Revised
Generation Interconnection
Combined Feasibility/System
Impact Study Report

For

PJM Generation Interconnection Request
Queue Position AD1-028

“Cheesequake 12.5 kV”

February 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.

Revision from February 12, 2018

The report has been updated to reflect the commercial operation date as stated in the Wholesale Market Participation Agreement with this customer.

General

Home Depot, the Interconnection Customer (IC), has proposed a fuel cell generating facility located at 1100 Route 9, Old Bridge, New Jersey. The installed facilities will have a total capability of **200 kW** with **0 MW** of this output being recognized by PJM as capacity. This project is expected to be in commercial operation by **March 31, 2020**.

Point of Interconnection

AD1-028 "Cheesequake 12.5 kV" fuel cell project will interconnect at the existing Home Depot location in Old Bridge, New Jersey which is currently served off of 12.5 kV Circuit #47398 through 34.5-12.5 kV Transformer Bank #2 at the Cheesequake Substation. The Point of Interconnection (POI) will be at the IC side of the 1000 kVA pad mount transformer, site #210162-58960 (12.45/7.2 – 277/480V), owned by JCP&L. The secondary cables from this transformer are owned by the IC. This POI is approximately 1.4 miles from the Cheesequake Substation. The one-line identifying the POI is shown in **Attachment 1.**

Cost Summary

The AD1-028 "Cheesequake 12.5 kV" project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 9,054
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades	$ 0
Total Costs	**$ 9,054**

In addition, the AD1-028 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**

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 (per IRS Notice 88-129) for this project, JCP&L shall be reimbursed by the Interconnection Customer for such taxes. JPCL estimates the tax, if applicable, would be approximately **$1,456**.

The required Attachment Facilities, Direct Connection, and Non-Direct Connection work for the interconnection of the AD1-028 generation uprate project to the JCP&L Transmission System is detailed in the following sections. The associated one-line with the generation project is shown in Attachment 1.

Note - This estimate is based on similar work orders previously worked by JCPL for the types of work described in the analysis above. It is accurate to within plus or minus 25%. Should the customer want to proceed with the connection of this facility, a contract with JCPL in the form of an Interconnection Agreement will be developed based on these costs and a true-up of actual charges will be made at the completion of the project.

All JCP&L costs are not subject to refundable provisions of the NJ-BPU approved JCP&L Tariff for service.

Attachment Facilities

The Attachment Facilities work will include replacement of the existing meter with a bi-directional meter. It also includes provision for cellular modem interface outputs. JCP&L will supply and maintain a cellular connection to the meter interface at the IC's expense. Engineering review and commissioning are also included in this cost.

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

Description	Total Cost
Replace existing meter with Bi-Directional meter. Engineering review and commissioning.	$9,054
Total Attachment Facilities Cost	**$9,054**

Direct Connection Cost Estimate

There is no Direct Connection work required for this project.

Non-Direct Connection Cost Estimate

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

Interconnection Customer Requirements

In addition to the above required work, Home Depot will also be responsible for meeting all criteria as specified below:

- IC must meet all applicable JCP&L/FE standards and requirements which are included in the current JCP&L Tariff for Electric Service.

- IC's main breaker shall have a SEL 351 Multi-function relay (or equivalent) which is required for interconnection protection. This relay must have the capability to measure Reverse Power.

- All breakers, lightning protection etc. should meet JCP&L/FE's minimum BIL Ratings.

- IC must meet applicable "Technical Requirements for the Interconnection of Parallel Operated Generation to the JCP&L/FE Distribution System". https://www.firstenergycorp.com/content/dam/feconnect/files/wholesale/DG-Tech-Requirements.pdf

- IC is required to execute a retail service agreement to account for the generation and for times, on an hourly basis, when power is supplied by JCP&L/FE.

The above requirements are in addition to any metering required by PJM.

Schedule

Based on the scope of the required work, it is expected to take a minimum of **three months (3)** from the date of fully executed applicable agreements and the construction kickoff call to complete the installation required for the Project. This elapsed time includes 2 months for design work and an additional one month to schedule and implement the meter replacement. A true up of the actual cost versus estimated cost of the project will be performed by JCP&L at the end of the project.

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.

