Generation Interconnection

Facilities Study Report

For

Queue Project AC2-059/AD1-072/AD2-016

Biers Run – Circleville 138 kV

Ross County, Ohio

274 MW Energy / 138.73 MW Capacity

July 2021

1 Facilities Study Summary

1.1 Project Description

The Interconnection Customer (IC) proposes to install PJM project AC2-059/AD1-072/AD2-016, a 274 MW (138.73 MW Capacity) Solar generating facility in Ross County, Ohio (Figure 2). The point of interconnection for the generating facility will be a new station cut into the Biers Run - Circleville 138 kV circuit. The IC has indicated they plan to elect the Option to Build (OTB) and will be responsible to construct the Direct Connection and Attachment Facilities, with AEP providing oversight of those activities.

1.2 Amendments/Changes to the Impact Study Report

During the engineering review, it was determined that the Harrison risers flagged in the System Impact Studies had been replaced as part of AEP Supplemental project s1665.2, and are adequate for these queue positions. In addition, following re-tools of the System Impact Study analysis, the need to replace a 600A switch at Harrison associated with the Harrison-Zuber 138 kV circuit, initially identified as overloaded in the AC2-queue, is now attributed to AD2-016.

1.3 Stability Study Results

Queue project AD1-072, does not meet the 0.95 lagging power factor requirement. An additional 35.2 Mvar would be required for the plant to meet the 0.95 lagging power factor requirement. The plant did meet the 0.95 leading power factor requirement.

Queue project AD2-016, does not meet the 0.95 lagging power factor requirement. An additional 59.10 Mvar would be required for the plant to meet the 0.95 lagging power factor requirement. The plant did meet the 0.95 leading power factor requirement.

1.4 Interconnection Customer Schedule

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

Receive back feed power from AEP: Q3 2022

Generation Commercial Operation Date: Q4 2022

1.5 AEP's Scope of Work to Facilitate Interconnection

- To accommodate the interconnection on the Biers Run – Circleville 138 kV circuit, AEP will provide oversight for the IC's construction of a new three (3) circuit breaker 138 kV station physically configured and operated as a ring bus will be constructed (Figure 1).
- AEP will provide oversight for the IC's installation of associated protection and control equipment, line risers, switches, jumpers, SCADA, and 138 kV revenue metering required at the proposed 138 kV station. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.
- AEP will own and provide oversight for the IC's extension of one span of 138 kV transmission line for the generation lead going to the AC2-059/AD1-072/AD2-016 site. This span will extend directly from within the AEP station to the adjacent IC collector station structure at the Point of Interconnection (POI, the point of change of ownership).
- AEP will review and revise (as needed) the remote end station protection schemes and settings.
- AEP will replace the 600A switch at Harrison associated with the Harrison-Zuber 138 kV circuit.

1.6 Description of Transmission Owner Facilities Included in the Facilities Study

1.6.1 Direct Connection Work

- To accommodate the interconnection on the Biers Run - Circleville 138 kV circuit, AEP will provide oversight for the IC's construction of a new three (3) circuit breaker 138 kV station physically configured and operated as a ring bus will be constructed (Figure 1).
- AEP will provide oversight for the IC's installation of associated line protection and control equipment, line risers, switches, jumpers, and SCADA at the proposed 138 kV station.

1.6.2 Non-Direct Connection Work

- AEP will construct 138 kV line extensions from the two (2) dead-end structures at the existing Right of Way of the Biers Run - Circleville circuit and perform final connection of the circuit to the new station.

- AEP will replace the 600A switch at Harrison associated with the Harrison-Zuber 138 kV circuit.
- AEP will review the protection and control settings at the Biers Run station and adjust as needed.
- AEP will review the protection and control settings at the Circleville station and adjust as needed.
- AEP will perform a protection and controls checkout including end-to-end testing.

