

***Merchant Transmission Interconnection
Feasibility Study Report-Web Version***

For

***PJM Merchant Transmission Request
Queue Position Y3-092***

Erie West 345kV Project

September, 2013

Feasibility Study Report

Erie West 345kV Project

Introduction

This Feasibility Study report provides the documentation of an assessment that has been performed by PJM Interconnection, PPL Energy, and FirstEnergy (FE) in response to a request made by the Interconnection Customer (IC) for the connection of a +/- 1000 MW HVDC Project (the Project) to the Penelec Transmission System. The IC has proposed commercial operation date of December, 2017 for the Project. This study does not imply a FE commitment to this in-service date. As per the PJM RTEP study process, the Erie West 345kV Project assessment was accomplished by: 1. Evaluating the reliability impact of the proposed facilities and connection on the interconnected transmission system by the performance of a power flow study; 2. Ensuring compliance with the NERC, ReliabilityFirst, PJM and FE Reliability Standards by identifying the system reinforcements that will need to be installed for an interconnection of the proposed project; 3. Coordinating and cooperating with the PJM staff and the IC by participating in project meetings and issuing this report as a part of the RTEP study process; 4. Performing a Steady State, Short-Circuit and Dynamics Study as necessary; 5. Conducting all studies in accordance with the PJM Manuals, the "FE Requirements for Transmission Connected Facilities", and the "FE Study Guide".

Connection Facilities

In compliance with the Regional Transmission Expansion Planning (RTEP) protocol, Interconnection Customer has submitted a "Form of Transmission Interconnection Feasibility Study Agreement" to PJM that identifies its plan to construct a +/- 1000 MW HVDC Project to connect Penelec's Erie West substation with Nanticoke substation in IESO. For purposes of this report, it has therefore been designated as the Erie West 345kV Project to reflect its interconnection voltage and its proximity to Erie West substation. The IC has requested the study of both a Primary and Secondary Point of Interconnection (POI) for the Project. This report contains detailed connection requirements, direct connection costs and schedule, power flow analysis, short circuit analysis, and a cost and schedule for any associated system reinforcements for the Primary POI. For the Secondary POI, this report only provides the results of the power flow analysis and short circuit analysis. It does not contain a cost/schedule associated with direct connection or any identified system reinforcements pertaining to the analysis performed.

The IC did not provide a single line diagram with their study agreement. Prior to the start of the System Impact Study, the IC must submit an electrical single line diagram for review by FE during the SIS. This diagram must show all transformers connecting to the

345kV system, all 345kV circuit breakers, and the proposed location of interconnection metering.

Primary Point of Interconnection: Erie West 345kV Substation:

The interconnection of the Project at the primary POI for will be accomplished by constructing a new 345kV breaker and a half string with 2-345kV breakers (future 3 breakers) at Erie West substation. A summary of the Project direct connection facilities that will be required for the Primary POI and their estimated costs are shown on Attachment 3. The one-line for the Primary POI is shown in Attachment 2.

Secondary Point of Interconnection: Erie South 345kV Substation:

The interconnection of the project at the secondary POI will be accomplished by constructing a 345kV ring bus at Erie South substation. The IC will be responsible for acquiring all easements, properties and permits that may be required to expand the existing substation yard. The IC will also be responsible for the rough grade of the property and an access road to the proposed 3 breaker ring bus site. As mentioned previously, there is not an estimated cost or schedule provided for the Secondary POI.

PJM Interconnection Study Results – Primary POI

The following are the results of the analysis performed by PJM engineers with respect to the transmission system impacts. Appendices listing generators' contributions to flowgates are listed at the end of this report.

Network Impacts

The Queue Project #Y3-092 was studied as a 1000.0MW (Capacity 1000.0MW) injection at the Erie West 345 kV substation in the Penelec area. Project #Y3-092 was evaluated for compliance with reliability criteria for summer peak conditions in 2017. Potential network impacts were as follows:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

1. (PENELEC - FE) The ERIE W-02AT 345 kV line (from bus 200599 to bus 238547 ckt 1) loads from 26.67% to 63.54% (**DC power flow**) of its normal rating (1559 MVA) for non-contingency condition. This project contributes approximately 574.71 MW to the thermal violation.

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

2. (PENELEC - FE) The ERIE W-02AT 345 kV line (from bus 200599 to bus 238547 ckt 1) loads from 26.67% to 63.54% (**DC power flow**) of its normal rating (1559 MVA) for non-contingency condition. This project contributes approximately 574.71 MW to the thermal violation.

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

3. (AP - AP) The GARRETTS R J-KISKI VALLEY 138 kV line (from bus 235282 to bus 235202 ckt 1) loads from 11.94% to 56.77% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 67.69 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

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

4. (AP - AP) The GARRETTS R J-KISKI VALLEY 138 kV line (from bus 235282 to bus 235202 ckt 1) loads from 11.94% to 56.77% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 67.69 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                       /* LINE ERIE W TO
02PERRY 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END
```

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

5. (AP - AP) The GARRETTS R J-KISKI VALLEY 138 kV line (from bus 235282 to bus 235202 ckt 1) loads from 11.94% to 56.77% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 67.69 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
```

DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
 02PERRY 345.00 02AT 345.00
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
 02AT 345.00 02S8-ATT 345.00
 DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
 02S8-ATT 345.00 02ASH_3 138.00
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
 02AT 345.00 ERIE W 345.00
 END

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

6. (FE - PENELEC) The 02AT-ERIE W 345 kV line (from bus 238547 to bus 200599 ckt 1) loads from 28.1% to 64.96% (**DC power flow**) of its normal rating (1559 MVA) for non-contingency condition. This project contributes approximately 574.71 MW to the thermal violation.

Please refer to Appendix 9 for a table containing the generators having contribution to this flowgate.

7. (FE - PENELEC) The 02AT-ERIE W 345 kV line (from bus 238547 to bus 200599 ckt 1) loads from 28.1% to 64.96% (**DC power flow**) of its normal rating (1559 MVA) for non-contingency condition. This project contributes approximately 574.71 MW to the thermal violation.

Please refer to Appendix 10 for a table containing the generators having contribution to this flowgate.

8. (FE - FE) The 02S8-ATT 345/138 kV transformer (from bus 239082 to bus 238544 ckt 8) loads from 50.39% to 76.2% (**DC power flow**) of its normal rating (297 MVA) for non-contingency condition. This project contributes approximately 76.64 MW to the thermal violation.

Please refer to Appendix 11 for a table containing the generators having contribution to this flowgate.

9. (FE - FE) The 02AT-02S8-ATT 345 kV line (from bus 238547 to bus 239082 ckt 1) loads from 34.17% to 68.21% (**DC power flow**) of its emergency rating (828 MVA) for

the single line contingency outage of 'DQE_161'. This project contributes approximately 281.88 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```

Please refer to Appendix 13 for a table containing the generators having contribution to this flowgate.

10. (FE - FE) The 02SP Q-4-02LRCRQ4 138 kV line (from bus 239115 to bus 239057 ckt 1) loads from .5% to 53.6% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.79 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```

Please refer to Appendix 21 for a table containing the generators having contribution to this flowgate.

11. (AP - AP) The PARADISE JCT-BUTLER 138 kV line (from bus 235141 to bus 235152 ckt 1) loads from 16.07% to 62.15% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 84.33 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                            /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
  END
```

Please refer to Appendix 30 for a table containing the generators having contribution to this flowgate.

12. (PENELEC - PENELEC) The CNYO&G-N.MESHPN 230 kV line (from bus 200924 to bus 200706 ckt 1F) loads from 91.29% to 99.82% (**DC power flow**) of its emergency rating (617 MVA) for the single line contingency outage of 'SUSQ 1'. This project contributes approximately 52.63 MW to the thermal violation.

```
CONTINGENCY 'SUSQ 1'
```

REMOVE MACHINE 1 FROM BUS 208918
END

Please refer to Appendix 31 for a table containing the generators having contribution to this flowgate.

13. (AP - AP) The KARNs CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.29% to 62.37% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 84.33 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Please refer to Appendix 32 for a table containing the generators having contribution to this flowgate.

14. (AP - AP) The KARNs CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.29% to 62.37% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 84.33 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
02PERRY 345.00 02AT 345.00
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
02AT 345.00 02S8-ATT 345.00
DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
02S8-ATT 345.00 02ASH_3 138.00
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Please refer to Appendix 33 for a table containing the generators having contribution to this flowgate.

15. (AP - AP) The KARNs CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.29% to 62.37% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 84.33 MW to the thermal violation.

CONTINGENCY 'DQE_163'
02PERRY 345 CK 1

/* LINE ERIE W TO

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END

Please refer to Appendix 34 for a table containing the generators having contribution to this flowgate.

16. (FE - FE) The 02AUSTQ1-02LRCRQ1 138 kV line (from bus 239213 to bus 239112 ckt 1) loads from 7.05% to 57.95% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 76.85 MW to the thermal violation.

CONTINGENCY 'DQE_161'
345 CK 1

/* LINE 02AT TO 02PERRY

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 35 for a table containing the generators having contribution to this flowgate.

17. (FE - FE) The 02SBRNQ1-02AUSTQ1 138 kV line (from bus 239095 to bus 239213 ckt 1) loads from 7.05% to 57.95% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 76.85 MW to the thermal violation.

CONTINGENCY 'DQE_161'
345 CK 1

/* LINE 02AT TO 02PERRY

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 36 for a table containing the generators having contribution to this flowgate.

18. (PENELEC - PENELEC) The 4MILE_230 230/115 kV transformer (from bus 200928 to bus 200927 ckt 6) loads from 70.14% to 89.81% (**DC power flow**) of its emergency rating (323 MVA) for the single line contingency outage of 'B_PN230-SX-#17A'. This project contributes approximately 54.46 MW to the thermal violation.

CONTINGENCY 'B_PN230-SX-#17A'
FOURMILE 230 KV

/* ERIE EAST -

DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1 /*
ERIE SE 230.00 FOURMILE 230.00
END

Please refer to Appendix 37 for a table containing the generators having contribution to this flowgate.

19. (AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.74% to 82.23% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 57.24 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 46 for a table containing the generators having contribution to this flowgate.

20. (AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.74% to 82.23% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 57.24 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 47 for a table containing the generators having contribution to this flowgate.

21. (AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.74% to 82.23% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 57.24 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                       /* LINE ERIE W TO
02PERRY 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
```

END

Please refer to Appendix 48 for a table containing the generators having contribution to this flowgate.

22. (PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 39.04% to 76.19% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 219.88 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 50 for a table containing the generators having contribution to this flowgate.

23. (PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 39.04% to 76.19% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 219.88 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                       /* LINE ERIE W TO
02PERRY 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END
```

Please refer to Appendix 51 for a table containing the generators having contribution to this flowgate.

24. (PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 39.04% to 76.19% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 219.88 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
```

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Please refer to Appendix 52 for a table containing the generators having contribution to this flowgate.

25. (FE - FE) The 02AUSTQ2-02SP Q-2 138 kV line (from bus 239212 to bus 239113 ckt 1) loads from 11.42% to 62.89% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

CONTINGENCY 'DQE_161' /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 53 for a table containing the generators having contribution to this flowgate.

26. (AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.85% to 85.17% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 57.27 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Please refer to Appendix 54 for a table containing the generators having contribution to this flowgate.

27. (AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.85% to 85.17% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 57.27 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
02PERRY 345.00 02AT 345.00
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
02AT 345.00 02S8-ATT 345.00

DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
 02S8-ATT 345.00 02ASH_3 138.00
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
 02AT 345.00 ERIE W 345.00
 END

Please refer to Appendix 55 for a table containing the generators having contribution to this flowgate.

28. (AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.85% to 85.17% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 57.27 MW to the thermal violation.

CONTINGENCY 'DQE_163' /* LINE ERIE W TO
 02PERRY 345 CK 1
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
 END

Please refer to Appendix 56 for a table containing the generators having contribution to this flowgate.

29. (NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 42.28% to 78.5% (**DC power flow**) of its emergency rating (607 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 219.88 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
 W 345 CK 1
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
 02AT 345.00 ERIE W 345.00
 END

Please refer to Appendix 57 for a table containing the generators having contribution to this flowgate.

30. (NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 42.28% to 78.5% (**DC power flow**) of its emergency rating (607 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 219.88 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
 PERRY-AT-ERIE W 345 CK 1
 DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
 02PERRY 345.00 02AT 345.00

```

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END

```

Please refer to Appendix 58 for a table containing the generators having contribution to this flowgate.

31. (NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 42.28% to 78.5% (**DC power flow**) of its emergency rating (607 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 219.88 MW to the thermal violation.

```

CONTINGENCY 'DQE_163'                                     /* LINE ERIE W TO
02PERRY 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END

```

Please refer to Appendix 59 for a table containing the generators having contribution to this flowgate.

32. (PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 40.48% to 77.62% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 219.88 MW to the thermal violation.

```

CONTINGENCY 'B_LINE_SY_018'                               /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END

```

Please refer to Appendix 60 for a table containing the generators having contribution to this flowgate.

33. (PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 40.48% to 77.62% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 219.88 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                /* LINE ERIE W TO
02PERRY 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
  END
```

Please refer to Appendix 61 for a table containing the generators having contribution to this flowgate.

34. (PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 40.48% to 77.62% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 219.88 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                          /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
  END
```

Please refer to Appendix 62 for a table containing the generators having contribution to this flowgate.

35. (FE - FE) The 02SBRNQ4-02SP Q-4 138 kV line (from bus 239098 to bus 239115 ckt 1) loads from 8.51% to 62.02% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.79 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```

Please refer to Appendix 66 for a table containing the generators having contribution to this flowgate.

36. (AP - AP) The KISKI VALLEY-GARRETTS R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.9% to 81.19% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 67.69 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Please refer to Appendix 70 for a table containing the generators having contribution to this flowgate.

37. (AP - AP) The KISKI VALLEY-GARRETTS R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.9% to 81.19% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 67.69 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
02PERRY 345.00 02AT 345.00
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
02AT 345.00 02S8-ATT 345.00
DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
02S8-ATT 345.00 02ASH_3 138.00
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Please refer to Appendix 71 for a table containing the generators having contribution to this flowgate.

38. (AP - AP) The KISKI VALLEY-GARRETTS R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.9% to 81.19% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 67.69 MW to the thermal violation.

CONTINGENCY 'DQE_163' /* LINE ERIE W TO
02PERRY 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END

Please refer to Appendix 72 for a table containing the generators having contribution to this flowgate.

39. (FE - FE) The 02SBRNQ1-02ASH_1 138 kV line (from bus 239095 to bus 238542 ckt 1) loads from 24.2% to 71.15% (**DC power flow**) of its emergency rating (151 MVA)

for the single line contingency outage of 'DQE_161'. This project contributes approximately 75.05 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```

Please refer to Appendix 73 for a table containing the generators having contribution to this flowgate.

40. (FE - FE) The 02ASH_1-02SBRNQ1 138 kV line (from bus 238542 to bus 239095 ckt 1) loads from 19.84% to 69.54% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 75.05 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```

Please refer to Appendix 74 for a table containing the generators having contribution to this flowgate.

41. (FE - FE) The 02SBRNQ2-02AUSTQ2 138 kV line (from bus 239096 to bus 239212 ckt 1) loads from 17.91% to 69.38% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```

Please refer to Appendix 75 for a table containing the generators having contribution to this flowgate.

42. (FE - FE) The 02ASH_2-02SBRNQ2 138 kV line (from bus 238543 to bus 239096 ckt 1) loads from 17.91% to 69.38% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```


Please refer to Appendix 76 for a table containing the generators having contribution to this flowgate.

43. (PENELEC - PENELEC) The CNYO&G-N.MESHPN 230 kV line (from bus 200924 to bus 200706 ckt 1F) loads from 99.99% to 110.77% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 52.63 MW to the thermal violation.

Please refer to Appendix 77 for a table containing the generators having contribution to this flowgate.

44. (FE - FE) The 02SBRNQ4-02ASH_3 138 kV line (from bus 239098 to bus 238544 ckt 1) loads from 21.93% to 72.23% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.37 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Please refer to Appendix 78 for a table containing the generators having contribution to this flowgate.

45. (FE - FE) The 02AUSTQ2-02SBRNQ2 138 kV line (from bus 239212 to bus 239096 ckt 1) loads from 27.44% to 76.07% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Please refer to Appendix 80 for a table containing the generators having contribution to this flowgate.

46. (FE - FE) The 02SBRNQ2-02ASH_2 138 kV line (from bus 239096 to bus 238543 ckt 1) loads from 27.44% to 76.07% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

CONTINGENCY 'DQE_161' /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 81 for a table containing the generators having contribution to this flowgate.

47. (FE - FE) The 02ASH_3-02SBRNQ4 138 kV line (from bus 238544 to bus 239098 ckt 1) loads from 22.31% to 75.53% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.37 MW to the thermal violation.

CONTINGENCY 'DQE_161' /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 87 for a table containing the generators having contribution to this flowgate.

48. (FE - FE) The 02SP Q-2-02AUSTQ2 138 kV line (from bus 239113 to bus 239212 ckt 1) loads from 33.93% to 82.56% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

CONTINGENCY 'DQE_161' /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 89 for a table containing the generators having contribution to this flowgate.

49. (FE - FE) The 02AUSTQ1-02SBRNQ1 138 kV line (from bus 239213 to bus 239095 ckt 1) loads from 37.8% to 85.88% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 76.85 MW to the thermal violation.

CONTINGENCY 'DQE_161' /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 92 for a table containing the generators having contribution to this flowgate.

50. (FE - FE) The 02LRCRQ1-02AUSTQ1 138 kV line (from bus 239112 to bus 239213 ckt 1) loads from 37.8% to 85.88% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 76.85 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```

Please refer to Appendix 93 for a table containing the generators having contribution to this flowgate.

