# *Generation Interconnection*
# *Feasibility Study Report*
# *Queue Position AC2-191*

The Interconnection Customer (IC) has proposed a 9.6 MW (9.6 MWC) biogas fueled reciprocating engine generating facility to be located in Georgetown, Sussex County, Delaware. PJM studied AC2-191 as a 9.6 MW injection into the Delmarva Power and Light Company (DPL) system at a tap of the Sussex-Harbeson 69 kV circuit and evaluated it for compliance with reliability criteria for summer peak conditions in 2020. The planned in-service date, as stated in the Attachment N is September 28, 2018. This date may not be attainable due to additional PJM studies (System Impact and Facilities) and the Transmission Owner's construction schedule. Project AC2-191 was studied with a commercial probability of 53%.

## Point of Interconnection

The Interconnection Customer requested a transmission level Point of Interconnection (POI). As a result, the AC2-191 project will interconnect with the DPL transmission system at a new 69 kV terminal position in the new 69 kV three breaker ring bus substation to be constructed adjacent to the Sussex to Harbeson 69 kV circuit by queue project AC2-190.

### Transmission Owner Scope of Direct Connection Work

#### Substation Interconnection Estimate

**Scope:** Create a new 69 kV terminal position at the 69 kV substation tapping the Sussex-Harbson 69 kV circuit. This assumes the new substation is constructed as part of the AC1-190 project.

**Estimate:** $2,085,000
**Construction Time:** 24-36 months

**Major Equipment Included in Estimate:**

- Power Circuit Breaker, 69 kV, 2000A, 40kA, 3 cycle — Qty. 1
- Disconnect Switch, 69 kV, 2000A, Manual Wormgear, Arcing Horns — Qty. 4
- CT/VT Combination Units, 69 kV — Qty. 3
- Disconnect Switch Stand, High, 69 kV, Steel — Qty. 4
- Disconnect Switch Stand, Low, 69 kV, Steel — Qty. 2
- CT/VT Stand, Single Phase, Low, 69 kV, Steel — Qty. 3
- CVT Stand, Single Phase, Low, 69 kV, Steel — Qty. 3
- Relay Panel, Transmission Line, FL/BU (20") — Qty. 1
- Control Panel, 69 kV Circuit Breaker (10") — Qty. 1
- Bus Support Structure, 3 phase, 69 kV, Steel — Qty. 3
- Take-off structure, 69 kV — Qty. 1

**Estimate Assumptions:**

- 3-Breaker Substation will be constructed as part of the AC2-190 project.

**Required Relaying and Communications**

New protection relays are required for the new terminals.

An SEL-487 will be required for primary protection and an SEL-387 will be required for back-up protection. One 20" relay panel for each generator terminal will be required for front line and back-up protection.

New protection relays are required for the new line terminals. An SEL-421 will be required for primary protection and an SEL-311C will be required for back-up protection. A 20" relay panel will be required for each transmission line (2 total).

An SEL-451 relay on a 20" breaker control panel will be required for the control and operation of each new 69 kV circuit breaker.

The project will require re-wiring and adjustment of existing relay schemes to accommodate the new 69 kV substation.

The cost of the required relay and communications is included in the Substation Interconnection Estimate.

**Metering**

Three phase 69 kV revenue metering points will need to be established. DPL will purchase and install all metering instrument transformers as well as construct a metering structure. The secondary wiring connections at the instrument transformers will be completed by DPL's metering technicians. The metering control cable and meter cabinets will be supplied and installed by DPL. DPL will install conduit for the control cable between the instrument transformers and the metering enclosure. The location of the metering enclosure will be determined in the construction phase. DPL will provide both the Primary and the Backup meters. DPL's meter technicians will program and install the Primary & Backup solid state multi-function meters for each new metering position. Each meter will be equipped with load profile, telemetry, and DNP outputs. The IC will be provided with one meter DNP output for each meter. DPL will own the metering equipment for the interconnection point, unless the IC asserts its right to install, own, and operate the metering system.

The Interconnection Customer will be required to make provisions for a voice quality phone line within approximately 3 feet of each Company metering position to facilitate remote interrogation and data collection.

It is the IC's responsibility to send the data that PJM and DPL requires directly to PJM. The IC will grant permission for PJM to send DPL the following telemetry that the IC sends to PJM: real time MW, MVAR, volts, amperes, generator status, and interval MWH and MVARH.
The estimate for DPL to design, purchase, and install metering as specified in the aforementioned scope for metering is included in the Substation Interconnection Estimate.

