Generation Interconnection
Feasibility Study Report
Queue Position AB2-136

The Interconnection Customer (IC) has proposed a 60 MW (24.8 MWC) solar generating facility to be located in Cambridge, Maryland. PJM studied the AB2-136 project at both a Primary and Secondary Point of Interconnection. The study results are provided below. The planned in-service date, as requested by the IC during the project kick-off call, is May 1, 2018. This date may not be attainable due to required additional studies and construction schedules.

Point(s) of Interconnection

The Interconnection Customer requested a Primary and Secondary Point of Interconnection (POI) be evaluated for the AB2-136 project. Both POIs are at the 69 kV transmission level.

Primary Point of Interconnection

PJM studied the AB2-136 project into the Delmarva Power and Light Company (DPL) system as a direct connection into the West Cambridge 69 kV Substation and evaluated it for compliance with reliability criteria for summer peak conditions in 2020.

Transmission Owner Scope of Attachment Facilities Work

Substation Interconnection Estimate

Scope: Reconfigure West Cambridge 69 kV Substation to be a 5 position ring bus. This will include adding 3 new 69 kV circuit breakers, disconnect switches, CVTs, line relays, breaker relays, and associated bus equipment and support structures.

Estimate: $2,974,000
Construction Time: 24 months

Major Equipment Included in Estimate:

- Power Circuit Breaker, 69 kV, 2000A, 40kA, 3 cycle — Qty. 3
- Disconnect Switch, 69 kV, 2000A, Manual Wormgear, Arcing Horns — Qty. 10
- CT/VT Combination Units, 69 kV — Qty. 3
- CVTs — Qty. 6
- Disconnect Switch Stand, High, 69 kV, Steel — Qty. 6
- 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
- Relay Panel, Transmission Line, FL/BU (20”) — Qty. 3
- Control Panel, 69 kV Circuit Breaker (10”) — Qty. 3
- Bus Support Structure, 3 phase, 69 kV, Steel — Qty. 8

Estimate Assumptions:

- Property and substation within existing fence line is large enough to allow construction of a 69 kV ring bus.
- Permitting will be performed by DPL.
- No additional purchase of property required.
- No expansion of the existing control house is 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 line terminal will be required for front line and back-up protection.

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 arrangement.

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. 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 West Cambridge 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 PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) loads from 55.38% to 74.81% (**DC power flow**) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 18.07 MW to the thermal violation.

CONTINGENCY 'DP11'/*STEELE BUS BREAKER TO MILFORD
DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1/*MILFORD STEELE 230 230
DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1/*STEELE VIENNA 230 230
END

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

2. (DP&L - DP&L) The TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) loads from 61.3% to 80.73% (**DC power flow**) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 18.07 MW to the thermal violation.

   CONTINGENCY 'DP11'/*STEELE BUS BREAKER TO MILFORD
   DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1/*MILFORD STEELE 230 230
   DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1/*STEELE VIENNA 230 230
   END

   Please refer to Appendix 2 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)

1. (DP&L – DP&L) The MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 143.78% to 145.28% (DC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 18.4 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 5 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)

1. To mitigate the (DP&L) PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) overload will require the replacement of a disconnect switch at Preston Substation. The estimate to perform this work is **$36,000** and will take approximately **1 year** to complete.

2. To mitigate the (DP&L) TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) overload will require substation reinforcements at Preston Substation and Todd Substation. The estimate to perform this work is **$67,000** and will take approximately **1 year** to complete.

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)

1. To mitigate the (DP&L) MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) overload will require rebuilding of the circuit including the replacement of poles to increase the emergency rating. 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).

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.

1. (DP&L - DP&L) The SHARPTWN-W1-070TAP1 69 kV line (from bus 232239 to bus 901490 ckt 1) loads from 66.94% to 92.74% (DC power flow) of its emergency rating (43 MVA) for the single line contingency outage of 'CKT 6708'. This project contributes approximately 11.09 MW to the thermal violation.