51. (FE - FE) The 02SP Q-4-02SBRNQ4 138 kV line (from bus 239115 to bus 239098 ckt 1) loads from 36.56% to 87.11% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.79 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```

Please refer to Appendix 94 for a table containing the generators having contribution to this flowgate.

52. (AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.7% to 108.0% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 84.33 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                          /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
  END
```

Please refer to Appendix 98 for a table containing the generators having contribution to this flowgate.

53. (AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.7% to 108.0% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 84.33 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                /* LINE ERIE W TO
02PERRY 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
  END
```

Please refer to Appendix 99 for a table containing the generators having contribution to this flowgate.

54. (AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.7% to 108.0% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 84.33 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                          /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
  END
```

Please refer to Appendix 100 for a table containing the generators having contribution to this flowgate.

55. (AP - AP) The BUTLER-PARADISE JCT 138 kV line (from bus 235152 to bus 235141 ckt 1) loads from 70.97% to 108.28% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 84.33 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                /* LINE ERIE W TO
02PERRY 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
  END
```

Please refer to Appendix 101 for a table containing the generators having contribution to this flowgate.

56. (AP - AP) The BUTLER-PARADISE JCT 138 kV line (from bus 235152 to bus 235141 ckt 1) loads from 70.97% to 108.28% (**DC power flow**) of its emergency rating

(183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 84.33 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 102 for a table containing the generators having contribution to this flowgate.

57. (FE - FE) The 02LRCRQ2-02SP Q-2 138 kV line (from bus 238913 to bus 239113 ckt 1) loads from 48.69% to 97.33% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                       /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Please refer to Appendix 103 for a table containing the generators having contribution to this flowgate.

58. (FE - FE) The 02LRCRQ4-02SP Q-4 138 kV line (from bus 239057 to bus 239115 ckt 1) loads from 45.37% to 95.92% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.79 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                       /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Please refer to Appendix 104 for a table containing the generators having contribution to this flowgate.

59. (FE - FE) The 02S8-ATT 345/138 kV transformer (from bus 238544 to bus 239082 ckt 8) loads from 38.76% to 104.57% (**DC power flow**) of its emergency rating (371

MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 281.88 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Please refer to Appendix 111 for a table containing the generators having contribution to this flowgate.

60. (FE - FE) The 02S8-ATT 345/138 kV transformer (from bus 239082 to bus 238544 ckt 8) loads from 76.25% to 152.23% (**DC power flow**) of its emergency rating (371 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 281.88 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Please refer to Appendix 118 for a table containing the generators having contribution to this flowgate.

Light Load Analysis

Light Load Studies to be conducted during later study phases (applicable to wind, coal, nuclear, and pumped storage projects).

Multiple Facility Contingency

(Double Circuit Tower Line, Failed Breaker and Bus Fault contingencies for the full energy output)

1. (PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 63.37% to 82.55% (**DC power flow**) of its emergency rating (824 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-9I'. This project contributes approximately 158.02 MW to the thermal violation.

```
CONTINGENCY 'C2_PN230-SB-9I'                          /* HOMER CITY 230 KV
STUCK CB - CB210
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200807 CKT 1
DISCONNECT BRANCH FROM BUS 200807 TO BUS 200808 CKT 1
DISCONNECT BRANCH FROM BUS 200808 TO BUS 200809 CKT 1
REMOVE MACHINE 1 FROM BUS 200809                      /* 0
DISCONNECT BUS 200807
```

DISCONNECT BUS 200808
DISCONNECT BUS 200809
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200769 CKT 1
END

Please refer to Appendix 12 for a table containing the generators having contribution to this flowgate.

2. (PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line (from bus 200928 to bus 200819 ckt 1) loads from 29.01% to 65.73% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2E'. This project contributes approximately 214.42 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2E' /* ERIE WEST 345 KV
STUCK CB - CB7
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Please refer to Appendix 14 for a table containing the generators having contribution to this flowgate.

3. (PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 73.4% to 92.54% (**DC power flow**) of its emergency rating (824 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-4G'. This project contributes approximately 157.71 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-4G' /* HOMER CITY 345
KV STUCK CB - CB307
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 1
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200930 CKT 1 /*
HOMER CITY-MAINESBRG 345
END

Please refer to Appendix 49 for a table containing the generators having contribution to this flowgate.

4. (PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 1) loads from 75.34% to 94.99% (**DC power flow**) of its emergency rating (807 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-4H'. This project contributes approximately 158.57 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-4H' /* HOMER CITY 345
KV STUCK CB - CB308
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 2
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200930 CKT 1 /*
HOMER CITY-MAINESBRG 345
END

Please refer to Appendix 63 for a table containing the generators having contribution to this flowgate.

5. (FE - FE) The 02PERRY-02EASTLK 345 kV line (from bus 239036 to bus 238684 ckt 1) loads from 71.26% to 93.66% (**DC power flow**) of its emergency rating (1793 MVA) for the tower line contingency outage of 'C5-TWL-NR057A'. This project contributes approximately 401.52 MW to the thermal violation.

CONTINGENCY 'C5-TWL-NR057A' /* PERRY-LRCR AND
PERRY-NRFD 345KV LINE OUTAGES
OPEN BRANCH FROM BUS 239334 TO BUS 239036 CKT 1 / 239334
02L.CENTER 345 239036 02PERRY 345 1
OPEN BRANCH FROM BUS 239358 TO BUS 239036 CKT 1 / 239358
02NFIELD 345.00 239036 02PERRY 345
END

Please refer to Appendix 69 for a table containing the generators having contribution to this flowgate.

6. (PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 1) loads from 83.14% to 102.74% (**DC power flow**) of its emergency rating (807 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-9E'. This project contributes approximately 158.14 MW to the thermal violation.

CONTINGENCY 'C2_PN230-SB-9E' /* HOMER CITY 230
KV STUCK CB - CB206
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200769 CKT 2
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200837 CKT 1
REMOVE MACHINE 1 FROM BUS 200837 /* 0
END

Please refer to Appendix 79 for a table containing the generators having contribution to this flowgate.

7. (FE - FE) The 02PERRY-02L.CENTER 345 kV line (from bus 239036 to bus 239334 ckt 1) loads from 77.91% to 102.12% (**DC power flow**) of its emergency rating (1673 MVA) for the tower line contingency outage of 'C5-TWL-NR63A'. This project contributes approximately 404.97 MW to the thermal violation.

CONTINGENCY 'C5-TWL-NR63A' /* PERRY-EASTLAKE
 AND PERRY-NORTHFIELD 345KV LINE OUTAGES
 DISCONNECT BRANCH FROM BUS 238684 TO BUS 239036 CKT 1 /*
 02EASTLK 345.00 02PERRY 345.00
 DISCONNECT BRANCH FROM BUS 239358 TO BUS 239036 CKT 1 /*
 02NFIELD 345.00 02PERRY 345.00
 END

Please refer to Appendix 83 for a table containing the generators having contribution to this flowgate.

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

To be determined

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. (PENELEC - PENELEC) The 4MILE_230 230/115 kV transformer (from bus 200928 to bus 200927 ckt 6) loads from 103.02% to 106.31% (**DC power flow**) of its emergency rating (323 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-6G'. This project contributes approximately 43.72 MW to the thermal violation.

CONTINGENCY 'C2_PN230-SB-6G' /* ERIE SOUTH 230 KV
 STUCK CB - CBBS (BUS SECTION BREAKER)
 DISCONNECT BRANCH FROM BUS 200819 TO BUS 200820 CKT 1
 DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1
 DISCONNECT BRANCH FROM BUS 200819 TO BUS 200625 CKT 4
 DISCONNECT BRANCH FROM BUS 200819 TO BUS 200600 CKT 8
 REDUCE BUS 200819 SHUNT BY 100 PERCENT
 DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
 DISCONNECT BRANCH FROM BUS 200568 TO BUS 200600 CKT 5
 DISCONNECT BRANCH FROM BUS 200568 TO BUS 200624 CKT 3
 DISCONNECT BRANCH FROM BUS 200568 TO BUS 200641 CKT 7
 REDUCE BUS 200568 SHUNT BY 100 PERCENT
 END

Please refer to Appendix 38 for a table containing the generators having contribution to this flowgate.

2. (PENELEC - PENELEC) The E.TWANDA-CNYO&G 230 kV line (from bus 200675 to bus 200924 ckt 1F) loads from 107.99% to 117.57% (**DC power flow**) of its emergency rating (549 MVA) for the single line contingency outage of 'SUSQ 1'. This project contributes approximately 52.63 MW to the thermal violation.

CONTINGENCY 'SUSQ 1'
REMOVE MACHINE 1 FROM BUS 208918
END

Please refer to Appendix 84 for a table containing the generators having contribution to this flowgate.

3. (PENELEC - PENELEC) The ROCKWOOD-Q34 115 kV line (from bus 200746 to bus 290079 ckt 1) loads from 124.28% to 125.77% (**DC power flow**) of its emergency rating (166 MVA) for the bus fault outage of 'AP_C1_11'. This project contributes approximately 9.77 MW to the thermal violation.

CONTINGENCY 'AP_C1_11' /CUMBERLAND_138
OPEN BUS 235454
OPEN BUS 237027
END

Please refer to Appendix 85 for a table containing the generators having contribution to this flowgate.

4. (PENELEC - PENELEC) The E.TWANDA-CNYO&G 230 kV line (from bus 200675 to bus 200924 ckt 1F) loads from 106.03% to 116.82% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 52.63 MW to the thermal violation.

Please refer to Appendix 86 for a table containing the generators having contribution to this flowgate.

5. (PENELEC - PL) The OXBOW-LACK 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 110.22% to 121.46% (**DC power flow**) of its emergency rating (624 MVA) for the single line contingency outage of 'PJM SUSQ-LACK 500'. This project contributes approximately 70.19 MW to the thermal violation.

CONTINGENCY 'PJM SUSQ-LACK 500'
OPEN BRANCH FROM BUS 200022 TO BUS 200074 CKT 1 /* 22 SUSQ
500 74 LACKAW 500 1
END

Please refer to Appendix 90 for a table containing the generators having contribution to this flowgate.

6. (PENELEC - PENELEC) The N.MESHPPN-OXBOW 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 110.42% to 121.62% (**DC power flow**) of its emergency rating (617 MVA) for the single line contingency outage of 'PJM SUSQ-LACK 500'. This project contributes approximately 69.1 MW to the thermal violation.

CONTINGENCY 'PJM SUSQ-LACK 500'

OPEN BRANCH FROM BUS 200022 TO BUS 200074 CKT 1 /* 22 SUSQ
500 74 LACKAW 500 1
END

Please refer to Appendix 91 for a table containing the generators having contribution to this flowgate.

7. (PENELEC - PL) The OXBOW-LACK 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 114.1% to 128.41% (**DC power flow**) of its normal rating (494 MVA) for non-contingency condition. This project contributes approximately 70.71 MW to the thermal violation.

Please refer to Appendix 96 for a table containing the generators having contribution to this flowgate.

8. (PENELEC - PENELEC) The N.MESHPPN-OXBOW 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 115.73% to 130.29% (**DC power flow**) of its normal rating (478 MVA) for non-contingency condition. This project contributes approximately 69.61 MW to the thermal violation.

Please refer to Appendix 97 for a table containing the generators having contribution to this flowgate.

9. (PENELEC - PENELEC) The Q34-SOMERST 115 kV line (from bus 290079 to bus 200744 ckt 1) loads from 166.54% to 168.03% (**DC power flow**) of its emergency rating (166 MVA) for the bus fault outage of 'AP_C1_11'. This project contributes approximately 9.77 MW to the thermal violation.

CONTINGENCY 'AP_C1_11'

/CUMBERLAND_138

OPEN BUS 235454
OPEN BUS 237027
END

Please refer to Appendix 110 for a table containing the generators having contribution to this flowgate.

Steady-State Voltage Requirements

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

To be determined

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation. The FirstEnergy reinforcements are also listed in the “Interconnected Transmission Owner’s Analysis Results” section of this report)

Generator Deliverability

1, 2, 6, 7, 8, 9, 10, 16, 17, 25, 35, 39, 40, 41, 42, 44, 45, 46, 47, 48, 49, 50, 51, 57, 58, 59, 60.

At the Leroy Center SS, install one 345 kV breaker for a new line exit to Erie West, after the completion of the 2016 expansion. This will make the 345 kV yard a 5 breaker ring bus.

Total Cost w Tax: \$1,670,000; Tax: \$324,900

Install a new 345 kV line from Erie West to Leroy Center, approximately 47 miles in length.

Total Cost w Tax: \$228,829,600; Tax: \$45,751,300

At the Erie West SS, install one new 345 kV circuit breaker and line exit for the new line to Leroy Center.

Total Cost w Tax: \$2,776,700; Tax: \$643,100

It is estimated to take 52 months to complete (4 years & 4 months).

3, 4, 5, 36, 37, 38. (AP - AP) The GARRETTS R J-KISKI VALLEY 138 kV line: Reconductor Garretts Run Jct – Kiski Valley 14.3 mile 138 kV line. Total Cost w Tax: \$12,248,000; Tax: \$2,797,400; Estimated Project Duration: 28 Months

11, 13, 14, 15, 52, 53, 54, 55, 56.

Paradise Jct is cancelled; open Paradise Jct to make Butler – Cabot E 138 kV line and Butler to Karns City 138 kV line; with this change to the model, there is a violation on Butler – Karns City 138 kV and no new violations.

At the Karns City SS, reconductor the Butler 138 kV line terminal.

Total Cost w Tax: \$15,000; Tax: \$3,500

At the Butler SS, reconductor the Karns City 138 kV line terminal including wave trap, line and bus disconnects.

Total Cost w Tax: \$112,500; Tax: \$25,700

Reconductor the 15.6 mile Butler – Karns City 138 kV line to achieve a 228 MVA summer emergency rating.

Total Cost w Tax: \$17,105,600; Tax: \$3,906,900

Estimated Project Duration: 28 Months

12, 43. (PENELEC - PENELEC) The CNYO&G-N.MESHPN 230 kV line:

At the Canyon SS, replace the 1200A disconnect switch on the 230 kV North Meshoppen line.

Total Cost w Tax: \$100,100; Tax: \$23,200

Reconductor the 10 mile Canyon – North Meshoppen 230 kV line with 1033 ACSS replacing the existing 1033 ACSR conductor.

Total Cost w Tax: \$9,721,600; Tax: \$2,217,500

Estimated Project Duration: 22 months

18. (PENELEC - PENELEC) The 4MILE_230 230/115 kV transformer:

Install a second 230/115 kV transformer at Four Mile. Install one 230 kV breaker and one 115 kV breaker. Total Cost w Tax: \$6,654,600; Tax: \$1,541,200; Estimated Time: 19 months

19, 20, 21. . (AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line:

Reconductor the 11.7 mile Allegheny Dam 6 Tap to Allegheny Ludlum 4 Jct. to achieve a 188 MVA summer emergency rating. Total Cost w Tax: \$6,965,100; Tax: \$1,590,800; Estimated Time: 26 months

22, 23, 24. (PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line:

At the Erie East SS, replace the line drops on the 230 kV W3-099 (currently Erie South) line with 1033 ACSS.

Total Cost w Tax: \$38,100; Tax: \$8,900

Reconductor the 2.6 mile Erie East – W3-099 230 kV line with 1033 kcmil ACSS, replacing the existing 1033 kcmil ACSR conductor.

Total Cost w Tax: \$3,649,000; Tax: \$832,400

Estimated Project Duration: 16 months

26, 27, 28. (AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line:

Reconductor the 6.4 mile Kittanning to Allegheny Dam 6 Tap 138 kV line to achieve a 188 MVA summer emergency rating. Total Cost w Tax: \$6,108,700; Tax: \$1,395,200; Estimated Time: 26 months

29, 30, 31. (NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line:

PENELEC:

At the Erie East SS, replace the line drops on the 230 kV South Ripley line with 1033 ACSS.

Total Cost w Tax: \$38,100; Tax: \$8,900
Reconductor the 4.5 mile Erie East – South Ripley 230 kV line with 1033 kcmil ACSS, replacing the existing 1033 kcmil ACSR conductor.

Total Cost w Tax: \$5,170,600; Tax: \$1,188,300
Estimated Project Duration: 16 months

NYISO:

Results were sent to NYISO; no reinforcements are required at this time. This violation will be further analyzed in the SIS phase.

32, 33, 34. (PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line:
Reconductor the 6.5 mile Four Mile Jct – W3-099 230 kV line with 1033 kcmil ACSS, replacing the existing 1033 kcmil ACSR conductor.

Total Cost w Tax: \$8,077,200; Tax: \$1,842,400; Estimated Project Duration: 20 months

Multiple Facility Contingency

1, 3, 4, 6. (PENELEC - PENELEC) The HOMER CY 345/230 kV transformer:
Install 500/345 kV transformer at Homer City and new 500 kV 3 breaker ring bus (with future plans for breaker and a half) Install one new 345 kV circuit breaker to accommodate new transformation.

Total Cost w Tax: \$37,998,200; Tax: \$8,800,300
Conemaugh – Keystone 500 kV, loop to Homer City 500 kV sub expansion: Install a loop, approx. 1000' in length, to the proposed Homer City 500 kV substation expansion. New structures shall be steel with concrete foundations.

Total Cost w Tax: \$5,690,900; Tax: \$1,318,000
Estimated Project Duration: 27 months

2. (PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line:
Note: The following is a duplicate of an earlier reinforcement. This will be charged only once.
Install a second 230/115 kV transformer at Four Mile. Install one 230 kV breaker and one 115 kV breaker. Total Cost w Tax: \$6,654,600; Tax: \$1,541,200; Estimated Time: 19 months

5, 7. Note: The following is a duplicate of earlier reinforcements. These will be charged only once.

