Generation Interconnection
Facilities Study Report
For
Queue Project AC2-061
Hillsboro - Clinton County 138 kV
Highland County, Ohio
117 MW Energy / 58.1 MW Capacity

March 2022

1 Facilities Study Summary

1.1 Project Description

The Interconnection Customer, Dodson Creek Solar, LLC, proposes to install PJM project AC2-061, a 117 MW (58.1 MW Capacity) Solar generating facility in Highland County, Ohio (Figure 2). The Point of Interconnection (POI) for the generating facility will be a new station (Spickard 138 kV Station) cut into the Hillsboro - Clinton County (Duke) section of the Hillsboro - Warren (Duke) 138 kV circuit (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 requested the following schedule dates:

Receive back feed power from AEP: Q3 2022

Generation Commercial Operation Date: Q4 2022

Acknowledgment of the Interconnection Customer's requested back feed and commercial operation dates does not imply AEP's commitment to or guarantee of these dates.

1.4 AEP's Scope of Work to Facilitate Interconnection

- The Hillsboro - Clinton County (Duke) section of the Hillsboro - Warren (Duke) 138 kV circuit will be tapped by constructing a new three (3) circuit breaker 138 kV station, Spickard 138 kV Station, physically configured and operated as a ring bus (Figure 1). Planned circuit breaker ratings are 3000 A, 40 kA, 3~.
- Associated protection and control equipment, line risers, switches, jumpers, SCADA, and 138 kV revenue metering will also be installed at the proposed Spickard 138 kV Station. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.
- AEP will install two (2) new dead end structures in the existing Hillsboro - Clinton County (Duke) section of the Hillsboro - Warren (Duke)/Hutchings (Dayton) 138 kV double circuit Right of Way between Structures #64 & #65. One (1) structure is planned to be a steel, double circuit monopole dead end and will support both circuits in the double circuit ROW to control blowout of the adjacent Hillsboro-Hutchings 138 kV circuit. The other structure is planned to be a steel single circuit monopole dead end. One (1) span of transmission line will be extended from each dead end structure to the proposed Spickard 138 kV Station in an in-and-out arrangement. OPGW shield wire will also be strung between the northerly cut-in dead end structure and existing structure #64 to the northwest.

- Existing OPGW shield wire in the existing Hillsboro - Clinton County (Duke) section of the Hillsboro - Warren (Duke)/Hutchings (Dayton) 138 kV double circuit Right of Way will be cut between Structures #64 & #65 to extend fiber-optic cable connectivity to the proposed new Spickard 138 kV Station. Connectivity will be accomplished via underground fiber-optic cable. Fiber connectivity at the Spickard 138 kV Station will support both relaying and SCADA communication.
- AEP will extend one (1) span of 138 kV transmission line for the generation lead going to the AC2-061 site. The aerial bus tie will connect from a dead end structure inside the proposed Spickard 138 kV Station to a dead end structure inside the adjacent customer owned collector station.
- AEP will replace the existing Hillsboro 138 kV Station remote end line protective relays with new fiber based current differential relays. Associated fiber-optic network connectivity will also be installed to support the new line relays.
- AEP will upgrade the fiber-optic cable connectivity at the Highland 138 kV Station by replacing an existing 40km SFP with a new 1G 10km SFP in the existing station CES.
- Two (2) fiber-optic cable connections to the AC2-061 collector station are required to support redundant direct fiber relaying. AEP will extend two (2) underground fiber-optic cables via diverse paths from the proposed Spickard 138 kV Station control house to the POI. The Interconnection Customer will be responsible for the fiber work on the IPP side of the POI.
- AEP will coordinate with Duke to support the Duke review and changes (as needed) of Duke protection systems at Clinton County and Warren stations.

1.5 Description of Transmission Owner Facilities Included in the Facilities Study

1.5.1 Direct Connection Work

- The Hillsboro - Clinton County (Duke) section of the Hillsboro - Warren (Duke) 138 kV circuit will be tapped by constructing a new three (3) circuit breaker 138 kV station, Spickard 138 kV Station, physically configured and operated as a ring bus (Figure 1). Planned circuit breaker ratings are 3000 A, 40 kA, 3~.
- AEP will install associated line protection and control equipment, line risers, switches, jumpers, and SCADA at the proposed Spickard 138 kV Station. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

1.5.2 Non-Direct Connection Work

- AEP will install two (2) new dead end structures in the existing Hillsboro - Clinton County (Duke) section of the Hillsboro - Warren (Duke) 138 kV double circuit Right of Way between Structures #64 & #65. One (1) structure is planned to be a steel, double circuit monopole dead end and will support both circuits in the double circuit ROW to control blowout. The other structure is planned to be a steel single circuit monopole dead end. One (1) span of transmission line will be extended from each dead end structure to the proposed Spickard 138 kV Station in an in-and-out arrangement. OPGW shield wire will also be strung between the northerly cut-in dead end structure and existing structure #64 to the northwest.