   CONTINGENCY 'CKT 6708'
   DISCONNECT BUS 232270/ MARDELA - HEBRON 69 & HEBRON XFMR
   DISCONNECT BUS 232838/ VIENNA - MARDELA 69
   DISCONNECT BUS 232644/ HEBRON 12
   DISCONNECT BUS 232291/ ROCKAWALKIN - NORTH SALISBURY 69
   END

2. (DP&L - DP&L) The ROCKAWLKN-NSALSBRY 69 kV line (from bus 232291 to bus 232271 ckt 1) loads from 81.07% to 96.09% (DC power flow) of its emergency rating (58 MVA) for the single line contingency outage of 'CKT 6728'. This project contributes approximately 8.71 MW to the thermal violation.

   CONTINGENCY 'CKT 6728'
   OPEN LINE FROM BUS 232272 TO BUS 232274 CIRCUIT 1/MOUNT HERMON - PINEY GROVE 69
   DISCONNECT BUS 230912 PINEY GROVE 69 CAP
   END

3. (DP&L - DP&L) The W1-070TAP1-LAUREL 69 kV line (from bus 901490 to bus 232249 ckt 1) loads from 66.71% to 92.5% (DC power flow) of its emergency rating (43 MVA) for the single line contingency outage of 'CKT 6708'. This project contributes approximately 11.09 MW to the thermal violation.

   CONTINGENCY 'CKT 6708'
   DISCONNECT BUS 232270/ MARDELA - HEBRON 69 & HEBRON XFMR
   DISCONNECT BUS 232838/ VIENNA - MARDELA 69
   DISCONNECT BUS 232644/ HEBRON 12
   DISCONNECT BUS 232291/ ROCKAWALKIN - NORTH SALISBURY 69
   END

Facilities Study Estimate

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

7 months; $100,000

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 AB2-136 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 AB2-136 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 AB2-136 project.

Secondary Point of Interconnection

PJM studied the AB2-136 project into the Delmarva Power and Light Company (DPL) system at a tap of the West Cambridge-Bayly 69 kV circuit and evaluated it for compliance with reliability criteria for summer peak conditions in 2020.

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 PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) loads from 55.28% to 74.91% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 18.26 MW to the thermal violation.

   CONTINGENCY 'DP11'/*STEELE BUS BREAKER TO MILFORD
   DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1/*MILFORD STEELE 230 230
   DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1/*STEELE VIENNA 230 230
   END

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

2. (DP&L - DP&L) The TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) loads from 61.19% to 80.83% (DC power flow) of its emergency rating (93 MVA) for the line fault

with failed breaker contingency outage of 'DP11'. This project contributes approximately 18.26 MW to the thermal violation.

CONTINGENCY 'DP11'/*STEELE BUS BREAKER TO MILFORD
DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1/*MILFORD STEELE 230 230
DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1/*STEELE VIENNA 230 230
END

Please refer to Appendix 2 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)

1. (DP&L - DP&L) The MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 143.82% to 145.32% (DC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 18.31 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 5 for a table containing the generators having contribution to this flowgate.

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.

1. (DP&L - DP&L) The SHARPTWN-W1-070TAP1 69 kV line (from bus 232239 to bus 901490 ckt 1) loads from 66.94% to 92.61% (DC power flow) of its emergency rating (43 MVA) for the single line contingency outage of 'CKT 6708'. This project contributes approximately 11.04 MW to the thermal violation.

CONTINGENCY 'CKT 6708'
DISCONNECT BUS 232270 / MARDELA - HEBRON 69 & HEBRON XFMR
DISCONNECT BUS 232838 / VIENNA - MARDELA 69
DISCONNECT BUS 232644 / HEBRON 12
DISCONNECT BUS 232291/ ROCKAWALKIN - NORTH SALISBURY 69
END

2. (DP&L - DP&L) The ROCKAWLKN-NSALSBRY 69 kV line (from bus 232291 to bus 232271 ckt 1) loads from 81.07% to 96.01% (DC power flow) of its emergency rating (58 MVA) for the single line contingency outage of 'CKT 6728'. This project contributes approximately 8.67 MW to the thermal violation.

