

Generation Interconnection Feasibility Study Report Queue Position AB2-063

The Interconnection Customer (IC) has proposed a 20 MW (7.6 MWC) solar generating facility to be located in Queen Anne's County, Maryland. PJM studied AB2-063 as a 20 MW injection into the Delmarva Power and Light Company (DPL) system at the Price 69 kV Substation and evaluated it for compliance with reliability criteria for summer peak conditions in 2020. The planned in-service date, as requested by the IC during the project kick-off call, is December 31, 2018.

Point of Interconnection

The Interconnection Customer requested the same Point of Interconnection as their prior queue project AB1-162. As a result, AB2-063 will interconnect with the DPL system at the Price 69 kV Substation.

Transmission Owner Scope of Work

Substation Interconnection Estimate

All work to establish the POI is assumed to have been performed by PJM Queue Project AB1-162. AB2-063 would assume the costs of the interconnection of AB1-162 in the event of cancellation of that project. Any delay to the construction schedule for the interconnection of AB1-162 would also delay the in-service date of AB2-063.

Required Relaying and Communications

AB2-063 will use the same POI as AB1-162, therefore no additional relay and communications work is required.

Metering

AB2-063 will use the same POI as AB1-162; therefore, no additional metering work is required.

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)

1. (DP&L - DP&L) The TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) loads from 43.36% to 45.53% (DC power flow) of its emergency rating (348 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 7.56 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.

2. (DP&L - DP&L) The AB2-135 TAP-NMEREDTH 69 kV line (from bus 924820 to bus 232812 ckt 1) loads from 51.77% to 54.29% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP65_A'. This project contributes approximately 2.34 MW to the thermal violation.

```
CONTINGENCY 'DP65_A'                                /*CHURCH BUS BREAKER /*  
ADDED DEC_ 22 2009  
DISCONNECT BRANCH FROM BUS 232100 TO BUS 923320 CKT 1      /*CHURCH  
AB1-141 TAP 138  
DISCONNECT BRANCH FROM BUS 232801 TO BUS 923950 CKT 1      /*CHURCH  
AB2-036 TAP 138 138  
END
```

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

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

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)

1. To mitigate the (DP&L) TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) overload will require reinforcements to increase the emergency rating of the Townsend to Middletown Tap 138 kV line. Those reinforcements include rebuilding a small section of the circuit and installing new poles and the re-mounting of 138 kV disconnect switches. The estimated cost to perform this work is **\$800,000** and will take **18 months**.
2. To mitigate the (DP&L) AB2-135 TAP-NMEREDTH 69 kV line (from bus 924820 to bus 232812 ckt 1) overload will require increasing the emergency rating of the AB2-135 to New Meredith 69 kV line. Work to include rebuild of the circuit, including the installation of new poles and a new disconnect switch. The estimate to perform this work is **\$8,674,000** and will take **3 years** to complete.

Note: Queue project AB2-063 is not expected to have cost responsibility for this network upgrade due to cost allocation rules.

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

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

To be performed during later study phases if required.

Short Circuit

(Summary of impacted circuit breakers)

No issues identified.

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

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

(If a Facilities Study is required, provide the estimated duration and cost estimate to perform Facilities Study)

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 AB2-063 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 AB2-036 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 AB2-063 project.

Appendices

The following appendices contain additional information about each flow gate presented in the body of the report. For each appendix, a description of the flow gate 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 flow gate 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 TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) loads from 43.36% to 45.53% (DC power flow) of its emergency rating (348 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 7.56 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>
232900	DEMECSMY	2.15
232851	DUP-SFR1	0.41
232902	EASTMUNI	3.4
232923	MR1	3.36
232924	MR2	3.36
232910	NRG_G1	2.43
232911	NRG_G2	2.43
292089	T-011	0.17
297076	V2-028 C	0.09
297077	V2-028 E	0.75
904212	V4-022E	0.61
232813	VAUGHN	0.15

232919	VN10	0.57
901004	W1-003 E	0.89
901014	W1-004 E	0.89
901024	W1-005 E	0.89
901034	W1-006 E	0.89
901411	W1-062	2.28
907052	X1-032 E	0.79
907324	X1-096 E	18.27
910571	X3-008 C	0.32
910572	X3-008 E	2.68
910591	X3-015 C	0.3
910592	X3-015 E	2.51
910821	X3-066 C	0.17
910822	X3-066 E	1.41
913361	Y1-079 C	0.24
913362	Y1-079 E	1.96
913411	Y1-080 C	0.05
913412	Y1-080 E	0.43
915751	Y3-033	1.46
915752	Y3-033	9.76
920543	Y3-054 E	2.48
915541	Y3-058 C	0.22
915542	Y3-058 E	1.86
920582	Z1-076 C	1.05
920583	Z1-076 E	1.71
920592	Z1-077 C	0.75
920593	Z1-077 E	1.22
916281	Z1-081 C	0.2
916282	Z1-081 E	1.65
917082	Z2-012 E	2.44
920763	Z2-076 E	0.4
920773	Z2-077 E	0.4
920812	Z2-097 C	1.57
920813	Z2-097 E	0.65
921122	AA1-059 C	0.84
921123	AA1-059 E	0.33
921142	AA1-061 C	2.87
921143	AA1-061 E	1.41
921442	AA1-110 C	1.78
921443	AA1-110 E	0.89
921592	AA1-140 C	1.51
921593	AA1-140 E	2.47
921602	AA1-141 C	1.13
921603	AA1-141 E	1.84
921872	AA2-069	104.81

