 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.

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12 Network Impacts

The Queue Project AE1-105 was evaluated as a 1235.0 MW (Capacity 1235.0 MW) injection at the North Longview 500kV substation in the APS area. Project AE1-105 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-105 was studied with a commercial probability of 100%. Potential network impacts were as follows:

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Summer Peak Load Flow

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13 Generation Deliverability

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

None

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)

None

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

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17 System Reinforcements

None

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18 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.

None

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Affected Systems

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19 Affected Systems

19.1 LG&E

None.

19.2 MISO

None.

19.3 TVA

None.

19.4 Duke Energy Progress

None.

19.5 NYISO

None.

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Short Circuit

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20 Short Circuit

The following Circuit Breakers are overdutied:

None

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Stability

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21 Executive Summary

Generator Interconnection Request AE1-105 is for a new 1270 MW Maximum Facility Output (MFO) 2x1 combined cycle natural gas generating facility. AE1-105 has a Point of Interconnection (POI) at the 500 kV bus of the existing North Longview Substation located in the Alleghany Power (APS) transmission system, Greene County, Pennsylvania.

This report describes a dynamic simulation analysis of AE1-105 as part of the overall system impact study.

The load flow scenario for the analysis was based on the RTEP 2022 light load case modified to include applicable queue projects. AE1-105 consists of 3 conventional generators making up 2x1 closed cycle gas powered plant. The CT1, CT2 and ST units have been dispatched online at maximum power output, with 1.046, 1.046 and 1.049 p.u. voltage at the generator terminal buses.

AE1-105 was tested for compliance with NERC, PJM, Transmission Owner and other applicable criteria. Steady-state condition and 45 contingencies were studied, each with a 10 second simulation time period. Studied scenarios include:

a) Steady-state operation (20 second);

b) Three-phase faults with normal clearing time and with unsuccessful high speed reclosing;

c) Single-phase bus faults with normal clearing time;

d) Single-phase faults with stuck breaker;

e) Single-phase faults placed at 80% of the line with delayed (Zone 2) clearing at line end remote from the fault due to primary communications/relay failure.

No relevant tower faults were identified for this study.

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

For all of the fault contingencies tested on the 2022 light load case:

a) AE1-105 was able to ride through the faults (except for faults where protective action trips a generator(s)),

b) AE1-105 post-contingency oscillations were positively damped with a damping margin of at least 3%.

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

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

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The reactive power capability of AE1-105 meets the 0.95 lagging and leading PF requirement at the high side of the main transformer.

No mitigations were found to be required.

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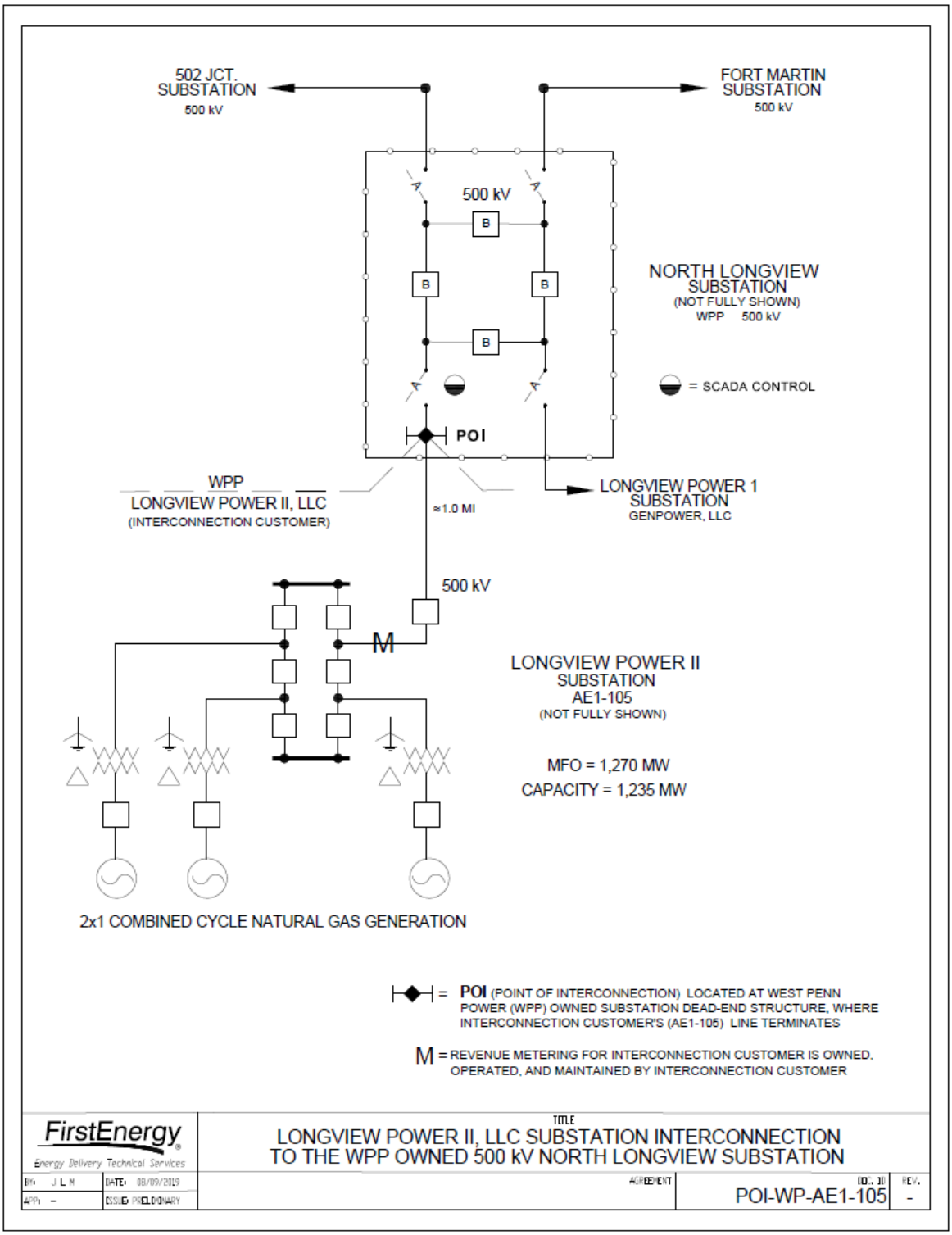
22 Attachment 1 – One Line