At the Leroy Center SS, install one 345 kV breaker for a new line exit to Erie West, after the completion of the 2016 expansion. This will make the 345 kV yard a 5 breaker ring bus.

Total Cost w Tax: \$1,670,000; Tax: \$324,900
Install a new 345 kV line from Erie West to Leroy Center, approximately 47 miles in length.

Total Cost w Tax: \$228,829,600; Tax: \$45,751,300

At the Erie West SS, install one new 345 kV circuit breaker and line exit for the new line to Leroy Center.

Total Cost w Tax: \$2,776,700; Tax: \$643,100

It is estimated to take 52 months to complete (4 years & 4 months).

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. (PENELEC - PENELEC) The 4MILE_230 230/115 kV transformer:

Note: This is a duplicate of an earlier reinforcement. It will be charged only once.

Install a second 230/115 kV transformer at Four Mile. Install one 230 kV breaker and one 115 kV breaker. Total Cost w Tax: \$6,654,600; Tax: \$1,541,200; Estimated Time: 19 months

2, 4. (PENELEC - PENELEC) The E.TWANDA-CNYO&G 230 kV line:

At the East Towanda SS, replace the substation conductor and relaying on the 230 kV Canyon line.

Total Cost w Tax: \$194,900; Tax: \$42,200

At the Canyon SS, replace the 1200A disconnect switch on the 230 kV East Towanda line with a 2000A unit.

Total Cost w Tax: \$100,100; Tax: \$23,200

Reconductor the 12.3 mile Canyon – East Towanda 230 kV line with 1033 ACSS, replacing the existing 1033 ACSR conductor.

Total Cost w Tax: \$11,896,400; Tax: \$2,713,600

Estimated Project Duration: 33 Months

3, 9.

At the Somerset SS, adjust the CT ratios on the Rockwood 115 kV line breaker.

Total Cost w Tax: \$20,200; Tax: \$4,700

Rebuild the 8.12 Rockwood – Somerset 115 kV line to reconductor with single 477 kcmil ACSS conductor, replacing the existing single 397 kcmil ACSR.

Total Cost w Tax: \$10,809,100; Tax: \$2,503,400

Estimated Project Duration: 23 Months

5, 7. (PENELEC - PL) The OXBOW-LACK 230 kV line:

PPL:

Lackawanna – Oxbow 230 kV (200708 to 208009): This overload can be mitigated by rebuilding the 0.4 miles of the PPL EU owned portion of the line and upgrading the bay equipment at Lackawanna at a cost of approximately **\$1.5M** to achieve ratings of 647 MVA SN, 801 MVA SE, 746 MVA WN, 903 MVA WE. This assumes that the

FirstEnergy portion of the line is upgraded to meet these ratings as well. This upgrade may take approximately 24-36 months to complete.

PENELEC:

At the Oxbow SS, replace the 1200A disconnect switch with a 2000A switch.

Total Cost w Tax: \$124,700; Tax: \$28,500

Reconductor the 16.3 miles of 1033 ACSR with 1033 ACSS high temperature conductor.

Total Cost w Tax: \$16,026,800; Tax: \$3,711,800

Estimated Project Duration: 28 months

6, 8. (PENELEC - PENELEC) The N.MESHPN-OXBOW 230 kV line:

At the North Meshoppen SS, replace the wave trap, substation conductor and adjust the CT ratios on the 230 kV Oxbow line.

Total Cost w Tax: \$115,700; Tax: \$26,800

At the Oxbow SS, replace the 1200A disconnect switch on the 230 kV North Meshoppen line.

Total Cost w Tax: \$100,300; Tax: \$23,300

Reconductor the 10.6 mile North Meshoppen – Oxbow section of the Lackawanna – North Meshoppen 230 kV line with 1033 kcmil ACSS, replacing the existing 1033 kcmil ACSR conductor.

Total Cost w Tax: \$10,654,900; Tax: \$2,430,400

Estimated Project Duration: 25 months

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.

Not Applicable

Interconnected Transmission Owner's Analysis Results

The following was generated by FirstEnergy (Pennsylvania Electric Company or "Penelec") the Interconnected Transmission Owner, based upon its analysis, as well as that of PJM, for mitigation of the project's impacts on the transmission and lower voltage system as applicable. It includes the costs and schedules for any system upgrades. Costs for affected Transmission owners other than FirstEnergy are included and reported in the "New System Reinforcements" and "Contribution to Previously Identified System Reinforcements" sections of the "PJM Interconnection Study Results" above.

Power Flow Analysis

A Power Flow study was conducted to determine the reliability impact of the proposed Erie West 345kV Project on the FE Transmission System. This included the performance of a contingency analysis to identify any facility overload or voltage condition that violates the FE Planning Criteria. Any such violation that is either directly attributable to this project or for which it will have a shared responsibility is included in this report with a least cost plan identified to mitigate them.

The Power Flow Analysis was performed using a 2017 summer peak load base case provided by the PJM staff. This base case included a detailed representation of the Penelec transmission system in the area of the Erie West 345kV substation. A simulation of all possible contingencies within the NERC and FE Planning Standards that are impacted by the Project was conducted to test for criteria compliance. The direct connection of the Project to the Penelec transmission system was studied at both the Primary and Secondary POI.

The results from the PJM study Power Flow Analysis are detailed on Attachment 4. Please note that the Attachment displays the Power Flow Analysis results only the Primary POI. PJM will provide the Power Flow Analysis results for the secondary POI in their report. As shown, the conclusion from this analysis is that there are new upgrades required for the Project.

Short Circuit and Dynamics Analysis

For both the Primary and Secondary POI, a short circuit analysis has been performed by PJM and the findings were confirmed by FE. The findings show that no circuit breakers are newly over dutied with the addition of the Project to the FE transmission system. The study also showed no significant fault current contribution to the breakers which are near the over-duty limit.

Metering

Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. These FE requirements are detailed on Attachment 7 of this report.

Compliance Issues

Interconnection Customer will be responsible for meeting all FE criteria as defined in the FE Requirements for Transmission Connected Facilities document. While the voltage analysis is not

performed for the feasibility study, any voltage criteria violations that would require the plant to provide reactive power, that determination of reactive power requirements will be determined in the system impact study, which will include the low voltage ride through analysis.

The IC must also meet all PJM, ReliabilityFirst and NERC reliability criteria and operating procedures required for standards compliance. For example, the IC will need to properly locate and report the over and under-voltage and over and under-frequency system protection elements for its units as well as the submission of the converter model and protection data required to satisfy the PJM and ReliabilityFirst audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the FE system.

FE Facility Upgrades and Costs

The results from the PJM and FE Power Flow Analysis (Attachment 4) show that there are FE criteria violations that are directly attributable to the capacity of the Project. Therefore in accordance with the RTEP procedures defined in the PJM Open Access Transmission Tariff and PJM Manuals, the IC is responsible for network upgrades. The Primary POI direct connection costs are detailed in Attachment 3. The Secondary POI costs are not provided.

Note that all cost estimates contained in this document were produced without a detailed engineering review and are therefore subject to error. More accurate estimates will be determined as a part of the System Impact Study. Interconnection Customer will be responsible for the actual cost of the direct connection that is implemented. FE herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any reinforcements to the transmission system.

Interconnection Customer Requirements

In addition to the FE facilities, Interconnection Customer will also be responsible for meeting all criteria as specified in the applicable sections of the "FE Requirements for Transmission Connected Facilities" document including:

1. The purchase and installation of a fully rated 345kV circuit breaker on the high side of the Y3-092 step-up transformer. If multiple step up transformers are installed, a single 345kV breaker must be installed on the transmission line connecting FE's Erie West substation and the IC's converter station. Multiple circuit breakers protecting the interconnection lead line are not permitted by FE's "Requirements for Transmission Connected Facilities" document.
2. The purchase and installation of the minimum required FE interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.
3. The purchase and installation of a 345kV interconnection metering instrument transformer. FE will provide the ratio and accuracy specifications based on the customer load and generation levels.

4. The purchase and installation of a revenue class meter to measure the power delivered or consumed in compliance with the FE standards.
5. The purchase and installation of supervisory control and data acquisition (SCADA) equipment to provide information in a compatible format to the FE Transmission System Control Center.
6. The establishment of dedicated communication circuits for SCADA report to the FE Transmission System Control Center.
7. A compliance with the FE and PJM power factor and voltage control requirements.
8. The execution of a back-up service agreement to serve the customer load supplied from the Y3-092 345kV interconnection substation when the HVDC line is out of service.

The above requirements are in addition to any metering required by PJM.

Summary

The Erie West 345kV Project direct connection for the Primary POI will require the facility upgrades defined in Attachment 3. As shown, the total estimated cost is \$5,468,000. This cost includes a CIAC (Contribution in Aid of Construction) Federal Income Tax Gross Up charge of \$1,266,500. This tax may or may not be charged based on whether or not this project meets the eligibility requirements of IRS Notice 88-129. The Project will require network upgrades to the FE system as defined in Attachment 5. As shown, the total estimated cost of the upgrades is \$403,012,700. This cost includes a CIAC (Contribution in Aid of Construction) Federal Income Tax Gross Up charge of \$85,721,900. PJM is responsible for determining the cost allocation of the upgrades.

Based on the scope of the direct connection for the Primary POI, it is expected to take a minimum of 24 months from the signing of a Connection Service Agreement to complete the installation required for the Project. This includes a preliminary payment that compensates FE for the first three months of the engineering design work that is related to the expansion of Erie West substation. It also assumes that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined direct connection and network upgrades, and that PJM will allow all transmission system outages when requested.

Affected Transmission Owner: PPL

Lackawanna – Oxbow 230 kV (200708 to 208009): This overload can be mitigated by rebuilding the 0.4 miles of the PPL EU owned portion of the line and upgrading the bay equipment at Lackawanna to achieve ratings of 647 MVA SN, 801 MVA SE, 746 MVA WN, 903 MVA WE. This assumes that the FirstEnergy portion of the line is also upgraded to meet these ratings.

Cost: \$ 1,500,000 plus tax

This upgrade will take approximately 24-36 months to complete.

Impacts outside of PJM: NYISO

Analysis results were sent to NYISO. No reinforcements are required at this time. This violation will be further analyzed in the SIS phase.

Total Project estimated cost

\$ 5,468,000 (tax included) for FirstEnergy Dir. Connection/Attachment Facilities

\$403,012,700 (tax included) for FirstEnergy network upgrades

\$ 1,500,000 plus tax for PPL network upgrades

\$409,980,700 Total (plus NYISO upgrade and tax for PPL portion)

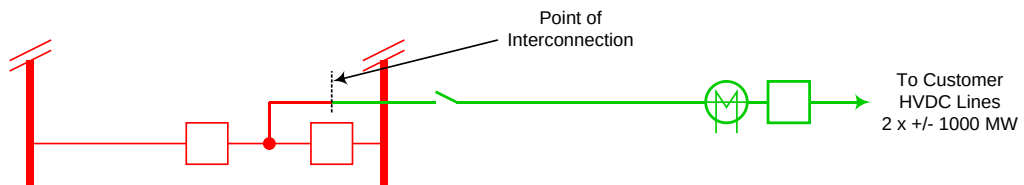
Attachment 1

Project Location

Not Provided

Attachment 2

Primary POI Substation Configuration



Extend both 345kV buses to the south and install a new 345kV breaker string with 2-345kV breakers (with provisions for a future 3rd breaker).

Attachment 3

Direct Connection Requirements

Estimate No.	Description	Total with Tax	Tax	Total Cost
PN-S-679	Erie West SS: Expand 345kV bus and install 2 new 345kV breakers.	\$5,296,400	\$1,226,700	\$4,069,700
EOC	Engineering Oversight and Commissioning	\$171,600	\$39,800	\$131,800
Total		\$5,468,000	\$1,266,500	\$4,201,500

Attachment 4

Contingency Analysis Results

Overloaded Element	Contingency Description	Rating	Final Loading	Comments/Reinforcement
Canyon - North Meshoppen 230kV	Base Case	546	108.82%	Reconductor line and upgrade terminal equipment.
East Towanda - Canyon 230kV	Base Case	489	127.56%	Reconductor line and upgrade terminal equipment.
Oxbow - Lackawanna 230kV	Base Case	494	143.20%	Reconductor line and upgrade terminal equipment.
North Meshoppen - Oxbow 230kV	Base Case	478	145.24%	Reconductor line and upgrade terminal equipment.
Erie East - W3-099 TAP 230kV	Ashtabula - Erie West - Perry 345kV Line	612	109.78%	Reconductor line and upgrade terminal equipment.
Erie East - W3-099 TAP 230kV	Ashtabula - Erie West - Perry 345kV Line	612	109.78%	Reconductor line and upgrade terminal equipment.
Erie East - South Ripley 230kV	Ashtabula - Erie West - Perry 345kV Line	607	114.89%	Reconductor line and upgrade terminal equipment.
Erie East - South Ripley 230kV	Ashtabula - Erie West - Perry 345kV Line	607	114.89%	Reconductor line and upgrade terminal equipment.
W3-099 TAP - 4 Mile 230kV	Ashtabula - Erie West - Perry 345kV Line	612	111.15%	Reconductor line and upgrade terminal equipment.
W3-099 TAP - 4 Mile 230kV	Ashtabula - Erie West - Perry 345kV Line	612	111.15%	Reconductor line and upgrade terminal equipment.
Four Mile 230/115kV XFMR	Erie South - Four Mile 230kV Line	323	109.82%	Install a second 230/115kV transformer at Four Mile.
Erie East - W3-099 TAP 230kV	Erie West - Ashtabula Tap 345kV Line	612	109.78%	Reconductor line and upgrade terminal equipment.
Erie East - South Ripley 230kV	Erie West - Ashtabula Tap 345kV Line	607	114.89%	Reconductor line and upgrade terminal equipment.
W3-099 TAP - 4 Mile 230kV	Erie West - Ashtabula Tap 345kV Line	612	111.15%	Reconductor line and upgrade terminal equipment.
Oxbow - Lackawanna 230kV	Susquehanna - Lackawanna 500kV Line	624	133.21%	Reconductor line and upgrade terminal equipment.
North Meshoppen - Oxbow 230kV	Susquehanna - Lackawanna 500kV Line	617	133.24%	Reconductor line and upgrade terminal equipment.
Canyon - North Meshoppen 230kV	Susquehanna Unit 1 Outage	666	100.54%	Reconductor line and upgrade terminal equipment.
East Towanda - Canyon 230kV	Susquehanna Unit 1 Outage	554	126.19%	Reconductor line and upgrade terminal equipment.
Homer City #1 345/230kV XFMR	Homer City Stuck 230kV Breaker 206	807	122.79%	Install 500/345kV transformation at Homer City.
Homer City #2 345/230kV XFMR	Homer City Stuck 230kV Breaker 210	824	102.17%	Install 500/345kV transformation at Homer City.
Homer City #2 345/230kV XFMR	Homer City Stuck 345kV Breaker 307	824	110.32%	Install 500/345kV transformation at Homer City.
Homer City #1 345/230kV XFMR	Homer City Stuck 345kV Breaker 308	807	113.24%	Install 500/345kV transformation at Homer City.
Y1-033 TAP - Rockwood 115kV	Black Oak 500kV Bus A Fault	174	100.20%	Reconductor line and upgrade terminal equipment.
Y1-033 TAP - Rockwood 115kV	Black Oak 500kV Bus A Fault	174	100.20%	Reconductor line and upgrade terminal equipment.
Y1-033 TAP - Rockwood 115kV	Black Oak 500kV Bus A Fault	174	100.20%	Reconductor line and upgrade terminal equipment.
Rockwood - Q34 115kV	Cumberland 138kV Bus Fault	179	118.11%	Reconductor line and upgrade terminal equipment.
Q34 - Somerset 115kV	Cumberland 138kV Bus Fault	179	118.11%	Reconductor line and upgrade terminal equipment.

NOTE: Values in red have been updated to reflect the current rating of the facility.

ATSI Overloads

Twenty-five separate FE ATSI 138kV, 345kV, and 345-138kV facilities overload, for Base Case and three separate contingency conditions. All of these issues are mitigated by the proposed system reinforcement discussed below.

a. List of overloaded FE ATSI facilities (Ashtabula region of CEI)

200599	ERIE W	238547	02AT	345kV	Ckt 1
239082	02S8-ATT	238544	02ASH_3	345-138kV	Ckt 8
239036	02PERRY	238684	02EASTLK	345kV	Ckt 1
239036	02PERRY	239334	02L.CENTER	345kV	Ckt 1
238547	02AT	239082	02S8-ATT	345kV	Ckt 1
239115	02SP Q-4	239057	02LRCRQ4	138kV	Ckt 1
239213	02AUSTQ1	239112	02LRCRQ1	138kV	Ckt 1
239095	02SBRNQ1	239213	02AUSTQ1	138kV	Ckt 1
239212	02AUSTQ2	239113	02SP Q-2	138kV	Ckt 1
239098	02SBRNQ4	239115	02SP Q-4	138kV	Ckt 1
239095	02SBRNQ1	238542	02ASH_1	138kV	Ckt 1
238542	02ASH_1	239095	02SBRNQ1	138kV	Ckt 1
239096	02SBRNQ2	239212	02AUSTQ2	138kV	Ckt 1
238543	02ASH_2	239096	02SBRNQ2	138kV	Ckt 1
239098	02SBRNQ4	238544	02ASH_3	138kV	Ckt 1
239212	02AUSTQ2	239096	02SBRNQ2	138kV	Ckt 1
239096	02SBRNQ2	238543	02ASH_2	138kV	Ckt 1
238544	02ASH_3	239098	02SBRNQ4	138kV	Ckt 1
239113	02SP Q-2	239212	02AUSTQ2	138kV	Ckt 1
239213	02AUSTQ1	239095	02SBRNQ1	138kV	Ckt 1
239112	02LRCRQ1	239213	02AUSTQ1	138kV	Ckt 1
239115	02SP Q-4	239098	02SBRNQ4	138kV	Ckt 1
238913	02LRCRQ2	239113	02SP Q-2	138kV	Ckt 1
239057	02LRCRQ4	239115	02SP Q-4	138kV	Ckt 1
238544	02ASH_3	239082	02S8-ATT	138kV	Ckt 1

FE Upgrade: Build a new 345kV circuit between Erie West and Leroy Center substations. Convert part of the Ashtabula-Leroy Center 'Q4' 138kV circuit to 345kV in the process. Add additional 345kV circuit breakers and line exits at Erie West and Leroy Center substations, to accommodate the new circuit.

