Generation Interconnection
Facilities Study Report
For
Queue Project AC2-060/AD1-073
Buckskin 69 kV
Ross County, Ohio
120 MW Energy / 77.2 MW Capacity

February 2022

1 Facilities Study Summary

1.1 Project Description

The Interconnection Customer, Ross County Solar, LLC, proposes to install PJM project AC2-060/AD1-073, a 120 MW (77.2 MW Capacity) Solar generating facility in Ross County, Ohio (Figure 2). The Point of Interconnection (POI) for the generating facility will be a direct connection to the Buckskin 69 kV Station (Figure 1).

1.2 Amendments/Changes to the Impact Study Report

The planned Buckskin expansion and AC2-060/AD1-073 connection topology have been adjusted to reflect the withdrawal of the AC2-055 queue request.

No mitigations were found to be required due to instability; however, it was observed that AC2-060 plant is deficient in lagging power factor requirement by 24.21 MVAr. This may need to be addressed through reactive power compensation.

No mitigations were found to be required due to instability; however, it was found that the reactive power capability of AD1-073 meets the 0.95 leading PF requirement whereas it does NOT meet the 0.95 lagging PF requirement at the high side of the main transformer.

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: 11/1/2023

Generation Commercial Operation Date: 12/31/2023

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 Buckskin 69 kV Station will be expanded by installing one (1) new circuit breaker (CB “B”) with a planned rating of 3000 A, 40 kA, 3~.
- AEP will also re-terminate the Buckskin - Highland 69 kV circuit from the “A” string to the “B” string in between circuit breakers A2 and the new B. To facilitate the retermination, the first two structures outside the Buckskin fence will be replaced and relocated. The first structure to the west of Buckskin on the Highland circuit will be replaced and repositioned by a new steel single circuit single pole dead end. The second structure in the Highland circuit, adjacent to the southwest corner of the station, will be replaced with a steel double circuit single pole structure to be shared by both the Highland circuit and a portion of the AC2-060/AD1-073 generation lead. AEP is using this shared double circuit structure to minimize impact on the landowner to the west of the Buckskin Station.

- AEP will extend three spans of 69 kV transmission line for the generation lead going to the AC2-060/AD1-073 site, starting from the CB "A"/"A2" bay position vacated by the re-terminated Buckskin - Highland 69 kV circuit. AEP will build and own the first three transmission line structures outside of the Buckskin Station fence. The AEP and AC2-060/AD1-073 transmission line conductors will attach to the final AEP-owned structure. The first and third structures will be new steel single circuit monopole dead end structures. The second structure will be the new double circuit single pole dead end being installed for the Buckskin - Highland 69 kV circuit re-termination.
- Associated protection and control equipment, line risers, switches, jumpers, SCADA, and 69 kV revenue metering will also be installed at the Buckskin 69 kV Station. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.
- AEP will reroute 0.2 miles of existing Buckskin Station - Highland Station Fiber-optic Cable to follow the relocated Buckskin - Highland 69kV Line into the Buckskin Station.
- Two (2) diverse fiber-optic cable paths to the AC2-060/AD1-073 collector station are required for direct fiber relaying and RTU connectivity. AEP will extend two (2) fiber-optic cables from the Buckskin 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 perform a protection and controls checkout including end-to-end testing.
- It is understood that the Interconnection Customer is responsible for all of the connection costs associated with interconnecting the PJM project AC2-060/AD1-073 to the AEP transmission system. The cost of the Interconnection Customer's generating facility is not included in this report. Those costs are assumed to be the Interconnection Customer's responsibility.

1.5 Description of Transmission Owner Facilities Included in the Facilities Study

1.5.1 Direct Connection Work

- No Direct Connection work will be required for this project.

1.5.2 Non-Direct Connection Work

- The Buckskin 69 kV Station will be expanded by installing one (1) new circuit breaker (CB "B") with a planned rating of 3000 A, 40 kA, 3~.
- AEP will also re-terminate the Buckskin - Highland 69 kV circuit from the "A" string to the "B" string in between circuit breakers A2 and the new B. To facilitate the retermination, the first two structures outside the Buckskin fence will be replaced and relocated. The first structure to the west of Buckskin on the Highland circuit will be replaced and repositioned by a steel single circuit single pole dead end. The second structure in the Highland circuit, adjacent to the southwest corner of the station, will be replaced by a steel double circuit single pole structure to be shared by both the Highland circuit and a portion of the AC2-060/AD1-073 generation lead.
- Associated protection and control equipment, line risers, switches, jumpers, and SCADA will also be installed at the Buckskin 69 kV Station. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.
- AEP will reroute 0.2 miles of existing Buckskin Station - Highland Station Fiber-optic Cable to follow the relocated Buckskin - Highland 69kV circuit into the Buckskin Station.
- AEP will perform a protection and controls checkout including end-to-end testing.

