Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-037

C.P. CRANE 115 KV

200 MW Capacity / 200 MW Energy

First Revision: February 2020

Original Issue: January, 2020

1 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.

An Interconnection Customer 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.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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.

2 General

The Interconnection Customer (IC) has proposed a Storage generating facility located in Baltimore County, Baltimore, Maryland. The installed facilities will have a total capability of 200 MW with 200 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is June 1, 2021. **This study does not imply a TO commitment to this in-service date.**

Queue Number	**AF1-037**
Project Name	C.P. CRANE 115 KV
State	Maryland
County	Baltimore County
Transmission Owner	BGE
MFO	200
MWE	200
MWC	200
Fuel	Storage
Basecase Study Year	2023

2.1 Point of Interconnection

AF1-037 will utilize the existing Crane Unit 1/Crane GT connection to the 115 kV transmission system via the Windy Edge - C.P. Crane 115 kV line No. 110591 (Future Northeast-C.P. Crane 115 kV line No. 110630).

The physical Point of Interconnection for this Crane Battery Energy Storage System (BESS) will be the IC's side of the 115 kV line coming off of the newly built BESS collector yard dead-end structure described below in the Transmission Owner Scope of Work.

2.2 Cost Summary

The AF1-037 project will be responsible for the following costs for the physical interconnection:

Description	**Total Cost**
Attachment Facilities	$0
Direct Connection Network Upgrade	$600,000
Non Direct Connection Network Upgrades	$0
Total Costs	**$600,000**

In addition, the AF1-037 project may be responsible for a contribution to the following costs for any Network Upgrades identified in this report:

Description	Total Cost
System Upgrades	$0

Cost allocations for these upgrades will be provided in the System Impact Study Report.

3 Transmission Owner Scope of Work

A change in configuration of plant facilities was accepted on PJM on January 27, 2020. **The Transmission Owner Scope of Work below is preliminary and will be re-evaluated during the System Impact Study.**

3.1 Attachment Facilities

This report assumes that the Interconnection Customer will utilize the existing Crane Unit1/Crane GT connection to the 115 kV transmission system via the Future Northeast-C.P. Crane 115kV line No. 110630. No Attachment Facilities costs have been identified.

3.2 Direct Connection Cost Estimate

To facilitate the interconnection of IC's generation facility, BGE requires a new 115kV motor-operated switch on 110630 line after the POI that will be owned and operated by BGE.

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Install 115kV MORC switch and ground switch	$600,000
Total Direct Connection Facility Costs	**$600,000**

3.3 Non-Direct Connection Cost Estimate

This report assumes that the Interconnection Customer will utilize the existing Crane Unit1/Crane GT connection to the 115 kV transmission system via the Future Northeast-C.P. Crane 115kV line No. 110630. No Non-Direct Connection costs have been identified.

4 Schedule

The estimated schedule to complete the Scope of Work in this report is **32-48 months** after the ISA/CSA are fully executed.

5 BGE Interconnection Requirements

The proposed interconnection facilities must be designed in accordance with the BGE "Exelon Utilities Transmission Facility Interconnection Requirements" document:

http://www.pjm.com/-/media/planning/plan-standards/private-ce/exelon-utilities-transmission-facility-interconnection-requirements.ashx?la=en

6 Revenue Metering and SCADA Requirements

6.1 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.

6.2 BGE Requirements

The IC will be required to comply with all BGE Revenue Metering Requirements for Generation Interconnection Customers as outlined in the link below. The Revenue Metering Requirements may be found within the BGE "Exelon Utilities Transmission Facility Interconnection Requirements" document located at the following link:

http://www.pjm.com/-/media/planning/plan-standards/private-ce/exelon-utilities-transmission-facility-interconnection-requirements.ashx?la=en

All Revenue Metering shall have ability to connect to BGE's Automated Meter Reading (AMR) system. Metering equipment shall be reviewed and approved for prior to purchase to ensure compatibility with AMR System. Interconnect customer will be required to make provisions for a POTS (plain old telephone service) line within approximately three feet of each metering position to facilitate Automated Meter Reading and data collection. Alternatives to a POTS line must be reviewed and approved by BGE to ensure compatibility with AMR System.

Depending on IC's final meter plan, BGE may require BGE owned check meters at or near the IC's revenue meter locations. The need for check meters will be determined during final engineering.

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6.4 Power Factor Requirements

The Interconnection Customer shall design its Customer Facility with the ability to maintain a power factor of at least 0.95 leading to 0.90 lagging measured at the generator's terminals.

7 Network Impacts

A change in configuration of plant facilities was accepted on PJM on January 27, 2020. **The analysis result in this report is preliminary and will be re-evaluated during the System Impact Study.**

The Queue Project AF1-037 was evaluated as a 200 MW (Capacity 200 MW) injection at the Crane 115 kV substation in the BGE area. Project AF1-037 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-037 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

8 Generation Deliverability

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

None

9 Multiple Facility Contingency

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

None

10 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

11 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.

None

Affected Systems

12 Affected Systems

12.1 LG&E

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

12.2 MISO

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

12.3 TVA

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

12.4 Duke Energy Progress

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

12.5 NYISO

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

Short Circuit

13 Short Circuit

The following Breakers are over duty

None