Generation Interconnection

Facilities Study Report

for

Queue Project AE2-290

Nottingham 138 kV

Harrison County, Ohio

September 2021

1 Facilities Study Summary

1.1 Project Description

BQ Energy Development, LLC proposes to install PJM Project AE2-290, a 100 MW (60 MW Capacity) solar generating facility in Harrison County, Ohio (Figure 2). The point of interconnection for the generating facility will be a direct connection to AEP's Nottingham 138 kV Station (Figure 1).

1.2 Amendments/Changes to the Impact Study Report

No significant amendments/changes noted.

1.3 Interconnection Customer Schedule

PJM and AEP understand that the Interconnection Customer has established the following schedule dates:

Receive back feed power from AEP: 09/30/2022

Generation Commercial Operation Date: 12/31/2022

1.4 AEP's Scope of Work to Facilitate Interconnection

- To accommodate the interconnection at AEP's existing Nottingham 138 kV Station, the station will be expanded by extending the 138 kV bus and adding a new circuit breaker string with two (2) new 138 kV circuit breakers.

- Installation of associated protection and control equipment, line risers, switches, jumpers, SCADA, and 138 kV revenue metering will be required at the Nottingham 138 kV Station. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

- AEP will extend one span of 138 kV transmission line for the generation lead going to the AE2-290 site. AEP will build and own the first transmission line structure outside of the Nottingham 138 kV Station, to which the AEP and AE2-290 transmission line conductors will attach.

- It is understood that the Interconnection Customer is responsible for all of the connection costs associated with interconnecting the PJM project AE2-290 to the AEP transmission system. The cost of the customer's generating facility and the costs for the line connecting the generating facility to AEP's transmission system (beyond the first span exiting the Nottingham 138 kV Station) are not included in this report; these are assumed to be the Customer's responsibility.

- The customer will be responsible for the cost of constructing a fiber-optic connection from their telecom equipment to the Nottingham 138 kV control house.

1.5 Description of Transmission Owner Facilities Included in the Facilities Study

1.5.1 Direct Connection Work

- To accommodate the new Interconnection Customer connection, AEP will expand the Nottingham 138 kV station and add a new circuit breaker string. The station expansion will extend the station bus to the Southwest and will maintain the existing breaker and a half arrangement.

- AEP will install two (2) new 138 kV circuit breakers and one generator lead line connection for AE2-290 in the new breaker string at the Nottingham 138 kV Station. (Figure 1).

- AEP will install associated line protection and control equipment, line risers, switches, jumpers and SCADA at the Nottingham 138 kV Station.

1.5.2 Non-Direct Connection Work

- AEP will review the existing protection and control settings at the Nottingham 138 kV Station and make adjustments as needed.

1.5.3 Attachment Facilities Work

- AEP will Install 138 kV revenue metering at the Nottingham 138 kV Station.

- AEP will extend one span of 138 kV transmission line for the generation lead going to the AE2-290 site. AEP will build and own the first transmission line structure outside of the Nottingham 138 kV Station, to which the AEP and AE2-290 transmission line conductors will attach.

- Two fiber connections are required. AEP will extend the fiber-optic cables from the points of transition into the Nottingham 138 kV control house. The customer will be responsible for the fiber work on the IPP side of the points of transition.

1.5.4 Network Upgrade Work

- No AEP facility upgrades will be needed.

1.6 Total Cost of Transmission Owner Facilities Included in the Facilities Study:

Attachment Facilities	$844,671
Direct Connection Facilities	$1,244,638
Non-Direct Connection Facilities	$0
Network Upgrade Facilities	$0
Total Cost	$2,089,309

The estimates do not include the impact that delays in obtaining ROW, permits, or other approvals may have.

1.7 Summary of Schedule Milestones for Completion of Transmission Owner Work Included in Facilities Study:

Standard Process

Task	Dates
Engineering Start	Q2, 2022
Material Ordered	Q2, 2022
Construction Start (Grading & Below Grade)	Q3, 2022
Construction Start (Above Grade)	Q4, 2022
Outage Requests Made By	TBD
Outage (Structure Foundations)	TBD
Outage (Interconnection & Testing)	TBD
Ready For Back Feed (AEP's ISD)	04/06/2023
In-Service Date (Commercial Operation Date)	05/31/2023

Assumptions (Standard Process)

- **ISA and ICSA executed by 11/15/2021**
- **System conditions must allow scheduled outages to occur.**
- **The customer will obtain, at its cost, all necessary provisions for the AEP direct connection facilities.**
- **The customer will perform site development and road construction in accordance with AEP specifications as required.**
- **The customer will have their construction and required checkout completed prior to the start of the interconnection and testing outage.**