APS Results

Refer to PJM analysis

Attachment 5

FE Network Facility Reinforcement Conceptual Cost Estimates

Four Mile: Install Second 230/115kV XFMR

Estimate No.	Description	Total with Tax	Tax	Total Cost
PN-S-696	Four Mile SS: Install a second 230/115kV transformer. Install 1-230kV breaker and 1-115kV breaker.	\$6,654,600	\$1,541,200	\$5,113,400
Total		\$6,654,600	\$1,541,200	\$5,113,400

Estimated Project Duration: 19 Months

Homer City: Install 500/345kV Transformation

Estimate No.	Description	Total with Tax	Tax	Total Cost
PN-S-549A	Homer City SS: Install new 345/500kV transformer and new 500kV 3 breaker ring bus (with future plans for breaker and a half). Install one new 345kV circuit breaker to accommodate new transformation.	\$37,998,200	\$8,800,300	\$29,197,900
PN-T-153A	Conemaugh-Keystone 500kV, Loop to Homer City 500kV Sub Expansion: Install a loop, approx. 1000' in length, to the proposed Homer City 500kV substation expansion. New structures shall be steel with concrete foundations.	\$5,690,900	\$1,318,000	\$4,372,900
Total		\$43,689,100	\$10,118,300	\$33,570,800

Estimated Project Duration: 27 Months

North Meshoppen – Canyon: Reconductor Line and Upgrade Terminal Equipment

Estimate No.	Description	Total with Tax	Tax	Total Cost
PN-S-709	Canyon SS: Replace 1200A disconnect switch on 230kV North Meshoppen line.	\$100,100	\$23,200	\$76,900
PN-T-183A	Canyon – North Meshoppen 230kV: Reconductor the 10 mile Canyon – North Meshoppen 230kV line with 1033 ACSS replacing existing 1033 ACSR conductor.	\$9,721,600	\$2,217,500	\$7,504,100
Total		\$9,821,700	\$2,240,700	\$7,581,000

Estimated Project Duration: 22 Months**Oxbow – Lackawanna 230kV: Reconductor Line and Upgrade Terminal Equipment**

Estimate No.	Description	Total with Tax	Tax	Total Cost
PN-S-536A	Oxbow SS: Replace 1200A disconnect switch with a 2000A switch.	\$124,700	\$28,500	\$96,200
PN-T-149B	Oxbow – Lackawanna 230kV: Reconductor 16.3 miles of 1033 ACSR with 1033 ACSS high temperature conductor.	\$16,026,800	\$3,711,800	\$12,315,000
Total		\$16,151,500	\$3,740,300	\$12,411,200

Estimated Project Duration: 28 Months**NOTE:** PPL will need to review the loadability of terminal equipment at Lackawanna substation to determine if any upgrades are required.**Erie East – South Ripley 230kV: Reconductor Line and Upgrade Terminal Equipment**

Estimate No.	Description	Total with Tax	Tax	Total Cost
PN-S-695	Erie East SS: Replace the line drops on the 230kV South Ripley line with 1033 ACSS.	\$38,100	\$8,900	\$29,200
PN-T-193	Erie East-South Ripley 230kV: Reconductor the 4.5 mile Erie East-South Ripley 230kV line with 1033 kcmil ACSS, replacing the existing 1033 kcmil ACSR conductor.	\$5,170,600	\$1,179,400	\$3,991,200
Total		\$5,208,700	\$1,188,300	\$4,020,400

Estimated Project Duration: 16 Months**NOTE:** National Grid and NYISO will need to review the loadability of National Grid owned equipment to determine if any upgrades are required.

Erie West – W3-099 TAP 230kV: Reconductor Line and Upgrade Terminal Equipment

Estimate No.	Description	Total with Tax	Tax	Total Cost
PN-S-694	Erie East SS: Replace the line drops on the 230kV W3-099 (currently Erie South) line with 1033 ACSS.	\$38,100	\$8,900	\$29,200
PN-T-192	Erie East-(W3-099) 230kV: Reconductor the 2.6 mile Erie East-(W3-099) 230kV line with 1033 kcmil ACSS, replacing the existing 1033 kcmil ACSR conductor.	\$3,649,000	\$832,400	\$2,816,600
Total		\$3,687,100	\$841,300	\$2,845,800

Estimated Project Duration: 16 Months

North Meshoppen – Oxbow 230kV: Reconductor Line and Upgrade Terminal Equipment

Estimate No.	Description	Total with Tax	Tax	Total Cost
PN-S-691	North Meshoppen SS: Replace wave trap, substation conductor, and adjust CT ratios on 230kV Oxbow line.	\$115,700	\$26,800	\$88,900
PN-S-692	Oxbow SS: Replace 1200A disconnect switch on 230kV North Meshoppen Line.	\$100,300	\$23,300	\$77,000
PN-T-190	Lackawanna-North Meshoppen 230kV: Reconductor the 10.6 mile North Meshoppen-Oxbow section of the Lackawanna-North Meshoppen 230kV line with 1033 kcmil ACSS, replacing the existing 1033 kcmil ACSR conductor.	\$10,654,900	\$2,430,400	\$8,224,500
Total		\$10,870,900	\$2,480,500	\$8,390,400

Estimated Project Duration: 25 Months

East Towanda – Canyon 230kV: Reconductor Line and Upgrade Terminal Equipment

Estimate No.	Description	Total with Tax	Tax	Total Cost
PN-S-659A	East Towanda SS: Replace substation conductor and relaying on 230kV Canyon line.	\$194,900	\$42,200	\$149,700
PN-S-690	Canyon SS: Replace 1200 A disconnect switch on 230kV East Towanda line with 2000A unit.	\$100,100	\$23,200	\$76,900
PN-T-182A	Canyon – East Towanda 230kV: Reconductor the 12.3 mile Canyon – East Towanda 230kV line with 1033 ACSS, replacing existing 1033 ACSR conductor.	\$11,896,400	\$2,713,600	\$9,182,800
Total		\$12,191,400	\$2,782,000	\$9,409,400

Estimated Project Duration: 33 Months

W3-099 TAP – Four Mile 230kV: Reconductor Line and Upgrade Terminal Equipment

Estimate No.	Description	Total with Tax	Tax	Total Cost
PN-T-191	Four Mile Jct-(W3-099) 230kV: Reconductor the 6.5 mile Four Mile Jct-(W3-099) 230kV line with 1033 kcmil ACSS, replacing the existing 1033 kcmil ACSR conductor.	\$8,077,200	\$1,842,400	\$6,234,800
Total		\$8,077,200	\$1,842,400	\$6,2234,800

Estimated Project Duration: 20 Months

Somerset – Rockwood 115kV: Reconductor Line and Upgrade Terminal Equipment

Estimate No.	Description	Total with Tax	Tax	Total Cost
PN-S-708	Somerset SS: Adjust CT ratios on the Rockwood 115kV line breaker.	\$20,200	\$4,700	\$15,500
PN-T-196	Rockwood-Somerset 115kV: Rebuild the 8.12 Rockwood-Somerset 115kV line to reconductor with single 477 kcmil ACSS conductor, replacing the existing single 397 kcmil ACSR.	\$10,809,100	\$2,503,400	\$8,305,700
Total		\$10,829,300	\$2,508,100	\$8,321,200

Estimated Project Duration: 23 Months

ATSI Reinforcements**Erie West – Leroy Center 345kV: Construct new 345kV Line**

Estimate No.	Description	Total with Tax	Tax	Total Cost
	Leroy Center SS: Install 1-345kV breaker at Leroy Center for a new line exit to Erie West, after the completion of the 2016 expansion. This will make the 345kV yard a 5-breaker ring bus.	\$1,670,000	\$324,900	\$1,345,100
	Erie West – Leroy Center 345kV: Install new 345kV line from Erie West to Leroy Center, approximately 47 miles in length.	\$228,829,600	\$45,751,300	\$183,078,300
PN-S-704	Erie West SS: Install one new 345kV circuit breaker and line exit for new line to Leroy Center.	\$2,776,700	\$643,100	\$2,133,600
Total		\$233,276,300	\$46,719,300	\$186,557,000

Estimated Project Duration: 52 Months

APS Reinforcements**AL 4 Jct. – All Dam 6 138kV: Reconductor Line**

Estimate No.	Description	Total with Tax	Tax	Total Cost
WP-T-34	All Dam 6 Tap – Allegheny Ludlum 4 Jct: Reconductor Allegheny Dam 6 Tap to Allegheny Ludlum 4 Jct. 11.7 mile 138kV line to achieve a 188 MVA summer emergency rating	\$6,965,100	\$1,590,800	\$5,374,300
Total		\$6,965,100	\$1,590,800	\$5,374,300

Estimated Project Duration: 26 Months

All Dam 6 – Kittanning 138kV: Reconductor Line

Estimate No.	Description	Total with Tax	Tax	Total Cost
WP-T-34	Kittanning – All Dam 6 Tap 138kV: Reconductor Kittanning to Allegheny Dam 6 Tap 6.4 mile 138kV line to achieve a 188 MVA summer emergency rating	\$6,108,700	\$1,395,200	\$4,713,500
Total		\$6,108,700	\$1,395,200	\$4,713,500

Estimated Project Duration: 26 Months

Butler – Karns City 138kV: Reconductor Line and Upgrade Terminals

Estimate No.	Description	Total with Tax	Tax	Total Cost
WP-S-177	Karns City SS: Reconductor butler 138kV line terminal.	\$15,000	\$3,500	\$11,500
WP-S-178	Butler SS: Reconductor the Karns City 138kV line terminal including wave trap and line and bus side disconnects.	\$112,500	\$25,700	\$86,800
WP-T-35	Butler – Karns City 138kV: Reconductor Butler to Karns City 138kV line, 15.6 mile to achieve a 228 MVA summer emergency rating.	\$17,105,600	\$3,906,900	\$13,198,700
Total		\$17,233,100	\$3,936,100	\$13,297,000

Estimated Project Duration: 28 Months

Kiski Valley – Garretts Run Jct. 138kV: Reconductor Line

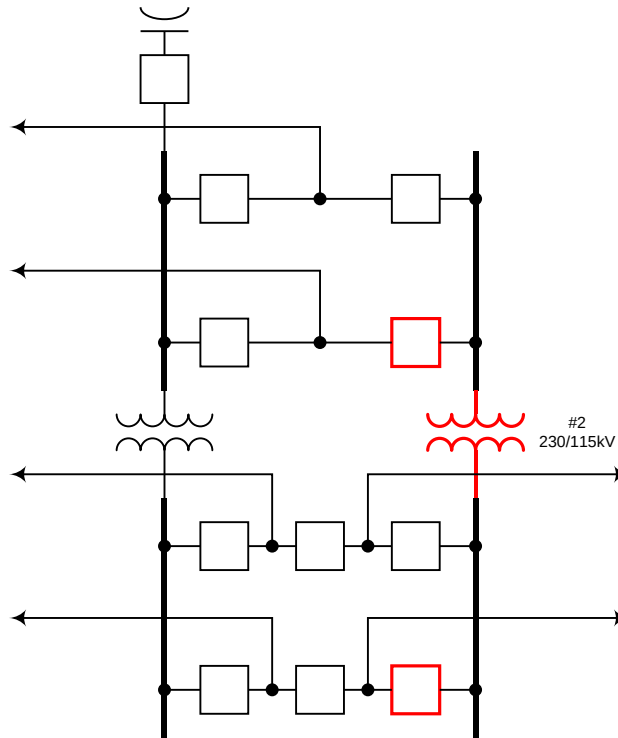
Estimate No.	Description	Total with Tax	Tax	Total Cost
WP-T-34	Kiski Valley – Garretts Run Jct.: Reconductor Garretts Run Jct. – Kiski Valley 14.3 mile 138kV line.	\$12,248,000	\$2,797,400	\$9,450,600
Total		\$12,248,000	\$2,797,400	\$9,450,600

Estimated Project Duration: 28 Months

Attachment 6

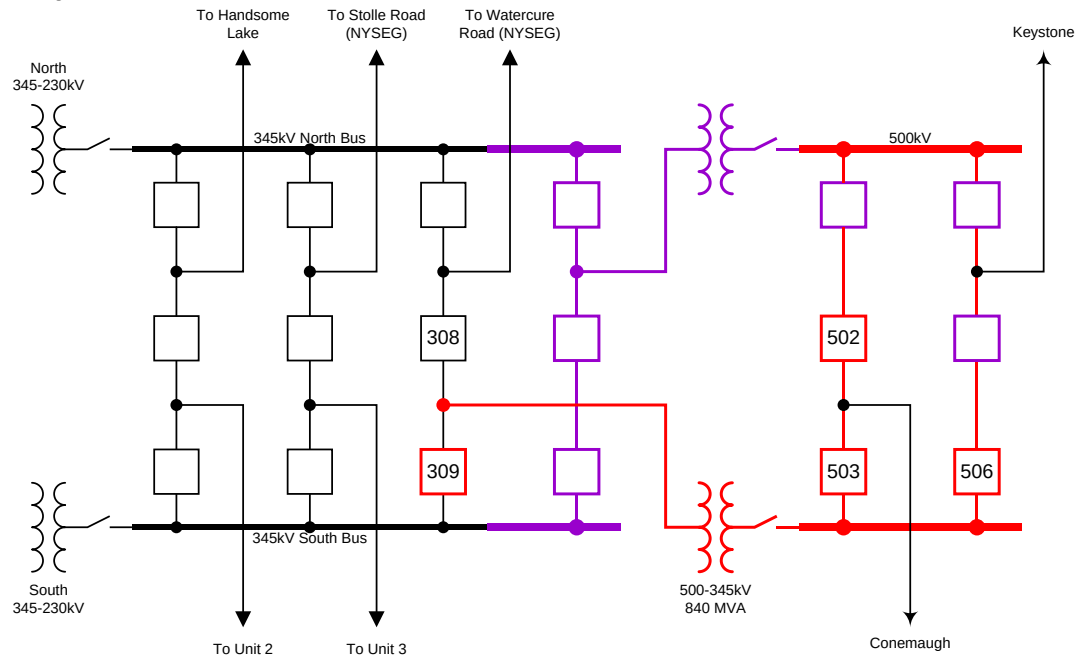
FE Network Facility Reinforcement Conceptual One Line Diagrams

Four Mile: Install Second 230/115kV XFMR



Install a second 230/115kV transformer. Install
1-230kV breaker and 1-115kV breaker.

Homer City: Install 500/345kV Transformation



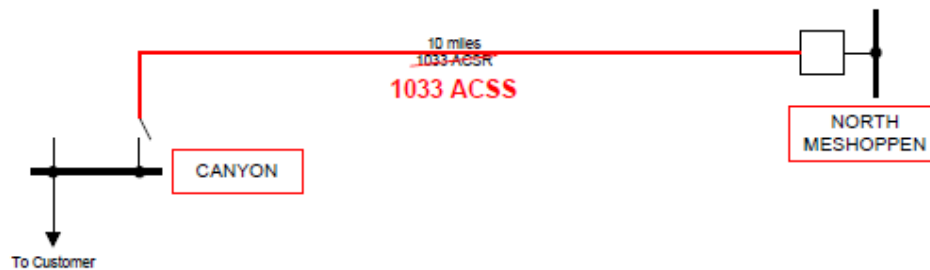
Construct a 500kV yard consisting of 3-500kV breakers configured in breaker-and-a-half layout (initially a ring bus). Tap the Keystone – Conemaugh 500kV line into Homer City. Install a 840 MVA 500-345kV transformer.

Install 1-345kV breaker as shown.

Upgrade relaying, as necessary, at Keystone and Conemaugh.

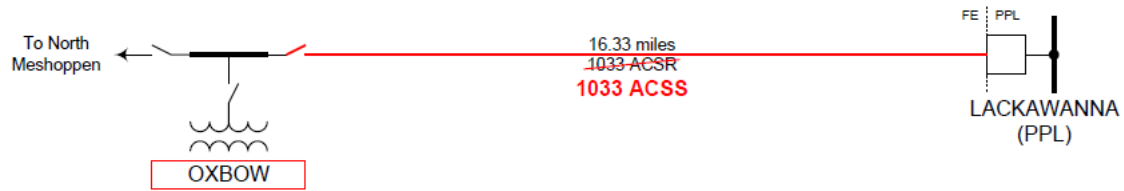


North Meshoppen – Canyon: Reconductor Line and Upgrade Terminal Equipment



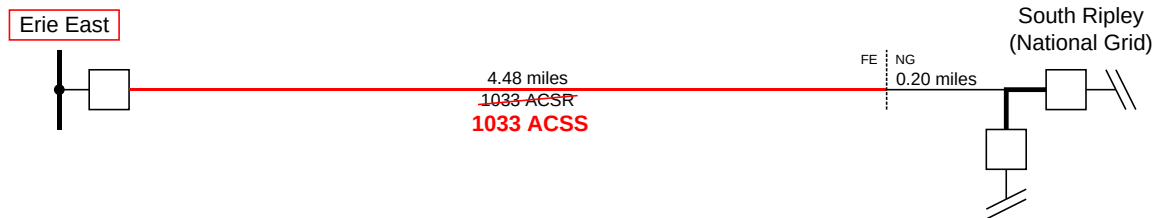
Reconductor 10 miles of 1033 ACSR with 1033 ACSS high temperature conductor.