1.6.3 Attachment Facilities Work

- Two fiber connections are required. AEP will own and provide oversight for the IC to extend the fiber-optic cables from the points of transition into the proposed 138 kV station control house. The customer will be responsible for the fiber work on the IPP side of the points of transition.
- AEP will own and provide oversight for the IC's installation of 138 kV revenue metering at the proposed 138 kV station.
- AEP will own and provide oversight for the IC's extension of one span of 138 kV transmission line for the generation lead going to the AC2-059/AD1-072/AD2-016 site. AEP will own and provide oversight for the IC to build the first transmission line structure outside of the proposed 138 kV station fence to which the AEP and AC2-059/AD1-072/AD2-016 transmission line conductors will attach.

1.6.4 Network Upgrade Work

Due to system overloads found during the PJM studies, the following network reinforcements are required:

- None

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

Attachment Facilities	$0
Direct Connection Facilities	$467,269.99
Non-Direct Connection Facilities	$1,089,569.00
Network Upgrade Facilities	$0
Total Cost	$1,556,839.99

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

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

Standard Process

Task	Dates
Engineering Start	Q4 2021
Material Ordered	Q1 2022
Construction Start (Grading & Below Grade)	Q2 2022
Construction Start (Above Grade)	Q3 2023
Outage Requests Made By	TBD
Outage (Structure Foundations)	TBD
Outage (Cut-in & Testing)	TBD
Ready For Back Feed (TO In-Service Date)	11/11/2023
In-Service Date	12/31/2023

Assumptions

- **The IC will elect the Option to Build.**
- **ISA and ICSA executed by 08/31/2021**
- **Estimates provided are based on a table top process without the benefit of the results of site specific engineering studies (e.g., soil borings, environmental survey, ground grid, etc.), unless otherwise provided by the interconnection customer.**
- **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 for this interconnection.**
- **The customer will provide a site acceptable to AEP (for transfer in Fee Simple) and any required additional easements for the 138 kV station and line work to enable access to all facilities and structures.**
- **The customer will have their construction and required checkout complete prior to the start of the interconnection to the proposed 138 kV station and any required testing outages.**
- **Mobile station hook up is not needed at this station for any future work as station is not designed for such hookup**
- **Proper long term storm water maintenance coordination occurs with adequate time to discuss with both parties**
- **Customer fence lines will be separate from the substation fencing**

Transmission Outage Plan

No transmission outage plan has been specified at this time.

Note that all 138 kV 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 own and provide oversight for the IC's extension of one span of 138 kV transmission line for the generation lead going to the AC2-059/AD1-072/AD2-016 site. This span will extend directly from within the AEP station to the adjacent IC collector station structure at the Point of Interconnection (POI, the point of change of ownership).
- Biers Run – Circleville 138 kV – AEP will construct 138 line extensions from the two(2) dead-end structures at the existing circuit Right of Way to the new AC2-059/AD1-072/AD2-016 138 kV interconnection station and perform final connection of the 138 kV circuit to the new station.
- IC will extend two (2) fiber-optic cables from the points of transition into the proposed 138 kV station control house. The customer will be responsible for the fiber work on the IPP side of the points of transition.

2.2 Transmission Line - Upgrades

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

2.3 Station Facilities - New

- A new 138 kV station will be established consisting of a three (3) circuit breaker ring bus that taps AEP's Biers Run - Circleville 138 kV circuit.
- Installation of associated protection and control equipment, line risers, switches, jumpers, SCADA, and 138 kV revenue metering will be required at the proposed 138 kV station. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

2.4 Station Facilities - Upgrades

- Protective relay settings at AEP's Biers Run and Circleville 138 kV remote end stations will need to be reviewed and updated (as needed) to coordinate with the proposed 138 kV station.
- AEP will replace the 600A switch at Harrison associated with the Harrison-Zuber 138 kV circuit.

2.5 Metering & Communications

Standard 138 kV metering will be installed at the proposed 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).

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 proposed 138 kV station.

