Generation Interconnection Combined Feasibility/System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AD1-059

“Lakewood 230 kV II”

14.9 MWC Uprate Only

April 2018

Preface

The intent of the Combined Feasibility/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, if any, is included in the System Impact Study.

The 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 associated with them will be addressed when seeking an Interconnection Agreement as outlined below. Developer will also be responsible for providing and installing metering equipment in compliance with applicable PJM and Transmission Owner standards.

General

Lakewood Cogeneration, LP, the Interconnection Customer (IC), has proposed an increase to the Capacity of their existing Lakewood Cogeneration natural gas generating facility located at 123 Energy Way, Lakewood, New Jersey (**Attachment 1**). The uprate will increase the Capacity value by **14.9 MW**, for a total of **265 MW** being recognized by PJM as Capacity. There is no Maximum Facility Output (MFO) increase requested with this queue position. (See the summary table below.) The proposed in-service date for this project is **September 30, 2019**.

Queue Number	MFO (MW)	Capacity (MW)
Y2-078	280	242
AB2-014	0	8.1
AD1-059	0	14.9
Total	**280**	**265.0**

PJM studied the proposed request and evaluated it for compliance with reliability criteria for summer peak conditions in 2021.

Point of Interconnection

AD1-059 "Lakewood 230 kV II" uprate project will be an increase in Capacity to the existing Lakewood natural gas generation plant which interconnects to the JCP&L transmission system at the Lakewood 230 kV bus. As defined by the IC and shown on Attachment 2, the connection point for this project will be accomplished by utilizing the existing Lakewood Cogeneration power plant connection to a 230 kV seven breaker ring bus, networking together the Lakewood Cogeneration power plant, the Ocean Peaking power plant, the Lakewood Cogen – Larrabee (Z2026) 230 kV line, the Lakewood Cogen – Larrabee (K2011) 230 kV line, the Lakewood Cogen – Leisure Village (U2021) 230 kV line, and the Lakewood Cogen – Leisure Village (D2030) 230 kV line.

Attachment 2 shows a one-line diagram of the connection facilities that exist for the (AD1-059) generation project. There is no change to the total output (280 MW) with this Capacity only increase. No upgrades to JCP&L facilities are required to accommodate this request.

Cost Summary

The AD1-059 "Lakewood 230 kV II" project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades	$ 0
Total Costs	**$ 0**

In addition, the AD1-059 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	$ 0
Previously Identified Upgrades	$ 0
Total Costs	**$ 0**

Attachment Facilities

There is no Attachment Facilities work required for this project.

Direct Connection Cost Estimate

There is no Direct Connection scope of work required for this project.

Non-Direct Connection Cost Estimate

There is no Non-Direct Connection scope of work required for this project.

JCP&L Analysis and Interconnection Requirements

Power Flow Analysis

A power flow study was conducted to determine the reliability impact of the proposed (AD1-059) generation project on the JCP&L transmission systems. This study was completed using a 2021 summer peak power flow model that contains a detailed representation of the Jersey Central Power & Light transmission networks in the area of the proposed (AD1-059) generation project. The findings and the recommendations from this analysis are based on a contingency review that was performed to identify the facility loadings and/or voltage conditions that violate the ReliabilityFirst, PJM, or FE Planning Criteria and are attributable to this project. Note that in accordance with PJM RTEP study procedures, the (AD1-059) generation project under study and earlier active queue projects are considered to be in-service. All active queue projects after the (AD1-059) project are considered to not be in-service.

The results of the analysis show that there are no network upgrades required for the deliverability of the (AD1-059) generation project to the JCP&L transmission system. There also are no reinforcements defined for previous projects for which this project will have an impact.

The existing 280 MW (250.1 MW capacity) portion of the Lakewood Cogen generation plant shall retain the power factor requirements stated in the Interconnection Service Agreements for the existing generation, which is as follows:

- The original 260 MW portion of the Customer Facility shall retain its existing ability to maintain a power factor of at least 0.95 leading to 0.90 lagging measured at the generator's terminals.

- The increase of 20 MW to the Customer Facility designated as Queue Y2-078 shall be designed with the ability to maintain a power factor of at least 1.0 (unity) to 0.90 lagging measured at the generator's terminals.

Short Circuit and Dynamics Analysis

In accordance with the RTEP process, short circuit and dynamics analysis will not be conducted by PJM since the (AD1-059) generation project capacity increase request has no change to the electrical characteristics of the Lakewood Cogeneration, LP generating facility as indicated by the developer.

System Protection Analysis

An analysis was conducted to assess the impact of the (AD1-059) generation project on the system protection requirements in the area. The results of this review have identified the following as a result of the (AD1-059) generation project ring bus direct connection.

For the 14.9 MW capacity rights increase, there are no additional system protection upgrades.

The fault currents at 230 kV Lakewood Cogen substation are listed below.