- Existing OPGW shield wire in the existing Hillsboro - Clinton County (Duke) section of the Hillsboro - Warren (Duke) 138 kV double circuit Right of Way will be cut between Structures #64 & #65 to extend fiber-optic cable connectivity to the proposed new Spickard 138 kV Station. Connectivity will be accomplished via underground underground fiber-optic cable. Fiber connectivity at the Spickard 138 kV Station will support both relaying and SCADA communication.
- AEP will replace the existing Hillsboro 138 kV Station remote end line protective relays with new fiber based current differential relays. Associated fiber-optic network connectivity will also be installed to support the new line relays.
- AEP will upgrade the fiber-optic cable connectivity at the Highland 138 kV Station by replacing an existing 40km SFP with a new 1G 10km SFP in the existing station CES.
- AEP will coordinate with Duke to support the Duke review and changes (as needed) of Duke protection systems at Clinton County and Warren stations.
- AEP will perform a protection and controls checkout including end-to-end testing.

1.5.3 Attachment Facilities Work

- Two (2) fiber-optic connections to the AC2-061 collector station are required to support redundant direct fiber relaying. AEP will extend two (2) underground fiber-optic cables via diverse paths from the proposed Spickard 138 kV Station control house to the POI. The Interconnection Customer will be responsible for the fiber work on the IPP side of the POI.
- AEP will install 138 kV revenue metering at the proposed Spickard 138 kV Station.
- AEP will extend one (1) span of 138 kV transmission line for the generation lead going to the AC2-061 site. The aerial gen tie will connect from a dead end structure inside the proposed Spickard 138 kV Station to a dead end structure inside the adjacent customer owned collector station.

1.5.4 Network Upgrade Work

Due to system overloads found during the PJM studies, the following network reinforcements are driven by this project:

- None

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

Attachment Facilities	$571,557.97
Direct Connection Facilities	$4,921,559.01
Non-Direct Connection Facilities	$1,247,310.00
Network Upgrade Facilities	$
Total Cost	$6,740,426.98

The estimates do not include the impact that delays in obtaining ROW, permits, or other approvals may have. AEP estimates do not include Duke review and changes (as needed) of Duke protection systems at Clinton County and Warren stations.

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

Typical Schedule for Scope Indicated (Actual schedule to be determined at PJM project kick off meeting)

Task	Dates(See Notes)
Engineering Start	Day 1*
Material Ordering	Starts Day 30
Construction Start (Grading & Below Grade)	Starts Day 356
Construction Start (Above Grade)	Starts Day 416
Outage Requests Made By	Day 144
Outage (Structure Foundations)**	Starts Day 356
Outage (Cut-in & Testing)**	Starts Day 515
Ready For Back Feed (Interconnected Transmission Owner In-Service Date)	Day 545

***Day 1 will be determined at the PJM kick off meeting.**

****Scheduled outages are contingent upon outage availability. Longer duration outages are not available during peak load periods.**

Notes Regarding the Schedule

- **All transmission outages are subject to PJM and Interconnected Transmission Owner outage scheduling requirements.**
- **Significant scope of work changes will impact the schedule.**

