Generation Interconnection
Feasibility Study Report
Queue Position AD2-029

The Interconnection Customer (IC) has proposed a 19.5 MW (7.9 MWC) solar generating facility to be located in Dorchester County, Maryland. PJM studied AD2-029 as a 19.5 MW injection into the Delmarva Power and Light Company (DPL) system at the Airey 69 kV Substation and evaluated it for compliance with reliability criteria for summer peak conditions in 2021. AD2-029 was studied with a commercial probability of 53%. The planned in-service date, as requested by the IC during the project kick-off call, is December 31, 2019. This date may not be attainable due to additional required PJM studies and Transmission Owner construction schedule.

Point of Interconnection

The Interconnection Customer requested a distribution level interconnection. Distribution facilities in the area of the AD2-029 project are owned by the Choptank Electric Cooperative (CEC). It is anticipated that the AD2-029 project will connect with the CEC system at a new substation to be constructed adjacent to the DPL West Cambridge to Vienna 69 kV circuit. The DPL transmission system will supply the new CEC substation.

Transmission Owner Scope of Attachment Facility Work

There is no DPL Attachment Facility work required for the AD2-029 project. The IC must contact CEC for their work scope and schedule.

Metering

Revenue metering specifications will be established by CEC.

Interconnection Customer Scope of Work

The Interconnection Customer assumes full responsibility for design and construction of all facilities associated with the AD2-029 generating station and the direct connection line on the IC side of the Point of Interconnection.

The IC will be required to install metering and telemetry equipment to provide revenue metering and real-time telemetry data to PJM. The requirements for this equipment are listed in Appendix 2, Section 8 of Attachment O to the PJM Tariff, as well as PJM Manuals 01 and 14D.

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.

Summer Peak Analysis - 2021

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 CHURCH-TOWNSEND 138 kV line (from bus 232100 to bus 232107 ckt 1) loads from 123.55% to 124.83% (**DC power flow**) of its emergency rating (348 MVA) for the tower line contingency outage of 'DPL_P7_1_DBL_1NCB_A'. This project contributes approximately 4.48 MW to the thermal violation.

   CONTINGENCY 'DPL_P7_1_DBL_1NCB_A'/* #1 & #2 KEENEY-STEELE 230
   OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
   OPEN LINE FROM BUS 231003 TO BUS 923960 CKT 2
   END

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

2. (DP&L - DP&L) The CHURCH-TOWNSEND 138 kV line (from bus 232100 to bus 232107 ckt 1) loads from 108.64% to 109.93% (**DC power flow**) of its emergency rating (348 MVA) for the tower line contingency outage of 'DPL_P7_1_DBL_1NCB_B'. This project contributes approximately 4.48 MW to the thermal violation.

   CONTINGENCY 'DPL_P7_1_DBL_1NCB_B'/* #1 & #2 KEENEY-STEELE 230
   OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
   OPEN LINE FROM BUS 923960 TO BUS 232000 CKT 2
   END

3. (DP&L - DP&L) The MIDLTNTP-MT PLSNT 138 kV line (from bus 232106 to bus 232104 ckt 1) loads from 119.6% to 120.89% (**DC power flow**) of its emergency rating (348 MVA) for the tower line contingency outage of 'DPL_P7_1_DBL_1NCB_A'. This project contributes approximately 4.48 MW to the thermal violation.

   CONTINGENCY 'DPL_P7_1_DBL_1NCB_A'/* #1 & #2 KEENEY-STEELE 230
   OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
   OPEN LINE FROM BUS 231003 TO BUS 923960 CKT 2

END

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

4. (DP&L - DP&L) The MIDLTNTP-MT PLSNT 138 kV line (from bus 232106 to bus 232104 ckt 1) loads from 104.7% to 105.99% (**DC power flow**) of its emergency rating (348 MVA) for the tower line contingency outage of 'DPL_P7_1_DBL_1NCB_B'. This project contributes approximately 4.48 MW to the thermal violation.

   CONTINGENCY 'DPL_P7_1_DBL_1NCB_B'/* #1 & #2 KEENEY-STEELE 230
   OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
   OPEN LINE FROM BUS 923960 TO BUS 232000 CKT 2
   END

5. (DP&L - DP&L) The TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) loads from 130.04% to 131.32% (**DC power flow**) of its emergency rating (348 MVA) for the tower line contingency outage of 'DPL_P7_1_DBL_1NCB_A'. This project contributes approximately 4.48 MW to the thermal violation.

   CONTINGENCY 'DPL_P7_1_DBL_1NCB_A'/* #1 & #2 KEENEY-STEELE 230
   OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
   OPEN LINE FROM BUS 231003 TO BUS 923960 CKT 2
   END

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

6. (DP&L - DP&L) The TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) loads from 115.13% to 116.42% (**DC power flow**) of its emergency rating (348 MVA) for the tower line contingency outage of 'DPL_P7_1_DBL_1NCB_B'. This project contributes approximately 4.48 MW to the thermal violation.

   CONTINGENCY 'DPL_P7_1_DBL_1NCB_B'/* #1 & #2 KEENEY-STEELE 230
   OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
   OPEN LINE FROM BUS 923960 TO BUS 232000 CKT 2
   END

7. (DP&L - DP&L) The PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) loads from 162.43% to 167.92% (**DC power flow**) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP11'. This project contributes approximately 5.11 MW to the thermal violation.

   CONTINGENCY 'DPL_P4-2_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 936020 CKT 1/*STEELE AD2-004 TAP 230 230
END

Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

8. (DP&L - DP&L) The PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) loads from 109.6% to 114.69% (**DC power flow**) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP12'. This project contributes approximately 4.73 MW to the thermal violation.

   CONTINGENCY 'DPL_P4-2_DP12'/*STEELE BUS BREAKER TO VIENNA
   DISCONNECT BRANCH FROM BUS 232000 TO BUS 232103 CKT 2 /*STEELE STEELE 230 138 AT21
   DISCONNECT BRANCH FROM BUS 232000 TO BUS 936020 CKT 1/*STEELE AD2-004 TAP 230 230
   END

9. (DP&L - DP&L) The PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) loads from 103.44% to 105.52% (**DC power flow**) of its emergency rating (93 MVA) for the single line contingency outage of '"232000'. This project contributes approximately 1.93 MW to the thermal violation.

   CONTINGENCY '232000'STEELE 230 936020 AD2-004 TAP 230 1
   OPEN BRANCH FROM BUS 232000 TO BUS 936020 CKT 1
   END

10. (DP&L - DP&L) The TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) loads from 168.23% to 173.73% (**DC power flow**) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP11'. This project contributes approximately 5.11 MW to the thermal violation.

    CONTINGENCY 'DPL_P4-2_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 936020 CKT 1/*STEELE AD2-004 TAP 230 230
    END

    Please refer to Appendix 5 for a table containing the generators having contribution to this flowgate.

11. (DP&L - DP&L) The TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) loads from 115.41% to 120.49% (**DC power flow**) of its emergency rating (93 MVA) for the line fault

with failed breaker contingency outage of 'DPL_P4-2_DP12'. This project contributes approximately 4.73 MW to the thermal violation.

CONTINGENCY 'DPL_P4-2_DP12'/*STEELE BUS BREAKER TO VIENNA
DISCONNECT BRANCH FROM BUS 232000 TO BUS 232103 CKT 2/*STEELE STEELE 230 138 AT21
DISCONNECT BRANCH FROM BUS 232000 TO BUS 936020 CKT 1/*STEELE AD2-004 TAP 230 230
END

12. (DP&L - DP&L) The TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) loads from 109.24% to 111.32% (**DC power flow**) of its emergency rating (93 MVA) for the single line contingency outage of '"232000'. This project contributes approximately 1.93 MW to the thermal violation.

    CONTINGENCY '232000'STEELE 230 936020 AD2-004 TAP 230 1
    OPEN BRANCH FROM BUS 232000 TO BUS 936020 CKT 1
    END

13. (DP&L - DP&L) The VIENN_69-SHARPTWN 69 kV line (from bus 232241 to bus 232239 ckt 1) loads from 126.74% to 133.69% (**DC power flow**) of its emergency rating (42 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP36'. This project contributes approximately 2.92 MW to the thermal violation.

