

***Generation Interconnection  
Combined Feasibility/System  
Impact Study Report***

***For***

***PJM Generation Interconnection Request  
Queue Position AC1-170***

***“New Canton 12.47 kV”***

**February 2017**

## 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

**Mercedes-Benz USA, LLC**, the Interconnection Customer (IC), has proposed a battery storage generating facility located at 100 New Canton Way in Robbinsville, New Jersey. The installed facilities will have a total capability of **1 MW** with **0 MW** of this output being recognized by PJM as capacity. The proposed in-service date for this project is **October 1, 2017**. **This study does not imply a Jersey Central Power & Light (JCPL) commitment to this in-service date.**

## Point of Interconnection

**AC1-170 “New Canton 12.47 kV”** will be located at a point approximately 2350 line-feet from the JPCL New Canton Substation and will be connected to the New Canton 47310 circuit at 12.47 KV Y at a padmount switch (Site ID 202700A49434). The POI for the project will be at the designated bushing positions of the padmount switch. The IC will be responsible for acquiring all easements, properties and permits that may be required to extend underground cable to the designated POI. The one-line identifying the POI is shown in **Attachment 1**.

The Mercedes-Benz USA, LLC will be responsible for constructing all of the facilities on its side of the POI including the attachment line. The JCPL facilities required to be upgraded for

the primary Direct Connection, Non-Direct Connection and Network Upgrades are defined in the next section below.

### **Cost Summary**

The **AC1-170** project will be responsible for the following costs. These costs do not include CIAC Tax Gross-up.

<b>Description</b>	<b>Total Cost</b>
Attachment Facilities	\$ 2,000
Direct Connection Network Upgrades	\$ 0
Non Direct Connection Network Upgrades	\$ 10,000
New System Upgrades	\$ 0
Previously Identified Upgrades	\$ 0
<b>Total Costs</b>	<b>\$ 12,000</b>

**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 30%. Should the customer want to proceed with the connection of this facility, a contract with JCPL will be developed based on these costs and a true-up of actual charges will be made at the completion of the project.

## Attachment Facilities

AC1-170 “New Canton 12.47 kV” will be located at a point located 2350 Line-Feet from the JCPL New Canton Substation and will be interconnected to the New Canton 47310 circuit at 12.47 KV Y at a padmount switch (Site ID 202700A49434). (See **Attachments 1 & 2**)

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

Description	Total Cost
Termination of IC cables at JCPL-owned switch (n5213)	\$2,000
<b>Total Attachment Facilities Cost</b>	<b>\$2,000</b>

## Direct Connection Cost Estimate

None.

## Non-Direct Connection Cost Estimate

The Non-Direct Connection work will include relay setting changes and functional testing on the New Canton 47310 12.47 kV for the interconnection of the AC1-170 IC.

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
Adjust remote relaying and metering settings (n5214)	\$10,000
<b>Total Non-Direct Connection Cost</b>	<b>\$10,000</b>

## Interconnection Customer Requirements

In addition to the JCPL facilities, Mercedes-Benz USA, LLC will also be responsible for meeting all criteria as specified below:

- IC must meet all PJM, Reliability First and NERC reliability criteria and operating procedures required for standards compliance. For example, the IC 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 Reliability First 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 FE system.

- IC must meet all applicable JCPL/FirstEnergy standards and requirements which are included in the current Tariff for Electric Service.
- All breakers, lightning protection etc. should meet JCPL/FE's minimum BIL Ratings.
- The Battery Storage System must not interfere with operation of FE voltage line regulating equipment including voltage regulators, line capacitors and substation LTC.
- IC must meet applicable FE Technical Standards and Requirements for Distribution Connected Facilities and for Transmission Connected Facilities which can be found under:

[www.firstenergycorp.com/feconnect](http://www.firstenergycorp.com/feconnect)

[www.pjm.com/planning/design-engineering/to-tech-standards.aspx](http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx)

- Frequency response systems participating in the PJM Ancillary Services Market respond to an automatic signal from PJM in order to correct for short-term changes in electricity use that might affect the stability of the power system by matching generation and load to maintain system frequency.
- Presence of frequency response may significantly increase costs to reconfigure system to accommodate future load growth or inhibit / prevent system reconfiguration. Additional costs to reconfigure system because of frequency response may be passed on to IC or Frequency Response may be required to cease interconnection operations.
- Customer shall be capable of maintaining Power Factor between .95 leading to .95 lagging measured at the Point of Interconnection. JCPL may require customer to absorb vars after the generating unit is operational.
- Distributed IC must not interfere or degrade the quality of service to any other FirstEnergy Corp. customers (service voltage, voltage flicker, harmonics, service reliability etc.)
- The IC's battery storage facilities used in PJM's frequency regulation market and settled via PJM's ancillary market shall provide, own, operate, test and maintain the revenue metering at the IC's expense.