1.5.3 Attachment Facilities Work

- AEP will extend three (3) spans of 69 kV transmission line for the generation lead going to the AC2-060/AD1-073 site, starting from the CB "A"/"A2" bay position vacated by the re-terminated Buckskin - Highland 69 kV circuit. AEP will build and own the first three transmission line structures outside of the Buckskin Station fence. The AEP and AC2-060/AD1-073 transmission line conductors will attach to the final AEP-owned structure. The first and third structures will be new steel single circuit monopole dead end structures. The second structure will be the new double circuit single pole dead end being shared with the Buckskin - Highland 69 kV circuit re-termination.
- AEP will install 69 kV revenue metering at the Buckskin 69 kV Station.
- Two (2) diverse fiber-optic cable paths to the AC2-060/AD1-073 collector station are required for direct fiber relaying and RTU connectivity. AEP will extend two (2) fiber-optic cables from the Buckskin 69 kV Station control house to the AEP/IPP fiber-optic cable POI. The Interconnection Customer will be responsible for the fiber work on the IPP side of the POI.

1.5.4 Network Upgrade Work

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

- None

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

Attachment Facilities	$1,024,466.01
Direct Connection Facilities	$0.00
Non-Direct Connection Facilities	$1,531,151.00
Network Upgrade Facilities	$0
Total Cost	$2,555,617.01

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: Typical Schedule for Scope Indicated (Actual schedule to be determined at kick off)

Task	Dates(See Notes)
Engineering Start	Day 1*
Material Ordered	Day 30
Construction Start (Grading & Below Grade)	Day 376
Construction Start (Above Grade)	Day 436
Outage Requests Made By	Day 154
Outage (Structure Foundations)**	Day 376
Outage (Cut-in & Testing)**	Day 535
Ready For Back Feed (TO In-Service Date)	Day 585

***Day 1 occurs on the first working day after the ISA/ICSA have been fully executed or a mutually agreed upon start date that is later and meets the requested back feed date. Day 1 will generally not be before the PJM project kick off meeting.**
****Scheduled Outages are contingent upon outage availability. Longer duration outages are not available during peak load periods.**

Notes Regarding the Schedule

- **Slippage by the customer / developer in executing the ISA and ICSA agreement 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 availability has the potential to shift by weeks or months depending on conditions at the time of the fully executed agreement.**
- **System conditions must allow scheduled outages to occur.**
- **All transmission outages are subject to PJM and AEP Operations outage scheduling requirements.**
- **Significant scope of work changes will impact the schedule.**

Scope Assumptions

- **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.**
- **The Interconnection Customer will provide any required additional easements to all facilities and structures.**
- **The Interconnection Customer will have their construction and required checkout completed prior to the start of the interconnection to the Buckskin Station and any required testing outages.**
- **P&C coordination with the Interconnection Customer will be needed throughout the project. Functional scope includes for the Interconnection Customer to install an AEP line relaying protection panel at the generation collector station using AEP standards to ensure relay coordination and adequate line protection.**
- **Buckskin 69 kV is already connected to the AEP Fiber-optic network**
- **No ROW constraints will pose design challenges to combining the AEP Buckskin - Highland 69 kV circuit on the southwest double circuit structure with the tie line to the Interconnection Customer.**

2 Transmission Owner Facilities Study Results

2.1 Transmission Lines - New

- AEP will extend three (3) spans of 69 kV transmission line for the generation lead going to the AC2-060/AD1-073 site, starting from the CB "A"/"A2" bay position vacated by the re-terminated Buckskin - Highland 69 kV circuit. AEP will build and own the first three transmission line structures outside of the Buckskin Station fence. The AEP and AC2-060/AD1-073 transmission line conductors will attach to the final AEP-owned structure. The first and third structures will be new steel single circuit monopole dead end structures. The second structure will be the new double circuit single pole dead end being installed for the Buckskin - Highland 69 kV circuit re-termination.

2.2 Transmission Line - Upgrades

- AEP will re-terminate the Buckskin - Highland 69 kV circuit from the "A" string to the "B" string between circuit breakers A2 and the new B. To facilitate the retermination, the first two structures outside the Buckskin fence will be replaced and relocated. The first structure to the west of Buckskin on the Highland circuit will be replaced and repositioned by a new steel single circuit single pole dead end. The second structure in the Highland circuit, adjacent to the southwest corner of the station, will be replaced with a steel double circuit single pole structure to be shared by both the Highland circuit and a portion of the AC2-060/AD1-073 generation lead. AEP is using this shared double circuit structure to minimize impact on the landowner to the west of the Buckskin Station.

2.3 Station Facilities - New

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

2.4 Station Facilities - Upgrades

- The Buckskin 69 kV Station will be expanded by installing one (1) new circuit breaker (CB "B") with a planned rating of 3000 A, 40 kA, 3~ to reterminate the Buckskin - Highland 69 kV circuit.
- The AC2-060/AD1-073 generator lead will be terminated in the position previously occupied by the Highland circuit.
- Installation of associated protection and control equipment, line risers, switches, jumpers, SCADA, and 69 kV revenue metering will be required at the Buckskin 69 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.