   CONTINGENCY 'CKT 6728'
   OPEN LINE FROM BUS 232272 TO BUS 232274 CIRCUIT 1/MOUNT HERMON - PINEY GROVE 69
   DISCONNECT BUS 230912/ PINEY GROVE 69 CAP
   END

3. (DP&L - DP&L) The W1-070TAP1-LAUREL 69 kV line (from bus 901490 to bus 232249 ckt 1) loads from 66.71% to 92.38% (DC power flow) of its emergency rating (43 MVA) for the single line contingency outage of 'CKT 6708'. This project contributes approximately 11.04 MW to the thermal violation.

   CONTINGENCY 'CKT 6708'
   DISCONNECT BUS 232270 / MARDELA - HEBRON 69 & HEBRON XFMR
   DISCONNECT BUS 232838/ VIENNA - MARDELA 69
   DISCONNECT BUS 232644 / HEBRON 12
   DISCONNECT BUS 232291/ ROCKAWALKIN - NORTH SALISBURY 69
   END

Appendices
(Primary Point of Interconnection)

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 PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) loads from 55.38% to 74.81% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 18.07 MW to the thermal violation.

CONTINGENCY 'DP11' /*STEELE BUS BREAKER TO MILFORD
DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1 /*MILFORD STEELE 230 230
DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1 /*STEELE VIENNA 230 230
END

Bus Number	*Bus Name*	*Full Contribution*
232926	*CRISFLD1*	*1.20*
293670	*O-025 C*	*0.80*
297076	*V2-028 C*	*0.50*
297077	*V2-028 E*	*0.81*
904212	*V4-022E*	*0.36*
232919	*VN10*	*3.11*
232907	*VN8*	*22.70*
901003	*W1-003 C*	*0.87*
901004	*W1-003 E*	*0.52*
901013	*W1-004 C*	*0.87*
901014	*W1-004 E*	*0.52*
901023	*W1-005 C*	*0.87*
901024	*W1-005 E*	*0.52*

901033	*W1-006 C*	*0.87*
901034	*W1-006 E*	*0.52*
907052	*X1-032 E*	*0.47*
907323	*X1-096 C*	*2.35*
907324	*X1-096 E*	*11.19*
910571	*X3-008 C*	*2.93*
910572	*X3-008 E*	*4.78*
910591	*X3-015 C*	*2.10*
910592	*X3-015 E*	*3.43*
913411	*Y1-080 C*	*0.35*
913412	*Y1-080 E*	*0.56*
915541	*Y3-058 C*	*0.88*
915542	*Y3-058 E*	*1.43*
920582	*Z1-076 C*	*0.61*
920583	*Z1-076 E*	*1.00*
920592	*Z1-077 C*	*0.44*
920593	*Z1-077 E*	*0.71*
916441	*Z1-100*	*0.48*
916451	*Z1-101*	*0.48*
916461	*Z1-102*	*0.48*
920602	*Z1-103*	*0.48*
917082	*Z2-012 E*	*1.42*
920763	*Z2-076 E*	*0.18*
920773	*Z2-077 E*	*0.18*
920952	*AA1-025*	*0.42*
920962	*AA1-026*	*0.42*
920972	*AA1-027*	*0.42*
920982	*AA1-028*	*0.42*
921122	*AA1-059 C*	*0.52*
921123	*AA1-059 E*	*0.20*
921142	*AA1-061 C*	*4.87*
921143	*AA1-061 E*	*2.40*
918831	*AA1-102*	*4.51*
921592	*AA1-140 C*	*0.67*
921593	*AA1-140 E*	*1.10*
921602	*AA1-141 C*	*0.65*
921603	*AA1-141 E*	*1.07*

