Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Positions

AD2-103"Crane CT1 115 kV" & AD2-104"Crane CT 2-3-4 115 kV"

AD2-103: 14 MW Capacity / 14 MW Energy AD2-104: 144.6 MW Capacity/144.6 MW Energy

April 2020

Introduction

This System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between **C.P. Crane LLC,** the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Baltimore Gas & Electric (BGE).

Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, 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 System Impact Study is performed.

The System Impact 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

Under AD2-103, **C.P. Crane LLC,** the Interconnection Customer (IC), has proposed to repurpose the existing Crane GT1 oil-fired combustion turbine generating facility located at 1001 Carroll Island Road, Baltimore, Maryland 21220 and claim the unit's Capacity rights. The installed facilities will have a total capability of **14 MW** with **14 MW** of this output being recognized by PJM as capacity.

Under AD2-104, **C.P. Crane LLC,** the Interconnection Customer (IC), has proposed to claim the rights of the old Crane Unit 2 and install a new gas-fired combustion turbine generating facility located at 1001 Carroll Island Road, Baltimore, Maryland 21220. The installed facilities will have a total capability of **144.6 MW** with **144.6 MW** of this output being recognized by PJM as Capacity.

The proposed in-service date for these projects is **June 1, 2020**. This study does not imply a BGE commitment to this in-service date.

Point of Interconnection

AD2-103 "Crane CT1 115 kV" and **AD2-104 "Crane CT2-3-4 115 kV**" will utilize the existing Crane Unit 1/Crane CT and Crane Unit 2 connections to the 115 kV transmission system. Specifically, AD2-103/AD2-104 will connect via the Windy Edge[1] - C.P. Crane 115 kV line No. 110592 (Future Northeast-C.P. Crane 115 kV line No. 110631). The physical Point of Interconnection will be on the IC side of the newly installed BGE owned and Operated Switch.

Attachment 1 shows a one-line diagram of the connection of the AD2-103 and AD2-104 projects to the BGE transmission system including the location of the Point of Interconnection (POI). **Attachment 2** provides the Site Location.

[1] RTEP baseline project b2816 will reterminate Line No. 110592 from the Windy Edge Substation to the Northeast Substation. The scheduled in-service date for the b2816 project is 11/1/2020.

Transmission Owner Scope of Work (BGE)

After the AD2-103 and AD2-104 impact study was completed, the AF1-037 C.P. Crane 115 kV queue proposed a new configuration at Crane that modified the AD2-103 and AD2-104 layout. The description in the "Point of Interconnection" section of this report reflects the updated configuration. As a result of the updated configuration, the AD2-103 and AD2-104 direct connection upgrade have been modified from installing two motor-operated switches to one. The AD2-103 and AD2-104 will now be responsible of installing one motor-operated switch on the 110631 line after the POI. Similarly, The AF1-037 will be responsible of installing the adjacent motor-operated switch on the 110630 line. Both the switches will be owned and operated by BGE.

In addition, since the proposed configuration was accepted by PJM on January 27, 2020. All studies and attachment facilities shall be considered preliminary, to be confirmed or modified during the AD2-103 and AD2-104 Facilities Study.

To facilitate the interconnection of IC's generation facility, BGE will replace the relaying in what is now the 110583 bay position with a pilot wire current differential relay. All other required relaying will be completed with the RTEP Baseline b2816. Relay settings will also need to be modified on both terminals to C.P. Crane at the Northeast Substation to accommodate the interconnection.

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer (IC) is responsible for all design and construction related to activities on their side of the Point of Interconnection. Site preparation, including grading and an access road, as necessary, is assumed to be by the IC. Route selection, line design, and right-of-way acquisition of the direct connect facilities is not included in this report and is the responsibility of the IC. The Interconnection Customer will be responsible for future O & M costs associated with the direct connect facilities.

Protective relaying and metering design and installation must comply with BGE's applicable standards. The IC is also required to provide revenue metering and real-time telemetering data to PJM in conformance with the requirements contained in PJM Manuals M-01 and M-14 and the PJM Tariff. BGE will require the capability to remotely trip the generator from its System Operations facility.