Assumptions

- **Slippage by the customer / developer in executing the ISA and ICSA agreements does not equate to a "day for day" slippage in the scheduled back feed and in service dates. Depending on the time of year, planned outages, neighboring projects and maintenance of the grid, outage availably has the potential to shift by weeks or months depending on conditions at the time of the fully executed agreement.**
- **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.**
- **All transmission outages are subject to PJM and AEP Operations outage scheduling requirements.**
- **The Interconnection Customer will obtain, at its cost, all necessary provisions for the AEP direct connection facilities.**
- **The Interconnection Customer will perform site development and road construction in accordance with AEP specifications as required for this interconnection.**
- **The Interconnection Customer will provide a site acceptable to AEP (for transfer in Fee Simple) and any required easements for the Spickard 138 kV Station and line work to enable access to all facilities and structures.**
- **The proposed Spickard 138 kV Station interconnecting AC2-061 will be located in close proximity to the existing Hillsboro - Clinton County (Duke) section of the Hillsboro - Warren (Duke) 138 kV Right of Way.**
- **The Interconnection Customer will have their construction and required checkout completed prior to the start of the interconnection to the proposed Spickard 138 kV Station and any required testing outages.**
- **Access road will be shared and AEP will be responsible for road construction around Spickard Station.**
- **Additional ROW will NOT be needed for cut into the existing Hillsboro - Clinton County (Duke) 138kV line section**
- **P&C coordination with the Interconnection Customer will be needed throughout the project. IPP to install AEP-compatible line relaying protection panel at IPP station using AEP standards to ensure relaying coordination and adequate line protection. Design team to ensure firmware at IPP terminal matches the approved firmware at the AEP terminal. Failure to accept cost of matching line relay panel may change scoping.**

2 Transmission Owner Facilities Study Results

2.1 Transmission Lines - New

- AEP will extend one (1) span of 138 kV transmission line for the generation lead going to the AC2-061 site. The aerial gen tie will connect from a dead end structure inside the proposed Spickard 138 kV Station to a dead end structure inside the adjacent customer owned collector station.
- AEP will install two (2) new dead end structures in the existing Hillsboro - Clinton County (Duke) section of the Hillsboro - Warren (Duke) 138 kV double circuit Right of Way between Structures #64 & #65. One (1) structure is planned to be a steel, double circuit monopole dead end and will support both circuits in the double circuit ROW to prevent blowout problems. The other structure is planned to be a steel single circuit monopole dead end. One (1) span of transmission line will be extended from each dead end structure to the proposed Spickard 138 kV Station in an in-and-out arrangement. OPGW shield wire will also be strung between the northerly cut-in dead end structure and existing structure #64 to the northwest.

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, Spickard 138 kV Station, will be established consisting of a 3-breaker ring bus loop fed by tapping AEP's Hillsboro - Clinton County (Duke) section of the Hillsboro - Warren (Duke) 138 kV circuit. Planned circuit breaker ratings are 3000 A, 40 kA, 3~.
- Associated protection and control equipment, line risers, switches, jumpers, SCADA, and 138 kV revenue metering will also be installed at the proposed Spickard 138 kV Station. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.
- AEP will perform a protection and controls checkout including end-to-end testing.

2.4 Station Facilities - Upgrades

- AEP will replace the existing Hillsboro 138 kV Station remote end line protective relays with new fiber based current differential relays. Associated fiber-optic network connectivity will also be installed to support the new line relays.
- AEP will coordinate with Duke to support the Duke review and changes (as needed) of Duke protection systems at Clinton County and Warren stations.

2.5 Metering & Communications

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

Two (2) fiber-optic connections to the AC2-061 collector station are required to support redundant direct fiber relaying. AEP will extend two (2) underground fiber-optic cables via diverse paths from the proposed Spickard 138 kV Station control house to the POI. The Interconnection Customer will be responsible for the fiber work on the IPP side of the POI.

Existing OPGW shield wire in the existing Hillsboro - Clinton County (Duke) section of the Hillsboro - Warren (Duke) 138 kV double circuit Right of Way will be cut between Structures #64 & #65 to extend fiber-optic cable connectivity to the proposed new Spickard 138 kV Station. Connectivity will be accomplished via underground fiber-optic cable. Fiber connectivity at the Spickard 138 kV Station will support both relaying and SCADA communication.

AEP will upgrade the fiber-optic cable connectivity at the Highland 138 kV Station by replacing an existing 40km SFP with a new 1G 10km SFP in the existing station CES.