**Interconnection Customer Scope of Work**
The Interconnection Customer 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. Protective relaying and metering design and installation must comply with DPL'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.

**DPL Interconnection Customer Scope of Direct Connection Work Requirements:**

- DPL requires that an IC circuit breaker is located within 500 feet of the DPL substation to facilitate the relay protection scheme between DPL and the IC at the Point of Interconnection (POI).

**Special Operating Requirements**

1. DPL will require the capability to remotely disconnect the generator from the grid by communication from its System Operations facility. Such disconnection may be facilitated by a generator breaker, or other method depending upon the specific circumstances and the evaluation by DPL.

2. DPL reserves the right to charge the Interconnection Customer operation and maintenance expenses to maintain the Interconnection Customer attachment facilities, including metering and telecommunications facilities, owned by DPL.

# Summer Peak Analysis - 2020

## Transmission Network Impacts

Potential transmission network impacts are as follows:

**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)*

1. (DP&L - DP&L) The MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 188.68% to 189.17% (DC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 5.92 MW to the thermal violation.

   CONTINGENCY 'DBL_4NC'/* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
   OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
   OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
   END

   Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

## 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)*

1. To mitigate the (DP&L) MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) overload will require increasing the emergency rating of the Milford to Steele 230 kV line by rebuilding the circuit. The rebuild includes the replacement of poles. The estimate to perform this work is **$43,965,000** and will take **4 years** to complete.

**Steady-State Voltage Requirements**

To be performed during later study phases.

**Short Circuit**

No issues identified.

**Stability and Reactive Power Requirement**

To be performed during later study phases.

**Light Load Analysis - 2020**
Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

**Facilities Study Estimate**

7 months: $50,000

**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

**Delmarva Power and Light Costs**
Cost estimates will further be refined as a part of the Impact Study and Facilities Study for this project. The Interconnection Customer will be responsible for all costs incurred by DPL in connection with the AC2-191 project. Such costs may include, but are not limited to, any transmission system assets currently in DPL's rate base that are prematurely retired due to the AC2-191 project. PJM shall work with DPL to identify these retirement costs and any additional expenses. DPL reserves the right to reassess issues presented in this document and, upon appropriate justification, submit additional costs related to the AC2-191 project.

# Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.
It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

## Appendix 1

(DP&L - DP&L) The MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 188.68% to 189.17% (DC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 5.92 MW to the thermal violation.

CONTINGENCY 'DBL_4NC' /* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
END

| *Bus Number* | *Bus Name* | *Full Contribution* |
|---|---|---|
| *931161* | *AC2-023 C* | *11.13* |
| *931162* | *AC2-023 E* | *20.99* |
| *932631* | *AC2-185 C* | *10.11* |
| *932632* | *AC2-185 E* | *16.5* |
| *932641* | *AC2-186 C* | *2.49* |
| *932642* | *AC2-186 E* | *4.06* |
| *932651* | *AC2-187 C OP* | *4.57* |
| *932652* | *AC2-187 E OP* | *7.45* |
| *932661* | *AC2-188 C* | *4.98* |
| *932662* | *AC2-188 E* | *8.12* |
| *932671* | *AC2-189 C1 O* | *0.32* |
| *932673* | *AC2-189 C2 O* | *4.43* |
| *932672* | *AC2-189 E O* | *0.6* |
| *932741* | *AC2-190* | *5.92* |
| *932691* | *AC2-191* | *5.92* |
| *232900* | *DEMECSMY* | *5.* |
| *232616* | *GEN FOOD* | *1.83* |
| *232904* | *IR4* | *44.* |
| *232923* | *MR1* | *12.52* |
| *232924* | *MR2* | *12.52* |
| *232922* | *MR3* | *12.27* |
| *232901* | *NORTHST* | *5.41* |
| *297077* | *V2-028 E* | *1.28* |
| *904212* | *V4-022 E* | *1.52* |
| *901004* | *W1-003 E* | *2.22* |
| *901014* | *W1-004 E* | *2.22* |
| *901024* | *W1-005 E* | *2.22* |
| *901034* | *W1-006 E* | *2.22* |
| *901411* | *W1-062* | *5.31* |
| *903511* | *W3-032A* | *37.18* |
| *907052* | *X1-032 E* | *1.89* |
| *907324* | *X1-096 E* | *42.95* |
| *910572* | *X3-008 E* | *3.32* |
| *910592* | *X3-015 E* | *3.8* |
| *913412* | *Y1-080 E* | *0.68* |
| *915542* | *Y3-058 E* | *4.1* |
| *920582* | *Z1-076 C* | *2.63* |
| *920583* | *Z1-076 E* | *4.3* |

