Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-420

HUNT FARM-BALLARD 69 KV

12 MW Capacity / 20 MW Energy

July 2020

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1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is EKPC.

2 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. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. 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 Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

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.

3 General

The Interconnection Customer (IC) has proposed an uprate to a planned/existing Solar generating facility located in Boyle, Kentucky. This project is an increase to the Interconnection Customer's AF2-419 project, which will share the same point of interconnection. The AF2-420 queue position is a 20 MW uprate (12 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 40 MW with 24 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is October 01, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-420
Project Name	HUNT FARM-BALLARD 69 KV
State	Kentucky
County	Boyle
Transmission Owner	EKPC
MFO	40
MWE	20
MWC	12
Fuel	Solar
Basecase Study Year	2023

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

AF2-420 will interconnect with the EKPC transmission system as an uprate to AF2-419 tapping the Hunt Farm to Ballard 69 kV line.

5 Cost Summary

The AF2-420 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$0
Total System Network Upgrade Costs	$325,000
Total Costs	$325,000

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

6 Transmission Owner Scope of Work

None needed (utilizes Attachment, Direct Connection, and Non Direct Connection Facilities needed for AF2-419)

7 Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase

8 Interconnection Customer Requirements

It is understood that the Interconnection Customer (IC) is responsible for all costs associated with this interconnection. The costs above are reimbursable to the Transmission Owner. The cost of the IC's generating plant and the costs for the line connecting the generating plant to the Point of Interconnection are not included in this report; these are assumed to be the IC's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for the Transmission Owner 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.

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.

9 Revenue Metering and SCADA Requirements

9.1 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 Section 8 of Attachment O.

9.2 Meteorological Data Reporting Requirements

Solar generation facilities shall provide the Transmission Provider with site-specific meteorological data including:

- Back Panel temperature (Fahrenheit)
- Irradiance (Watts/meter^2)
- Ambient air temperature (Fahrenheit) – (Accepted, not required)
- Wind speed (meters/second) – (Accepted, not required)
- Wind direction (decimal degrees from true north) – (Accepted, not required)

9.3 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

http://www.pjm.com/planning/design-engineering/to-tech-standards/

10 Summer Peak - Load Flow Analysis

The Queue Project AF2-420 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection as an uprate to AF2-419 tapping the Hunt Farm to Ballard 69 kV line in the EKPC area. Project AF2-420 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-420 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

10.1 Generation Deliverability

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

None

10.2 Multiple Facility Contingency

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

None

10.3 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)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
10208788 0	34167 1	2HUN T FARM J	69. 0	EKPC	34206 1	2PERRYVILL E	69. 0	EKPC	1	342406 2VAN ARSDEL L 69.0 936570 AD2- 072 TAP 69.0 1	singl e	46.0	110.89	125.14	DC	6.56

10.4 Potential Congestion due to Local Energy Deliverability

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.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
10208787 9	34167 1	2HUNT FARM J	69. 0	EKPC	34206 1	2PERRYVILL E	69. 0	EKPC	1	342406 2VAN ARSDEL L 69.0 936570 AD2- 072 TAP 69.0 1	operatio n	46.0	174.4	198.16	DC	10.93
10208788 1	34167 1	2HUNT FARM J	69. 0	EKPC	34206 1	2PERRYVILL E	69. 0	EKPC	1	Base Case	operatio n	41.0	100.4	117.02	DC	6.81

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
102088036	341794	2MACKVILK U T	69.0	EKPC	341935	2N SPRINGFLD	69.0	EKPC	1	342406 2VAN ARSDEL L 69.0 936570 AD2-072 TAP 69.0 1	operation	63.0	117.34	134.68	DC	10.93
102088034	342061	2PERRYVILL E	69.0	EKPC	341794	2MACKVILK U T	69.0	EKPC	1	342406 2VAN ARSDEL L 69.0 936570 AD2-072 TAP 69.0 1	operation	63.0	118.45	135.8	DC	10.93
102088058	961280	AF2-419 TAP	69.0	EKPC	341044	2BALLARD	69.0	EKPC	1	342406 2VAN ARSDEL L 69.0 936570 AD2-072 TAP 69.0 1	operation	46.0	111.76	131.48	DC	9.07

10.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
102087880	1	**2HUNT FARM J 69.0 kV - 2PERRYVILLE 69.0 kV Ckt 1**	**EKPC-r0102 (1494) : Increase the maximum operating temperature of the 266 MCM ACSR conductor in the Hunt Farm Junction-Perryville 69 kV line section to 212 degrees F (5.3 miles)** **Project Type : FAC** **Cost : $325,000** **Time Estimate : 12.0 Months**	$325,000
			TOTAL COST	**$325,000**

10.6 Flow Gate Details

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

10.6.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
102087880	341671	2HUNT FARM J	EKPC	342061	2PERRYVILLE	EKPC	1	342406 2VAN ARSDELL 69.0 936570 AD2-072 TAP 69.0 1	single	46.0	110.89	125.14	DC	6.56

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
936571	AD2-072 C O1	38.7621	80/20	38.7621
945541	AF1-219 C O1	12.4048	80/20	12.4048
961281	AF2-419 C	6.5573	80/20	6.5573
961291	AF2-420 C	6.5573	80/20	6.5573
NEWTON	NEWTON	0.0838	Confirmed LTF	0.0838
FARMERCITY	FARMERCITY	0.0040	Confirmed LTF	0.0040
G-007A	G-007A	0.0072	Confirmed LTF	0.0072
VFT	VFT	0.0193	Confirmed LTF	0.0193
CALDERWOOD	CALDERWOOD	0.0303	Confirmed LTF	0.0303
PRAIRIE	PRAIRIE	0.2299	Confirmed LTF	0.2299
CHEOAH	CHEOAH	0.0300	Confirmed LTF	0.0300
EDWARDS	EDWARDS	0.0182	Confirmed LTF	0.0182
TILTON	TILTON	0.0384	Confirmed LTF	0.0384
GIBSON	GIBSON	0.0682	Confirmed LTF	0.0682
BLUEG	BLUEG	0.2708	Confirmed LTF	0.2708
TRIMBLE	TRIMBLE	0.0729	Confirmed LTF	0.0729
CATAWBA	CATAWBA	0.0105	Confirmed LTF	0.0105

10.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AD2-072	Van Arsdell-Mercer Industrial 69kV	Active
AF1-219	Hunt Farm 69 kV	Active
AF2-419	Hunt Farm-Ballard 69 kV	Active
AF2-420	Hunt Farm-Ballard 69 kV	Active

10.8 Contingency Descriptions

Contingency Name	Contingency Definition
342406 2VAN ARSDELL 69.0 936570 AD2-072 TAP 69.0 1	CONTINGENCY '342406 2VAN ARSDELL 69.0 936570 AD2-072 TAP 69.0 1' OPEN BRANCH FROM BUS 342406 TO BUS 936570 CKT 1 END
Base Case	

11 Light Load Analysis

Light Load Studies (As applicable)

To be determined during later study phases.

12 Short Circuit Analysis

The following Breakers are overdutied:

To be determined during later study phases.

13 Stability and Reactive Power Assessment

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be determined during later study phases.

14 Affected Systems

14.1 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

14.2 MISO

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

14.3 TVA

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

14.4 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).