    CONTINGENCY 'DPL_P4-2_DP36'/*COOL SPRINGS BUS BREAKER TO IR 2
    DISCONNECT BRANCH FROM BUS 232001 TO BUS 232006 CKT 1 /*COOL SPRINGS INDRIV 4 230 230
    DISCONNECT BRANCH FROM BUS 232001 TO BUS 232004 CKT 1 /*COOL SPRINGS MILFORD 230 230
    END

    Please refer to Appendix 6 for a table containing the generators having contribution to this flowgate.

14. (DP&L - DP&L) The VIENN_69-SHARPTWN 69 kV line (from bus 232241 to bus 232239 ckt 1) loads from 126.74% to 133.69% (**DC power flow**) of its emergency rating (42 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP34'. This project contributes approximately 2.92 MW to the thermal violation.

    CONTINGENCY 'DPL_P4-2_DP34'/*COOL SPRINGS BUS BREAKER TO MILFORD
    DISCONNECT BRANCH FROM BUS 232001 TO BUS 232004 CKT 1/*COOL SPRINGS INDRIV 4 230 230
    DISCONNECT BRANCH FROM BUS 232001 TO BUS 232269 CKT 1/*COOL SPRINGS 230 138
    END

15. (DP&L - DP&L) The VIENN_69-SHARPTWN 69 kV line (from bus 232241 to bus 232239 ckt 1) loads from 126.74% to 133.69% (**DC power flow**) of its emergency rating (42 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP35'. This project contributes approximately 2.92 MW to the thermal violation.

    CONTINGENCY 'DPL_P4-2_DP35'/*COOL SPRINGS BUS BREAKER TO IR
    DISCONNECT BRANCH FROM BUS 232001 TO BUS 232006 CKT 1/*COOL SPRINGS INDRIV 4 230 230
    DISCONNECT BRANCH FROM BUS 232001 TO BUS 232269 CKT 1/*COOL SPRINGS 230 138
    END

16. (DP&L - DP&L) The ROCKAWLKN-NSALSBRY 69 kV line (from bus 232291 to bus 232271 ckt 1) loads from 114.74% to 116.89% (**DC power flow**) of its emergency rating (58 MVA) for the single line contingency outage of 'DPL_P1_2_CKT 6728'. This project contributes approximately 1.24 MW to the thermal violation.

    CONTINGENCY 'DPL_P1_2_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

    Please refer to Appendix 7 for a table containing the generators having contribution to this flowgate.

17. (DP&L - DP&L) The ROCKAWLKN-NSALSBRY 69 kV line (from bus 232291 to bus 232271 ckt 1) loads from 114.44% to 116.65% (**DC power flow**) of its emergency rating (58 MVA) for the single line contingency outage of 'DPL_P1_3_LORETO AT1&2'. This project contributes approximately 1.28 MW to the thermal violation.

    CONTINGENCY 'DPL_P1_3_LORETO AT1&2'
    OPEN LINE FROM BUS 232127 TO BUS 232275 CIRCUIT 1/LORETTO AT1 138/69
    OPEN LINE FROM BUS 232127 TO BUS 232275 CIRCUIT 2 /LORETTO AT2 138/69
    END

18. (DP&L - DP&L) The AD2-004 TAP-STEELE 230 kV line (from bus 936020 to bus 232000 ckt 1) loads from 141.96% to 142.58% (**DC power flow**) of its emergency rating (551 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP59'. This project contributes approximately 7.63 MW to the thermal violation.

    CONTINGENCY 'DPL_P4-2_DP59'/*PINEY GROVE BUS BREAKER
    DISCONNECT BRANCH FROM BUS 232131 TO BUS 924680 CKT 1/*PINEY GROVE AB2-120 TAP 138 138
    DISCONNECT BRANCH FROM BUS 232007 TO BUS 232128 CKT 1/*PINEY GROVE PINEY GROVE 230 138

END

Please refer to Appendix 8 for a table containing the generators having contribution to this flowgate.

19. (DP&L - DP&L) The AD2-004 TAP-STEELE 230 kV line (from bus 936020 to bus 232000 ckt 1) loads from 141.88% to 142.5% (**DC power flow**) of its emergency rating (551 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP60A'. This project contributes approximately 7.63 MW to the thermal violation.

    CONTINGENCY 'DPL_P4-2_DP60A' /*PINEY GROVE BUS BREAKER
    DISCONNECT BRANCH FROM BUS 232007 TO BUS 232006 CKT 1/*PINEY GROVE INDIAN RIVER 230 230
    DISCONNECT BRANCH FROM BUS 232007 TO BUS 232128 CKT 1/*PINEY GROVE PINEY GROVE 230 138
    END

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 VIENNA 8-NELSON 138 kV line (from bus 232117 to bus 232119 ckt 1) loads from 164.17% to 165.02% (**DC power flow**) of its emergency rating (226 MVA) for the single line contingency outage of '"232000'. This project contributes approximately 4.25 MW to the thermal violation.

    CONTINGENCY '232000'STEELE 230 936020 AD2-004 TAP 230 1
    OPEN BRANCH FROM BUS 232000 TO BUS 936020 CKT 1
    END

2. (DP&L - DP&L) The NELSON-INDRV2&3 138 kV line (from bus 232119 to bus 232121 ckt 1) loads from 151.52% to 152.58% (**DC power flow**) of its emergency rating (193 MVA) for the single line contingency outage of '"232000'. This project contributes approximately 4.55 MW to the thermal violation.

    CONTINGENCY '232000'STEELE 230 936020 AD2-004 TAP 230 1
    OPEN BRANCH FROM BUS 232000 TO BUS 936020 CKT 1
    END

3. (DP&L - DP&L) The LORETTO-PINEY138 138 kV line (from bus 232127 to bus 232128 ckt 1) loads from 127.83% to 128.7% (**DC power flow**) of its emergency rating (159 MVA) for the single line contingency outage of '"232000'. This project contributes approximately 3.06 MW to the thermal violation.

   CONTINGENCY '232000'STEELE 230 936020 AD2-004 TAP 230 1
   OPEN BRANCH FROM BUS 232000 TO BUS 936020 CKT 1
   END

4. (DP&L - DP&L) The PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) loads from 108.71% to 113.81% (**DC power flow**) of its emergency rating (93 MVA) for the single line contingency outage of '"232000'. This project contributes approximately 4.74 MW to the thermal violation.

   CONTINGENCY '232000'STEELE 230 936020 AD2-004 TAP 230 1
   OPEN BRANCH FROM BUS 232000 TO BUS 936020 CKT 1
   END

5. (DP&L - DP&L) The TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) loads from 114.52% to 119.62% (**DC power flow**) of its emergency rating (93 MVA) for the single line contingency outage of '"232000'. This project contributes approximately 4.74 MW to the thermal violation.

   CONTINGENCY '232000'STEELE 230 936020 AD2-004 TAP 230 1
   OPEN BRANCH FROM BUS 232000 TO BUS 936020 CKT 1
   END

6. (DP&L - DP&L) The SHARPTWN-LAUREL 69 kV line (from bus 232239 to bus 232249 ckt 1) loads from 111.32% to 120.0% (**DC power flow**) of its emergency rating (43 MVA) for the single line contingency outage of 'DPL_P1_2_CKT 67BB'. This project contributes approximately 3.73 MW to the thermal violation.

   CONTINGENCY 'DPL_P1_2_CKT 67BB'
   DISCONNECT BUS 232233/ TODD - PRESTON - TANYARD 69
   DISCONNECT BUS 232606/ PRESTON 12
   DISCONNECT BUS 232821/ TANYARD - TALBOT 69
   DISCONNECT BUS 232820/ TALBOT - LAKESIDE 69
   END

7. (DP&L - DP&L) The VIENN_69-SHARPTWN 69 kV line (from bus 232241 to bus 232239 ckt 1) loads from 125.12% to 132.13% (**DC power flow**) of its emergency rating (42 MVA) for the single line contingency outage of 'DPL_P1_3_COOLSPG AT20'. This project contributes approximately 2.95 MW to the thermal violation.