- **Other assumptions specific to the queue position addressed in this study:**
    - **Assumed 5 months for engineering design**
    - **Assumed the last 30 days leading to ISD is primarily spent doing fiber, relay, and communications checks.**
    - **Settings are approximately 4 months of coordination with the developer's engineer.**
    - **Assumptions were made based on preliminary conversations with the developer on relay coordination and length of fiber path.**
    - **Will need to coordinate OPSB filings to ensure accuracy between parties on POI change of ownership structure.**
    - **Assumed that no additional station work would be required that would result in an expansion of the control house other than what has been scoped.**
    - **Assumed suitable soil conditions for standard foundation and structure installation for AEP's exit structure.**
    - **Request for generation lead line to have no more than 100' ROW corridor and to align towards the North, leaving AEP the ability to bring out future line exits. AEP reserves the right to approve the developers' line route prior to construction.**
    - **No environmental or engineering surveys were completed during the development of the scopes used for this facility study report. Future surveys may be required and could alter the scope as currently documented.**

Transmission Outage Plan

No transmission outage plan has been specified at this time

Note that all 138 kV and above outages are subject to PJM and AEP Operations BES outage scheduling requirements.

2 Transmission Owner Facilities Study Results

2.1 Transmission Lines – New

- AEP will extend one span of 138 kV transmission line for the generation lead going to the AE2-290 site from the Nottingham 138 kV Station. AEP will build and own the first transmission line structure outside of the Nottingham 138 kV Station, to which the AEP and AE2-290 transmission line conductors will attach.

2.2 Transmission Line – Upgrades

- No transmission line upgrades will be required for this project.

2.3 Station Facilities – New

- No new station facilities will be required for this project.

2.4 Station Facilities – Upgrades

- AEP will expand the existing Nottingham 138 kV Station to facilitate the connection of the generation lead going to the PJM project AE2-290. To accomplish this, Nottingham 138 kV buses 3 and 4 will be extended to the Southwest and a new circuit breaker string added. Two additional circuit breakers will be installed in the new breaker string. Installation of associated protection and control equipment, line risers, switches, jumpers, SCADA, and 138 kV revenue metering will also be required (Figure 1).

- Nearby Protective relay settings for the remainder of the Nottingham 138 kV Station will be reviewed and updated (as needed) to account for the addition of the AE2-290 generation source.

2.5 Metering & Communications

Standard 138 kV metering will be installed at the Nottingham 138 kV Station. A standard station communication scheme will be used. All metering equipment shall meet the requirements as specified by AEP in the "AEP Metering and Telemetering Requirements for AEP Transmission Customers" document (SS-490011). Communication requirements are published in the "AEP SCADA RTU Requirements at Transmission Interconnection Facilities" (SS-500000).

AEP will update the telecom equipment at the Nottingham 138 kV Station for SCADA/EMS functionality. Fiber-optic cable will be extended to the AEP/AE2-290 points of transition.

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 must 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 installed. The metering work above and associated cost estimates indicated below do not include any potential work or cost to address metering requirements of the local service provider. It is the responsibility of the developer to contact the local service provider to obtain a local service agreement prior to energization.

2.6 Environmental, Real Estate, and Permitting issues

The Interconnection customer is expected to obtain, at its cost, all necessary permits and provisions for the IPP station connecting to the Nottingham 138 kV Station.

2.7 System Modeling & Operating Requirements

In addition to the IPP modeling requirements imposed by PJM as part of the Generation Interconnection process, the following system modeling parameters are required to be supplied by the Interconnection Customer to AEP:

In the case of transmission conductor crossing or lengths of parallel conductor:

- 138 kV transmission line impedances, including positive and zero sequence, up to the agreed-upon Point of Interconnection.
- Physical arrangement of transmission line phases for the 138 kV circuit, in relationship to AEP's and ATSI's 138 kV facilities. This is critical in order to calculate the mutual coupling effects between the generation leads and any ATSI lines in the area. High flows on the generation leads could have significant impacts on the protection settings.
- Coordination of the protection equipment and settings at the AE2-290 site, to coordinate with the Nottingham 138 kV Station relays and communication equipment