Oxbow – Lackawanna 230kV: Reconductor Line and Upgrade Terminal Equipment



Reconductor 16.33 miles of 1033 ACSR with 1033 ACSS high temperature conductor.
Replace the 1200 A disconnect switch at Oxbow with a 2000 A switch.

Erie East – South Ripley 230kV: Reconductor Line and Upgrade Terminal Equipment

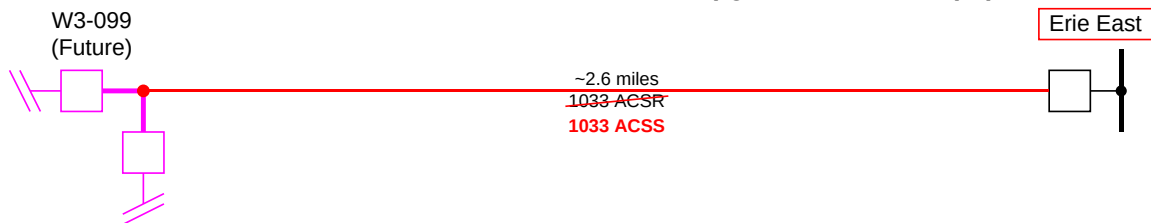


Reconductor 4.48 miles of 1033 ACSR with 1033 ACSS high temperature conductor.

At Erie East, replace the 1033 ACSR line drops with 1033 ACSS.

NOTE: PJM is responsible for coordinating this upgrade with National Grid and NYISO.

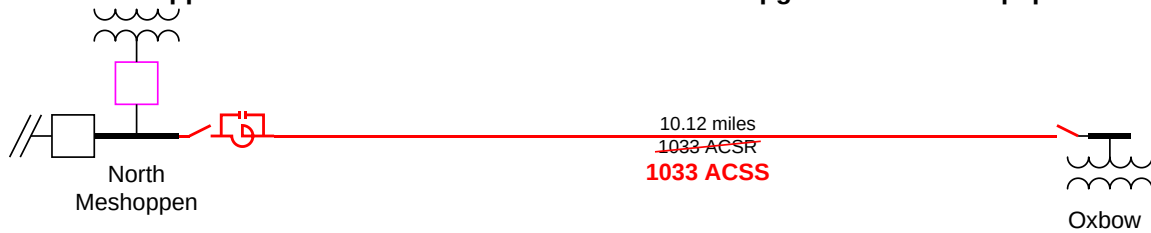
Erie East – W3-099 TAP 230kV: Reconductor Line and Upgrade Terminal Equipment



Reconductor approximately 2.6 miles of 1033 ACSR with 1033 ACSS high temperature conductor.

At Erie East, replace the 1033 ACSR substation conductor with 1033 ACSS.

North Meshoppen – Oxbow 230kV: Reconductor Line and Upgrade Terminal Equipment

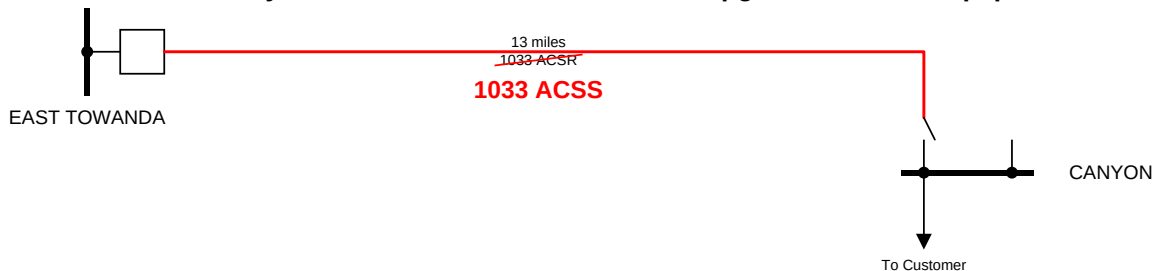


Reconductor 10.12 miles of 1033 ACSR with 1033 ACSS high temperature conductor.

At North Meshoppen, Replace the 1033 AAC substation conductor, replace the 1600 A wave trap with a 2000 A unit, and adjust 3 CT ratios.

At Oxbow, replace the 1200 A disconnect switch with a 2000 A unit.

East Towanda – Canyon 230kV: Reconductor Line and Upgrade Terminal Equipment

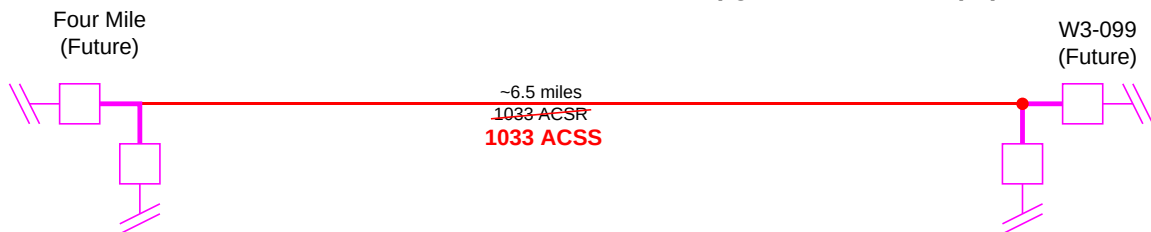


Reconductor 13 miles of 1033 ACSR with 1033 ACSS high temperature conductor.

At Canyon, replace the 1200 A disconnect switch with a 2000 A unit.

At East Towanda, upgrade terminal equipment.

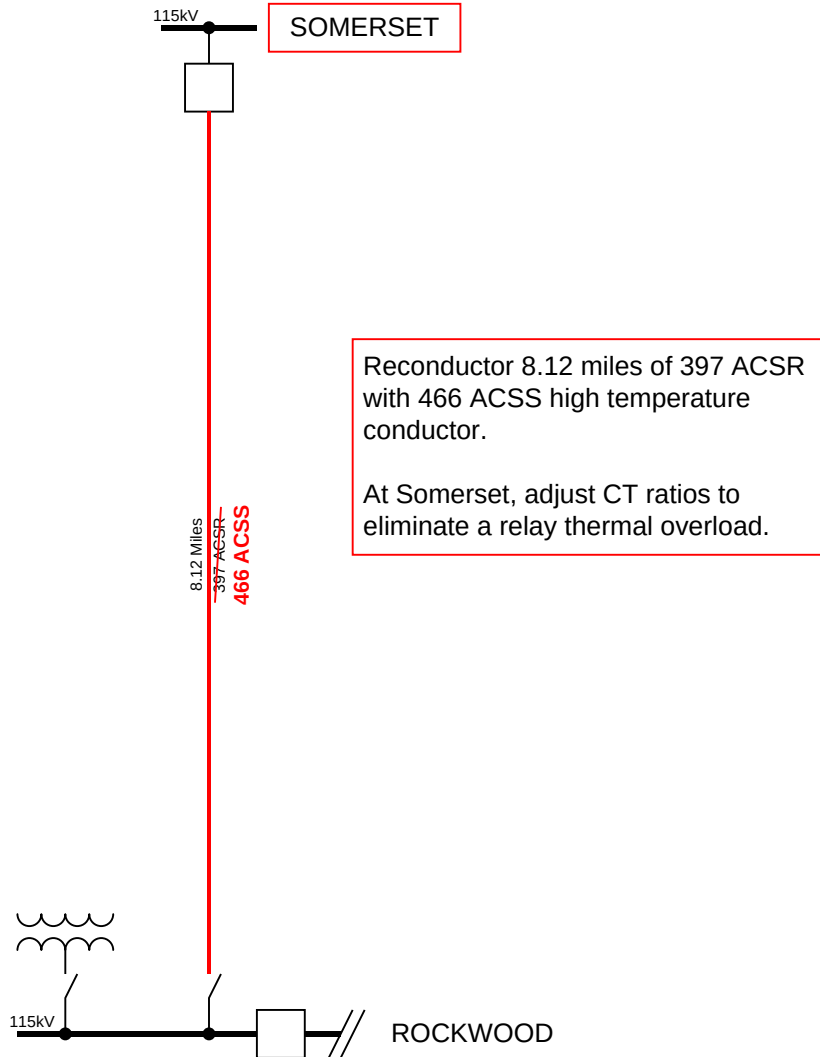
W3-099 TAP – Four Mile 230kV: Reconductor Line and Upgrade Terminal Equipment



Reconductor approximately 11.04 miles of 1033 ACSR with 1033 ACSS high temperature conductor.

At Erie South, replace the 1033 AAC substation conductor with 1033 ACSS.

Rockwood – Somerset 115kV: Reconductor line and Upgrade Terminal Equipment



Attachment 7

FE Revenue Metering Requirements

The FirstEnergy Revenue Metering Requirements may be found in the FirstEnergy Requirements for Transmission Connected Facilities document located at the following links:

www.firstenergycorp.com/feconnect
www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Appendices for Primary POI

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 gauge 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

(PENELEC - PENELEC) The Y1-033 TAP-ROCKWOOD 115 kV line (from bus 913140 to bus 200746 ckt 1) loads from 97.24% to 98.66% (**DC power flow**) of its emergency rating (174 MVA) for the bus fault outage of '4'. This project contributes approximately 9.15 MW to the thermal violation.

CONTINGENCY '4' /BLACKOAK_500_A
 OPEN BRANCH FROM BUS 235103 TO BUS 235446 CKT 3 / BUS
 253103 -> 235103.
 OPEN BUS 237001
 END

Bus Number	Bus Name	Full Contribution
235564	ALBRIGHT 1	5.56
235565	ALBRIGHT 2	5.56
235566	ALBRIGHT 3	10.43
200840	DEEPCRK1	0.12
200841	DEEPCRK2	0.12
292090	J-007	9.49
292380	K-026	2.37
292401	K--28 C2	6.66
293381	N-047 E	6.54
290228	S-014 C	0.08
290229	S-014 E	7.23
885641	T-016 C	0.5
885642	T-016 E	1.99
929522	U2-030 E	5.14
293023	U2-073C OP1	0.13
293024	U2-073E OP1	18.64
236001	WARRIOR RUN	0.95
900404	X3-028 C	1.16
900405	X3-028 E	1.55
913001	Y1-003 C OP1	2.76
913002	Y1-003 E OP1	18.49
913141	Y1-033 C OP1	2.98
913142	Y1-033 E OP1	19.93
Y2-068	Y2-068	13.85
915771	Y3-092	9.15
200813	YOUGH	0.13

Appendix 2

(PENELEC - PENELEC) The Y1-033 TAP-ROCKWOOD 115 kV line (from bus 913140 to bus 200746 ckt 1) loads from 97.24% to 98.66% (**DC power flow**) of its emergency rating (174 MVA) for the bus fault outage of 'AP_C1_5'. This project contributes approximately 9.15 MW to the thermal violation.

CONTINGENCY 'AP_C1_5' /BLACKOAK_138_A
OPEN BRANCH FROM BUS 235446 TO BUS 235103 CKT 3
OPEN BUS 237025
END

Bus Number	Bus Name	Full Contribution
235564	ALBRIGHT 1	5.56
235565	ALBRIGHT 2	5.56
235566	ALBRIGHT 3	10.43
200840	DEEPCRK1	0.12
200841	DEEPCRK2	0.12
292090	J-007	9.49
292380	K-026	2.37
292401	K--28 C2	6.66
293381	N-047 E	6.54
290228	S-014 C	0.08
290229	S-014 E	7.23
885641	T-016 C	0.5
885642	T-016 E	1.99
929522	U2-030 E	5.14
293023	U2-073C OP1	0.13
293024	U2-073E OP1	18.64
236001	WARRIOR RUN	0.95
900404	X3-028 C	1.16
900405	X3-028 E	1.55
913001	Y1-003 C OP1	2.76
913002	Y1-003 E OP1	18.49
913141	Y1-033 C OP1	2.98
913142	Y1-033 E OP1	19.93
Y2-068	Y2-068	13.85
915771	Y3-092	9.15
200813	YOUGH	0.13

Appendix 3

(PENELEC - PENELEC) The Y1-033 TAP-ROCKWOOD 115 kV line (from bus 913140 to bus 200746 ckt 1) loads from 97.24% to 98.66% (**DC power flow**) of its emergency rating (174 MVA) for the bus fault outage of 'AP_C1_4'. This project contributes approximately 9.15 MW to the thermal violation.

CONTINGENCY 'AP_C1_4' /BLACKOAK_500_A
 OPEN BRANCH FROM BUS 235103 TO BUS 235446 CKT 3
 OPEN BUS 237001
 OPEN BUS 237004
 OPEN BUS 235130
 END

Bus Number	Bus Name	Full Contribution
235564	ALBRIGHT 1	5.56
235565	ALBRIGHT 2	5.56
235566	ALBRIGHT 3	10.43
200840	DEEPCRK1	0.12
200841	DEEPCRK2	0.12
292090	J-007	9.49
292380	K-026	2.37
292401	K--28 C2	6.66
293381	N-047 E	6.54
290228	S-014 C	0.08
290229	S-014 E	7.23
885641	T-016 C	0.5
885642	T-016 E	1.99
929522	U2-030 E	5.14
293023	U2-073C OP1	0.13
293024	U2-073E OP1	18.64
236001	WARRIOR RUN	0.95
900404	X3-028 C	1.16
900405	X3-028 E	1.55
913001	Y1-003 C OP1	2.76
913002	Y1-003 E OP1	18.49
913141	Y1-033 C OP1	2.98
913142	Y1-033 E OP1	19.93
Y2-068	Y2-068	13.85
915771	Y3-092	9.15
200813	YOUGH	0.13

Appendix 4

(PENELEC - FE) The ERIE W-02AT 345 kV line (from bus 200599 to bus 238547 ckt 1) loads from 26.67% to 63.54% (**DC power flow**) of its normal rating (1559 MVA) for non-contingency condition. This project contributes approximately 574.71 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.18
235567	ARMSTRONG 1	29.47
235569	ARMSTRONG 2	29.3
203261	BLOSSBCT	0.17
200503	C.SLOPE	0.74
200805	COLVER13	0.71
94106	GRAYMONT	0.19
200828	HNSMLK 1	0.95
200829	HNSMLK 2	0.95
200830	HNSMLK 3	0.95
200831	HNSMLK 4	0.95
200832	HNSMLK 5	0.95
200837	HOMER C1	3.75
200838	HOMER C2	4.84
200839	HOMER C3	5.12
200636	IUP CO-G	0.07
200864	K-013	0.03
200849	LAKVU GN	0.11
203283	MANOR	0.01
200851	MEHOOP3	0.41
293270	N-036 C	2.21
293300	N-039 C	0.08
293602	O-018 C	0.07
293801	O-038 C	0.05
294512	P-022 C	0.02
294572	P-028 C	0.21
200649	PENNTech	0.42
200608	PINEY #1	0.27
200657	PINEY CK	0.31
290085	Q-036 C	0.07
295247	Q-046	0.07
200882	Q-053 C	0.06
290113	Q-063 C	0.22
296322	R-032 C	0.08

296914	R-092 C	2.66
291011	S-103	0.9
200662	SCRUB GR	1.26
200642	SENECA#1	2.84
200643	SENECA#2	2.64
200644	SENECA#3	0.41
200715	SHAWVL 1	21.45
200722	SHAWVL 2	21.97
200665	SHAWVL 3	31.09
200666	SHAWVL 4	31.13
200809	SITHE	0.22
292391	T-121C	3.48
292548	T-155	0.04
292984	U2-055C	1.87
293392	V3-030C	0.02
293416	V3-042C	2.11
903651	W3-099 C OP1	5.96
907481	X1-109	129.55
909091	X2-031 C	0.76
910651	X3-039	42.12
X3-050	X3-050	26.1
913131	Y1-032 C	2.91
913191	Y1-047 OP1	2.36
913311	Y1-071	0.06
914061	Y2-042	2.47
Y2-044	Y2-044	42.26
914131	Y2-055	17.67
914151	Y2-060	0.54
914421	Y2-104	0.99
915011	Y3-010 C	1.36
Y3-059	Y3-059	29.75
915331	Y3-062 C	1.08
915771	Y3-092	574.71

Appendix 5

(PENELEC - FE) The ERIE W-02AT 345 kV line (from bus 200599 to bus 238547 ckt 1) loads from 26.67% to 63.54% (**DC power flow**) of its normal rating (1559 MVA) for non-contingency condition. This project contributes approximately 574.71 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.18
235567	ARMSTRONG 1	29.47
235569	ARMSTRONG 2	29.3
203261	BLOSSBCT	0.17
200503	C.SLOPE	0.74
200805	COLVER13	0.71
94106	GRAYMONT	0.19
200828	HNSMLK 1	0.95
200829	HNSMLK 2	0.95
200830	HNSMLK 3	0.95
200831	HNSMLK 4	0.95
200832	HNSMLK 5	0.95
200837	HOMER C1	3.75
200838	HOMER C2	4.84
200839	HOMER C3	5.12
200636	IUP CO-G	0.07
200864	K-013	0.03
200849	LAKVU GN	0.11
203283	MANOR	0.01
200851	MEHOOP3	0.41
293270	N-036 C	2.21
293300	N-039 C	0.08
293602	O-018 C	0.07
293801	O-038 C	0.05
294512	P-022 C	0.02
294572	P-028 C	0.21
200649	PENNTECH	0.42
200608	PINEY #1	0.27
200657	PINEY CK	0.31
290085	Q-036 C	0.07
295247	Q-046	0.07
200882	Q-053 C	0.06
290113	Q-063 C	0.22
296322	R-032 C	0.08