   CONTINGENCY 'DPL_P1_3_COOLSPG AT20'
   OPEN LINE FROM BUS 232001 TO BUS 232269 CIRCUIT 1/COOL SPRINGS AT20 230/69

END

8. (DP&L - DP&L) The VIENN_69-SHARPTWN 69 kV line (from bus 232241 to bus 232239 ckt 1) loads from 103.63% to 110.79% (**DC power flow**) of its normal rating (42 MVA) for non-contingency condition. This project contributes approximately 3.01 MW to the thermal violation.

9. (DP&L - DP&L) The HEBRON-ROCKAWLKN 69 kV line (from bus 232270 to bus 232291 ckt 1) loads from 118.43% to 124.84% (**DC power flow**) of its emergency rating (64 MVA) for the single line contingency outage of 'DPL_P1_2_CKT 6705'. This project contributes approximately 4.1 MW to the thermal violation.

   CONTINGENCY 'DPL_P1_2_CKT 6705'
   DISCONNECT BUS 232239/ LAUREL - SHARPTOWN - VIENNA 69 & SHARPTOWN XFMR
   DISCONNECT BUS 232607/ SHARPTOWN 12
   END

10. (DP&L - DP&L) The HEBRON-ROCKAWLKN 69 kV line (from bus 232270 to bus 232291 ckt 1) loads from 98.52% to 103.6% (**DC power flow**) of its normal rating (64 MVA) for non-contingency condition. This project contributes approximately 3.25 MW to the thermal violation.

11. (DP&L - DP&L) The ROCKAWLKN-NSALSBRY 69 kV line (from bus 232291 to bus 232271 ckt 1) loads from 172.88% to 178.3% (**DC power flow**) of its emergency rating (58 MVA) for the single line contingency outage of 'DPL_P1_3_LORETO AT1&2'. This project contributes approximately 3.14 MW to the thermal violation.

    CONTINGENCY 'DPL_P1_3_LORETO AT1&2'
    OPEN LINE FROM BUS 232127 TO BUS 232275 CIRCUIT 1/LORETTO AT1 138/69
    OPEN LINE FROM BUS 232127 TO BUS 232275 CIRCUIT 2/LORETTO AT2 138/69
    END

12. (DP&L - DP&L) The ROCKAWLKN-NSALSBRY 69 kV line (from bus 232291 to bus 232271 ckt 1) loads from 151.64% to 157.25% (**DC power flow**) of its normal rating (58 MVA) for non-contingency condition. This project contributes approximately 3.25 MW to the thermal violation.

13. (DP&L - DP&L) The AD2-004 TAP-STEELE 230 kV line (from bus 936020 to bus 232000 ckt 1) loads from 137.9% to 138.5% (**DC power flow**) of its emergency rating (551 MVA) for the single line contingency outage of 'DPL_P1_2_CKT 13707'. This project contributes approximately 7.28 MW to the thermal violation.

    CONTINGENCY 'DPL_P1_2_CKT 13707'
    OPEN LINE FROM BUS 232119 TO BUS 232117 CIRCUIT 1/NELSON - VIENNA 138
    END

14. (DP&L - DP&L) The AD2-004 TAP-STEELE 230 kV line (from bus 936020 to bus 232000 ckt 1) loads from 132.32% to 132.86% (**DC power flow**) of its normal rating (551 MVA) for non-contingency condition. This project contributes approximately 6.59 MW to the thermal violation.

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&2. To mitigate the (DP&L) CHURCH-TOWNSEND 138 kV line (from bus 232100 to bus 232107 ckt 1) overload will require substation reinforcements at Church Substation. The estimate to perform this work is **$500,000** and will take approximately **24-36 months** to complete.

3&4. To mitigate the (DP&L) MIDLTNTP-MT PLSNT 138 kV line (from bus 232106 to bus 232104 ckt 1) overload will require increasing the emergency rating of the Townsend to Middletown Tap 138 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. It will also require substation reinforcements at Middletown Tap Substation. The estimate to perform this work is **$480,000** and will take approximately **32-48 months** to complete.

5&6. To mitigate the (DP&L) TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) overload will require increasing the emergency rating of the Townsend to Middletown Tap 138 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. It will also require substation reinforcements at Townsend & Middletown Tap Substation. The estimate to perform this work is **$700,000** and will take approximately **36-48 months** to complete.

7,8,9. This overload is identified in a previous queue and cost was allocated to that queue, AD2-029 will not get any cost allocation for the below project. However if all prior projects withdraw, AD2-029 will need to be re-tooled and could get cost allocation for the below upgrade in the future. AD2-029 isn't deliverable until the below upgrade is built.

Reinforcements include 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.

10, 11,12. To mitigate the (DP&L) TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) overload will require substation reinforcements at Todd Substation. The estimate to perform this work is **$600,000** and will take approximately **24 months** to complete.

In addition, there are limiting equipment at Todd & Preston that has been previously identified in a previous queue and cost was allocated to that queue, AD2-029 will not get any cost allocation for the below project. However if all prior projects withdraw, AD2-029 will need to be re-tooled and could get cost allocation for the below upgrade in the future. AD2-029 isn't deliverable until the below upgrade is built.

Reinforcements include 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.

13,14,15. To mitigate the (DP&L - DP&L) VIENN-SHARPTWN 69 kV line overload will require rebuilding the 69 kV transmission line. The estimated cost to perform this work is **$5,839,000** and will take approximately **3 years** to complete.

16&17. (DPL) To mitigate the overload will require increasing the emergency rating of the Rockawalkin to N Salisbury 69 kV line by rebuilding that section of the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. The estimated cost to perform this work is **$5,157,000** and will take **44-48 months** to complete.

Note: There is a supplemental project (s0835) in place to upgrade this entire circuit 6708 from Vienna to N Salisbury. The portion from Hebron to N Salisbury (which includes Rockawalkin – N Salisbury) is estimated to cost approximately $8.6M and is scheduled to be completed by 12/31/2019. Total cost of the entire project (Vienna to N Salisbury) is approximately **$21.1M**. Expected ISD is 12/31/2023.

18&19. To mitigate the (DP&L) AD2-004 TAP-STEELE 230 kV line (from bus 936020 to bus 232000 ckt 1) overload will require increasing the emergency rating of the Vienna to Steele 230 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. It will also require substation reinforcements at Steele Substation. The estimate to perform this work is **$59,000,000** and will take approximately **36-60 months** to complete.

Steady-State Voltage Requirements

To be performed during later study phases if required.

Short Circuit

No issues identified.

Stability and Reactive Power Requirement

To be performed during later study phases if required.

Light Load Analysis - 2021

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)

If required the deposit would be $50,000.

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 AD2-029 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 AD2-029 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 AD2-029 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 CHURCH-TOWNSEND 138 kV line (from bus 232100 to bus 232107 ckt 1) loads from 123.55% to 124.83% (**DC power flow**) of its emergency rating (348 MVA) for the tower

line contingency outage of 'DPL_P7_1_DBL_1NCB_A'. This project contributes approximately 4.48 MW to the thermal violation.

```
CONTINGENCY 'DPL_P7_1_DBL_1NCB_A'                    /* #1 & #2 KEENEY-STEELE 230
  OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
  OPEN LINE FROM BUS 231003 TO BUS 923960 CKT 2
  END
```