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

## **Schedule**

Based on the scope of the direct connection, it is expected to take a minimum of **three months (3)** from the date of fully executed applicable agreements to complete the installation required for the Project. The schedule is based on the assumption that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring any necessary permits, and that PJM will allow all transmission system outages when requested. Full payment of the estimated cost of the project will be required upon execution of the necessary agreement(s). A true up of the actual cost versus estimated cost of the project will be performed by FE 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**

AC1-170 IC is to be independently metered and the IC shall provide the communication link required for the meter data directly to PJM. All costs associated with the meter upgrades shall be the responsibility of the IC. The IC must meet the requirements of PJM.

## **JCPL Analysis**

### **Short Circuit Study**

The available fault current on the existing 12.47KV distribution system at the bushings of the pad mounted switch, without the proposed IC, is 3200 Amperes – 3 phase and 2000 Amperes single line to ground.

### **Power Flow Analysis**

Power flow studies were conducted to determine the reliability impact of the proposed AC1-170 generation project on the JCPL transmission and distribution systems. These studies were completed using 2020 and 2016 summer peak power flow models that contain a detailed representation of the Jersey Central Power & Light transmission and distribution networks in the area of the proposed AC1-170 generation project. The findings and the recommendations from these analyses 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 AC1-170 generation project under study and earlier active queue projects are considered to be in-service. Also, all active retail net-meter projects with an application date preceding the proposed (AC1-170) generation project are considered to be in-service. All active queue projects and retail net-meter projects after the AC1-170 project are considered not in-service. The results of the FE analyses show that there are no transmission or distribution network upgrades required for the deliverability of the (AC1-170) generation project generation to the JCPL transmission and distribution systems.

IC must not interfere or degrade the quality of service to any other JCPL / FE customers (service voltage, voltage flicker, harmonics, service reliability, etc.)

## **Control Systems**

Due to the relatively low power capacity of the proposed project, Direct Transfer Trip will NOT be required. The proposed 1.0 MW of rated IC capacity will be withdrawn, or injected into the circuit at the POI. It is expected that reverse power flow at New Canton Bank # 1 and the 47310 circuit will increase, but it is expected to stay well below the nominal ratings of the transformer and the circuit. New Canton Bank #1 has previously been equipped with control systems that allow for reverse power flow.

The IC will be responsible for designing its facilities to be in compliance with FE's Transmission System protection practices, which can be found at:

[www.firstenergycorp.com/feconnect](http://www.firstenergycorp.com/feconnect)

[www.pjm.com/planning/design-engineering/to-tech-standards.aspx](http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx)

## **Power Quality**

The connected facility shall comply with harmonic voltage and current limits specified in IEEE Standards as they now exist. These IEEE standards include, but not limited to: 141-19921, 519-19922, and 1453-20043. To provide continuous monitoring of Power Quality performance, JCPL

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<sup>1</sup> IEEE Standard 141-1993, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants, The Institute of Electrical and Electronics Engineers, Inc. 345 East 47th Street, New York, NY 10017-2394, USA

<sup>2</sup> IEEE Standard 519-1992, IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems, The Institute of Electrical and Electronics Engineers, Inc. 345 East 47th Street, New York, NY 10017-2394, USA

will require the installation of a Power Quality Meter (SEL-735 with intermediate PQ option) to monitor and capture power quality information so that ongoing compliance can be assessed. This unit shall be installed in close proximity to the POI on the high side of the Customer transformer.

### **Anti-Island Protection**

The proposed AC1-170 Mercedes-Benz facility must be equipped with adequate protection to detect an island condition and disconnect from the FirstEnergy distribution system within two seconds of the formation of an island (per IEEE 1547).