296914	R-092 C	2.66
291011	S-103	0.9
200662	SCRUB GR	1.26
200642	SENECA#1	2.84
200643	SENECA#2	2.64
200644	SENECA#3	0.41
200715	SHAWVL 1	21.45
200722	SHAWVL 2	21.97
200665	SHAWVL 3	31.09
200666	SHAWVL 4	31.13
200809	SITHE	0.22
292391	T-121C	3.48
292548	T-155	0.04
292984	U2-055C	1.87
293392	V3-030C	0.02
293416	V3-042C	2.11
903651	W3-099 C OP1	5.96
907481	X1-109	129.55
909091	X2-031 C	0.76
910651	X3-039	42.12
X3-050	X3-050	26.1
913131	Y1-032 C	2.91
913191	Y1-047 OP1	2.36
913311	Y1-071	0.06
914061	Y2-042	2.47
Y2-044	Y2-044	42.26
914131	Y2-055	17.67
914151	Y2-060	0.54
914421	Y2-104	0.99
915011	Y3-010 C	1.36
Y3-059	Y3-059	29.75
915331	Y3-062 C	1.08
915771	Y3-092	574.71

Appendix 6

(AP - AP) The GARRETTS R J-KISKI VALLEY 138 kV line (from bus 235282 to bus 235202 ckt 1) loads from 11.94% to 56.77% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 67.69 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.05
235567	ARMSTRONG 1	30.34
235569	ARMSTRONG 2	30.16
200828	HNSMLK 1	0.2
200829	HNSMLK 2	0.2
200830	HNSMLK 3	0.2
200831	HNSMLK 4	0.2
200832	HNSMLK 5	0.2
200849	LAKVU GN	0.01
200649	PENNTECH	0.11
200608	PINEY #1	0.12
200657	PINEY CK	0.14
290113	Q-063 C	0.04
291011	S-103	0.15
200662	SCRUB GR	0.34
200642	SENECA#1	0.54
200643	SENECA#2	0.5
200644	SENECA#3	0.08
292548	T-155	0.07
903651	W3-099 C OP1	0.81
910651	X3-039	7.25
913311	Y1-071	0.04
914131	Y2-055	2.92
915331	Y3-062 C	0.15
915771	Y3-092	67.69

Appendix 7

(AP - AP) The GARRETTS R J-KISKI VALLEY 138 kV line (from bus 235282 to bus 235202 ckt 1) loads from 11.94% to 56.77% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 67.69 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.05
235567	ARMSTRONG 1	30.34
235569	ARMSTRONG 2	30.16
200828	HNSMLK 1	0.2
200829	HNSMLK 2	0.2
200830	HNSMLK 3	0.2
200831	HNSMLK 4	0.2
200832	HNSMLK 5	0.2
200849	LAKVU GN	0.01
200649	PENNTECH	0.11
200608	PINEY #1	0.12
200657	PINEY CK	0.14
290113	Q-063 C	0.04
291011	S-103	0.15
200662	SCRUB GR	0.34
200642	SENECA#1	0.54
200643	SENECA#2	0.5
200644	SENECA#3	0.08
292548	T-155	0.07
903651	W3-099 C OP1	0.81
910651	X3-039	7.25
913311	Y1-071	0.04
914131	Y2-055	2.92
915331	Y3-062 C	0.15
915771	Y3-092	67.69

Appendix 8

(AP - AP) The GARRETTS R J-KISKI VALLEY 138 kV line (from bus 235282 to bus 235202 ckt 1) loads from 11.94% to 56.77% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 67.69 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1

DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
02PERRY 345.00 02AT 345.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
02AT 345.00 02S8-ATT 345.00

DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
02S8-ATT 345.00 02ASH_3 138.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.05
235567	ARMSTRONG 1	30.34
235569	ARMSTRONG 2	30.16
200828	HNSMLK 1	0.2
200829	HNSMLK 2	0.2
200830	HNSMLK 3	0.2
200831	HNSMLK 4	0.2
200832	HNSMLK 5	0.2
200849	LAKVU GN	0.01
200649	PENNTECH	0.11
200608	PINEY #1	0.12
200657	PINEY CK	0.14
290113	Q-063 C	0.04
291011	S-103	0.15
200662	SCRUB GR	0.34
200642	SENECA#1	0.54
200643	SENECA#2	0.5
200644	SENECA#3	0.08
292548	T-155	0.07
903651	W3-099 C OP1	0.81
910651	X3-039	7.25
913311	Y1-071	0.04
914131	Y2-055	2.92
915331	Y3-062 C	0.15
915771	Y3-092	67.69

Appendix 9

(FE - PENELEC) The 02AT-ERIE W 345 kV line (from bus 238547 to bus 200599 ckt 1) loads from 28.1% to 64.96% (**DC power flow**) of its normal rating (1559 MVA) for non-contingency condition. This project contributes approximately 574.71 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	55.48
239267	02AVG10	0.09
238554	02AVONG7	0.29
238555	02AVONG9	1.63
238571	02BEAVGA	0.21
238572	02BEAVGB	0.21
238670	02DVBSG1	2.65
239203	02EASTG6	0.17
238688	02EDGEGA	1.6
238689	02EDGEGB	1.6
238602	02FRMENG 2	0.49
238603	02FRMENG 3	0.88
239035	02PERRG1	11.18
239171	02WLORG-2	0.32
239172	02WLORG-3	0.32
239173	02WLORG-4	0.32
239174	02WLORG-5	0.32
239175	02WLORG-6	0.32
99210	G07_NEW	5.32
94130	O66_NONFIRM	18.39
884780	S-058 C	1.6
884781	S-058 E	5.26
292078	V1-034	0.16
900041	V4-011	0.16
901211	W1-070A_AT4	1.47
903231	W3-005 C	3.26
903511	W3-059A_AT6	0.97
904683	W3-149C	-0.33
905051	W4-004A	0.06
905071	W4-004B_AT11	3.17
907061	X1-027A C1	1.22
907064	X1-027A C2	1.22
907066	X1-027A C3	1.22
907068	X1-027A C4	1.22

907991	X1-078	26.33
907481	X1-109	-129.55
909231	X2-085 C	0.02
910501	X3-001 C	0.03
913401	Y1-012	0.06
913041	Y1-015 C	43.58
913161	Y1-035	72.55
913171	Y1-036	76.64
Y2-049	Y2-049	32.25
914301	Y2-085 OP1	64.91
Y3-032	Y3-032	16.13
Y3-083	Y3-083	16.29
915771	Y3-092	574.71

Appendix 10

(FE - PENELEC) The 02AT-ERIE W 345 kV line (from bus 238547 to bus 200599 ckt 1) loads from 28.1% to 64.96% (**DC power flow**) of its normal rating (1559 MVA) for non-contingency condition. This project contributes approximately 574.71 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	55.48
239267	02AVG10	0.09
238554	02AVONG7	0.29
238555	02AVONG9	1.63
238571	02BEAVGA	0.21
238572	02BEAVGB	0.21
238670	02DVBSG1	2.65
239203	02EASTG6	0.17
238688	02EDGEGA	1.6
238689	02EDGEGB	1.6
238602	02FRMENG 2	0.49
238603	02FRMENG 3	0.88
239035	02PERRG1	11.18
239171	02WLORG-2	0.32
239172	02WLORG-3	0.32
239173	02WLORG-4	0.32
239174	02WLORG-5	0.32
239175	02WLORG-6	0.32
99210	G07_NEW	5.32
94130	O66_NONFIRM	18.39
884780	S-058 C	1.6
884781	S-058 E	5.26
292078	V1-034	0.16
900041	V4-011	0.16
901211	W1-070A_AT4	1.47
903231	W3-005 C	3.26
903511	W3-059A_AT6	0.97
904683	W3-149C	-0.33
905051	W4-004A	0.06
905071	W4-004B_AT11	3.17
907061	X1-027A C1	1.22
907064	X1-027A C2	1.22
907066	X1-027A C3	1.22
907068	X1-027A C4	1.22

907991	X1-078	26.33
907481	X1-109	-129.55
909231	X2-085 C	0.02
910501	X3-001 C	0.03
913401	Y1-012	0.06
913041	Y1-015 C	43.58
913161	Y1-035	72.55
913171	Y1-036	76.64
Y2-049	Y2-049	32.25
914301	Y2-085 OP1	64.91
Y3-032	Y3-032	16.13
Y3-083	Y3-083	16.29
915771	Y3-092	574.71

Appendix 11

(FE - FE) The 02S8-ATT 345/138 kV transformer (from bus 239082 to bus 238544 ckt 8) loads from 50.39% to 76.2% (**DC power flow**) of its normal rating (297 MVA) for non-contingency condition. This project contributes approximately 76.64 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.01
903651	W3-099 C OP1	0.79
910651	X3-039	5.62
915331	Y3-062 C	0.14
915771	Y3-092	76.64

Appendix 12

(PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 63.37% to 82.55% (**DC power flow**) of its emergency rating (824 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-9I'. This project contributes approximately 158.02 MW to the thermal violation.

CONTINGENCY 'C2_PN230-SB-9I' /* HOMER CITY 230 KV
STUCK CB - CB210

DISCONNECT BRANCH FROM BUS 200767 TO BUS 200807 CKT 1
DISCONNECT BRANCH FROM BUS 200807 TO BUS 200808 CKT 1
DISCONNECT BRANCH FROM BUS 200808 TO BUS 200809 CKT 1
REMOVE MACHINE 1 FROM BUS 200809 /* 0
DISCONNECT BUS 200807
DISCONNECT BUS 200808
DISCONNECT BUS 200809
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200769 CKT 1
END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	19.52
200887	ARMNA MT P47	0.24
235567	ARMSTRONG 1	29.43
235569	ARMSTRONG 2	29.26
203261	BLOSSBCT	0.21
200828	HNSMLK 1	0.72
200829	HNSMLK 2	0.72
200830	HNSMLK 3	0.72
200831	HNSMLK 4	0.72
200832	HNSMLK 5	0.72
200838	HOMER C2	14.67
200839	HOMER C3	15.53
200849	LAKVU GN	0.04
200857	LAURHILL	8.76
203283	MANOR	0.01
293270	N-036 C	2.91
293271	N-036 E	11.65
294573	P-028 E	16.64
200888	P-047 E	20.98
200649	PENNTECH	0.32
290113	Q-063 C	0.16
296914	R-092 C	1.42
296915	R-092 E	5.68
291011	S-103	0.55

200662	SCRUB GR	0.62
200642	SENECA#1	2.1
200643	SENECA#2	1.95
200644	SENECA#3	0.3
200715	SHAWVL 1	9.81
200722	SHAWVL 2	10.01
200665	SHAWVL 3	16.23
292391	T-121C	4.4
292392	T-121E	17.61
297050	V2-019 E	< 0.01
293416	V3-042C	2.13
293417	V3-042E	14.28
901211	W1-070A_AT4	0.52
901212	W1-070A_AT4	3.47
903651	W3-099 C OP1	2.47
903652	W3-099 E OP1	16.52
907481	X1-109	123.01
910522	X3-003 E	2.77
910651	X3-039	18.59
X3-050	X3-050	25.32
913131	Y1-032 C	3.76
913132	Y1-032 E	25.17
913191	Y1-047 OP1	2.14
914061	Y2-042	1.89
Y2-044	Y2-044	41.
914131	Y2-055	10.71
914151	Y2-060	0.49
914421	Y2-104	0.89
915331	Y3-062 C	0.46
915332	Y3-062 E	3.14
915771	Y3-092	158.02

Appendix 13

(FE - FE) The 02AT-02S8-ATT 345 kV line (from bus 238547 to bus 239082 ckt 1) loads from 34.17% to 68.21% (**DC power flow**) of its emergency rating (828 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 281.88 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.09
235567	ARMSTRONG 1	14.45
235569	ARMSTRONG 2	14.37
203261	BLOSSBCT	0.08
200503	C.SLOPE	0.36
200805	COLVER13	0.35
94106	GRAYMONT	0.09
200828	HNSMLK 1	0.46
200829	HNSMLK 2	0.46
200830	HNSMLK 3	0.46
200831	HNSMLK 4	0.46
200832	HNSMLK 5	0.46
200837	HOMER C1	1.84
200838	HOMER C2	2.37
200839	HOMER C3	2.51
200636	IUP CO-G	0.04
200864	K-013	0.02
200849	LAKVU GN	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.2
293270	N-036 C	1.08
293300	N-039 C	0.04
293602	O-018 C	0.03
293801	O-038 C	0.03
294512	P-022 C	0.01
294572	P-028 C	0.1
200649	PENNTECH	0.21
200608	PINEY #1	0.13
200657	PINEY CK	0.15
290085	Q-036 C	0.03
295247	Q-046	0.04
200882	Q-053 C	0.03

290113	Q-063 C	0.11
296322	R-032 C	0.04
296914	R-092 C	1.3
291011	S-103	0.44
200662	SCRUB GR	0.62
200642	SENECA#1	1.39
200643	SENECA#2	1.29
200644	SENECA#3	0.2
200715	SHAWVL 1	10.52
200722	SHAWVL 2	10.77
200665	SHAWVL 3	15.24
200666	SHAWVL 4	15.26
200809	SITHE	0.11
292391	T-121C	1.71
292548	T-155	0.02
292984	U2-055C	0.92
293392	V3-030C	0.01
293416	V3-042C	1.04
903651	W3-099 C OP1	2.92
907481	X1-109	63.5
909091	X2-031 C	0.37
910651	X3-039	20.66
X3-050	X3-050	12.8
913131	Y1-032 C	1.43
913191	Y1-047 OP1	1.16
913311	Y1-071	0.03
914061	Y2-042	1.21
Y2-044	Y2-044	20.72
914131	Y2-055	8.67
914151	Y2-060	0.26
914421	Y2-104	0.49
915011	Y3-010 C	0.67
915331	Y3-062 C	0.53
915771	Y3-092	281.88

Appendix 14

(PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line (from bus 200928 to bus 200819 ckt 1) loads from 29.01% to 65.73% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2E'. This project contributes approximately 214.42 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2E' /* ERIE WEST 345 KV
STUCK CB - CB7
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Bus Number	Bus Name	Full Contribution
294573	P-028 E	6.33
200888	P-047 E	4.55
293416	V3-042C	0.91
293417	V3-042E	6.09
903651	W3-099 C OP1	7.05
903652	W3-099 E OP1	47.17
907481	X1-109	43.05
910522	X3-003 E	1.05
X3-050	X3-050	14.39
913191	Y1-047 OP1	0.81
Y2-044	Y2-044	23.29
914151	Y2-060	0.18
914421	Y2-104	0.33
915331	Y3-062 C	1.26
915332	Y3-062 E	8.55
915771	Y3-092	214.42

Appendix 15

(FE - FE) The 02HANNA-02JUNIPER 345 kV line (from bus 238781 to bus 238850 ckt 1) loads from 80.08% to 91.59% (**DC power flow**) of its emergency rating (1554 MVA) for the tower line contingency outage of 'C5-TWL-NR066'. This project contributes approximately 178.83 MW to the thermal violation.

```
CONTINGENCY 'C5-TWL-NR066'                                /* STAR-JUNIPER &
MANSFIELD-NORTHFIELD 345KV
  DISCONNECT BRANCH FROM BUS 238850 TO BUS 239122 CKT 1    /*
02JUNIPER 345.00 02STAR 345.00
  DISCONNECT BRANCH FROM BUS 239358 TO BUS 238941 CKT 1    /*
02NFIELD 345.00 02MANSFD 345.00
END
```

Bus Number	Bus Name	Full Contribution
240967	02-G689	26.67
240213	02-H093	0.54
239006	02NILEG1	9.35
239007	02NILEG2	9.26
253922	15STJOE1	5.9
905031	W4-001A_AT9	0.22
905061	W4-004A_AT10	1.31
913041	Y1-015 C	68.22
913042	Y1-015 E	10.19
915771	Y3-092	178.83

Appendix 16

(AP - AP) The BURMA 138/115 kV transformer (from bus 235150 to bus 235151 ckt 1) loads from 54.46% to 79.38% (**DC power flow**) of its emergency rating (254 MVA) for the single line contingency outage of 'B_PN345-SX-#6'. This project contributes approximately 63.28 MW to the thermal violation.

CONTINGENCY 'B_PN345-SX-#6' /* HANDSOME LAKE -
WAYNE (WHL) 345 KV - (PJM-PN33A)
DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
235567	ARMSTRONG 1	20.82
235569	ARMSTRONG 2	20.7
292548	T-155	0.02
913311	Y1-071	0.08
915771	Y3-092	63.28

Appendix 17

(PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 65.05% to 85.25% (**DC power flow**) of its emergency rating (558 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 112.7 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
200828	HNSMLK 1	0.17
200829	HNSMLK 2	0.17
200830	HNSMLK 3	0.17
200831	HNSMLK 4	0.17
200832	HNSMLK 5	0.17
200849	LAKVU GN	0.03
293270	N-036 C	0.61
290113	Q-063 C	0.24
291011	S-103	0.65
200642	SENECA#1	3.21
200643	SENECA#2	2.98
200644	SENECA#3	0.46
292391	T-121C	1.14
903651	W3-099 C OP1	1.75
910651	X3-039	8.58
X3-050	X3-050	6.93
913131	Y1-032 C	0.88
Y2-044	Y2-044	11.21
914131	Y2-055	12.64
915331	Y3-062 C	0.32
915771	Y3-092	112.7

Appendix 18

(PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 65.05% to 85.25% (**DC power flow**) of its emergency rating (558 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 112.7 MW to the thermal violation.