Bus Number	*Bus Name*	*Full Contribution*
932161	*AC2-023 C*	*5.57*
932162	*AC2-023 E*	*4.05*
933641	*AC2-186 C*	*0.73*
933642	*AC2-186 E*	*1.19*
933651	*AC2-187 C*	*1.46*
933652	*AC2-187 E*	*2.38*
933661	*AC2-188 C*	*1.46*
933662	*AC2-188 E*	*2.38*
935121	*AD1-145*	*1.83*
935131	*AD1-146 C*	*0.68*
935132	*AD1-146 E*	*1.11*
936021	*AD2-004 O1*	*153.22*
936231	*AD2-029 C*	*1.82*
936232	*AD2-029 E*	*2.65*
936351	*AD2-045 C O1*	*5.1*
936352	*AD2-045 E O1*	*3.26*
936611	*AD2-076 C O1*	*7.35*
936612	*AD2-076 E O1*	*11.99*
936691	*AD2-088 C O1*	*3.52*
936692	*AD2-088 E O1*	*2.35*
LTF	*AMIL*	*0.05*
LTF	*BAYOU*	*0.19*
LTF	*BIG_CAJUN1*	*0.3*
LTF	*BIG_CAJUN2*	*0.6*
LTF	*BLUEG*	*0.32*
LTF	*CALDERWOOD*	*0.1*
LTF	*CANNELTON*	*0.06*
LTF	*CARR*	*0.06*
LTF	*CATAWBA*	*0.06*
LTF	*CELEVELAND*	*0.19*
LTF	*CHEOAH*	*0.09*
LTF	*CHILHOWEE*	*0.03*
LTF	*CHOCTAW*	*0.2*
LTF	*CLIFTY*	*1.3*
LTF	*COTTONWOOD*	*0.76*
LTF	*DEARBORN*	*0.16*

232902	*EASTMUNI*	*4.18*
LTF	*EDWARDS*	*0.1*
LTF	*ELMERSMITH*	*0.16*
LTF	*FARMERCITY*	*0.06*
LTF	*G-007*	*0.02*
LTF	*GIBSON*	*0.11*
LTF	*HAMLET*	*0.21*
LTF	*MORGAN*	*0.32*
LTF	*NEWTON*	*0.24*
232910	*NRG_G1*	*2.05*
232911	*NRG_G2*	*2.05*
LTF	*O-066*	*0.19*
LTF	*PRAIRIE*	*0.47*
LTF	*RENSSELAER*	*0.05*
LTF	*ROSETON*	*0.33*
LTF	*ROWAN*	*0.13*
LTF	*SANTEETLA*	*0.03*
LTF	*SMITHLAND*	*0.04*
LTF	*TATANKA*	*0.11*
LTF	*TILTON*	*0.11*
LTF	*TRIMBLE*	*0.06*
LTF	*TVA*	*0.14*
LTF	*UNIONPOWER*	*0.14*
904210	*V4-022C*	*0.38*
904212	*V4-022E*	*0.61*
232919	*VN10*	*0.63*
901004	*W1-003 E*	*0.9*
901014	*W1-004 E*	*0.9*
901024	*W1-005 E*	*0.9*
901034	*W1-006 E*	*0.9*
907052	*X1-032 E*	*0.8*
910571	*X3-008 C*	*0.37*
910572	*X3-008 E*	*3.05*
910821	*X3-066 C*	*0.19*
910822	*X3-066 E*	*1.57*
913361	*Y1-079 C*	*0.28*
913362	*Y1-079 E*	*2.29*
913411	*Y1-080 C*	*0.06*
913412	*Y1-080 E*	*0.48*
915542	*Y3-058 E*	*1.92*
917082	*Z2-012 E*	*2.45*
917432	*Z2-076 E*	*0.37*
917442	*Z2-077 E*	*0.37*
917581	*Z2-097 C*	*0.33*
917582	*Z2-097 E*	*0.69*

918432	*AA1-059 E*	*0.34*
918832	*AA1-102 E*	*18.74*
920312	*AA2-129 E*	*3.96*
930201	*AB1-056 C*	*11.43*
930202	*AB1-056 E*	*32.54*
930211	*AB1-057 C*	*11.6*
930212	*AB1-057 E*	*33.07*
930881	*AB1-137 C*	*0.76*
930882	*AB1-137 E*	*0.32*
930921	*AB1-141 C*	*5.88*
930922	*AB1-141 E*	*2.74*
930931	*AB1-142 C*	*5.88*
930932	*AB1-142 E*	*2.74*
931111	*AB1-162 C*	*2.67*
931112	*AB1-162 E*	*4.37*
931261	*AB1-176 C*	*1.43*
931262	*AB1-176 E*	*2.36*
923921	*AB2-032 C*	*5.92*
923922	*AB2-032 E*	*2.79*
923951	*AB2-036 C*	*12.59*
923952	*AB2-036 E*	*20.59*
923961	*AB2-037 C*	*19.69*
923962	*AB2-037 E*	*32.17*
924191	*AB2-063 C*	*3.2*
924192	*AB2-063 E*	*5.23*
924361	*AB2-084 C*	*0.76*
924362	*AB2-084 E*	*1.24*
924681	*AB2-120 C*	*7.5*
924682	*AB2-120 E*	*12.23*
924781	*AB2-130 C O1*	*6.31*
924782	*AB2-130 E O1*	*10.3*
924801	*AB2-133 C O1*	*11.57*
924802	*AB2-133 E O1*	*14.67*
924821	*AB2-135 C*	*12.3*
924822	*AB2-135 E*	*14.03*
924831	*AB2-136 C*	*5.82*
924832	*AB2-136 E*	*6.17*
924971	*AB2-153 C*	*3.31*
924972	*AB2-153 E*	*5.4*
925091	*AB2-166 C*	*0.4*
925092	*AB2-166 E*	*0.7*
925151	*AB2-172 C*	*4.68*
925152	*AB2-172 E*	*7.63*
925261	*AB2-180 C*	*2.89*
925262	*AB2-180 E*	*1.24*

925271	*AB2-185 C*	*5.16*
925272	*AB2-185 E*	*2.21*
925651	*AC1-041 C*	*0.37*
925652	*AC1-041 E*	*0.61*
925731	*AC1-049 C*	*0.28*
925732	*AC1-049 E*	*0.45*
925741	*AC1-050 C*	*0.41*
925742	*AC1-050 E*	*0.65*
926721	*AC1-154 C*	*0.53*
926722	*AC1-154 E*	*0.87*
926911	*AC1-177*	*0.81*
927031	*AC1-190 C*	*8.54*
927032	*AC1-190 E*	*3.66*
927191	*AC1-213 C*	*0.64*
927192	*AC1-213 E*	*0.42*
927241	*AC1-220 C*	*6.57*
927242	*AC1-220 E*	*4.61*
927321	*AC1-229 C*	*0.68*
927322	*AC1-229 E*	*1.1*

Appendix 2

(DP&L - DP&L) The MIDLTNTP-MT PLSNT 138 kV line (from bus 232106 to bus 232104 ckt 1) loads from 119.6% to 120.89% (**DC power flow**) of its emergency rating (348 MVA) for the tower line contingency outage of 'DPL_P7_1_DBL_1NCB_A'. This project contributes approximately 4.48 MW to the thermal violation.

CONTINGENCY 'DPL_P7_1_DBL_1NCB_A' /* #1 & #2 KEENEY-STEELE 230
OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
OPEN LINE FROM BUS 231003 TO BUS 923960 CKT 2
END

Bus Number	*Bus Name*	*Full Contribution*
932161	*AC2-023 C*	*5.57*
932162	*AC2-023 E*	*4.05*
933641	*AC2-186 C*	*0.73*
933642	*AC2-186 E*	*1.19*
933651	*AC2-187 C*	*1.46*
933652	*AC2-187 E*	*2.38*
933661	*AC2-188 C*	*1.46*
933662	*AC2-188 E*	*2.38*
935121	*AD1-145*	*1.83*
935131	*AD1-146 C*	*0.68*
935132	*AD1-146 E*	*1.11*
936021	*AD2-004 O1*	*153.22*
936231	*AD2-029 C*	*1.82*
936232	*AD2-029 E*	*2.65*
936351	*AD2-045 C O1*	*5.1*
936352	*AD2-045 E O1*	*3.26*
936611	*AD2-076 C O1*	*7.35*
936612	*AD2-076 E O1*	*11.99*
936691	*AD2-088 C O1*	*3.52*
936692	*AD2-088 E O1*	*2.35*
LTF	*AMIL*	*0.05*
LTF	*BAYOU*	*0.19*
LTF	*BIG_CAJUN1*	*0.3*
LTF	*BIG_CAJUN2*	*0.6*
LTF	*BLUEG*	*0.32*
LTF	*CALDERWOOD*	*0.1*
LTF	*CANNELTON*	*0.06*
LTF	*CARR*	*0.06*
LTF	*CATAWBA*	*0.06*
LTF	*CELEVELAND*	*0.19*
LTF	*CHEOAH*	*0.09*
LTF	*CHILHOWEE*	*0.03*