922213	*AA2-129 E*	*2.29*
922222	*AA2-130*	*0.24*
922752	*AB1-056 C OP*	*4.91*
922753	*AB1-056 E OP*	*13.99*
922762	*AB1-057 C*	*4.99*
922763	*AB1-057 E*	*14.22*
923282	*AB1-137 C*	*1.14*
923283	*AB1-137 E*	*0.49*
923902	*AB2-030 E*	*0.46*
923931	*AB2-033 C*	*0.82*
923932	*AB2-033 E*	*0.32*
924361	*AB2-084 C*	*0.45*
924362	*AB2-084 E*	*0.73*
924461	*AB2-095 C*	*1.16*
924462	*AB2-095 E*	*1.89*
924681	*AB2-120 C OP*	*4.32*
924682	*AB2-120 E OP*	*7.04*
924781	*AB2-130 C OP*	*4.57*
924782	*AB2-130 E OP*	*7.45*
924831	*AB2-136 C OP*	*7.47*
924832	*AB2-136 E OP*	*10.60*
925091	*AB2-166 C*	*0.26*
925092	*AB2-166 E*	*0.45*
925101	*AB2-167 C*	*0.61*
925102	*AB2-167 E*	*1.00*
925151	*AB2-172 C OP*	*7.33*
925152	*AB2-172 E OP*	*11.96*
925231	*AB2-177 C*	*0.29*

925232	*AB2-177 E*	*0.47*
925261	*AB2-180 C*	*2.15*
925262	*AB2-180 E*	*0.92*

Appendix 2

(DP&L - DP&L) The TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) loads from 61.3% to 80.73% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 18.07 MW to the thermal violation.

```
CONTINGENCY 'DP11'                                  /*STEELE BUS BREAKER TO MILFORD
  DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1          /*MILFORD
STEELE 230 230
  DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1          /*STEELE
VIENNA 230 230
  END
```

Bus Number	*Bus Name*	*Full Contribution*
232926	*CRISFLD1*	*1.20*
293670	*O-025 C*	*0.80*
297076	*V2-028 C*	*0.50*
297077	*V2-028 E*	*0.81*
904212	*V4-022E*	*0.36*
232919	*VN10*	*3.11*
232907	*VN8*	*22.70*
901003	*W1-003 C*	*0.87*
901004	*W1-003 E*	*0.52*
901013	*W1-004 C*	*0.87*
901014	*W1-004 E*	*0.52*
901023	*W1-005 C*	*0.87*
901024	*W1-005 E*	*0.52*
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901034	*W1-006 E*	*0.52*
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915542	*Y3-058 E*	*1.43*
920582	*Z1-076 C*	*0.61*
920583	*Z1-076 E*	*1.00*
920592	*Z1-077 C*	*0.44*
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916441	*Z1-100*	*0.48*
916451	*Z1-101*	*0.48*
916461	*Z1-102*	*0.48*
920602	*Z1-103*	*0.48*
917082	*Z2-012 E*	*1.42*
920763	*Z2-076 E*	*0.18*
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920972	*AA1-027*	*0.42*
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921593	*AA1-140 E*	*1.10*
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921603	*AA1-141 E*	*1.07*
922213	*AA2-129 E*	*2.29*
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922763	*AB1-057 E*	*14.22*
923282	*AB1-137 C*	*1.14*
923283	*AB1-137 E*	*0.49*
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923931	*AB2-033 C*	*0.82*
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924361	*AB2-084 C*	*0.45*
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924681	*AB2-120 C OP*	*4.32*
924682	*AB2-120 E OP*	*7.04*
924781	*AB2-130 C OP*	*4.57*
924782	*AB2-130 E OP*	*7.45*
924831	*AB2-136 C OP*	*7.47*
924832	*AB2-136 E OP*	*10.60*
925091	*AB2-166 C*	*0.26*
925092	*AB2-166 E*	*0.45*
925101	*AB2-167 C*	*0.61*
925102	*AB2-167 E*	*1.00*
925151	*AB2-172 C OP*	*7.33*
925152	*AB2-172 E OP*	*11.96*
925231	*AB2-177 C*	*0.29*
925232	*AB2-177 E*	*0.47*
925261	*AB2-180 C*	*2.15*
925262	*AB2-180 E*	*0.92*