| | | |
|---|---|---|
| *920592* | *Z1-077 C* | *1.88* |
| *920593* | *Z1-077 E* | *3.07* |
| *917082* | *Z2-012 E* | *6.09* |
| *920763* | *Z2-076 E* | *1.22* |
| *920773* | *Z2-077 E* | *1.22* |
| *921122* | *AA1-059 C* | *1.99* |
| *921123* | *AA1-059 E* | *0.79* |
| *921142* | *AA1-061 C* | *3.72* |
| *921143* | *AA1-061 E* | *1.83* |
| *921592* | *AA1-140 C* | *4.6* |
| *921593* | *AA1-140 E* | *7.51* |
| *921602* | *AA1-141 C* | *2.84* |
| *921603* | *AA1-141 E* | *4.63* |
| *921872* | *AA2-069* | *390.46* |
| *922213* | *AA2-129 E* | *9.83* |
| *922222* | *AA2-130* | *0.92* |
| *922752* | *AB1-056 C OP* | *41.89* |
| *922753* | *AB1-056 E OP* | *119.28* |
| *922762* | *AB1-057 C* | *42.54* |
| *922763* | *AB1-057 E* | *121.23* |
| *923282* | *AB1-137 C* | *2.63* |
| *923283* | *AB1-137 E* | *1.13* |
| *923902* | *AB2-030 E* | *1.96* |
| *923931* | *AB2-033 C* | *3.52* |
| *923932* | *AB2-033 E* | *1.39* |
| *924361* | *AB2-084 C* | *1.79* |
| *924362* | *AB2-084 E* | *2.93* |
| *924681* | *AB2-120 C OP* | *18.78* |
| *924682* | *AB2-120 E OP* | *30.64* |
| *924781* | *AB2-130 C OP* | *16.78* |
| *924782* | *AB2-130 E OP* | *27.37* |
| *924831* | *AB2-136 C OP* | *7.6* |
| *924832* | *AB2-136 E OP* | *8.06* |
| *925091* | *AB2-166 C* | *0.95* |
| *925092* | *AB2-166 E* | *1.66* |
| *925101* | *AB2-167 C* | *2.63* |
| *925102* | *AB2-167 E* | *4.31* |
| *925151* | *AB2-172 C OP* | *5.08* |
| *925152* | *AB2-172 E OP* | *8.29* |
| *925231* | *AB2-177 C* | *1.25* |
| *925232* | *AB2-177 E* | *2.04* |
| *925261* | *AB2-180 C* | *6.18* |
| *925262* | *AB2-180 E* | *2.65* |
| *925381* | *AC1-009 C* | *3.73* |
| *925382* | *AC1-009 E* | *6.09* |

| | | |
|---|---|---|
| *925651* | *AC1-041 C* | *0.95* |
| *925652* | *AC1-041 E* | *1.55* |
| *925731* | *AC1-049 C* | *0.91* |
| *925732* | *AC1-049 E* | *1.51* |
| *925741* | *AC1-050 C* | *0.74* |
| *925742* | *AC1-050 E* | *1.21* |
| *925761* | *AC1-052 C* | *4.91* |
| *925762* | *AC1-052 E* | *1.96* |
| *926131* | *AC1-091 C* | *4.99* |
| *926132* | *AC1-091 E* | *8.18* |
| *926141* | *AC1-092 C* | *4.99* |
| *926142* | *AC1-092 E* | *8.18* |
| *926151* | *AC1-093 C* | *4.72* |
| *926152* | *AC1-093 E* | *7.78* |
| *926161* | *AC1-094 C* | *3.99* |
| *926162* | *AC1-094 E* | *6.59* |
| *926171* | *AC1-095 C* | *4.12* |
| *926172* | *AC1-095 E* | *3.13* |
| *926911* | *AC1-177* | *1.85* |
| *927031* | *AC1-190 C* | *9.6* |
| *927032* | *AC1-190 E* | *4.11* |
| *927191* | *AC1-213 C* | *1.65* |
| *927192* | *AC1-213 E* | *0.85* |
| *927311* | *AC1-228 C* | *0.29* |
| *927312* | *AC1-228 E* | *0.51* |
| *927321* | *AC1-229 C* | *2.39* |
| *927322* | *AC1-229 E* | *3.89* |