JCPL Requirements

The existing JCP&L/FE billing meter and or metering current transformers may be replaced with upgraded units if needed. Meters will record billing data in intervals of 15 or 30 minutes as required. JCP&L/FE will provide the customer with revenue meter KWH and KVARH pulse outputs if requested. JCP&L/FE shall provide the communication link required by the FE billing data collection system for access to the meter. All costs incurred by JCP&L/FE associated with the meters upgrades shall be the responsibility of the IC. Please see **Attachment 3** for meter requirements.

All costs associated with the meter upgrades shall be the responsibility of the IC.

JCPL Analysis

Scope

The Study scope is to identify any facility modifications needed to accommodate the installation of 200 kW generation at the POI described above.

Load Flow:

This 200 kW power injection will decrease the load on Cheesequake circuit #47398 but is not expected to cause a reverse power flow condition on Cheesequake Substation Bank #2.

Control Systems:

Due to the relatively low output capacity versus minimum loading on the circuit, Direct Transfer Trip will NOT be required for the proposed generation.

Short Circuit Study:

The available fault current at the 277/480 volt secondary terminals of the 1,000 kva pad mounted transformer, without the proposed generation on circuit 47398, is 16,691 Amperes – 3 phase and 14,827 Amperes line to ground

Voltage Study:

Analysis shows no adverse impact on the JCPL circuit voltage profile because of the connection of the proposed generation.

Distributed generation must not interfere or degrade the quality of service to any other JCP&L/FE customers (service voltage, voltage flicker, harmonics, service reliability etc.).

Work Requirements:

Main Line: JCP&L will not require any upgrades on the incoming distribution line.

At Substation: JCP&L will not require any substation facility changes, or upgrades.

At CoGen Facility:

Distributed Generation must not interfere with the proper detection and clearing of faults on the JCP&L/FE distribution or transmission system.

The connected facility shall comply with harmonic voltage and current limits specified in IEEE Standard 519-1992, "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems".

JCP&L/FE will require the installation of a Power Quality Meter (SEL-735) with Intermediate PQ option to monitor and capture power quality information to permit ongoing assessment of compliance. This unit will be installed at the circuit breaker dedicated to the generator system.

Anti-Island Protection

The proposed generation facility must be equipped with adequate relay protection to detect an island condition and disconnect from the JCP&L/FE distribution system within two seconds of the formation of an island (per IEEE 1547).

Power Factor

The Generation Interconnection Customer shall design its Customer Facility to maintain a composite power delivery at continuous rated power output at a power factor of at least 0.95 leading to 0.95 lagging at the High side of the Facility Substation Transformers.

Network Impacts (by PJM)

The Queue Project AD1-028 was evaluated as a 0.2 MW (Capacity 0.0 MW) injection at the Cheesequake 34.5 kV substation in the JCPL area. Project AD1-028 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-028 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