Appendix 5

(DP&L - DP&L) The MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 143.78% to 145.28% (DC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 18.4 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*
232900	*DEMECSMY*	*30.59*
232616	*GEN FOOD*	*11.20*
232904	*IR4*	*269.47*
232923	*MR1*	*12.53*
232924	*MR2*	*12.53*
232922	*MR3*	*75.16*
232901	*NORTHST*	*33.16*
297077	*V2-028 E*	*1.28*
904212	*V4-022E*	*1.52*
901004	*W1-003 E*	*2.21*
901014	*W1-004 E*	*2.21*
901024	*W1-005 E*	*2.21*
901034	*W1-006 E*	*2.21*
901411	*W1-062*	*32.50*
903511	*W3-032A*	*227.70*
907052	*X1-032 E*	*1.89*
907324	*X1-096 E*	*42.96*
910572	*X3-008 E*	*3.32*
910592	*X3-015 E*	*3.81*
913412	*Y1-080 E*	*0.68*
920543	*Y3-054 E*	*8.30*
915542	*Y3-058 E*	*4.10*
920582	*Z1-076 C*	*2.63*
920583	*Z1-076 E*	*4.31*
920592	*Z1-077 C*	*1.88*

920593	*Z1-077 E*	*3.07*
917082	*Z2-012 E*	*6.09*
920763	*Z2-076 E*	*1.21*
920773	*Z2-077 E*	*1.21*
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*	*4.60*
921593	*AA1-140 E*	*7.51*
921602	*AA1-141 C*	*2.84*
921603	*AA1-141 E*	*4.63*
921872	*AA2-069*	*390.55*
922213	*AA2-129 E*	*9.83*
922222	*AA2-130*	*0.92*
922752	*AB1-056 C OP*	*41.90*
922753	*AB1-056 E OP*	*119.31*
922762	*AB1-057 C*	*42.55*
922763	*AB1-057 E*	*121.27*
923282	*AB1-137 C*	*8.78*
923283	*AB1-137 E*	*3.76*
923902	*AB2-030 E*	*1.96*
923931	*AB2-033 C*	*3.54*
923932	*AB2-033 E*	*1.37*
924361	*AB2-084 C*	*1.79*
924362	*AB2-084 E*	*2.93*
924461	*AB2-095 C*	*6.46*
924462	*AB2-095 E*	*10.53*
924681	*AB2-120 C OP*	*18.82*
924682	*AB2-120 E OP*	*30.70*
924781	*AB2-130 C OP*	*19.74*

924782	*AB2-130 E OP*	*32.21*
924831	*AB2-136 C OP*	*7.60*
924832	*AB2-136 E OP*	*10.79*
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*

Appendices
(Secondary Point of Interconnection)

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 PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) loads from 55.28% to 74.91% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 18.26 MW to the thermal violation.