It is the IC's responsibility to send the data that both PJM and BGE require directly to PJM. The IC will grant permission for PJM to send BGE the following telemetry that the IC sends to PJM: real time MW, MVAR, volts, amperes, generator status, interval MWH and MVARH, and generator breaker position.

The IC is responsible for providing Automated Meter Reading access to revenue metering to facilitate remote meter interrogation.

Cost Summary

The **AD2-103 and AD2-104** projects will be responsible for the following costs. These costs do not include CIAC Tax Gross-up:

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 600,000
Non Direct Connection Network Upgrades	$ 115,416
New System Upgrades	$ 0
Contribution to Previously Identified Upgrades	$ 0
Total Costs	**$ 715,416**

The transmission and substation costs given above exclude any applicable state or federal taxes. If at a future date Federal CIAC (contribution in aid of construction) taxes are deemed necessary

by the IRS for this project, BGE shall be reimbursed by the Interconnection Customer for such taxes.

The required Attachment Facilities, Direct Connection and Non-Direct Connection work for the interconnection of the AD2-103 and AD2-104 generation projects to the BGE Transmission System is detailed in the following sections. The associated one-line with the generation projects is shown in Attachment 1.

Note: The aforementioned cost summary reflects the modified configuration. AF1-037 will we responsible for additional work.

Attachment Facilities

No Attachment Facility scope of work is required to accommodate the proposed AD2-103 and AD2-104 projects as this customer is utilizing the same Point of Interconnection as the deactivated C.P. Crane customer.

Direct Connection Cost Estimate

To facilitate the interconnection of IC's generation facility, BGE requires a new 115kV motor-operated switch on 110631 line after the POI that will be owned and operated by BGE.

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

Note: The aforementioned cost summary reflects the modified configuration. AF1-037 will we responsible for additional work.

Non-Direct Connection Cost Estimate

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

Description	Total Cost
Northeast Substation: Replace the existing primary relaying on the current 110583 position at Northeast Substation with a pilot wire current differential relay. *(PJM Network Upgrade Number n6036)*	$ 115,416
Total Non-Direct Connection Facility Costs	**$ 115,416**

The scope of work categorized as Non-Direct Connection is to replace the relaying in what is now the 110583 bay position with a pilot wire current differential relay. All other required relaying will be completed with the RTEP Baseline b2816. Relay settings will also need to be modified on both terminals to C.P. Crane at the Northeast Substation to accommodate the interconnection.

Note: The aforementioned cost summary reflects the modified configuration. AF1-037 will we responsible for additional work.

Schedule

Based on the extent of the BGE Direct and Non-Direct Connection work required to support the AD2-103 and AD2-104 generation projects, it is expected to take approximately **32-48-months** from the date of a fully executed Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the IC to make a Security payment to BGE which funds the Non-Direct Connection work. It further assumes that all system outages will be allowed when requested.

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 Attachment O, Appendix 2, Section 8.

BGE Metering Requirements

The Interconnection Customer 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. Interconnection 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.

Interconnection Customer Metering Location

The Interconnection Customer shall install 115kV revenue meters at the newly established Points of Interconnection.

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

IC shall provide BGE with 24/7 switching support and access to the 115kV switches located on customer side of POI.

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.

Network Impacts

The analysis below will be evaluated based on the updated AD2-103/AD2-104 configuration during the Facilities Study.

The Queue Project AD2-103 was evaluated as a 14 MW (Capacity 14 MW) injection into the future Northeast-Crane 110630 115 kV line in the BGE zone. Project AD2-103 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-103 was studied with a commercial probability of 100%. Potential network impacts were as follows:

The Queue Project AD2-104 was evaluated as a 144.6 MW (Capacity 144.6 MW) injection into the future Northeast-Crane 110630 and 110631 115 kV lines in the BGE zone Project AD2-104 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-104 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Analysis - 2021

Generator Deliverability

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

None

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

(Results of the steady-state voltage studies should be inserted here)

None

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

Stability study incorporating the Interconnection Customers' updated facility configuration will be performed as part of the Facilities Study.

Short Circuit

(Summary of impacted circuit breakers)

None

Affected System Analysis & Mitigation

None

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.

None

System Reinforcements

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

None

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

Stability study incorporating the Interconnection Customers' updated facility configuration will be performed as part of the Facilities Study.