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

Light Load Analysis - 2020

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

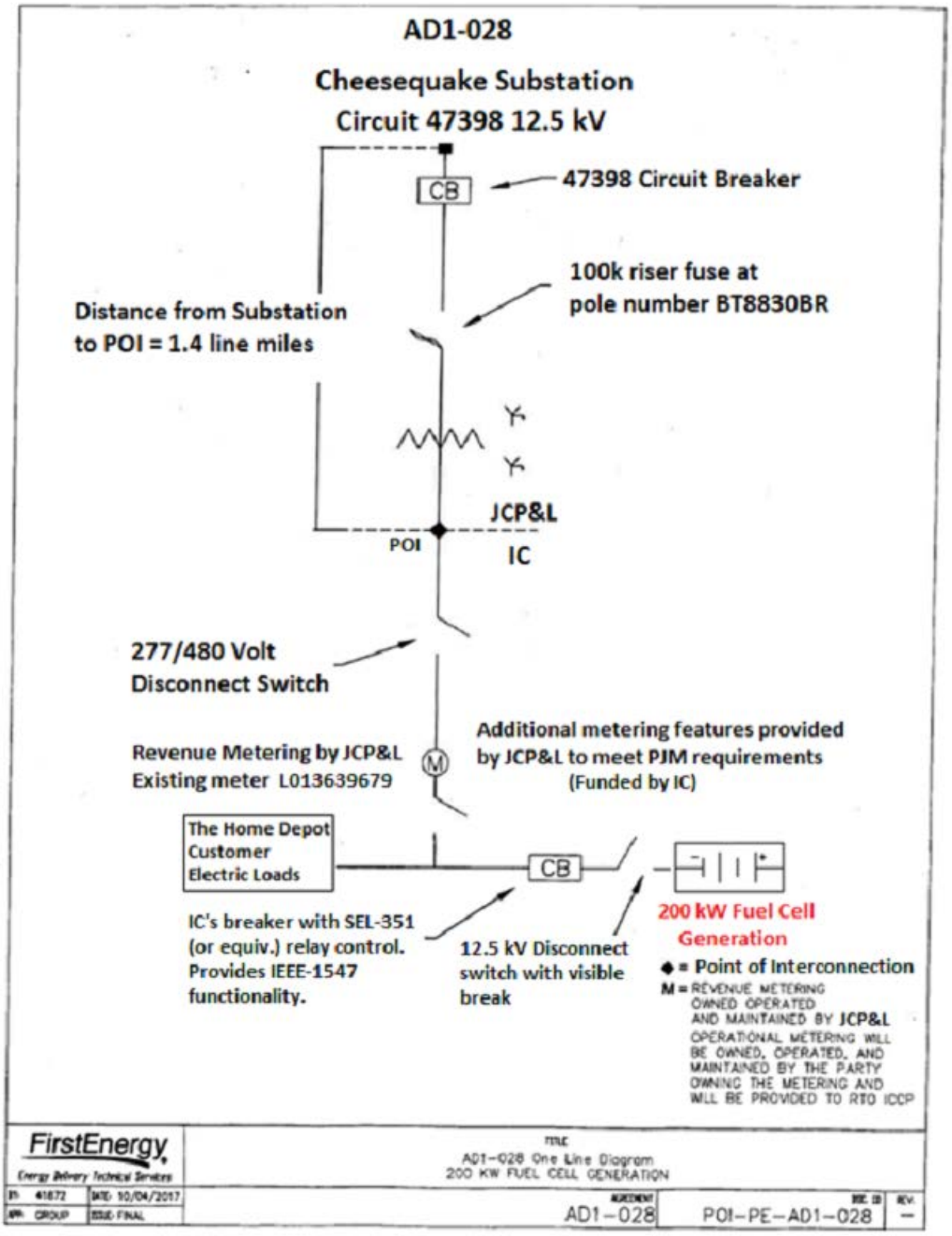
New System Reinforcements
(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

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

Attachment 1
Interconnection Single Line Diagram
"Cheesequake 12.5 kV" (AD1-028) Generation Project



Attachment 2
Site Location
"Cheesequake 12.5 kV" (AD1-028) Generation Project

Substation:	**Cheesequake**
Circuit#	**47398**
Pad Mounted Transformer#	**21062-58960**
Transformer size:	**1,000 KVA**
Meter No:	**L013639679**

Attachment 3

Customer Generator Facilities Participating in the PJM or Wholesale Energy Markets

The revenue metering requirements will be reviewed by FirstEnergy (FE) on a case-by-case basis.

In general, the FE Operating Company (FEOC) shall continue to own, operate, test, and maintain the existing revenue metering equipment per the applicable retail tariff or interconnection service agreement.

The Interconnection Customer (IC) must provide FE with a facility one line and the estimated bi-directional power flow at the existing FEOC metering point.

The existing FEOC billing meter at these locations will be replaced by FE with a bi-directional revenue meter and the FEOC metering current transformers will be replaced with higher capacity units if required. This work will be completed at the IC's expense.

The bi-directional revenue meter provided and installed by the FEOC will record billing data in intervals of typically fifteen or thirty minutes. FE will provide, at the IC's sole cost and expense, the communication link required by the FE billing data collection system for access to the meter.

The IC shall, at its expense, install, own, operate, test, and maintain any metering and telemetry equipment that may be required to provide real-time meter data to FE or PJM.

The FEOC will provide the IC access to bi-directional KWh and KVARh pulses from the FEOC meter at the IC's expense, if requested.

The IC shall provide FE with prior notification of any modifications at the facility that could affect the FEOC revenue meter measurements (substation reconfigurations, generator additions, etc.).