CONTINGENCY 'DP11' /*STEELE BUS BREAKER TO MILFORD

DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1 /*MILFORD STEELE 230 230
DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1 /*STEELE VIENNA 230 230
END

Bus Number	*Bus Name*	*Full Contribution*
232926	*CRISFLD1*	*1.2031*
293670	*O-025 C*	*0.80076*
297076	*V2-028 C*	*0.500411*
297077	*V2-028 E*	*0.805009*
904212	*V4-022E*	*0.355167*
232919	*VN10*	*3.111251*
232907	*VN8*	*22.69755*
901003	*W1-003 C*	*0.871568*
901004	*W1-003 E*	*0.51606*
901013	*W1-004 C*	*0.871568*
901014	*W1-004 E*	*0.51606*
901023	*W1-005 C*	*0.871568*
901024	*W1-005 E*	*0.51606*
901033	*W1-006 C*	*0.871568*
901034	*W1-006 E*	*0.51606*
907052	*X1-032 E*	*0.47312*
907323	*X1-096 C*	*2.346045*
907324	*X1-096 E*	*11.18883*
910571	*X3-008 C*	*2.93094*
910572	*X3-008 E*	*4.78206*
910591	*X3-015 C*	*2.098418*
910592	*X3-015 E*	*3.431197*
913411	*Y1-080 C*	*0.345774*
913412	*Y1-080 E*	*0.558558*
915541	*Y3-058 C*	*0.875292*
915542	*Y3-058 E*	*1.428108*
920582	*Z1-076 C*	*0.607645*
920583	*Z1-076 E*	*0.997455*
920592	*Z1-077 C*	*0.43567*
920593	*Z1-077 E*	*0.71083*
916441	*Z1-100*	*0.481656*
916451	*Z1-101*	*0.481656*
916461	*Z1-102*	*0.481656*
920602	*Z1-103*	*0.481656*
917082	*Z2-012 E*	*1.420668*
920763	*Z2-076 E*	*0.17734*
920773	*Z2-077 E*	*0.17734*
920952	*AA1-025*	*0.424316*

920962	*AA1-026*	*0.424316*
920972	*AA1-027*	*0.424316*
920982	*AA1-028*	*0.424316*
921122	*AA1-059 C*	*0.517333*
921123	*AA1-059 E*	*0.204527*
921142	*AA1-061 C*	*4.870766*
921143	*AA1-061 E*	*2.399034*
918831	*AA1-102*	*4.511625*
921592	*AA1-140 C*	*0.673892*
921593	*AA1-140 E*	*1.099508*
921602	*AA1-141 C*	*0.654645*
921603	*AA1-141 E*	*1.068105*
922213	*AA2-129 E*	*2.287*
922222	*AA2-130*	*0.24062*
922752	*AB1-056 C OP*	*4.91372*
922753	*AB1-056 E OP*	*13.99342*
922762	*AB1-057 C*	*4.99002*
922763	*AB1-057 E*	*14.22232*
923282	*AB1-137 C*	*1.14142*
923283	*AB1-137 E*	*0.48918*
923902	*AB2-030 E*	*0.45828*
923931	*AB2-033 C*	*0.824904*
923932	*AB2-033 E*	*0.320796*
924361	*AB2-084 C*	*0.449464*
924362	*AB2-084 E*	*0.733336*
924461	*AB2-095 C*	*1.160634*
924462	*AB2-095 E*	*1.893666*
924681	*AB2-120 C OP*	*4.30844*
924682	*AB2-120 E OP*	*7.02956*
924781	*AB2-130 C OP*	*4.53568*
924782	*AB2-130 E OP*	*7.40032*
924831	*AB2-136 C OP*	*7.54912*
924832	*AB2-136 E OP*	*10.71488*
925091	*AB2-166 C*	*0.2577*
925092	*AB2-166 E*	*0.450975*
925101	*AB2-167 C*	*0.607645*
925102	*AB2-167 E*	*0.997455*
925151	*AB2-172 C OP*	*7.23387*
925152	*AB2-172 E OP*	*11.80263*
925231	*AB2-177 C*	*0.287125*
925232	*AB2-177 E*	*0.470885*
925261	*AB2-180 C*	*2.14984*
925262	*AB2-180 E*	*0.92136*

Appendix 2

(DP&L - DP&L) The TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) loads from 61.19% to 80.83% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 18.26 MW to the thermal violation.