2.7 System Modeling and 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:

- None

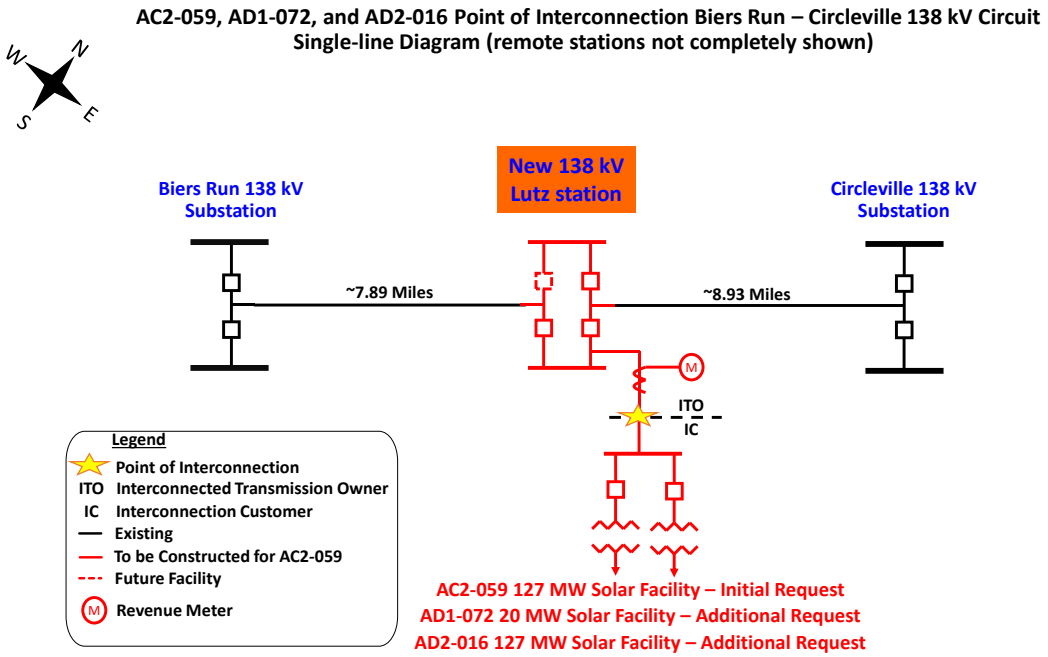
2.8 Summary of Results of Study

Task	Network Upgrade Number	Engineering	Material	Construction	Other	TOTAL
New 138 kV Station - Oversight	n7371	$66,004.33	$108,771.33	$187,737.33	$104,757.00	$467,269.99
Biers Run – Circleville 138 kV T-Line and Fiber Cut In	n7372	$143,611.00	$178,439.00	$374,231.00	$96,590.00	$792,871.00
Upgrade line protection and controls at the Biers Run 138 kV Station	n7373	$16,179.00	$6,073.00	$2,473.00	$20,124.00	$44,849.00
Upgrade line protection and controls at the Circleville 138 kV Substation	n7374	$16,179.00	$6,073.00	$2,473.00	$20,124.00	$44,849.00
Replace 600 A Line Disconnect Sw on Zuber circuit at Harrison 138 kV station	n6263.2	$23,333.33	$46,333.33	$106,333.34	$31,000.00	$207,000.00
TOTAL		$265,306.66	$345,689.66	$673,247.66	$272,595.00	$1,556,838.99

2.9 Information Required for Interconnection Service Agreement

Description	DCF Facility	NUF Facility	ATF Facility	TOTAL
Direct Material	$108,771.33	$236,918.33	$0.00	$345,689.66
Direct Labor	$253,741.66	$684,812.67	$0.00	$938,554.33
Indirect Material	$25,807.24	$42,162.02	$0.00	$67,969.26
Indirect Labor	$78,949.76	$125,675.98	$0.00	$204,625.74
TOTAL	$467,269.99	**$1,089,569.00**	$0.00	$1,556,838.99

Figure 1: Point of Interconnection One-Line Diagram



The Point of Interconnection is the first structure outside of AEP's proposed Lutz 138 kV station (such structure being located in Interconnection Customer's 34.5-138 kV Collector Substation) with the Interconnected Transmission Owner owning the first span of conductors, and the Interconnection Customer owning the first structure.

Figure 2: Point of Interconnection Map