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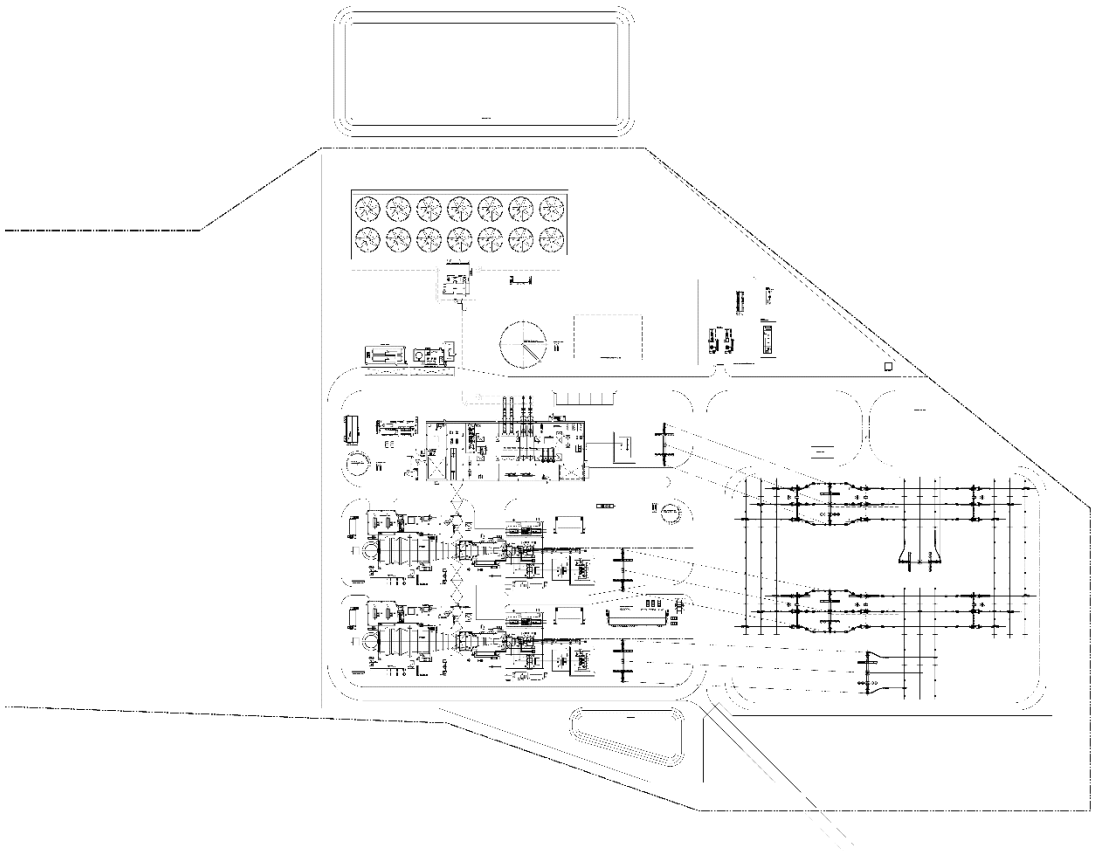
23 Attachment 2 – Project Site Plan



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