Three phase fault current:	28,830 Amps
Single line to ground fault current:	29,880 Amps
Positive Sequence thevenin (ohms):	0.2963 + j 4.5959
Zero Sequence thevenin (ohms):	0.5123 + j 4.0958

Any system changes in the area could have a significant impact on these values. It will be the responsibility of the Interconnection Customer to make any protection upgrades required should this occur. The proposed interconnection facilities must be designed in accordance with the FE "Requirements for Transmission Connected Facilities."

Compliance Issues

The proposed interconnection facilities must be designed in accordance with the FE "Requirements for Transmission Connected Facilities" document located at:

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

Lakewood Cogeneration, LP will also be responsible for following the requirements of the FE "Approved Vendors and Contractors" document which is also located at the above link.

Lakewood Cogeneration, LP will also be required to meet all PJM, ReliabilityFirst and NERC reliability criteria and operating procedures for standards compliance. For example, Lakewood Cogeneration, LP will need to properly locate and report the over and under voltage and over and under frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and ReliabilityFirst audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the JCP&L systems.

JCP&L Metering Requirements

Lakewood Cogeneration, LP will be required to comply with all FE revenue metering requirements for generation interconnection customers. The FE revenue metering requirements may be found in the FE "Requirements for Transmission Connected Facilities" document located at the following links:

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

JCP&L Facility Upgrades and Costs

The results of the FE power flow analysis show that the (AD1-059) generation project does not attribute to any planning criteria violations.

There are no attachment facilities or related system reinforcement requirements for the (AD1-059) generation project's direct connection to the Jersey Central Power & Light transmission system. The one-line for the generation project primary direct connection is shown in Attachment 2.

Lakewood Cogeneration, LP Requirements

Lakewood Cogeneration, LP will also be responsible for meeting all criteria as specified in the applicable sections of the FE "Requirements for Transmission Connected Facilities" document including:

1. A compliance with the FE and PJM generator power factor and voltage control requirements. If the Lakewood Cogen generation plant cannot meet these requirements, a reactive power device such as a fixed Capacitor Bank, STATCOM, or SVC may be required at Lakewood substation at Lakewood Cogeneration, LP cost as determined by PJM.

2. The execution of a back-up service agreement to serve the customer load supplied from the (AD1-059) generation project metering point when the units are out-of-service. This assumes the intent of Lakewood Cogeneration, LP is to net the generation with the load.

The above requirements are in addition to any metering or other requirements imposed by PJM.

Schedule

No work is required by JCP&L to accommodate this 14.9 MW Capacity only increase as there is no increase to the MFO.

Summary

The Lakewood Cogeneration, LP (AD1-059) generation project capacity rights increase will require no attachment facilities, direct connection facilities, non-direct connection facilities, or network upgrades.

Network Impacts

The Queue Project AD1-059 was evaluated as a 14.9 MW Capacity-only increase at the Lakewood 230kV substation in the JCPL area. Project AD1-059 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-059 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

Short Circuit
(Summary of impacted circuit breakers)

None

Affected System Analysis & Mitigation

NYISO Impacts:

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.

Not applicable.

Light Load Analysis - 2021

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

Not required.

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)

None

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 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

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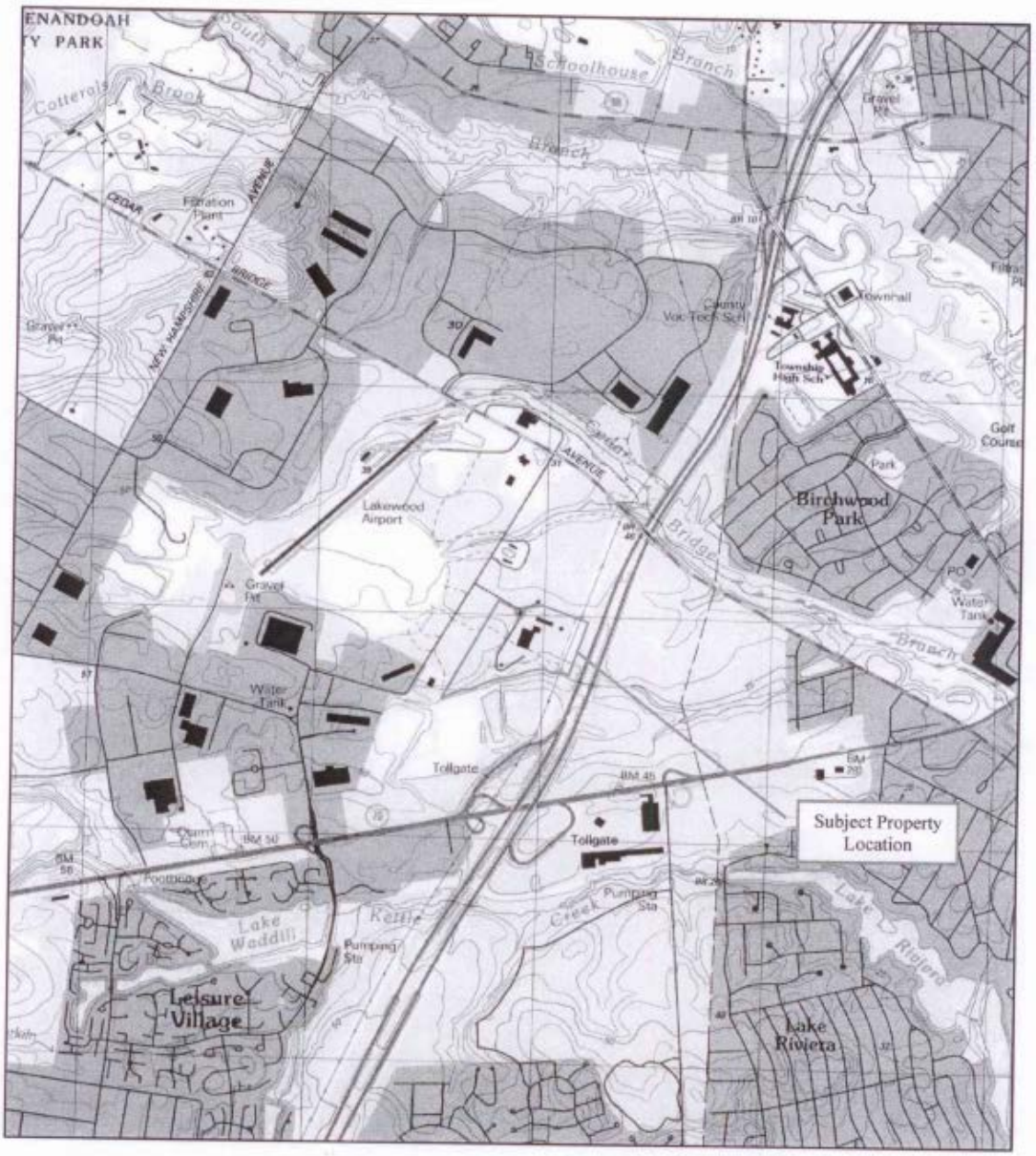
Attachment 1

