Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AD1-073

Buckskin 69kV

April 2018

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. 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 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.

General

The Interconnection Customer (IC) proposes to increase the generation of its previous PJM Project #AC2-060, a 100.0 MW (64.0 MW Capacity) solar generating facility in Ross County, Ohio by 20.0 MW (13.2 MW Capacity) (see Figure 1). The point of interconnection is a direct connection to AEP's Buckskin 69 kV substation.

The requested in service date is June 1, 2020.

Attachment Facilities

To be constructed by PJM Project #AC2-060.

Note: It is assume that the 69 kV revenue metering and gen lead installed for the #AC2-060 will be adequate for the additional generation.

Interconnection Customer Requirements

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.

Requirement from the PJM Open Access Transmission Tariff:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 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.

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

Revenue Metering and SCADA Requirements

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 Sections 24.1 and 24.2.

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

Network Impacts

The Queue Project AD1-073 was evaluated as a 20.0 MW (Capacity 13.2 MW) uprate to the AC2-060 Queue Project which is a direct connection to the Buckskin substation in the AEP area. Project AD1-073 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-073 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2021

Contingency Descriptions

The following contingencies resulted in overloads:

Option 1	
Contingency Name	**Description**
DAY_P1_1339_B3	OPEN BRANCH FROM BUS 253100 TO BUS 253099 CKT 1 / 253100 09ATLNTA 345 253099 09ATLNTA 69.0 1 END
DAY_P1_160_B3	OPEN BRANCH FROM BUS 253110 TO BUS 253100 CKT 1 / 253110 09ADKINS 345 253100 09ATLNTA 345 1 OPEN BRANCH FROM BUS 253100 TO BUS 253099 CKT 1 / 253100 09ATLNTA 345 253099 09ATLNTA 69.0 1 END

Table 1

Generator Deliverability

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

AD1-073 Generator Deliverability														
	Contingency		Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.*
1	N-1	DAY_P1_1339_B3	AEP-DAY	AC2-020 TAP-09GRNFLD 69 kV line	932130	253030	1	DC	97.07	102.44	ER	72	3.87	1
2	N-1	DAY_P1_160_B3	AEP-DAY	AC2-020 TAP-09GRNFLD 69 kV line	932130	253030	1	DC	96.88	102.25	ER	72	3.87	1

Table 2

*Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

Multiple Facility Contingency

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

None

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

Steady-State Voltage Requirements

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

Affected System Analysis & Mitigation

LGEE Impacts:

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

MISO Impacts:

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

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

OVEC Impacts:

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

Delivery of Energy Portion of Interconnection Request

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.

Only the most severely overloaded conditions are listed. 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 will study all overload conditions associated with the overloaded element(s) identified.

AD1-073 Generator Deliverability														
	Contingency		Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	N-1	DAY_P1_1339_B3	DAY-DAY	AC2-020 TAP-09GRNFLD 69 kV line	932130	253030	1	DC	149.42	157.56	ER	72	5.86	
2	NON	NON	DEO&K-DEO&K	AC2-061 TAP-08CLINCO 138 kV line	932430	249995	1	DC	99.86	100.16	ER	159	1.04	

Table 3

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

Generator Deliverability:

1. (AEP - DAY) The AC2-020 TAP-09GRNFLD 69 kV line (from bus 932130 to bus 253030 ckt 1) loads from 97.07% to 102.44% (DC power flow) of its emergency rating (72 MVA) for the single line contingency outage of 'DAY_P1_1339_B3'. This project contributes approximately 3.87 MW to the thermal violation.

AEP:

No mitigation is required

DAY:

Replace 600A circuit breaker at Greenfield Substation with a new 1200A circuit breaker.

Cost: $630,000; Time: 12 months to engineer, procure, construct, and place in service, subject to detailed engineering analysis

2. (AEP - DAY) The AC2-020 TAP-09GRNFLD 69 kV line (from bus 932130 to bus 253030 ckt 1) loads from 96.88% to 102.25% (DC power flow) of its emergency rating (72 MVA) for the single line contingency outage of 'DAY_P1_160_B3'. This project contributes approximately 3.87 MW to the thermal violation.

Same as Generator Deliverability #1

Previous System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)

None

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 be between 24 to 36 months after signing an interconnection agreement.