922213	AA2-129 E	3.94
922222	AA2-130	0.39
922752	AB1-056 C OP	12.79
922753	AB1-056 E OP	36.43
922762	AB1-057 C	12.99
922763	AB1-057 E	37.03
923282	AB1-137 C	2.79
923283	AB1-137 E	1.2
923322	AB1-141 C OP	5.3
923323	AB1-141 E OP	2.47
923332	AB1-142 C OP	5.3
923333	AB1-142 E OP	2.47
923452	AB1-162 C OP	2.4
923453	AB1-162 E OP	3.92
923602	AB1-176 C	1.29
923603	AB1-176 E	2.12
923902	AB2-030 E	0.79
923921	AB2-032 C	5.34
923922	AB2-032 E	2.51
923931	AB2-033 C	1.41
923932	AB2-033 E	0.56
923951	AB2-036 C	13.81
923952	AB2-036 E	22.54
923961	AB2-037 C	14.99
923962	AB2-037 E	24.45
924191	AB2-063 C	2.87
924192	AB2-063 E	4.69
924361	AB2-084 C	0.75
924362	AB2-084 E	1.22
924461	AB2-095 C	2.27
924462	AB2-095 E	3.7
924681	AB2-120 C OP	7.49
924682	AB2-120 E OP	12.21
924781	AB2-130 C OP	7.73
924782	AB2-130 E OP	12.62
924801	AB2-133 C OP	14.2
924802	AB2-133 E OP	19.08
924821	AB2-135 C	12.06
924822	AB2-135 E	18.18
924831	AB2-136 C OP	5.19
924832	AB2-136 E OP	7.37
924881	AB2-142 C	1.14
924882	AB2-142 E	1.85
924891	AB2-143 C OP	3.37
924892	AB2-143 E OP	5.5

924971	AB2-153 C	2.98
924972	AB2-153 E	4.87
925071	AB2-164 C OP	1.5
925072	AB2-164 E OP	2.44
925081	AB2-165 C OP	1.5
925082	AB2-165 E OP	2.44
925091	AB2-166 C	0.4
925092	AB2-166 E	0.7
925101	AB2-167 C	1.05
925102	AB2-167 E	1.72
925151	AB2-172 C OP	4.11
925152	AB2-172 E OP	6.7
925231	AB2-177 C	0.49
925232	AB2-177 E	0.81
925251	AB2-179 C OP	26.29
925252	AB2-179 E OP	8.67
925261	AB2-180 C	2.8
925262	AB2-180 E	1.2
925271	AB2-185 C OP	4.42
925272	AB2-185 E OP	1.89
925311	AB2-192 C OP	1.5
925312	AB2-192 E OP	2.44

Appendix 3

(DP&L - DP&L) The AB2-135 TAP-NMEREDTH 69 kV line (from bus 924820 to bus 232812 ckt 1) loads from 51.77% to 54.29% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP65_A'. This project contributes approximately 2.34 MW to the thermal violation.

CONTINGENCY 'DP65_A' /*CHURCH BUS BREAKER /* ADDED
DEC_ 22 2009

DISCONNECT BRANCH FROM BUS 232100 TO BUS 923320 CKT 1 /*CHURCH AB1-141 TAP 138

DISCONNECT BRANCH FROM BUS 232801 TO BUS 923950 CKT 1 /*CHURCH AB2-036 TAP 138 138

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
910821	X3-066 C	0.05
910822	X3-066 E	0.44
915751	Y3-033	0.71
915752	Y3-033	4.78
916281	Z1-081 C	0.1
916282	Z1-081 E	0.81

920812	Z2-097 C	0.77
920813	Z2-097 E	0.32
921442	AA1-110 C	0.87
921443	AA1-110 E	0.43
923452	AB1-162 C OP	0.74
923453	AB1-162 E OP	1.21
923602	AB1-176 C	0.4
923603	AB1-176 E	0.66
923951	AB2-036 C	8.08
923952	AB2-036 E	13.18
924191	AB2-063 C	0.89
924192	AB2-063 E	1.45
924801	AB2-133 C OP	6.96
924802	AB2-133 E OP	9.35
924821	AB2-135 C	10.31
924822	AB2-135 E	15.56
924891	AB2-143 C OP	1.65
924892	AB2-143 E OP	2.7
925251	AB2-179 C OP	3.76
925252	AB2-179 E OP	1.24