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<sup>3</sup> IEEE Standard 1453-2004, IEEE Recommended Practices for Measurement and Limits of Voltage Fluctuations Associated with Light Flicker on AC Power Systems, The Institute of Electrical and Electronics Engineers, Inc. 345 East 47th Street, New York, NY 10017-2394, USA

## **Network Impacts (by PJM)**

The Queue Project **AC1-170** was evaluated as a **1.0 MW (Capacity 0.0 MW)** injection at the North Canton 34.5kV substation in the JCPL area. Project AC1-170 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-170 was studied with a commercial probability of 100%. Potential network impacts were as follows:

### **Summer Peak Analysis - 2020**

#### **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.

None

## **Light Load Analysis - 2020**

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

## **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

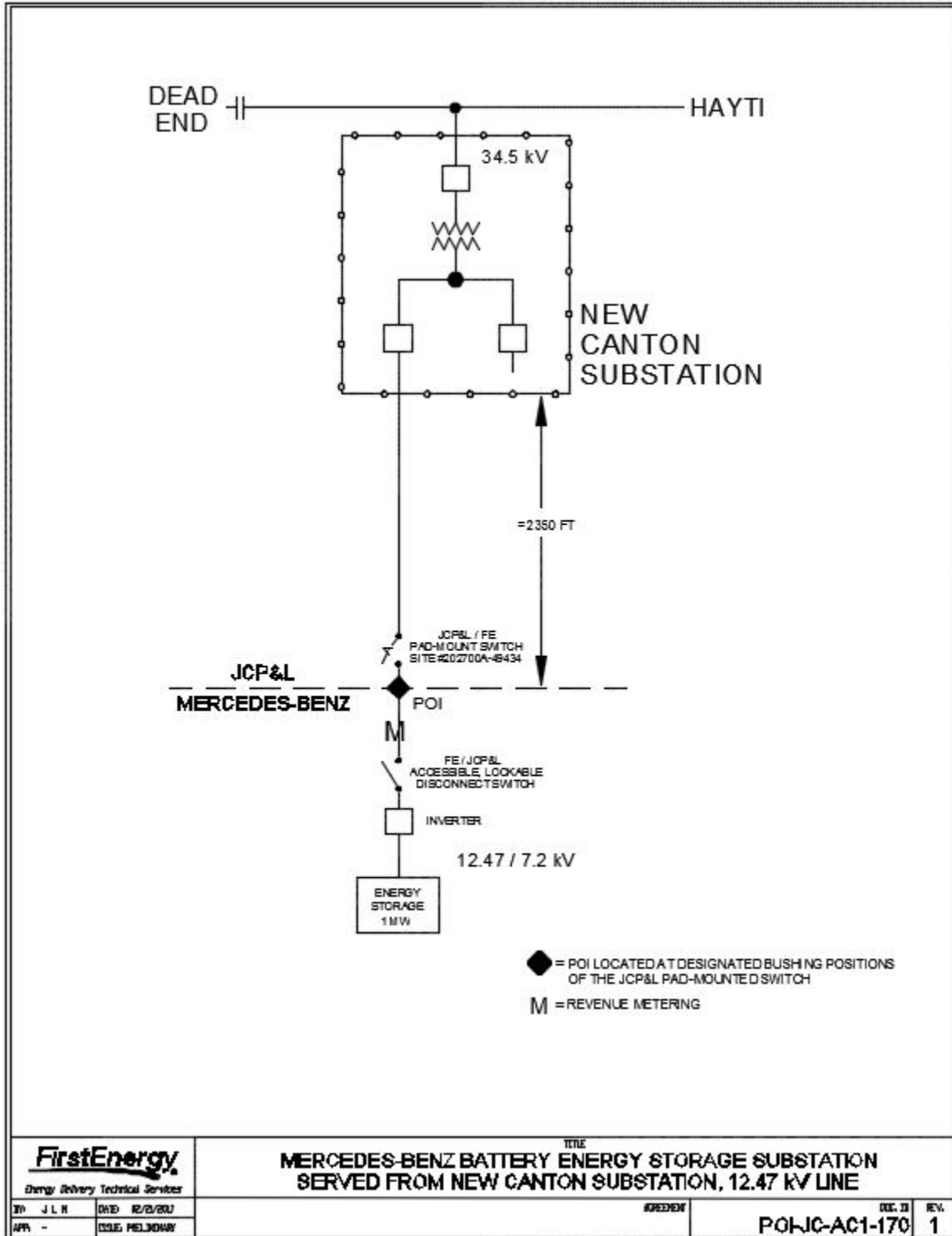
### **Contribution to Previously Identified System Reinforcements**

*(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**  
*“New Canton 12.47 kV” (AC1-170) Generation Project*



**Attachment 2**  
**Site Location**  
***“New Canton 12.47 kV” (AC1-170) Generation Project***