CONTINGENCY 'DQE_163' /* LINE ERIE W TO
02PERRY 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END

Bus Number	Bus Name	Full Contribution
200828	HNSMLK 1	0.17
200829	HNSMLK 2	0.17
200830	HNSMLK 3	0.17
200831	HNSMLK 4	0.17
200832	HNSMLK 5	0.17
200849	LAKVU GN	0.03
293270	N-036 C	0.61
290113	Q-063 C	0.24
291011	S-103	0.65
200642	SENECA#1	3.21
200643	SENECA#2	2.98
200644	SENECA#3	0.46
292391	T-121C	1.14
903651	W3-099 C OP1	1.75
910651	X3-039	8.58
X3-050	X3-050	6.93
913131	Y1-032 C	0.88
Y2-044	Y2-044	11.21
914131	Y2-055	12.64
915331	Y3-062 C	0.32
915771	Y3-092	112.7

Appendix 19

(PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 65.05% to 85.25% (**DC power flow**) of its emergency rating (558 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 112.7 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1

DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
02PERRY 345.00 02AT 345.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
02AT 345.00 02S8-ATT 345.00

DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
02S8-ATT 345.00 02ASH_3 138.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
200828	HNSMLK 1	0.17
200829	HNSMLK 2	0.17
200830	HNSMLK 3	0.17
200831	HNSMLK 4	0.17
200832	HNSMLK 5	0.17
200849	LAKVU GN	0.03
293270	N-036 C	0.61
290113	Q-063 C	0.24
291011	S-103	0.65
200642	SENECA#1	3.21
200643	SENECA#2	2.98
200644	SENECA#3	0.46
292391	T-121C	1.14
903651	W3-099 C OP1	1.75
910651	X3-039	8.58
X3-050	X3-050	6.93
913131	Y1-032 C	0.88
Y2-044	Y2-044	11.21
914131	Y2-055	12.64
915331	Y3-062 C	0.32
915771	Y3-092	112.7

Appendix 20

(PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200568 to bus 200600 ckt 5) loads from 3.62% to 54.81% (**DC power flow**) of its emergency rating (776 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 397.23 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
915771	Y3-092	397.23

Appendix 21

(FE - FE) The 02SP Q-4-02LRCRQ4 138 kV line (from bus 239115 to bus 239057 ckt 1) loads from .5% to 53.6% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.79 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	43.95
200828	HNSMLK 1	0.13
200829	HNSMLK 2	0.13
200830	HNSMLK 3	0.13
200831	HNSMLK 4	0.13
200832	HNSMLK 5	0.13
200849	LAKVU GN	0.02
901211	W1-070A_AT4	1.15
903651	W3-099 C OP1	0.84
910651	X3-039	5.92
913401	Y1-012	0.06
915331	Y3-062 C	0.15
915771	Y3-092	80.79

Appendix 22

(PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 82.4% to 94.6% (**DC power flow**) of its normal rating (426 MVA) for non-contingency condition. This project contributes approximately 51.95 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.02
293270	N-036 C	1.08
200649	PENNTECH	0.74
290113	Q-063 C	0.2
296914	R-092 C	0.86
291011	S-103	0.51
200642	SENECA#1	2.66
200643	SENECA#2	2.47
200644	SENECA#3	0.38
292391	T-121C	2.26
903651	W3-099 C OP1	1.11
913131	Y1-032 C	1.64
914131	Y2-055	10.
915331	Y3-062 C	0.21
915771	Y3-092	51.95

Appendix 23

(PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 82.4% to 94.6% (**DC power flow**) of its normal rating (426 MVA) for non-contingency condition. This project contributes approximately 51.95 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.02
293270	N-036 C	1.08
200649	PENNTECH	0.74
290113	Q-063 C	0.2
296914	R-092 C	0.86
291011	S-103	0.51
200642	SENECA#1	2.66
200643	SENECA#2	2.47
200644	SENECA#3	0.38
292391	T-121C	2.26
903651	W3-099 C OP1	1.11
913131	Y1-032 C	1.64
914131	Y2-055	10.
915331	Y3-062 C	0.21
915771	Y3-092	51.95

Appendix 24

(AP - PENELEC) The BURMA-PINEY 115 kV line (from bus 235151 to bus 200583 ckt 1) loads from 55.97% to 81.59% (**DC power flow**) of its emergency rating (247 MVA) for the single line contingency outage of 'B_PN345-SX-#6'. This project contributes approximately 63.28 MW to the thermal violation.

CONTINGENCY 'B_PN345-SX-#6' /* HANDSOME LAKE -
WAYNE (WHL) 345 KV - (PJM-PN33A)
DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
235567	ARMSTRONG 1	20.82
235569	ARMSTRONG 2	20.7
292548	T-155	0.02
913311	Y1-071	0.08
915771	Y3-092	63.28

Appendix 25

(AP - PENELEC) The BURMA-PINEY 115 kV line (from bus 235151 to bus 200583 ckt 1) loads from 55.97% to 81.59% (**DC power flow**) of its emergency rating (247 MVA) for the single line contingency outage of 'B_PN345-SX-#6'. This project contributes approximately 63.28 MW to the thermal violation.

CONTINGENCY 'B_PN345-SX-#6' /* HANDSOME LAKE -
WAYNE (WHL) 345 KV - (PJM-PN33A)
DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
235567	ARMSTRONG 1	20.82
235569	ARMSTRONG 2	20.7
292548	T-155	0.02
913311	Y1-071	0.08
915771	Y3-092	63.28

Appendix 26

(PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 84.89% to 96.13% (**DC power flow**) of its emergency rating (505 MVA) for the single line contingency outage of 'B_PN115-LX-#161'. This project contributes approximately 56.74 MW to the thermal violation.

CONTINGENCY 'B_PN115-LX-#161' /* RIDGWAY -
WHETSTONE (DR) 115 KV & WHETSTONE XF#1
DISCONNECT BRANCH FROM BUS 200582 TO BUS 200711 CKT 1
DISCONNECT BRANCH FROM BUS 200711 TO BUS 200596 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.02
293270	N-036 C	1.27
200649	PENNTECH	0.96
290113	Q-063 C	0.22
291011	S-103	0.55
200642	SENECA#1	2.86
200643	SENECA#2	2.66
200644	SENECA#3	0.41
292391	T-121C	2.66
903651	W3-099 C OP1	1.21
X3-050	X3-050	5.74
913131	Y1-032 C	1.93
Y2-044	Y2-044	9.29
914131	Y2-055	10.81
915331	Y3-062 C	0.22
915771	Y3-092	56.74

Appendix 27

(PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 84.89% to 96.13% (**DC power flow**) of its emergency rating (505 MVA) for the single line contingency outage of 'B_PN115-LX-#161'. This project contributes approximately 56.74 MW to the thermal violation.

CONTINGENCY 'B_PN115-LX-#161' /* RIDGWAY -
WHETSTONE (DR) 115 KV & WHETSTONE XF#1
DISCONNECT BRANCH FROM BUS 200582 TO BUS 200711 CKT 1
DISCONNECT BRANCH FROM BUS 200711 TO BUS 200596 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.02
293270	N-036 C	1.27
200649	PENNTECH	0.96
290113	Q-063 C	0.22
291011	S-103	0.55
200642	SENECA#1	2.86
200643	SENECA#2	2.66
200644	SENECA#3	0.41
292391	T-121C	2.66
903651	W3-099 C OP1	1.21
X3-050	X3-050	5.74
913131	Y1-032 C	1.93
Y2-044	Y2-044	9.29
914131	Y2-055	10.81
915331	Y3-062 C	0.22
915771	Y3-092	56.74

Appendix 28

(PENELEC - PENELEC) The ERIE SE-4MILE_230 230 kV line (from bus 200819 to bus 200928 ckt 1) loads from 21.52% to 64.6% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 377.28 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.09
910651	X3-039	12.16
914131	Y2-055	3.45
915771	Y3-092	377.28