LTF	*CHOCTAW*	*0.2*
LTF	*CLIFTY*	*1.3*
LTF	*COTTONWOOD*	*0.76*
LTF	*DEARBORN*	*0.16*
232902	*EASTMUNI*	*4.18*
LTF	*EDWARDS*	*0.1*
LTF	*ELMERSMITH*	*0.16*
LTF	*FARMERCITY*	*0.06*
LTF	*G-007*	*0.02*
LTF	*GIBSON*	*0.11*
LTF	*HAMLET*	*0.21*
LTF	*MORGAN*	*0.32*
LTF	*NEWTON*	*0.24*
232910	*NRG_G1*	*2.05*
232911	*NRG_G2*	*2.05*
LTF	*O-066*	*0.19*
LTF	*PRAIRIE*	*0.47*
LTF	*RENSSELAER*	*0.05*
LTF	*ROSETON*	*0.33*
LTF	*ROWAN*	*0.13*
LTF	*SANTEETLA*	*0.03*
LTF	*SMITHLAND*	*0.04*
LTF	*TATANKA*	*0.11*
LTF	*TILTON*	*0.11*
LTF	*TRIMBLE*	*0.06*
LTF	*TVA*	*0.14*
LTF	*UNIONPOWER*	*0.14*
904210	*V4-022C*	*0.38*
904212	*V4-022E*	*0.61*
232919	*VN10*	*0.63*
901004	*W1-003 E*	*0.9*
901014	*W1-004 E*	*0.9*
901024	*W1-005 E*	*0.9*
901034	*W1-006 E*	*0.9*
907052	*X1-032 E*	*0.8*
910571	*X3-008 C*	*0.37*
910572	*X3-008 E*	*3.05*
910821	*X3-066 C*	*0.19*
910822	*X3-066 E*	*1.57*
913361	*Y1-079 C*	*0.28*
913362	*Y1-079 E*	*2.29*
913411	*Y1-080 C*	*0.06*
913412	*Y1-080 E*	*0.48*
915542	*Y3-058 E*	*1.92*
917082	*Z2-012 E*	*2.45*

917432	*Z2-076 E*	*0.37*
917442	*Z2-077 E*	*0.37*
917581	*Z2-097 C*	*0.33*
917582	*Z2-097 E*	*0.69*
918432	*AA1-059 E*	*0.34*
918832	*AA1-102 E*	*18.74*
920312	*AA2-129 E*	*3.96*
930201	*AB1-056 C*	*11.43*
930202	*AB1-056 E*	*32.54*
930211	*AB1-057 C*	*11.6*
930212	*AB1-057 E*	*33.07*
930881	*AB1-137 C*	*0.76*
930882	*AB1-137 E*	*0.32*
930921	*AB1-141 C*	*5.88*
930922	*AB1-141 E*	*2.74*
930931	*AB1-142 C*	*5.88*
930932	*AB1-142 E*	*2.74*
931111	*AB1-162 C*	*2.67*
931112	*AB1-162 E*	*4.37*
931261	*AB1-176 C*	*1.43*
931262	*AB1-176 E*	*2.36*
923921	*AB2-032 C*	*5.92*
923922	*AB2-032 E*	*2.79*
923951	*AB2-036 C*	*12.59*
923952	*AB2-036 E*	*20.59*
923961	*AB2-037 C*	*19.69*
923962	*AB2-037 E*	*32.17*
924191	*AB2-063 C*	*3.2*
924192	*AB2-063 E*	*5.23*
924361	*AB2-084 C*	*0.76*
924362	*AB2-084 E*	*1.24*
924681	*AB2-120 C*	*7.5*
924682	*AB2-120 E*	*12.23*
924781	*AB2-130 C O1*	*6.31*
924782	*AB2-130 E O1*	*10.3*
924801	*AB2-133 C O1*	*11.57*
924802	*AB2-133 E O1*	*14.67*
924821	*AB2-135 C*	*12.3*
924822	*AB2-135 E*	*14.03*
924831	*AB2-136 C*	*5.82*
924832	*AB2-136 E*	*6.17*
924971	*AB2-153 C*	*3.31*
924972	*AB2-153 E*	*5.4*
925091	*AB2-166 C*	*0.4*
925092	*AB2-166 E*	*0.7*

925151	*AB2-172 C*	*4.68*
925152	*AB2-172 E*	*7.63*
925251	*AB2-179 C*	*26.91*
925252	*AB2-179 E*	*8.87*
925261	*AB2-180 C*	*2.89*
925262	*AB2-180 E*	*1.24*
925271	*AB2-185 C*	*5.16*
925272	*AB2-185 E*	*2.21*
925651	*AC1-041 C*	*0.37*
925652	*AC1-041 E*	*0.61*
925731	*AC1-049 C*	*0.28*
925732	*AC1-049 E*	*0.45*
925741	*AC1-050 C*	*0.41*
925742	*AC1-050 E*	*0.65*
926721	*AC1-154 C*	*0.53*
926722	*AC1-154 E*	*0.87*
926911	*AC1-177*	*0.81*
927031	*AC1-190 C*	*8.54*
927032	*AC1-190 E*	*3.66*
927191	*AC1-213 C*	*0.64*
927192	*AC1-213 E*	*0.42*
927241	*AC1-220 C*	*6.57*
927242	*AC1-220 E*	*4.61*
927321	*AC1-229 C*	*0.68*
927322	*AC1-229 E*	*1.1*

Appendix 3

(DP&L - DP&L) The TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) loads from 130.04% to 131.32% (**DC power flow**) of its emergency rating (348 MVA) for the tower line contingency outage of 'DPL_P7_1_DBL_1NCB_A'. This project contributes approximately 4.48 MW to the thermal violation.

CONTINGENCY 'DPL_P7_1_DBL_1NCB_A' /* #1 & #2 KEENEY-STEELE 230
OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1
OPEN LINE FROM BUS 231003 TO BUS 923960 CKT 2
END

Bus Number	*Bus Name*	*Full Contribution*
932161	*AC2-023 C*	*5.57*
932162	*AC2-023 E*	*4.05*
933641	*AC2-186 C*	*0.73*
933642	*AC2-186 E*	*1.19*
933651	*AC2-187 C*	*1.46*
933652	*AC2-187 E*	*2.38*
933661	*AC2-188 C*	*1.46*
933662	*AC2-188 E*	*2.38*
935121	*AD1-145*	*1.83*
935131	*AD1-146 C*	*0.68*
935132	*AD1-146 E*	*1.11*
936021	*AD2-004 O1*	*153.22*
936231	*AD2-029 C*	*1.82*
936232	*AD2-029 E*	*2.65*
936351	*AD2-045 C O1*	*5.1*
936352	*AD2-045 E O1*	*3.26*
936611	*AD2-076 C O1*	*7.35*
936612	*AD2-076 E O1*	*11.99*
936691	*AD2-088 C O1*	*3.52*
936692	*AD2-088 E O1*	*2.35*
LTF	*AMIL*	*0.05*
LTF	*BAYOU*	*0.19*
LTF	*BIG_CAJUN1*	*0.3*
LTF	*BIG_CAJUN2*	*0.6*
LTF	*BLUEG*	*0.32*
LTF	*CALDERWOOD*	*0.1*
LTF	*CANNELTON*	*0.06*
LTF	*CARR*	*0.06*
LTF	*CATAWBA*	*0.06*
LTF	*CELEVELAND*	*0.19*
LTF	*CHEOAH*	*0.09*
LTF	*CHILHOWEE*	*0.03*