CONTINGENCY 'DP11' /*STEELE BUS BREAKER TO MILFORD
DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1 /*MILFORD STEELE 230 230
DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1 /*STEELE VIENNA 230 230
END

Bus Number	*Bus Name*	*Full Contribution*
232926	*CRISFLD1*	*1.2031*
293670	*O-025 C*	*0.80076*
297076	*V2-028 C*	*0.500411*
297077	*V2-028 E*	*0.805009*
904212	*V4-022E*	*0.355167*
232919	*VN10*	*3.111251*
232907	*VN8*	*22.69755*
901003	*W1-003 C*	*0.871568*
901004	*W1-003 E*	*0.51606*
901013	*W1-004 C*	*0.871568*
901014	*W1-004 E*	*0.51606*
901023	*W1-005 C*	*0.871568*
901024	*W1-005 E*	*0.51606*
901033	*W1-006 C*	*0.871568*
901034	*W1-006 E*	*0.51606*
907052	*X1-032 E*	*0.47312*
907323	*X1-096 C*	*2.346045*
907324	*X1-096 E*	*11.18883*
910571	*X3-008 C*	*2.93094*
910572	*X3-008 E*	*4.78206*
910591	*X3-015 C*	*2.098418*
910592	*X3-015 E*	*3.431197*
913411	*Y1-080 C*	*0.345774*
913412	*Y1-080 E*	*0.558558*
915541	*Y3-058 C*	*0.875292*
915542	*Y3-058 E*	*1.428108*
920582	*Z1-076 C*	*0.607645*
920583	*Z1-076 E*	*0.997455*
920592	*Z1-077 C*	*0.43567*

920593	*Z1-077 E*	*0.71083*
916441	*Z1-100*	*0.481656*
916451	*Z1-101*	*0.481656*
916461	*Z1-102*	*0.481656*
920602	*Z1-103*	*0.481656*
917082	*Z2-012 E*	*1.420668*
920763	*Z2-076 E*	*0.17734*
920773	*Z2-077 E*	*0.17734*
920952	*AA1-025*	*0.424316*
920962	*AA1-026*	*0.424316*
920972	*AA1-027*	*0.424316*
920982	*AA1-028*	*0.424316*
921122	*AA1-059 C*	*0.517333*
921123	*AA1-059 E*	*0.204527*
921142	*AA1-061 C*	*4.870766*
921143	*AA1-061 E*	*2.399034*
918831	*AA1-102*	*4.511625*
921592	*AA1-140 C*	*0.673892*
921593	*AA1-140 E*	*1.099508*
921602	*AA1-141 C*	*0.654645*
921603	*AA1-141 E*	*1.068105*
922213	*AA2-129 E*	*2.287*
922222	*AA2-130*	*0.24062*
922752	*AB1-056 C OP*	*4.91372*
922753	*AB1-056 E OP*	*13.99342*
922762	*AB1-057 C*	*4.99002*
922763	*AB1-057 E*	*14.22232*
923282	*AB1-137 C*	*1.14142*
923283	*AB1-137 E*	*0.48918*
923902	*AB2-030 E*	*0.45828*
923931	*AB2-033 C*	*0.824904*
923932	*AB2-033 E*	*0.320796*
924361	*AB2-084 C*	*0.449464*
924362	*AB2-084 E*	*0.733336*
924461	*AB2-095 C*	*1.160634*
924462	*AB2-095 E*	*1.893666*
924681	*AB2-120 C OP*	*4.30844*
924682	*AB2-120 E OP*	*7.02956*
924781	*AB2-130 C OP*	*4.53568*
924782	*AB2-130 E*	*7.40032*

