

Generation Interconnection Feasibility Study Report Queue Position AC2-190

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 AC2-190 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 December 31, 2018. This date may not be attainable due to additional PJM studies (System Impact and Facilities) and the Transmission Owner's construction schedule. Project AC2-190 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 AC2-190 project will interconnect with the DPL transmission system at a new 69 kV three breaker ring bus substation to be constructed adjacent to the Sussex to Harbeson 69 kV circuit.

Transmission Owner Scope of Direct Connection Work

Substation Interconnection Estimate

Scope: Build a new 69 kV substation with a 3 position ring bus. Two of the positions on the ring bus will be transmission line terminals for the tie-in of Line 6742 to the substation. The other position will be a terminal configured for the interconnection of a generator.

Estimate: \$4,710,000

Construction Time: 24-36 months

Major Equipment Included in Estimate:

- Control Enclosure, 20' x 15' Qty. 1
- Power Circuit Breaker, 69 kV, 2000A, 40kA, 3 cycle Qty. 3
- Disconnect Switch, 69 kV, 2000A, Manual Wormgear, Arcing Horns Qty. 9
- CT/VT Combination Units, 69 kV Qty. 3
- CVT, 69 kV Qty. 6
- Disconnect Switch Stand, High, 69 kV, Steel Qty. 5
- Disconnect Switch Stand, Low, 69 kV, Steel Qty. 4
- CT/VT Stand, Single Phase, Low, 69 kV, Steel Qty. 3
- CVT Stand, Single Phase, Low, 69 kV, Steel Qty. 6
- SSVT, 69 kV/240-120 V Qty. 1
- Relay Panel, Transmission Line, FL/BU (20") Qty. 3
- Control Panel, 69 kV Circuit Breaker (10") Qty. 3
- Take-off structure, 69 kV Qty. 2

- Bus Support Structure, 3 phase, 69 kV, Steel

Qty. 8

Estimate Assumptions:

- Land purchase for the substation is not included.
- A 3.0 acre, relatively square lot is available for use.
- Site clearing and grading performed by Developer.
- Lightning protection (lightning masts) are not required.

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 188.2% to 188.68% (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 AC1-190 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 AC1-190 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 AC1-190 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 188.2% to 188.68% (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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
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