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 is installed. The metering work described above and the 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. This is required 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 proposed Spickard 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:

- Modeling parameters are required as outlined in the 'Connection Requirements for the AEP Transmission System.' These requirements can be accessed at: https://aep.com/requiredpostings/AEPTransmissionStudies

2.8 Summary of Results of Study

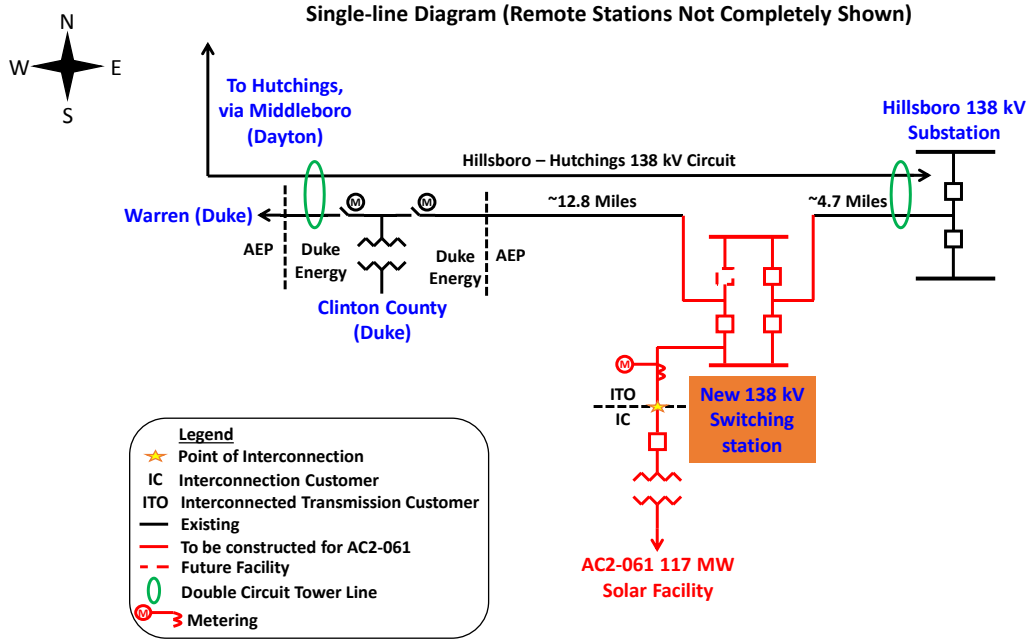
Task	Network Upgrade Number	Engineering	Material	Construction	Other	TOTAL
New Spickard 138 kV Station	**N6634.7**	$657,680.67	$1,879,250.67	$1,969,667.67	$414,960.00	$4,921,559.01
Hillsboro-Clinton County T-Line and Fiber Cut In	**N6634.8**	$152,701.00	$241,189.00	$449,939.00	$113,709.00	$957,538.00
138 kV Revenue Metering	**N6634.6**	$67,788.33	$118,342.33	$127,253.33	$42,650.00	$356,033.99
Upgrade line protection & fiber connectivity at Hillsboro 138kV Station	**N6634.9**	$25,271.67	$95,464.67	$95,070.67	$59,317.00	$275,124.01
Highland Station Telecom Upgrades	**N6634.10**	$5,207.33	$1,522.33	$1,127.33	$6,791.00	$14,647.99
IPP Gen-tie Fiber	**N6634.6**	$25,891.33	$23,602.33	$90,359.33	$22,531.00	$162,383.99
IPP Gen-tie	**N6634.6**	$9,671.33	$6,800.33	$23,150.33	$13,518.00	$53,139.99
TOTAL		$944,211.66	$2,366,171.66	$2,756,567.66	$673,476.00	**$6,740,426.98**

2.9 Information Required for Interconnection Service Agreement

Description	DCF Facility	NUF Facility	ATF Facility	TOTAL
Direct Material	$1,879,250.67	$338,176.00	$148,744.99	$2,366,171.66
Direct Labor	$2,627,348.34	$729,317.00	$344,113.98	$3,700,779.32
Indirect Material	$167,548.23	$58,897.70	$22,228.35	$248,674.28
Indirect Labor	$247,411.77	$120,919.30	$56,470.65	$424,801.72
TOTAL	$4,921,559.01	$1,247,310.00	$571,557.97	**$6,740,426.98**

Figure 1: Point of Interconnection One-Line Diagram

AC2-061 Point of Interconnection Hillsboro – Clinton County section of the Hillsboro – Warren 138 kV Circuit
Single-line Diagram (Remote Stations Not Completely Shown)



The Point of Interconnection is the first structure outside of AEP's proposed Spickard 138 kV Station (such structure being the station dead end structure located inside the Interconnection Customer's Collector Substation). The Interconnected Transmission Owner will own the span of conductors from the proposed Spickard 138 kV Station to the Interconnection Customer Collector Station dead end structure, with the Interconnection Customer owning said dead end structure.

Figure 2: Point of Interconnection Map