Summer Peak Load Flow Analysis Reinforcements

New System Reinforcements

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

None

Contribution to Previously Identified System Reinforcements
(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

Light Load Analysis - 2021

Not required for this project.

Light Load Load Flow Analysis Reinforcements

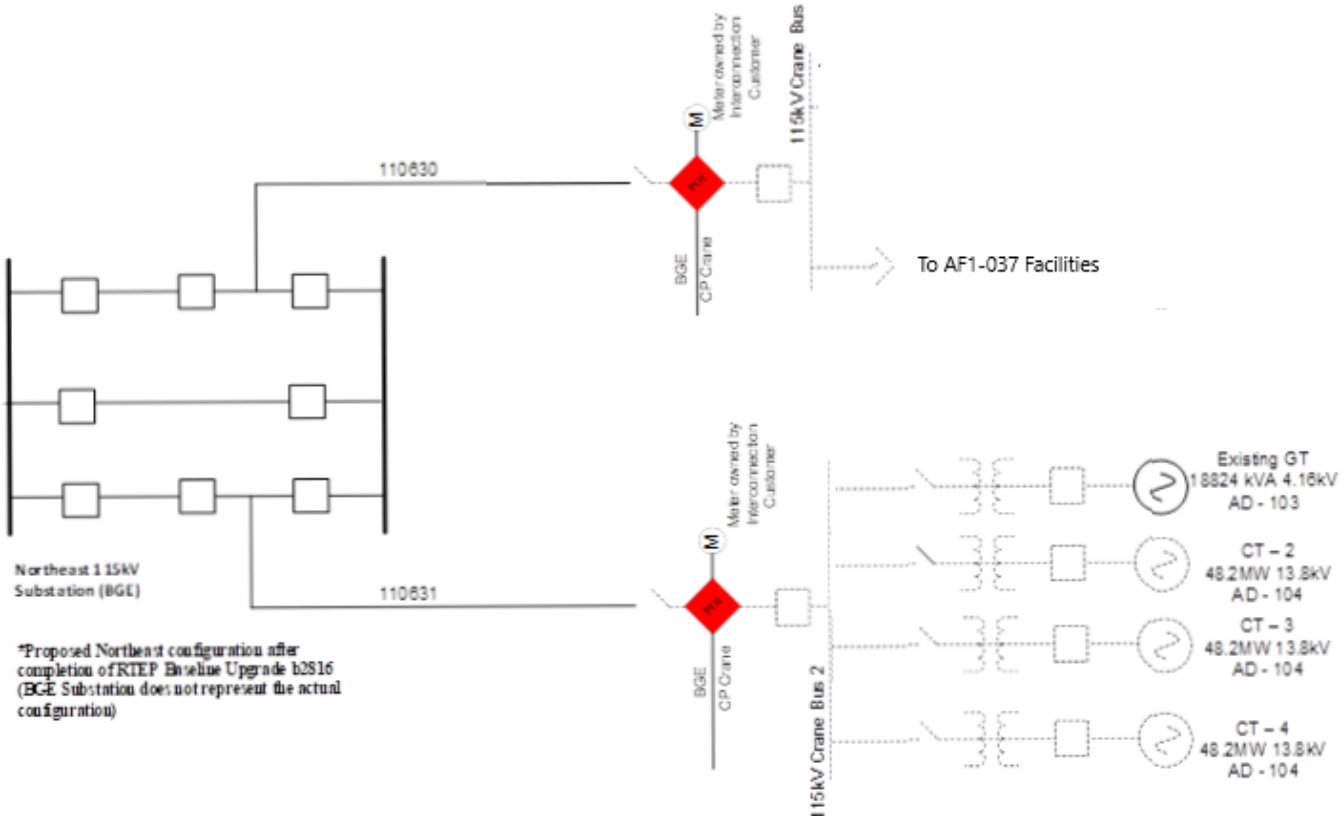
New System Reinforcements
(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Contribution to Previously Identified System Reinforcements
(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

Attachment 1
AD2-103/AD2-104
Crane 115 kV
Northeast 115 kV Substation*



Attachment 2

AD2-103 "Crane CT1 115 kV" & AD2-104 'Crane CT 2-3-4- 115 kV' Site Location

1001 Carroll Island Road, Baltimore MD