LTF	*CHOCTAW*	*0.2*
LTF	*CLIFTY*	*1.3*
LTF	*COTTONWOOD*	*0.76*
LTF	*DEARBORN*	*0.16*
232902	*EASTMUNI*	*4.18*
LTF	*EDWARDS*	*0.1*
LTF	*ELMERSMITH*	*0.16*
LTF	*FARMERCITY*	*0.06*
LTF	*G-007*	*0.02*
LTF	*GIBSON*	*0.11*
LTF	*HAMLET*	*0.21*
LTF	*MORGAN*	*0.32*
LTF	*NEWTON*	*0.24*
232910	*NRG_G1*	*2.05*
232911	*NRG_G2*	*2.05*
LTF	*O-066*	*0.19*
LTF	*PRAIRIE*	*0.47*
LTF	*RENSSELAER*	*0.05*
LTF	*ROSETON*	*0.33*
LTF	*ROWAN*	*0.13*
LTF	*SANTEETLA*	*0.03*
LTF	*SMITHLAND*	*0.04*
LTF	*TATANKA*	*0.11*
LTF	*TILTON*	*0.11*
LTF	*TRIMBLE*	*0.06*
LTF	*TVA*	*0.14*
LTF	*UNIONPOWER*	*0.14*
904210	*V4-022C*	*0.38*
904212	*V4-022E*	*0.61*
232919	*VN10*	*0.63*
901004	*W1-003 E*	*0.9*
901014	*W1-004 E*	*0.9*
901024	*W1-005 E*	*0.9*
901034	*W1-006 E*	*0.9*
907052	*X1-032 E*	*0.8*
910571	*X3-008 C*	*0.37*
910572	*X3-008 E*	*3.05*
910821	*X3-066 C*	*0.19*
910822	*X3-066 E*	*1.57*
913361	*Y1-079 C*	*0.28*
913362	*Y1-079 E*	*2.29*
913411	*Y1-080 C*	*0.06*
913412	*Y1-080 E*	*0.48*
915542	*Y3-058 E*	*1.92*
917082	*Z2-012 E*	*2.45*

917432	*Z2-076 E*	*0.37*
917442	*Z2-077 E*	*0.37*
917581	*Z2-097 C*	*0.33*
917582	*Z2-097 E*	*0.69*
918432	*AA1-059 E*	*0.34*
918832	*AA1-102 E*	*18.74*
920312	*AA2-129 E*	*3.96*
930201	*AB1-056 C*	*11.43*
930202	*AB1-056 E*	*32.54*
930211	*AB1-057 C*	*11.6*
930212	*AB1-057 E*	*33.07*
930881	*AB1-137 C*	*0.76*
930882	*AB1-137 E*	*0.32*
930921	*AB1-141 C*	*5.88*
930922	*AB1-141 E*	*2.74*
930931	*AB1-142 C*	*5.88*
930932	*AB1-142 E*	*2.74*
931111	*AB1-162 C*	*2.67*
931112	*AB1-162 E*	*4.37*
931261	*AB1-176 C*	*1.43*
931262	*AB1-176 E*	*2.36*
923921	*AB2-032 C*	*5.92*
923922	*AB2-032 E*	*2.79*
923951	*AB2-036 C*	*12.59*
923952	*AB2-036 E*	*20.59*
923961	*AB2-037 C*	*19.69*
923962	*AB2-037 E*	*32.17*
924191	*AB2-063 C*	*3.2*
924192	*AB2-063 E*	*5.23*
924361	*AB2-084 C*	*0.76*
924362	*AB2-084 E*	*1.24*
924681	*AB2-120 C*	*7.5*
924682	*AB2-120 E*	*12.23*
924781	*AB2-130 C O1*	*6.31*
924782	*AB2-130 E O1*	*10.3*
924801	*AB2-133 C O1*	*11.57*
924802	*AB2-133 E O1*	*14.67*
924821	*AB2-135 C*	*12.3*
924822	*AB2-135 E*	*14.03*
924831	*AB2-136 C*	*5.82*
924832	*AB2-136 E*	*6.17*
924971	*AB2-153 C*	*3.31*
924972	*AB2-153 E*	*5.4*
925091	*AB2-166 C*	*0.4*
925092	*AB2-166 E*	*0.7*

925151	*AB2-172 C*	*4.68*
925152	*AB2-172 E*	*7.63*
925251	*AB2-179 C*	*26.91*
925252	*AB2-179 E*	*8.87*
925261	*AB2-180 C*	*2.89*
925262	*AB2-180 E*	*1.24*
925271	*AB2-185 C*	*5.16*
925272	*AB2-185 E*	*2.21*
925651	*AC1-041 C*	*0.37*
925652	*AC1-041 E*	*0.61*
925731	*AC1-049 C*	*0.28*
925732	*AC1-049 E*	*0.45*
925741	*AC1-050 C*	*0.41*
925742	*AC1-050 E*	*0.65*
926721	*AC1-154 C*	*0.53*
926722	*AC1-154 E*	*0.87*
926911	*AC1-177*	*0.81*
927031	*AC1-190 C*	*8.54*
927032	*AC1-190 E*	*3.66*
927191	*AC1-213 C*	*0.64*
927192	*AC1-213 E*	*0.42*
927241	*AC1-220 C*	*6.57*
927242	*AC1-220 E*	*4.61*
927321	*AC1-229 C*	*0.68*
927322	*AC1-229 E*	*1.1*

Appendix 4

(DP&L - DP&L) The PRESTON-TANYARD 69 kV line (from bus 232233 to bus 232821 ckt 1) loads from 162.43% to 167.92% (**DC power flow**) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP11'. This project contributes approximately 5.11 MW to the thermal violation.

CONTINGENCY 'DPL_P4-2_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 936020 CKT 1 /*STEELE AD2-004 TAP 230 230
 END

Bus Number	*Bus Name*	*Full Contribution*
932161	*AC2-023 C*	*4.32*
932162	*AC2-023 E*	*3.14*
935121	*AD1-145*	*0.98*
935131	*AD1-146 C*	*0.29*
935132	*AD1-146 E*	*0.47*
936021	*AD2-004 O1*	*86.5*
936231	*AD2-029 C*	*2.08*
936232	*AD2-029 E*	*3.03*
936691	*AD2-088 C O1*	*2.09*
936692	*AD2-088 E O1*	*1.4*
LTF	*AMIL*	*0.02*
LTF	*BAYOU*	*0.07*
LTF	*BIG_CAJUN1*	*0.11*
LTF	*BIG_CAJUN2*	*0.23*
LTF	*BLUEG*	*0.12*
LTF	*CALDERWOOD*	*0.04*
LTF	*CANNELTON*	*0.02*
LTF	*CARR*	*0.02*
LTF	*CATAWBA*	*0.02*
LTF	*CELEVELAND*	*0.07*
LTF	*CHEOAH*	*0.04*
LTF	*CHILHOWEE*	*0.01*
LTF	*CHOCTAW*	*0.08*
LTF	*CLIFTY*	*0.51*
LTF	*COTTONWOOD*	*0.3*
LTF	*DEARBORN*	*0.06*
LTF	*EDWARDS*	*0.04*
LTF	*ELMERSMITH*	*0.06*
LTF	*FARMERCITY*	*0.02*
LTF	*G-007*	*0.03*

LTF	*GIBSON*	*0.04*
LTF	*HAMLET*	*0.08*
LTF	*MORGAN*	*0.12*
LTF	*NEWTON*	*0.09*
LTF	*O-066*	*0.12*
LTF	*PRAIRIE*	*0.18*
LTF	*RENSSELAER*	*0.02*
LTF	*ROSETON*	*0.13*
LTF	*ROWAN*	*0.05*
LTF	*SANTEETLA*	*0.01*
LTF	*SMITHLAND*	*0.01*
LTF	*TATANKA*	*0.04*
LTF	*TILTON*	*0.04*
LTF	*TRIMBLE*	*0.02*
LTF	*TVA*	*0.06*
LTF	*UNIONPOWER*	*0.06*
904210	*V4-022C*	*0.21*
904212	*V4-022E*	*0.34*
232919	*VN10*	*0.6*
901004	*W1-003 E*	*0.5*
901014	*W1-004 E*	*0.5*
901024	*W1-005 E*	*0.5*
901034	*W1-006 E*	*0.5*
907052	*X1-032 E*	*0.46*
910571	*X3-008 C*	*0.57*
910572	*X3-008 E*	*4.74*
913411	*Y1-080 C*	*0.07*
913412	*Y1-080 E*	*0.55*
915541	*Y3-058 C*	*0.17*
915542	*Y3-058 E*	*1.38*
917082	*Z2-012 E*	*1.37*
917432	*Z2-076 E*	*0.17*
917442	*Z2-077 E*	*0.17*
918432	*AA1-059 E*	*0.2*
918832	*AA1-102 E*	*10.78*
920312	*AA2-129 E*	*2.2*
930201	*AB1-056 C*	*4.65*
930202	*AB1-056 E*	*13.25*
930211	*AB1-057 C*	*4.73*
930212	*AB1-057 E*	*13.47*
930881	*AB1-137 C*	*0.33*
930882	*AB1-137 E*	*0.14*
924361	*AB2-084 C*	*0.43*
924362	*AB2-084 E*	*0.71*
924681	*AB2-120 C*	*4.15*