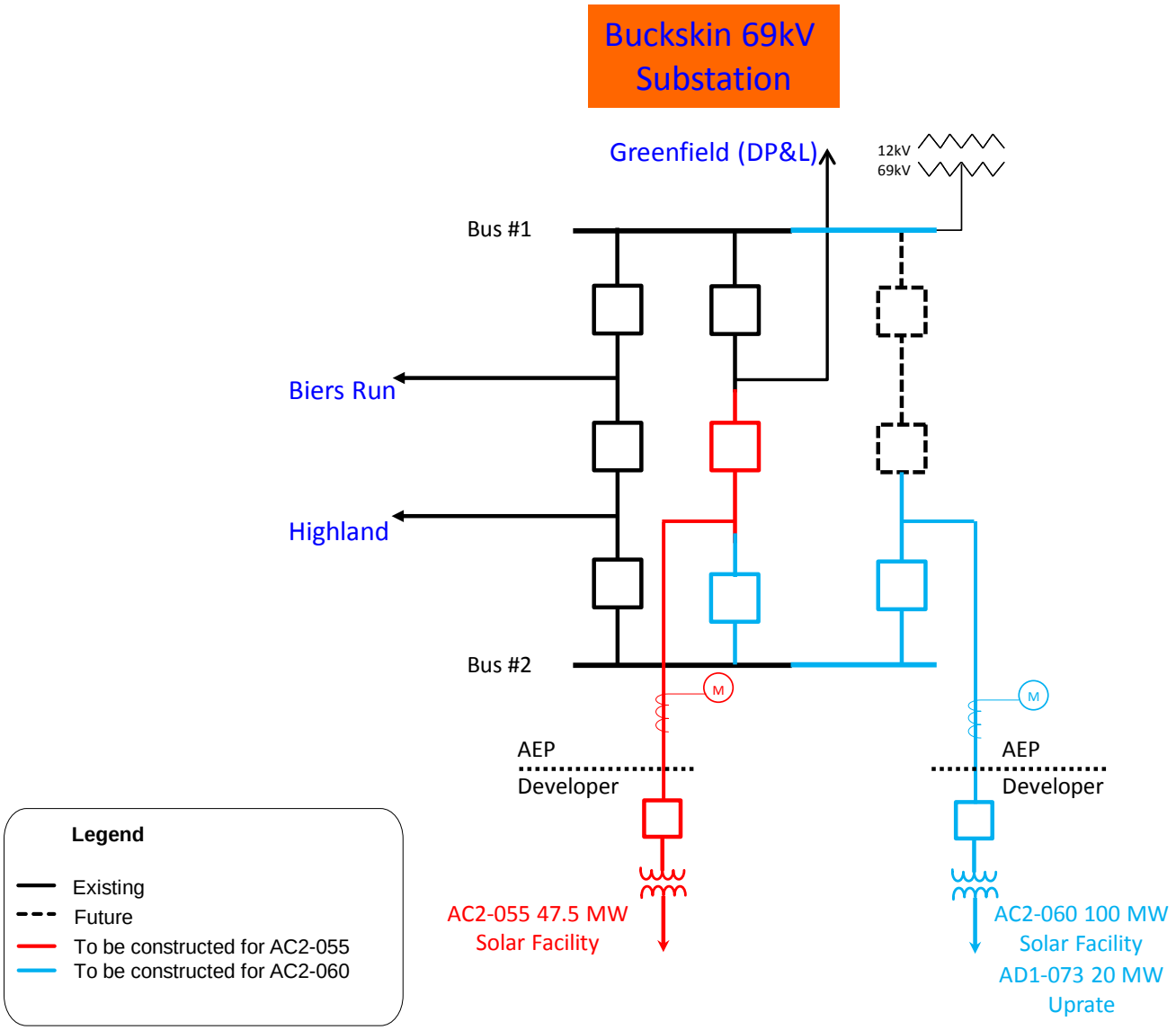
Note: The time provided between anticipated normal completion of System Impact, Facilities Studies, subsequent execution of ISA and ICSA documents, and the proposed In-Service Date is shorter than usual and may be difficult to achieve.

Conclusion

Based upon the results of this Feasibility Study, the increase of 20.0 MW (PJM Project #AD1-073) generation to the IC's previous request of 100.0 MW (64.0 MW Capacity) solar generating facility (PJM Project #AC2-060) will not require additional interconnection charges.

Figure 1: Point of Interconnection (Buckskin 69 kV Substation)

Single Line Diagram



Appendices

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.

Appendix 1

(AEP - DAY) The AC2-020 TAP-09GRNFLD 69 kV line (from bus 932130 to bus 253030 ckt 1) loads from 97.07% to 102.44% (**DC power flow**) of its emergency rating (72 MVA) for the single line contingency outage of 'DAY_P1_1339_B3'. This project contributes approximately 3.87 MW to the thermal violation.

CONTINGENCY 'DAY_P1_1339_B3'
OPEN BRANCH FROM BUS 253100 TO BUS 253099 CKT 1 / 253100 09ATLNTA 345 253099 09ATLNTA 69.0 1
END

Bus Number	*Bus Name*	*Full Contribution*
932131	*AC2-020 C*	*2.44*
932381	*AC2-055 C*	*5.29*
932421	*AC2-060 C*	*18.75*
932651	*AC2-087 C*	*13.89*
934491	*AD1-073 C*	*3.87*