2.8 Summary of Results of Study

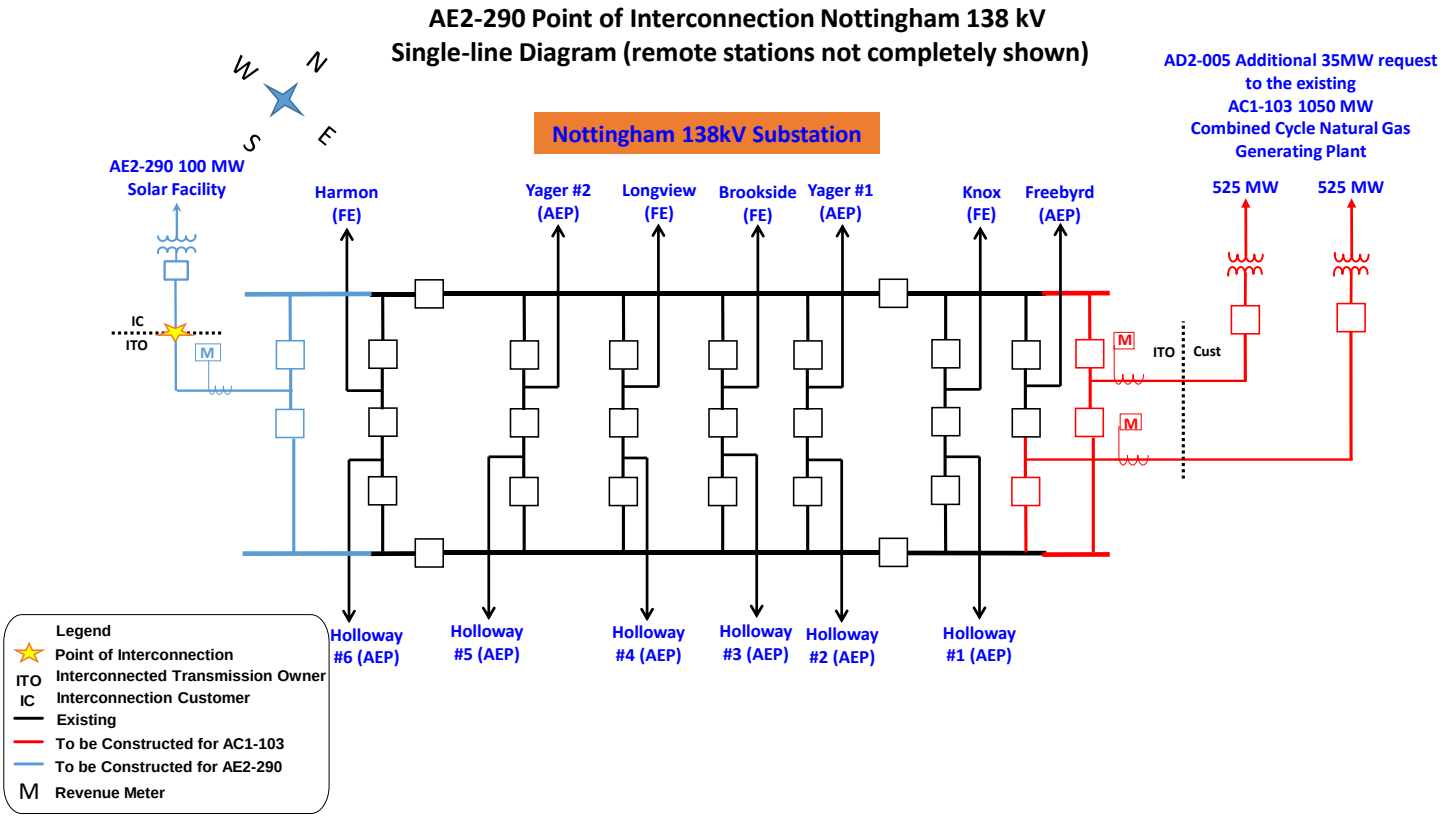
Cost Estimates for AEP

Task	Network Upgrade Number	Engineering	Material	Construction	Other	TOTAL
AE2-290 Gen-tie Line, Install	N7452	$150,045.67	$68,310.67	$260,077.67	$72,889.00	**$551,323.00**
Station Upgrade	N7453	$96,021.00	$434,078.00	$491,129.00	$223,410.00	**$1,244,638.00**
138 kV Revenue Metering	N7452	$27,254.67	$110,613.67	$71,662.67	$58,452.00	**$267,983.00**
Dual Fiber Telecom	N7452	$15,609.67	$24,328.67	$92,519.67	$32,907.00	**$165,365.00**
TOTAL		**$288,931.00**	**$637,331.00**	**$915,389.00**	**$387,658.00**	**$2,229,309.00**

2.9 Information Required for Interconnection Service Agreement

Description	DCF Facility	NUF Facility	ATF Facility	TOTAL
Direct Material	$434,078.00	$0.00	$203,253.00	**$637,331.00**
Direct Labor	$587,150.00	$0.00	$617,170.00	**$1,204,320.00**
Indirect Material	$94,961.52	$0.00	$47,308.56	**$142,270.09**
Indirect Labor	$128,448.48	$0.00	$116,939.44	**$245,387.91**
TOTAL	**$1,244,638.00**	**$0.00**	**$984,671.00**	**$2,229,309.00**

Figure 1: Point of Interconnection One-Line Diagram



The Point of Interconnection ("POI") is at the first (dead-end) structure outside (north-west) of the Nottingham 138 kV station fence. AEP owns the span from the Nottingham 138kV station to the Dead-end, including the jumpers and structure at the Dead-end. AE2-290 owns the span connecting to the POI, and the 138kV generator lead line and remaining structures back to the AE2-290 generation collector station.

Figure 2: Point of Interconnection Map

[Nottingham Station, 40.19618183, -81.03200401]