924682	*AB2-120 E*	*6.77*
924781	*AB2-130 C O1*	*3.76*
924782	*AB2-130 E O1*	*6.13*
924831	*AB2-136 C*	*7.4*
924832	*AB2-136 E*	*7.85*
925091	*AB2-166 C*	*0.25*
925092	*AB2-166 E*	*0.44*
925151	*AB2-172 C*	*7.26*
925152	*AB2-172 E*	*11.85*
925261	*AB2-180 C*	*2.08*
925262	*AB2-180 E*	*0.89*
925651	*AC1-041 C*	*0.21*
925652	*AC1-041 E*	*0.34*
925731	*AC1-049 C*	*0.13*
925732	*AC1-049 E*	*0.21*
925741	*AC1-050 C*	*0.35*
925742	*AC1-050 E*	*0.55*
926911	*AC1-177*	*0.46*
927031	*AC1-190 C*	*12.84*
927032	*AC1-190 E*	*5.5*
927191	*AC1-213 C*	*0.41*
927192	*AC1-213 E*	*0.27*
927321	*AC1-229 C*	*0.29*
927322	*AC1-229 E*	*0.47*

Appendix 5

(DP&L - DP&L) The TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) loads from 168.23% to 173.73% (**DC power flow**) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP11'. This project contributes approximately 5.11 MW to the thermal violation.

CONTINGENCY 'DPL_P4-2_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 936020 CKT 1 /*STEELE AD2-004 TAP 230 230
 END

Bus Number	*Bus Name*	*Full Contribution*
932161	*AC2-023 C*	*4.32*
932162	*AC2-023 E*	*3.14*
935121	*AD1-145*	*0.98*
935131	*AD1-146 C*	*0.29*
935132	*AD1-146 E*	*0.47*
936021	*AD2-004 O1*	*86.5*
936231	*AD2-029 C*	*2.08*
936232	*AD2-029 E*	*3.03*
936691	*AD2-088 C O1*	*2.09*
936692	*AD2-088 E O1*	*1.4*
LTF	*AMIL*	*0.02*
LTF	*BAYOU*	*0.07*
LTF	*BIG_CAJUN1*	*0.11*
LTF	*BIG_CAJUN2*	*0.23*
LTF	*BLUEG*	*0.12*
LTF	*CALDERWOOD*	*0.04*
LTF	*CANNELTON*	*0.02*
LTF	*CARR*	*0.02*
LTF	*CATAWBA*	*0.02*
LTF	*CELEVELAND*	*0.07*
LTF	*CHEOAH*	*0.04*
LTF	*CHILHOWEE*	*0.01*
LTF	*CHOCTAW*	*0.08*
LTF	*CLIFTY*	*0.51*
LTF	*COTTONWOOD*	*0.3*
LTF	*DEARBORN*	*0.06*
LTF	*EDWARDS*	*0.04*
LTF	*ELMERSMITH*	*0.06*
LTF	*FARMERCITY*	*0.02*
LTF	*G-007*	*0.03*

LTF	*GIBSON*	*0.04*
LTF	*HAMLET*	*0.08*
LTF	*MORGAN*	*0.12*
LTF	*NEWTON*	*0.09*
LTF	*O-066*	*0.12*
LTF	*PRAIRIE*	*0.18*
LTF	*RENSSELAER*	*0.02*
LTF	*ROSETON*	*0.13*
LTF	*ROWAN*	*0.05*
LTF	*SANTEETLA*	*0.01*
LTF	*SMITHLAND*	*0.01*
LTF	*TATANKA*	*0.04*
LTF	*TILTON*	*0.04*
LTF	*TRIMBLE*	*0.02*
LTF	*TVA*	*0.06*
LTF	*UNIONPOWER*	*0.06*
904210	*V4-022C*	*0.21*
904212	*V4-022E*	*0.34*
232919	*VN10*	*0.6*
901004	*W1-003 E*	*0.5*
901014	*W1-004 E*	*0.5*
901024	*W1-005 E*	*0.5*
901034	*W1-006 E*	*0.5*
907052	*X1-032 E*	*0.46*
910571	*X3-008 C*	*0.57*
910572	*X3-008 E*	*4.74*
913411	*Y1-080 C*	*0.07*
913412	*Y1-080 E*	*0.55*
915541	*Y3-058 C*	*0.17*
915542	*Y3-058 E*	*1.38*
917082	*Z2-012 E*	*1.37*
917432	*Z2-076 E*	*0.17*
917442	*Z2-077 E*	*0.17*
918432	*AA1-059 E*	*0.2*
918832	*AA1-102 E*	*10.78*
920312	*AA2-129 E*	*2.2*
930201	*AB1-056 C*	*4.65*
930202	*AB1-056 E*	*13.25*
930211	*AB1-057 C*	*4.73*
930212	*AB1-057 E*	*13.47*
930881	*AB1-137 C*	*0.33*
930882	*AB1-137 E*	*0.14*
924361	*AB2-084 C*	*0.43*
924362	*AB2-084 E*	*0.71*
924681	*AB2-120 C*	*4.15*

924682	*AB2-120 E*	*6.77*
924781	*AB2-130 C O1*	*3.76*
924782	*AB2-130 E O1*	*6.13*
924831	*AB2-136 C*	*7.4*
924832	*AB2-136 E*	*7.85*
925091	*AB2-166 C*	*0.25*
925092	*AB2-166 E*	*0.44*
925151	*AB2-172 C*	*7.26*
925152	*AB2-172 E*	*11.85*
925261	*AB2-180 C*	*2.08*
925262	*AB2-180 E*	*0.89*
925651	*AC1-041 C*	*0.21*
925652	*AC1-041 E*	*0.34*
925731	*AC1-049 C*	*0.13*
925732	*AC1-049 E*	*0.21*
925741	*AC1-050 C*	*0.35*
925742	*AC1-050 E*	*0.55*
926911	*AC1-177*	*0.46*
927031	*AC1-190 C*	*12.84*
927032	*AC1-190 E*	*5.5*
927191	*AC1-213 C*	*0.41*
927192	*AC1-213 E*	*0.27*
927321	*AC1-229 C*	*0.29*
927322	*AC1-229 E*	*0.47*

Appendix 6

(DP&L - DP&L) The VIENN_69-SHARPTWN 69 kV line (from bus 232241 to bus 232239 ckt 1) loads from 126.74% to 133.69% (**DC power flow**) of its emergency rating (42 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP36'. This project contributes approximately 2.92 MW to the thermal violation.

CONTINGENCY 'DPL_P4-2_DP36' /*COOL SPRINGS BUS BREAKER TO IR 2
 DISCONNECT BRANCH FROM BUS 232001 TO BUS 232006 CKT 1 /*COOL SPRINGS INDRIV 4 230 230
 DISCONNECT BRANCH FROM BUS 232001 TO BUS 232004 CKT 1 /*COOL SPRINGS MILFORD 230 230
 END

Bus Number	*Bus Name*	*Full Contribution*
932161	*AC2-023 C*	*1.7*
932162	*AC2-023 E*	*1.24*
936231	*AD2-029 C*	*1.19*
936232	*AD2-029 E*	*1.73*
LTF	*CARR*	*< 0.01*
LTF	*G-007*	*< 0.01*
LTF	*O-066*	*0.02*
LTF	*RENSSELAER*	*< 0.01*
LTF	*ROSETON*	*< 0.01*
232919	*VN10*	*0.45*
910571	*X3-008 C*	*0.19*
910572	*X3-008 E*	*1.55*
913411	*Y1-080 C*	*0.04*
913412	*Y1-080 E*	*0.31*
924831	*AB2-136 C*	*3.53*
924832	*AB2-136 E*	*3.75*
925151	*AB2-172 C*	*2.38*
925152	*AB2-172 E*	*3.89*
925741	*AC1-050 C*	*0.19*
925742	*AC1-050 E*	*0.31*
927031	*AC1-190 C*	*4.49*
927032	*AC1-190 E*	*1.93*

Appendix 7

(DP&L - DP&L) The ROCKAWLKN-NSALSBRY 69 kV line (from bus 232291 to bus 232271 ckt 1) loads from 114.74% to 116.89% (**DC power flow**) of its emergency rating (58 MVA) for the single line contingency outage of 'DPL_P1_2_CKT 6728'. This project contributes approximately 1.24 MW to the thermal violation.

