Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-113

GRISTMILL 345 KV

138.4 MW Capacity / 180 MW Energy

January 2020

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1 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.

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.

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.

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2 General

The Interconnection Customer (IC), has proposed a Solar; Storage generating facility located in Auglaize County, Ohio. The installed facilities will have a total capability of 180 MW with 137.3 MW of this output being recognized by PJM as Capacity. The primary point of Interconnection will be a direct connection to AEP's proposed Gristmill 345 substation. The secondary point of Interconnection will be via a new 345 kV switching station cut into the AEP-owned portion of the Southwest Lima to Shelby (Dayton) 345 kV tieline. The proposed in-service date for this project is 6/1/2022. This study does not imply a TO commitment to this in-service date.

Queue Number	**AF1-113**
Project Name	GRISTMILL 345 KV
State	Ohio
County	Auglaize
Transmission Owner	AEP
MFO	180
MWE	180
MWC	137.3
Fuel	Solar; Storage
Basecase Study Year	2023

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2.1 Point of Interconnection

AF1-113 will interconnect with the AEP transmission system via a direct connection to the AEP proposed Gristmill 345 kV station. The Gristmill station does not presently exist, but is part of a project presently under development by AEP for other purposes (see Figure 1).

To accommodate the interconnection at the proposed Gristmill 345 kV substation, the substation will have to be expanded requiring the installation of one 345 kV circuit breaker (see Figure 2). Installation of associated protection and control equipment, 345 kV line risers, SCADA and 345 kV revenue metering will also be required.

2.2 Cost Summary

The AF1-113 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$350,000
Direct Connection Network Upgrade	$2,500,000
Non Direct Connection Network Upgrades	$0
Total Costs	$2,850,000

In addition, the AF1-113 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$0

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

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3 Transmission Owner Scope of Work

4 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
345 kV Revenue Metering	$350,000
Total Attachment Facility Costs	$350,000

5 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
Expand the Gristmill 345 kV substation: Install one (1) additional 345 kV circuit breaker. Installation of associated protection and control equipment, 345 kV line risers and SCADA will also be required.	$2,500,000
Total Direct Connection Facility Costs	$2,500,000

6 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
Total Non-Direct Connection Facility Costs	$0

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7 Schedule

It is anticipated that the time between receipt of executed Agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would generally be between 24 to 36 months after Agreement execution.

8 Interconnection Customer Requirements

It is understood that the Interconnection Customer is responsible for all costs associated with this interconnection. The costs above are reimbursable to AEP. The cost of the Interconnection Customer's generating plant and the costs for the line connecting the generating plant to the Southwest Lima 138 kV station are not included in this report; these are assumed to be the Interconnection Customer 's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

In addition, if the Interconnection Customer considers use of the Option to Build, they should consult the guidance AEP has posted at:
https://www.aep.com/assets/docs/requiredpostings/TransmissionStudies/docs/2019/MerchantGenerationGuidelinesPJMoptiontoBuild.pdf

9 Revenue Metering and SCADA Requirements

9.1 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.

9.2 AEP Requirements

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

http://www.pjm.com/~/media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx

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10 Network Impacts – Option 1

The Queue Project AF1-113 was evaluated as a 180.0 MW (Capacity 137.3 MW) injection at Gristmill 345 kV substation in the AEP area. Project AF1-113 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-113 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

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Summer Peak Load Flow

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11 Generation Deliverability

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

None

12 Multiple Facility Contingency

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

None

13 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

14 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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15 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.

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Affected Systems

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16 Affected Systems

16.1 LG&E

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

16.2 MISO

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

16.3 TVA

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

16.4 Duke Energy Progress

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

16.5 NYISO

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

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Short Circuit

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17 Short Circuit

The following Breakers are overduty

Bus Number	Bus Name	BREAKER	Type	Capacity (Amps)	Duty Percentage Post Queue	Duty Percentage Pre Queue

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18 Secondary Point of Interconnection

AF1-113 will interconnect with the AEP transmission system at a new substation cut into the AEP-owned portion of the Southwest Lima- Shelby (Dayton) 345 kV tieline (see Figure 3).

To accommodate the interconnection on the AEP's Southwest Lima- Shelby (Dayton) tieline, a new three (3) circuit breaker 345 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed (Figure 3). Installation of associated protection and control equipment, 345 kV line risers, SCADA, and 345 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

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19 Network Impacts – Option 2

The Queue Project AF1-113 was evaluated as a 180.0 MW (Capacity 137.3 MW) injection tapping the Southwest Lima to Shelby 345 kV line in the AEP area. Project AF1-113 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-113 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

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Summer Peak Load Flow

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20 Generation Deliverability

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

None

21 Multiple Facility Contingency

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

None

22 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

23 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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24 Flow Gate Details

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25.1 LG&E

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

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

25.3 TVA

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

25.4 Duke Energy Progress

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

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

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Short Circuit

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26 Short Circuit

The following Breakers are overduty

Bus Number	Bus Name	BREAKER	Type	Capacity (Amps)	Duty Percentage Post Queue	Duty Percentage Pre Queue

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