	OP	
924831	*AB2-136 C OP*	*7.54912*
924832	*AB2-136 E OP*	*10.71488*
925091	*AB2-166 C*	*0.2577*
925092	*AB2-166 E*	*0.450975*
925101	*AB2-167 C*	*0.607645*
925102	*AB2-167 E*	*0.997455*
925151	*AB2-172 C OP*	*7.23387*
925152	*AB2-172 E OP*	*11.80263*
925231	*AB2-177 C*	*0.287125*
925232	*AB2-177 E*	*0.470885*
925261	*AB2-180 C*	*2.14984*
925262	*AB2-180 E*	*0.92136*

Appendix 5

(DP&L - DP&L) The MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 143.82% to 145.32% (DC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 18.31 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*
232900	*DEMECSMY*	*30.59184*
232616	*GEN FOOD*	*11.200576*
232904	*IR4*	*269.466094*
232923	*MR1*	*12.52696*
232924	*MR2*	*12.52696*
232922	*MR3*	*75.16176*
232901	*NORTHST*	*33.1596*
297077	*V2-028 E*	*1.277832*
904212	*V4-022E*	*1.5221*
901004	*W1-003 E*	*2.205225*
901014	*W1-004 E*	*2.205225*

901024	*W1-005 E*	*2.205225*
901034	*W1-006 E*	*2.205225*
901411	*W1-062*	*32.50383*
903511	*W3-032A*	*227.69592*
907052	*X1-032 E*	*1.8882*
907324	*X1-096 E*	*42.96228*
910572	*X3-008 E*	*3.317248*
910592	*X3-015 E*	*3.80908*
913412	*Y1-080 E*	*0.678174*
920543	*Y3-054 E*	*8.30388*
915542	*Y3-058 E*	*4.104276*
920582	*Z1-076 C*	*2.625991*
920583	*Z1-076 E*	*4.310589*
920592	*Z1-077 C*	*1.882786*
920593	*Z1-077 E*	*3.071914*
917082	*Z2-012 E*	*6.0884*
920763	*Z2-076 E*	*1.21142*
920773	*Z2-077 E*	*1.21142*
921122	*AA1-059 C*	*1.986428*
921123	*AA1-059 E*	*0.785332*
921142	*AA1-061 C*	*3.722252*
921143	*AA1-061 E*	*1.833348*
921592	*AA1-140 C*	*4.603396*
921593	*AA1-140 E*	*7.510804*
921602	*AA1-141 C*	*2.839797*
921603	*AA1-141 E*	*4.633353*
921872	*AA2-069*	*390.5464*
922213	*AA2-129 E*	*9.8316*
922222	*AA2-130*	*0.92392*
922752	*AB1-056 C OP*	*41.896708*
922753	*AB1-056 E OP*	*119.314538*
922762	*AB1-057 C*	*42.547278*
922763	*AB1-057 E*	*121.266248*
923282	*AB1-137 C*	*8.77814*
923283	*AB1-137 E*	*3.76206*
923902	*AB2-030 E*	*1.964*
923931	*AB2-033 C*	*3.5352*
923932	*AB2-033 E*	*1.3748*
924361	*AB2-084 C*	*1.79379*
924362	*AB2-084 E*	*2.92671*
924461	*AB2-095 C*	*6.456276*
924462	*AB2-095 E*	*10.533924*
924681	*AB2-120 C*	*18.8594*

	OP	
924682	*AB2-120 E OP*	*30.7706*
924781	*AB2-130 C OP*	*19.84664*
924782	*AB2-130 E OP*	*32.38136*
924831	*AB2-136 C OP*	*7.56772*
924832	*AB2-136 E OP*	*10.74128*
925091	*AB2-166 C*	*0.95074*
925092	*AB2-166 E*	*1.663795*
925101	*AB2-167 C*	*2.625991*
925102	*AB2-167 E*	*4.310589*
925151	*AB2-172 C OP*	*5.1262*
925152	*AB2-172 E OP*	*8.3638*
925231	*AB2-177 C*	*1.245525*
925232	*AB2-177 E*	*2.042661*
925261	*AB2-180 C*	*6.17848*
925262	*AB2-180 E*	*2.64792*