2.5 Metering & Communications

Standard 69 kV metering will be installed at the Buckskin 69 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 cable connections to the AC2-060/AD1-073 collector station are required for direct fiber relaying and RTU connectivity. AEP will extend two (2) fiber-optic cables from the Buckskin 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 reroute 0.2 miles of existing Buckskin Station - Highland Station Fiber-optic Cable to follow the relocated Buckskin - Highland 69kV Line into the Buckskin Station.

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 Buckskin 69 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

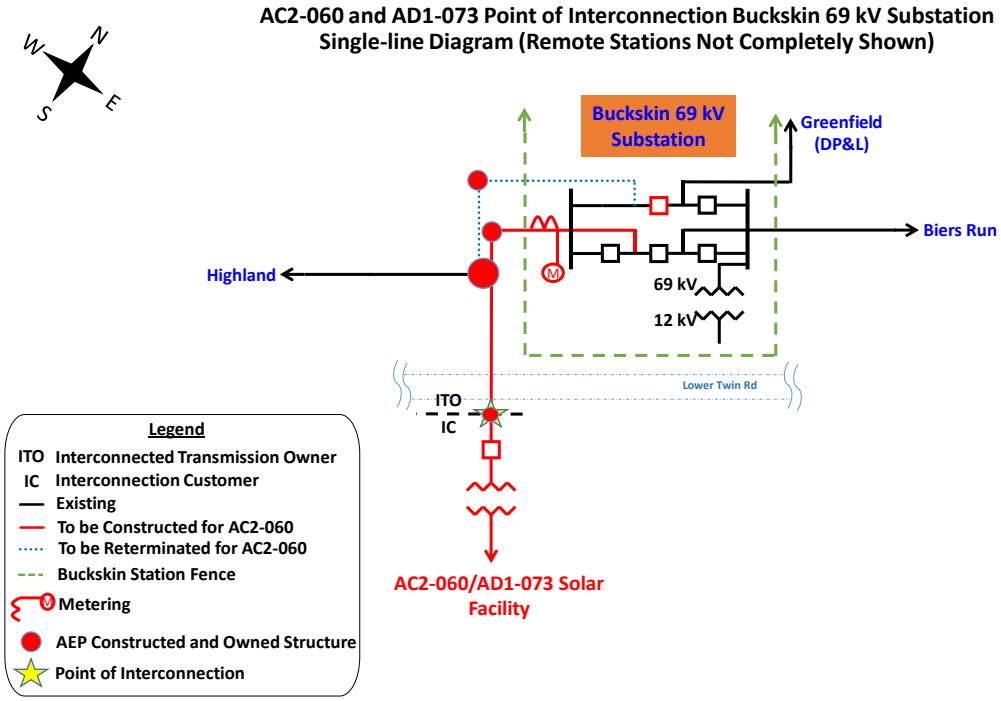
2.8 Summary of Results of Study

Task	Network Upgrade Number	Engineering	Material	Construction	Other	TOTAL
Buckskin 69 kV Station Upgrades including IPP and new Highland 69 kV line Internal Station Terminations and one (1) new circuit breaker	**N8035.2**	$153,885.67	$191,305.67	$239,294.67	$128,317.00	$712,803.01
69 kV Revenue Metering	**N8035.1**	$68,195.67	$99,909.67	$113,319.67	$52,830.00	$334,255.01
Buckskin - Highland T-line Re-termination External Station Associated Work, including two (2) structures, including one (1) double circuit structure	**N8035.3**	$114,823.33	$121,680.33	$402,542.33	$179,302.00	$818,347.99
Attachment Line - three (3) spans and two (2) structures outside the Buckskin Station	**N8035.1**	$85,237.00	$106,968.00	$289,302.00	$68,641.00	$550,148.00
AC2-060/AD1-073 Gen-tie Fiber-optic Cable	**N8035.1**	$19,079.00	$21,774.00	$77,456.00	$21,754.00	$140,063.00
TOTAL		$441,220.67	$541,637.67	$1,121,914.67	$450,844.00	**$2,555,617.01**

2.9 Information Required for Interconnection Service Agreement

Description	DCF Facility	NUF Facility	ATF Facility	TOTAL
Direct Material	$0.00	$312,986.00	$228,651.67	$541,637.67
Direct Labor	$0.00	$910,546.00	$652,589.33	$1,563,135.34
Indirect Material	$0.00	$74,052.93	$37,698.97	$111,751.90
Indirect Labor	$0.00	$233,566.07	$105,526.03	$339,092.10
TOTAL	$0.00	$1,531,151.00	$1,024,466.01	**$2,555,617.01**

Figure 1: Point of Interconnection One-Line Diagram



The Point of Interconnection (POI) is the third structure in the generation lead transmission circuit outside of AEP's Buckskin Station fence. The Interconnected Transmission Owner (AEP) will own the three (3) spans from the Buckskin Station to the third AEP constructed and owned dead end structure, including the jumpers. The Interconnection Customer, Ross County Solar, LLC, will own the other span connecting to the POI structure from the Collector Substation side, along with the remainder of the 69 kV generator lead transmission line, and associated structures, back to the AC2-060/AD1-073 generation Collector Substation.

Figure 2: Point of Interconnection Map