CONTINGENCY 'DPL_P1_2_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

Bus Number	*Bus Name*	*Full Contribution*
932161	*AC2-023 C*	*14.15*
936021	*AD2-004 O1*	*3.54*
936231	*AD2-029 C*	*1.24*
LTF	*CBM-N*	*< 0.01*
LTF	*CBM-S1*	*0.02*
LTF	*CBM-S2*	*0.02*
LTF	*CBM-W1*	*0.07*
LTF	*CBM-W2*	*0.11*
LTF	*CIN*	*0.01*
LTF	*CPLE*	*< 0.01*
LTF	*IPL*	*< 0.01*
LTF	*LGEE*	*< 0.01*
LTF	*MEC*	*0.03*
LTF	*MECS*	*0.02*
LTF	*NYISO*	*0.02*
LTF	*O-066A*	*< 0.01*
LTF	*VFT*	*< 0.01*
232919	*VN10*	*0.47*
LTF	*WEC*	*< 0.01*
910571	*X3-008 C*	*0.19*
913411	*Y1-080 C*	*0.04*
915541	*Y3-058 C*	*0.72*
924831	*AB2-136 C*	*3.68*
925091	*AB2-166 C*	*-0.32*
925151	*AB2-172 C*	*2.47*
925261	*AB2-180 C*	*8.94*
925741	*AC1-050 C*	*0.75*
927031	*AC1-190 C*	*4.67*

Appendix 8

(DP&L - DP&L) The AD2-004 TAP-STEELE 230 kV line (from bus 936020 to bus 232000 ckt 1) loads from 141.96% to 142.58% (**DC power flow**) of its emergency rating (551 MVA) for the line fault with failed breaker contingency outage of 'DPL_P4-2_DP59'. This project contributes approximately 7.63 MW to the thermal violation.

CONTINGENCY 'DPL_P4-2_DP59' /*PINEY GROVE BUS BREAKER
DISCONNECT BRANCH FROM BUS 232131 TO BUS 924680 CKT 1 /*PINEY GROVE AB2-120 TAP 138 138
DISCONNECT BRANCH FROM BUS 232007 TO BUS 232128 CKT 1 /*PINEY GROVE PINEY GROVE 230 138
END

Bus Number	*Bus Name*	*Full Contribution*
932161	*AC2-023 C*	*10.65*
932162	*AC2-023 E*	*7.75*
935121	*AD1-145*	*2.16*
935131	*AD1-146 C*	*0.52*
935132	*AD1-146 E*	*0.84*
936021	*AD2-004 O1*	*559.76*
936231	*AD2-029 C*	*3.11*
936232	*AD2-029 E*	*4.52*
936691	*AD2-088 C O1*	*4.8*
936692	*AD2-088 E O1*	*3.2*
LTF	*AMIL*	*0.07*
LTF	*BAYOU*	*0.24*
LTF	*BIG_CAJUN1*	*0.37*
LTF	*BIG_CAJUN2*	*0.74*
LTF	*BLUEG*	*0.4*
LTF	*CALDERWOOD*	*0.12*
LTF	*CANNELTON*	*0.07*
LTF	*CARR*	*0.08*
LTF	*CATAWBA*	*0.08*
LTF	*CELEVELAND*	*0.23*
LTF	*CHEOAH*	*0.11*
LTF	*CHILHOWEE*	*0.04*
LTF	*CHOCTAW*	*0.24*
LTF	*CLIFTY*	*1.63*
LTF	*COTTONWOOD*	*0.95*
232926	*CRISFLD1*	*0.97*
LTF	*DEARBORN*	*0.2*
LTF	*EDWARDS*	*0.12*
LTF	*ELMERSMITH*	*0.2*
LTF	*FARMERCITY*	*0.08*
LTF	*G-007*	*0.19*

LTF	*GIBSON*	*0.13*
LTF	*HAMLET*	*0.26*
LTF	*MORGAN*	*0.4*
LTF	*NEWTON*	*0.3*
LTF	*O-066*	*0.67*
232912	*OH NUG1*	*4.32*
232913	*OH NUG2*	*4.26*
232914	*OH NUG3*	*4.32*
232915	*OH NUG4*	*4.32*
232916	*OH NUG5*	*4.32*
232917	*OH NUG6*	*4.3*
232918	*OH NUG7*	*4.29*
LTF	*PRAIRIE*	*0.59*
LTF	*RENSSELAER*	*0.06*
LTF	*ROSETON*	*0.46*
LTF	*ROWAN*	*0.16*
LTF	*SANTEETLA*	*0.03*
LTF	*SMITHLAND*	*0.05*
LTF	*TATANKA*	*0.14*
LTF	*TILTON*	*0.14*
LTF	*TRIMBLE*	*0.08*
LTF	*TVA*	*0.18*
LTF	*UNIONPOWER*	*0.18*
904210	*V4-022C*	*0.92*
904212	*V4-022E*	*1.51*
232907	*VN8*	*17.06*
901003	*W1-003 C*	*1.49*
901004	*W1-003 E*	*2.21*
901013	*W1-004 C*	*1.49*
901014	*W1-004 E*	*2.21*
901023	*W1-005 C*	*1.49*
901024	*W1-005 E*	*2.21*
901033	*W1-006 C*	*1.49*
901034	*W1-006 E*	*2.21*
907052	*X1-032 E*	*1.97*
910572	*X3-008 E*	*3.93*
913412	*Y1-080 E*	*0.82*
915542	*Y3-058 E*	*3.69*
917082	*Z2-012 E*	*6.03*
917432	*Z2-076 E*	*0.37*
917442	*Z2-077 E*	*0.37*
918431	*AA1-059 C*	*0.42*
918432	*AA1-059 E*	*0.84*
918831	*AA1-102*	*3.65*
918832	*AA1-102 E*	*45.97*

920312	*AA2-129 E*	*9.75*
920321	*AA2-130*	*0.19*
930881	*AB1-137 C*	*0.61*
930882	*AB1-137 E*	*0.26*
924361	*AB2-084 C*	*1.87*
924362	*AB2-084 E*	*3.05*
924681	*AB2-120 C*	*18.28*
924682	*AB2-120 E*	*29.83*
924781	*AB2-130 C O1*	*8.61*
924782	*AB2-130 E O1*	*14.05*
924831	*AB2-136 C*	*9.15*
924832	*AB2-136 E*	*9.7*
925091	*AB2-166 C*	*0.74*
925092	*AB2-166 E*	*1.3*
925151	*AB2-172 C*	*6.03*
925152	*AB2-172 E*	*9.83*
925261	*AB2-180 C*	*5.55*
925262	*AB2-180 E*	*2.38*
925651	*AC1-041 C*	*0.89*
925652	*AC1-041 E*	*1.45*
925731	*AC1-049 C*	*0.27*
925732	*AC1-049 E*	*0.44*
925741	*AC1-050 C*	*0.78*
925742	*AC1-050 E*	*1.24*
926911	*AC1-177*	*1.98*
927031	*AC1-190 C*	*11.43*
927032	*AC1-190 E*	*4.9*
927191	*AC1-213 C*	*1.24*
927192	*AC1-213 E*	*0.82*
927321	*AC1-229 C*	*0.54*
927322	*AC1-229 E*	*0.87*