

***Generation Interconnection  
System Impact Study Report***

***For***

***PJM Generation Interconnection Request  
Queue Position AA2-121***

***Tidd-Wylie Ridge 345 kV***

**April 2016**

## 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 Interconnected 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

ESC Brooke County Power I, LLC (“Interconnection Customer” or “ESC Brooke”) has proposed a combined-cycle natural gas generating facility located approximately 10.4 miles south of Wylie Ridge substation on the Tidd-Wylie Ridge 345 kV line located in Brooke County, West Virginia. The installed facilities will have a total capability of 685 MW with 685 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is June 1, 2020. **This study does not imply a Monongahela Power Company commitment to this in-service date.**

## Point of Interconnection (POI)

For AA2-121 project, the connection from the Mon Power transmission system to ESC Brooke’s facilities will be provided by constructing a new three breaker ring bus station on the Tidd-Wylie Ridge 354 kV line as shown in Appendix 2.

## Transmission Owner Scope of Work and Costs Estimation

The Mon Power attachment facilities and network upgrades as well as related costs estimates required for AB1-121 interconnection project are shown in below table. Please note that these costs do not include CIAC Tax Gross-up:

Project Costs Description	Amount
<p><b>Attachment Facilities</b></p> <p><u>Metering</u> 345 kV metering package to be installed inside ESC Brooke’s facilities.</p> <p><u>Inline facilities from tap point to POI:</u> Install attachment line from developer installed dead-end structure outside the substation (at POI) to 345 kV bus.</p>	\$ 417,900
<p><b>Direct Connection Network Upgrades</b></p> <hr/> <p><i>NUN* Description</i></p> <hr/> <p><i>N4946 Construct a 345 kV three-breaker ring bus substation. Cost estimate: \$8,000,000.</i></p> <hr/> <p><i>N4947 Install a loop from Tidd-Wylie Ridge 345 kV line to proposed ring bus station, approx. 400' in length, consisting of two steel pole dead-end structures with concrete foundations. Cost estimate: \$1,348,900.</i></p> <hr/> <p><i>N4948 For system protection, install line protection relays on the Tidd 345 kV line including associated carrier and transfer-trip equipment. Cost estimate: \$208,600.</i></p>	\$ 9,557,500
<p><b>Non-Direct Connection Network Upgrades</b></p> <hr/> <p><i>NUN* Description</i></p> <hr/> <p><i>N4949 Replace 6 345 kV breakers (WK-1 thru WK-6) with 3000 A, 63 kA breakers. Estimate assumes foundations, risers and control cables will be replaced. Rewire 345 kV line transducers. Cost estimate: \$4,793,500.</i></p>	\$ 4,793,500

<b>Project Costs Description</b>	<b>Amount</b>
<b>Direct Connection Local Upgrades</b> <i>None.</i>	\$ 0
<b>Non-Direct Connection Local Upgrades</b> <i>None.</i>	\$ 0
<b>Contributions for Previously Identified Upgrades</b> <i>None.</i>	\$ 0
<b>Total Costs</b>	<b>\$ 14,768,900</b>

\* *NUN means Network Upgrade Number*

## **Interconnection Customer Requirements**

ESC Brooke will be responsible for meeting all criteria as specified in the applicable sections of the Interconnected Transmission Owner "Requirements for Transmission Connected Facilities" document including:

1. The purchase and installation of fully rated 345kV circuit breaker on the high side of the AA2-121 step-up transformers.
2. The purchase and installation of the minimum required Interconnected Transmission Owner 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.
5. A compliance with the FE and PJM generator power factor and voltage control requirements.
6. The execution of a back-up retail service agreement with the electric distribution company to serve the customer load supplied from the AA2-121 generation project interconnection point when the units are out-of-service. This assumes the intent of ESC Brooke County Power I, LLC is to net the generation with the load.

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

## **Schedule of Work**

Based on the scope of interconnection attachment facilities, direct and non-direct system upgrades, it is expected to take a minimum of twenty three (23) months from the date of a fully executed Interconnection Construction Service Agreement to complete the installation. This includes a preliminary payment that compensates the Interconnected Transmission Owner for the first three months of the engineering design work that is related to the interconnection facilities of the Project. It also assumes that the Interconnection Customer will provide the property for the Project direct connection facilities and all right-of-way, permits, easements, etc. that will be needed. A further assumption is 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 facilities and that transmission system outages will be possible when requested.

# **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.

## **Transmission Owner Requirements**

The IC will be required to comply with all Interconnected Transmission Owner revenue metering requirements for generation interconnection customers. The Interconnected Transmission Owner revenue metering requirements may be found in the Interconnected Transmission Owner "Requirements for Transmission Connected Facilities" document located at the following links:

[www.firstenergycorp.com/feconnect](http://www.firstenergycorp.com/feconnect)

[www.pjm.com/planning/design-engineering/to-tech-standards.aspx](http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx)

## **Network Impacts**

The Queue Project AA2-121 was evaluated as a 685 MW (Capacity 685 MW) injection into a tap of the Tidd – Wylie Ridge 345 kV line in the APS area. Project AA2-121 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AA2-121 was studied with a commercial probability of 100%. Potential network impacts were as follows:

### **Summer Peak Analysis - 2019**

#### **Generator Deliverability**

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

None

#### **Multiple Facility Contingency**

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

None

#### **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**

*(Results of the steady-state voltage studies should be inserted here)*

None

#### **Short Circuit**

*(Summary of impacted circuit breakers)*

None

### **Affected System Analysis & Mitigation**

#### **LGEE Impacts:**

None

**MISO Impacts:**

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

**Duke, Progress & TVA Impacts:**

None

**OVEC Impacts:**

None

**Delivery of Energy Portion of Interconnection Request**

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.

Only the most severely overloaded conditions are listed. 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 will study all overload conditions associated with the overloaded element(s) identified.

Not Applicable

**Light Load Analysis - 2019**

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

**System Reinforcements**

**Short Circuit**

*(Summary form of Cost allocation for breakers will be inserted here if any)*

None

**Stability and Reactive Power Requirement**

*(Results of the dynamic studies should be inserted here)*

No mitigations were found to be required.

**Summer Peak Load Flow Analysis Reinforcements**

**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)*

*(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)*

**Light Load Load Flow Analysis Reinforcements**

**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)*

*(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)*

# Appendix 1

## Project Location



## Appendix 2

### System Configuration – Single Line Diagram