Lakewood 230 kV
(AD1-059) Generation Project

Project

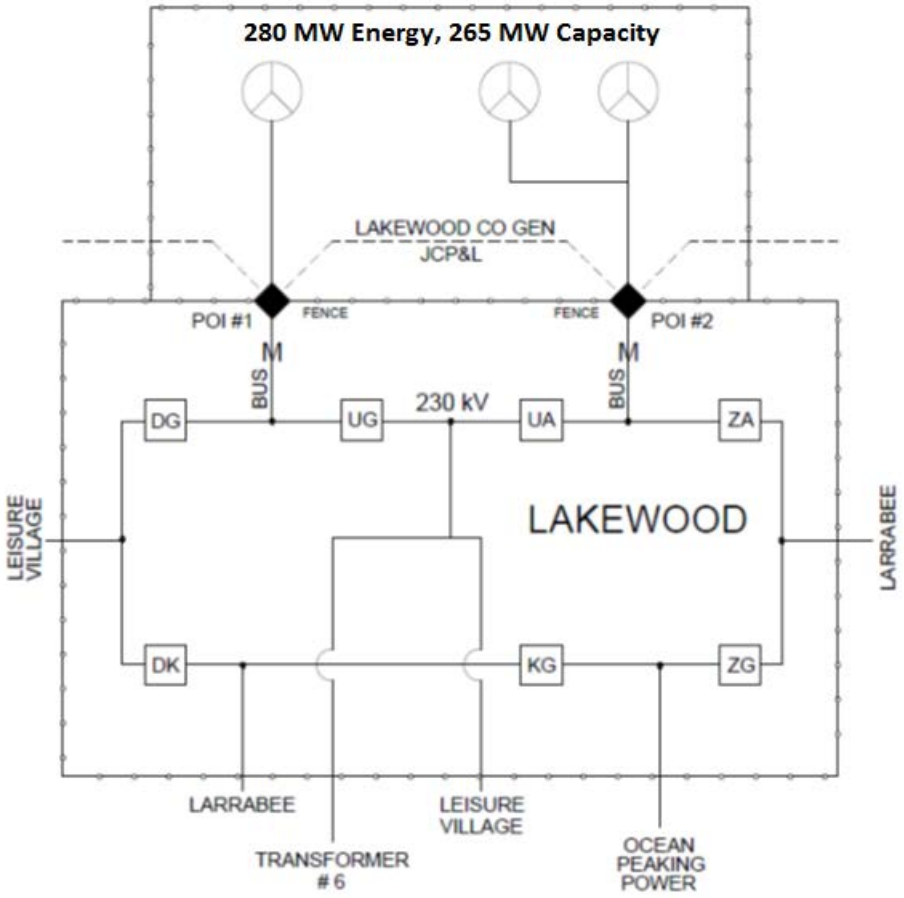


Location

Attachment 2

Lakewood 230 kV
(AD1-059) Generation Project

Planning Interconnection Single Line Diagram



◆ = POI #1, LOCATED WHERE BUS CROSSES ADJOINING SUBSTATION FENCE

POI #2, LOCATED WHERE BUS CROSSES ADJOINING SUBSTATION FENCE

M = REVENUE METERING FOR JCP&L CUSTOMER IS OWNED, OPERATED, AND MAINTAINED BY JCP&L