Appendix 29

(FE - FE) The 02AVON 345/138 kV transformer (from bus 238551 to bus 238552 ckt 91) loads from 107.9% to 108.0% (**DC power flow**) of its emergency rating (627 MVA) for the line fault with failed breaker contingency outage of 'C2-BRK-NR04A'. This project contributes approximately 49.43 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-NR04A'                /* BREAKER FAILURE
ON Q-92-AV-T @ AV
  DISCONNECT BRANCH FROM BUS 238551 TO BUS 238552 CKT 92      /*
02AVON 345.00 02AVON 138.00
  REMOVE MACHINE 9 FROM BUS 238555                /* 02AVONG9 20.00
  DISCONNECT BRANCH FROM BUS 238551 TO BUS 238850 CKT 1        /*
02AVON 345.00 02JUNIP 345.00
END
```

Bus Number	Bus Name	Full Contribution
238565	02BAYSG2	9.51
238566	02BAYSG3	9.79
238567	02BAYSG4	14.82
240968	02BG2 GEN	0.47
240969	02BG4 G1	0.12
240970	02BG4 G2&3	0.24
240971	02BG4 G4&5	0.24
240973	02BG6 AMPO	2.1
240975	02PGE GEN	3.25
239171	02WLORG-2	0.58
239172	02WLORG-3	0.58
239173	02WLORG-4	0.58
239174	02WLORG-5	0.58
884780	S-058 C	1.82
884781	S-058 E	6.01
889031	U2-028A_AT1	9.27
247548	V4-010 C	1.38
247947	V4-010 E	9.26
247546	V4-015 C	0.45
247938	V4-015 E	2.98
247571	W2-001 C	0.44
247945	W2-001 E	2.98
903511	W3-059A_AT6	0.98
903512	W3-059A_AT6	6.54
907061	X1-027A C1	1.95
907064	X1-027A C2	1.95
907066	X1-027A C3	1.95
907068	X1-027A C4	1.95

907062	X1-027A E1	13.02
907065	X1-027A E2	13.02
907067	X1-027A E3	13.02
907069	X1-027A E4	13.02
909161	X2-058 C	1.
909162	X2-058 E	6.7
913441	Y1-069 OP1	52.72
914111	Y2-053	2.41
Y2-082	Y2-082	43.03
Y3-032	Y3-032	17.29
Y3-083	Y3-083	17.36
915771	Y3-092	49.43

Appendix 30

(AP - AP) The PARADISE JCT-BUTLER 138 kV line (from bus 235141 to bus 235152 ckt 1) loads from 16.07% to 62.15% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 84.33 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
200887	ARMNA MT P47	0.05
235567	ARMSTRONG 1	28.95
235569	ARMSTRONG 2	28.78
203261	BLOSSBCT	0.04
200805	COLVER13	0.36
94106	GRAYMONT	0.07
200828	HNSMLK 1	0.24
200829	HNSMLK 2	0.24
200830	HNSMLK 3	0.24
200831	HNSMLK 4	0.24
200832	HNSMLK 5	0.24
200838	HOMER C2	1.52
200839	HOMER C3	1.61
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
293270	N-036 C	0.59
200649	PENNTECH	0.14
200608	PINEY #1	0.21
200657	PINEY CK	0.24
290085	Q-036 C	0.02
295247	Q-046	0.03
290113	Q-063 C	0.05
296914	R-092 C	0.95
291011	S-103	0.19
200662	SCRUB GR	0.51
200642	SENECA#1	0.69
200643	SENECA#2	0.64
200644	SENECA#3	0.1
200715	SHAWVL 1	8.08
200722	SHAWVL 2	8.28

200665	SHAWVL 3	11.69
200666	SHAWVL 4	11.72
292391	T-121C	0.93
292548	T-155	0.03
292984	U2-055C	0.68
293392	V3-030C	< 0.01
903651	W3-099 C OP1	1.03
910651	X3-039	9.55
X3-050	X3-050	5.93
913131	Y1-032 C	0.77
913311	Y1-071	0.06
Y2-044	Y2-044	9.6
914131	Y2-055	3.74
915011	Y3-010 C	0.49
915331	Y3-062 C	0.19
915771	Y3-092	84.33

Appendix 31

(PENELEC - PENELEC) The CNYO&G-N.MESHPN 230 kV line (from bus 200924 to bus 200706 ckt 1F) loads from 91.29% to 99.82% (**DC power flow**) of its emergency rating (617 MVA) for the single line contingency outage of 'SUSQ 1'. This project contributes approximately 52.63 MW to the thermal violation.

CONTINGENCY 'SUSQ 1'

REMOVE MACHINE 1 FROM BUS 208918

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.2
203261	BLOSSBCT	0.2
94106	GRAYMONT	0.1
200828	HNSMLK 1	0.14
200829	HNSMLK 2	0.14
200830	HNSMLK 3	0.14
200831	HNSMLK 4	0.14
200832	HNSMLK 5	0.14
200838	HOMER C2	1.61
200839	HOMER C3	1.7
200849	LAKVU GN	0.02
203283	MANOR	0.02
293270	N-036 C	1.55
200649	PENNTECH	0.18
290085	Q-036 C	0.03
295247	Q-046	0.03
290113	Q-063 C	0.07
296914	R-092 C	1.27
291011	S-103	0.24
200662	SCRUB GR	0.2
200642	SENECA#1	0.85
200643	SENECA#2	0.79
200644	SENECA#3	0.12
200715	SHAWVL 1	11.52
200722	SHAWVL 2	11.73
200665	SHAWVL 3	17.55
200666	SHAWVL 4	17.38
292391	T-121C	1.92
292984	U2-055C	1.08
293416	V3-042C	0.94
903651	W3-099 C OP1	1.07
907481	X1-109	303.98

910651	X3-039	5.45
X3-050	X3-050	19.59
913131	Y1-032 C	1.83
Y2-044	Y2-044	31.72
914131	Y2-055	4.6
Y2-068	Y2-068	46.54
915011	Y3-010 C	0.72
915331	Y3-062 C	0.2
915771	Y3-092	52.63

Appendix 32

(AP - AP) The KARNs CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.29% to 62.37% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 84.33 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
200887	ARMNA MT P47	0.05
235567	ARMSTRONG 1	28.95
235569	ARMSTRONG 2	28.78
203261	BLOSSBCT	0.04
200805	COLVER13	0.36
94106	GRAYMONT	0.07
200828	HNSMLK 1	0.24
200829	HNSMLK 2	0.24
200830	HNSMLK 3	0.24
200831	HNSMLK 4	0.24
200832	HNSMLK 5	0.24
200838	HOMER C2	1.52
200839	HOMER C3	1.61
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
293270	N-036 C	0.59
200649	PENNTECH	0.14
200608	PINEY #1	0.21
200657	PINEY CK	0.24
290085	Q-036 C	0.02
295247	Q-046	0.03
290113	Q-063 C	0.05
296914	R-092 C	0.95
291011	S-103	0.19
200662	SCRUB GR	0.51
200642	SENECA#1	0.69
200643	SENECA#2	0.64
200644	SENECA#3	0.1
200715	SHAWVL 1	8.08
200722	SHAWVL 2	8.28

200665	SHAWVL 3	11.69
200666	SHAWVL 4	11.72
292391	T-121C	0.93
292548	T-155	0.03
292984	U2-055C	0.68
293392	V3-030C	< 0.01
903651	W3-099 C OP1	1.03
910651	X3-039	9.55
X3-050	X3-050	5.93
913131	Y1-032 C	0.77
913311	Y1-071	0.06
Y2-044	Y2-044	9.6
914131	Y2-055	3.74
915011	Y3-010 C	0.49
915331	Y3-062 C	0.19
915771	Y3-092	84.33

Appendix 33

(AP - AP) The KARNs CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.29% to 62.37% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 84.33 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
200887	ARMNA MT P47	0.05
235567	ARMSTRONG 1	28.95
235569	ARMSTRONG 2	28.78
203261	BLOSSBCT	0.04
200805	COLVER13	0.36
94106	GRAYMONT	0.07
200828	HNSMLK 1	0.24
200829	HNSMLK 2	0.24
200830	HNSMLK 3	0.24
200831	HNSMLK 4	0.24
200832	HNSMLK 5	0.24
200838	HOMER C2	1.52
200839	HOMER C3	1.61
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
293270	N-036 C	0.59
200649	PENNTech	0.14
200608	PINEY #1	0.21
200657	PINEY CK	0.24
290085	Q-036 C	0.02
295247	Q-046	0.03
290113	Q-063 C	0.05
296914	R-092 C	0.95
291011	S-103	0.19

200662	SCRUB GR	0.51
200642	SENECA#1	0.69
200643	SENECA#2	0.64
200644	SENECA#3	0.1
200715	SHAWVL 1	8.08
200722	SHAWVL 2	8.28
200665	SHAWVL 3	11.69
200666	SHAWVL 4	11.72
292391	T-121C	0.93
292548	T-155	0.03
292984	U2-055C	0.68
293392	V3-030C	< 0.01
903651	W3-099 C OP1	1.03
910651	X3-039	9.55
X3-050	X3-050	5.93
913131	Y1-032 C	0.77
913311	Y1-071	0.06
Y2-044	Y2-044	9.6
914131	Y2-055	3.74
915011	Y3-010 C	0.49
915331	Y3-062 C	0.19
915771	Y3-092	84.33

Appendix 34

(AP - AP) The KARNs CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.29% to 62.37% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 84.33 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
200887	ARMNA MT P47	0.05
235567	ARMSTRONG 1	28.95
235569	ARMSTRONG 2	28.78
203261	BLOSSBCT	0.04
200805	COLVER13	0.36
94106	GRAYMONT	0.07
200828	HNSMLK 1	0.24
200829	HNSMLK 2	0.24
200830	HNSMLK 3	0.24
200831	HNSMLK 4	0.24
200832	HNSMLK 5	0.24
200838	HOMER C2	1.52
200839	HOMER C3	1.61
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
293270	N-036 C	0.59
200649	PENNTECH	0.14
200608	PINEY #1	0.21
200657	PINEY CK	0.24
290085	Q-036 C	0.02
295247	Q-046	0.03
290113	Q-063 C	0.05
296914	R-092 C	0.95
291011	S-103	0.19
200662	SCRUB GR	0.51
200642	SENECA#1	0.69
200643	SENECA#2	0.64
200644	SENECA#3	0.1
200715	SHAWVL 1	8.08
200722	SHAWVL 2	8.28

200665	SHAWVL 3	11.69
200666	SHAWVL 4	11.72
292391	T-121C	0.93
292548	T-155	0.03
292984	U2-055C	0.68
293392	V3-030C	< 0.01
903651	W3-099 C OP1	1.03
910651	X3-039	9.55
X3-050	X3-050	5.93
913131	Y1-032 C	0.77
913311	Y1-071	0.06
Y2-044	Y2-044	9.6
914131	Y2-055	3.74
915011	Y3-010 C	0.49
915331	Y3-062 C	0.19
915771	Y3-092	84.33

Appendix 35

(FE - FE) The 02AUSTQ1-02LRCRQ1 138 kV line (from bus 239213 to bus 239112 ckt 1) loads from 7.05% to 57.95% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 76.85 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	45.21
200849	LAKVU GN	0.01
901211	W1-070A_AT4	1.28
903651	W3-099 C OP1	0.8
910651	X3-039	5.63
913401	Y1-012	0.07
915331	Y3-062 C	0.14
915771	Y3-092	76.85

Appendix 36

(FE - FE) The 02SBRNQ1-02AUSTQ1 138 kV line (from bus 239095 to bus 239213 ckt 1) loads from 7.05% to 57.95% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 76.85 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	45.21
200849	LAKVU GN	0.01
901211	W1-070A_AT4	1.28
903651	W3-099 C OP1	0.8
910651	X3-039	5.63
913401	Y1-012	0.07
915331	Y3-062 C	0.14
915771	Y3-092	76.85

Appendix 37

(PENELEC - PENELEC) The 4MILE_230 230/115 kV transformer (from bus 200928 to bus 200927 ckt 6) loads from 70.14% to 89.81% (**DC power flow**) of its emergency rating (323 MVA) for the single line contingency outage of 'B_PN230-SX-#17A'. This project contributes approximately 54.46 MW to the thermal violation.

CONTINGENCY 'B_PN230-SX-#17A'
FOURMILE 230 KV

/* ERIE EAST -

DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1 /*
ERIE SE 230.00 FOURMILE 230.00
END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.07
203261	BLOSSBCT	0.06
203283	MANOR	< 0.01
200851	MEHOOP3	0.19
293270	N-036 C	0.66
294572	P-028 C	0.09
292391	T-121C	0.84
293416	V3-042C	1.12
903651	W3-099 C OP1	7.16
907481	X1-109	58.09
X3-050	X3-050	16.59
912251	X4-048 OP1	21.63
913131	Y1-032 C	0.79
913191	Y1-047 OP1	1.08
914061	Y2-042	1.04
Y2-044	Y2-044	26.86
914151	Y2-060	0.25
914421	Y2-104	0.45
915331	Y3-062 C	1.28
915771	Y3-092	54.46

Appendix 38

(PENELEC - PENELEC) The 4MILE_230 230/115 kV transformer (from bus 200928 to bus 200927 ckt 6) loads from 103.02% to 106.31% (**DC power flow**) of its emergency rating (323 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-6G'. This project contributes approximately 43.72 MW to the thermal violation.

CONTINGENCY 'C2_PN230-SB-6G' /* ERIE SOUTH 230 KV
STUCK CB - CBBS (BUS SECTION BREAKER)

DISCONNECT BRANCH FROM BUS 200819 TO BUS 200820 CKT 1
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200625 CKT 4
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200600 CKT 8
REDUCE BUS 200819 SHUNT BY 100 PERCENT
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200600 CKT 5
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200624 CKT 3
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200641 CKT 7
REDUCE BUS 200568 SHUNT BY 100 PERCENT
END

Bus Number	Bus Name	Full Contribution
293270	N-036 C	0.6
293271	N-036 E	2.38
294573	P-028 E	7.28
200888	P-047 E	5.62
292391	T-121C	0.79
292392	T-121E	3.18
293416	V3-042C	0.97
293417	V3-042E	6.48
903651	W3-099 C OP1	6.08
903652	W3-099 E OP1	40.66
907481	X1-109	50.25
910522	X3-003 E	1.21
X3-050	X3-050	14.22
912251	X4-048 OP1	8.31
913131	Y1-032 C	0.73
913132	Y1-032 E	4.87
913191	Y1-047 OP1	0.93
Y2-044	Y2-044	23.03
914151	Y2-060	0.21
914421	Y2-104	0.39
915331	Y3-062 C	1.09
915332	Y3-062 E	7.38

915771	Y3-092	43.72

Appendix 39

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.73% to 80.59% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 130.49 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.92
913131	Y1-032 C	0.96
Y2-044	Y2-044	12.83
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092	130.49

Appendix 40

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.73% to 80.59% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 130.49 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.92
913131	Y1-032 C	0.96

Y2-044	Y2-044	12.83
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092	130.49

Appendix 41

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.73% to 80.59% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 130.49 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.92
913131	Y1-032 C	0.96
Y2-044	Y2-044	12.83
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092	130.49

Appendix 42

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.73% to 80.59% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 130.49 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.92
913131	Y1-032 C	0.96
Y2-044	Y2-044	12.83
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092	130.49

Appendix 43

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.73% to 80.59% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 130.49 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.92
913131	Y1-032 C	0.96

Y2-044	Y2-044	12.83
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092	130.49

Appendix 44

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.73% to 80.59% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 130.49 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.92
913131	Y1-032 C	0.96
Y2-044	Y2-044	12.83
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092	130.49

Appendix 45

(PENELEC - PENELEC) The VENGO JT-SPRINGBO 115 kV line (from bus 200573 to bus 200574 ckt 1) loads from 16.12% to 63.68% (**DC power flow**) of its emergency rating (226 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 107.47 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
910651	X3-039	14.74
915771	Y3-092	107.47

Appendix 46

(AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.74% to 82.23% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 57.24 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
298466	B-018	0.07
884780	S-058 C	1.11
884781	S-058 E	3.66
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.48
915771	Y3-092	57.24

Appendix 47

(AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.74% to 82.23% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 57.24 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
298466	B-018	0.07
884780	S-058 C	1.11
884781	S-058 E	3.66
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.48
915771	Y3-092	57.24

Appendix 48

(AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.74% to 82.23% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 57.24 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
298466	B-018	0.07
884780	S-058 C	1.11
884781	S-058 E	3.66
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.48
915771	Y3-092	57.24

Appendix 49

(PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 73.4% to 92.54% (**DC power flow**) of its emergency rating (824 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-4G'. This project contributes approximately 157.71 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-4G' /* HOMER CITY 345
KV STUCK CB - CB307
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 1
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200930 CKT 1 /*
HOMER CITY-MAINESBRG 345
END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	19.82
200887	ARMNA MT P47	0.1
235567	ARMSTRONG 1	31.53
235569	ARMSTRONG 2	31.35
203261	BLOSSBCT	0.1
200828	HNSMLK 1	0.76
200829	HNSMLK 2	0.76
200830	HNSMLK 3	0.76
200831	HNSMLK 4	0.76
200832	HNSMLK 5	0.76
200838	HOMER C2	15.85
200839	HOMER C3	16.78
200849	LAKVU GN	0.04
200857	LAURHILL	5.83
293270	N-036 C	1.91
293271	N-036 E	7.63
200888	P-047 E	8.92
200649	PENNTech	0.3
200608	PINEY #1	0.15
200657	PINEY CK	0.18
290113	Q-063 C	0.15
296914	R-092 C	1.28
296915	R-092 E	5.13
291011	S-103	0.5
200662	SCRUB GR	0.65
200642	SENECA#1	2.
200643	SENECA#2	1.85
200644	SENECA#3	0.29
200715	SHAWVL 1	8.49
200722	SHAWVL 2	8.68

200665	SHAWVL 3	13.95
292391	T-121C	3.49
292392	T-121E	13.98
292548	T-155	0.03
297050	V2-019 E	< 0.01
293416	V3-042C	1.1
293417	V3-042E	7.36
901211	W1-070A_AT4	0.53
901212	W1-070A_AT4	3.52
903651	W3-099 C OP1	2.25
903652	W3-099 E OP1	15.05
905071	W4-004B_AT11	1.12
905072	W4-004B_AT11	0.96
907481	X1-109	61.59
910651	X3-039	18.93
X3-050	X3-050	15.27
913131	Y1-032 C	2.7
913132	Y1-032 E	18.1
913311	Y1-071	0.04
Y2-044	Y2-044	24.72
914131	Y2-055	9.88
915331	Y3-062 C	0.42
915332	Y3-062 E	2.83
915771	Y3-092	157.71

Appendix 50

(PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 39.04% to 76.19% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 219.88 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.16
294572	P-028 C	0.08
293416	V3-042C	1.07
907481	X1-109	50.61
X3-050	X3-050	16.96
913191	Y1-047 OP1	0.96
Y2-044	Y2-044	27.46
914151	Y2-060	0.22
914421	Y2-104	0.39
915331	Y3-062 C	1.51
915771	Y3-092	219.88

Appendix 51

(PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 39.04% to 76.19% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 219.88 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.16
294572	P-028 C	0.08
293416	V3-042C	1.07
907481	X1-109	50.61
X3-050	X3-050	16.96
913191	Y1-047 OP1	0.96
Y2-044	Y2-044	27.46
914151	Y2-060	0.22
914421	Y2-104	0.39
915331	Y3-062 C	1.51
915771	Y3-092	219.88

Appendix 52

(PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 39.04% to 76.19% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 219.88 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE

PERRY-AT-ERIE W 345 CK 1

DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*

02PERRY 345.00 02AT 345.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*

02AT 345.00 02S8-ATT 345.00

DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*

02S8-ATT 345.00 02ASH_3 138.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*

02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.16
294572	P-028 C	0.08
293416	V3-042C	1.07
907481	X1-109	50.61
X3-050	X3-050	16.96
913191	Y1-047 OP1	0.96
Y2-044	Y2-044	27.46
914151	Y2-060	0.22
914421	Y2-104	0.39
915331	Y3-062 C	1.51
915771	Y3-092	219.88

Appendix 53

(FE - FE) The 02AUSTQ2-02SP Q-2 138 kV line (from bus 239212 to bus 239113 ckt 1) loads from 11.42% to 62.89% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	45.85
200849	LAKVU GN	0.01
901211	W1-070A_AT4	1.2
903651	W3-099 C OP1	0.81
910651	X3-039	5.7
913401	Y1-012	0.04
915331	Y3-062 C	0.15
915771	Y3-092	77.72

Appendix 54

(AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.85% to 85.17% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 57.27 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.15
298466	B-018	0.07
884780	S-058 C	1.1
884781	S-058 E	3.63
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.5
915771	Y3-092	57.27

Appendix 55

(AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.85% to 85.17% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 57.27 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1

DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
02PERRY 345.00 02AT 345.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
02AT 345.00 02S8-ATT 345.00

DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
02S8-ATT 345.00 02ASH_3 138.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.15
298466	B-018	0.07
884780	S-058 C	1.1
884781	S-058 E	3.63
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.5
915771	Y3-092	57.27

Appendix 56

(AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.85% to 85.17% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 57.27 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.15
298466	B-018	0.07
884780	S-058 C	1.1
884781	S-058 E	3.63
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.5
915771	Y3-092	57.27

Appendix 57

(NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 42.28% to 78.5% (**DC power flow**) of its emergency rating (607 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 219.88 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.16
294572	P-028 C	0.08
293416	V3-042C	1.07
907481	X1-109	50.61
X3-050	X3-050	16.96
913191	Y1-047 OP1	0.96
Y2-044	Y2-044	27.46
914151	Y2-060	0.22
914421	Y2-104	0.39
915771	Y3-092	219.88

Appendix 58

(NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 42.28% to 78.5% (**DC power flow**) of its emergency rating (607 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 219.88 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.16
294572	P-028 C	0.08
293416	V3-042C	1.07
907481	X1-109	50.61
X3-050	X3-050	16.96
913191	Y1-047 OP1	0.96
Y2-044	Y2-044	27.46
914151	Y2-060	0.22
914421	Y2-104	0.39
915771	Y3-092	219.88

Appendix 59

(NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 42.28% to 78.5% (**DC power flow**) of its emergency rating (607 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 219.88 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.16
294572	P-028 C	0.08
293416	V3-042C	1.07
907481	X1-109	50.61
X3-050	X3-050	16.96
913191	Y1-047 OP1	0.96
Y2-044	Y2-044	27.46
914151	Y2-060	0.22
914421	Y2-104	0.39
915771	Y3-092	219.88

Appendix 60

(PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 40.48% to 77.62% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 219.88 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1

DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
02PERRY 345.00 02AT 345.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
02AT 345.00 02S8-ATT 345.00

DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
02S8-ATT 345.00 02ASH_3 138.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.16
294572	P-028 C	0.08
293416	V3-042C	1.07
903651	W3-099 C OP1	8.48
907481	X1-109	50.61
X3-050	X3-050	16.96
913191	Y1-047 OP1	0.96
Y2-044	Y2-044	27.46
914151	Y2-060	0.22
914421	Y2-104	0.39
915331	Y3-062 C	1.51
915771	Y3-092	219.88

Appendix 61

(PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 40.48% to 77.62% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 219.88 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.16
294572	P-028 C	0.08
293416	V3-042C	1.07
903651	W3-099 C OP1	8.48
907481	X1-109	50.61
X3-050	X3-050	16.96
913191	Y1-047 OP1	0.96
Y2-044	Y2-044	27.46
914151	Y2-060	0.22
914421	Y2-104	0.39
915331	Y3-062 C	1.51
915771	Y3-092	219.88

Appendix 62

(PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 40.48% to 77.62% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 219.88 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.16
294572	P-028 C	0.08
293416	V3-042C	1.07
903651	W3-099 C OP1	8.48
907481	X1-109	50.61
X3-050	X3-050	16.96
913191	Y1-047 OP1	0.96
Y2-044	Y2-044	27.46
914151	Y2-060	0.22
914421	Y2-104	0.39
915331	Y3-062 C	1.51
915771	Y3-092	219.88

Appendix 63

(PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 1) loads from 75.34% to 94.99% (**DC power flow**) of its emergency rating (807 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-4H'. This project contributes approximately 158.57 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-4H' /* HOMER CITY 345
KV STUCK CB - CB308
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 2
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200930 CKT 1 /*
HOMER CITY-MAINESBRG 345
END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	19.93
200887	ARMNA MT P47	0.1
235567	ARMSTRONG 1	31.7
235569	ARMSTRONG 2	31.52
203261	BLOSSBCT	0.1
200828	HNSMLK 1	0.77
200829	HNSMLK 2	0.77
200830	HNSMLK 3	0.77
200831	HNSMLK 4	0.77
200832	HNSMLK 5	0.77
200838	HOMER C2	15.94
200839	HOMER C3	16.87
200849	LAKVU GN	0.04
200857	LAURHILL	5.87
293270	N-036 C	1.92
293271	N-036 E	7.67
200888	P-047 E	8.96
200649	PENNTech	0.3
200608	PINEY #1	0.15
200657	PINEY CK	0.18
290113	Q-063 C	0.15
296914	R-092 C	1.29
296915	R-092 E	5.16
291011	S-103	0.51
200662	SCRUB GR	0.65
200642	SENECA#1	2.01
200643	SENECA#2	1.86
200644	SENECA#3	0.29
200715	SHAWVL 1	8.54

200722	SHAWVL 2	8.72
200665	SHAWVL 3	14.02
292391	T-121C	3.51
292392	T-121E	14.05
292548	T-155	0.03
297050	V2-019 E	< 0.01
293416	V3-042C	1.1
293417	V3-042E	7.4
901211	W1-070A_AT4	0.53
901212	W1-070A_AT4	3.54
903651	W3-099 C OP1	2.26
903652	W3-099 E OP1	15.13
905071	W4-004B_AT11	1.12
905072	W4-004B_AT11	0.97
907481	X1-109	61.92
910651	X3-039	19.04
X3-050	X3-050	15.35
913131	Y1-032 C	2.72
913132	Y1-032 E	18.2
913311	Y1-071	0.04
Y2-044	Y2-044	24.86
914131	Y2-055	9.93
915331	Y3-062 C	0.42
915332	Y3-062 E	2.85
915771	Y3-092	158.57

Appendix 64

(PENELEC - PENELEC) The E.TWANDA 230/115 kV transformer (from bus 200675 to bus 200674 ckt 4) loads from 107.83% to 111.57% (**DC power flow**) of its emergency rating (241 MVA) for the bus fault outage of 'C1_PN230-BS-#5A'. This project contributes approximately 24.37 MW to the thermal violation.

CONTINGENCY 'C1_PN230-BS-#5A'

/* EAST TOWANDA

#1 230 KV BUS FAULT

DISCONNECT BRANCH FROM BUS 200701 TO BUS 200675 CKT 1

DISCONNECT BRANCH FROM BUS 200675 TO BUS 130763 CKT 1

DISCONNECT BRANCH FROM BUS 200674 TO BUS 200675 CKT 3

END

Bus Number	Bus Name	Full Contribution
907481	X1-109	233.97
909021	X2-012 C	10.33
915771	Y3-092	24.37

Appendix 65

(PENELEC - PENELEC) The E.TWANDA 230/115 kV transformer (from bus 200675 to bus 200674 ckt 4) loads from 107.83% to 111.57% (**DC power flow**) of its emergency rating (241 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-#3F'. This project contributes approximately 24.37 MW to the thermal violation.

```
CONTINGENCY 'C2_PN230-SB-#3F'                                /* EAST TOWANDA
230 KV STUCK CB - (#3 XF)
DISCONNECT BRANCH FROM BUS 200675 TO BUS 130763 CKT 1
DISCONNECT BRANCH FROM BUS 200701 TO BUS 200675 CKT 1
DISCONNECT BRANCH FROM BUS 200674 TO BUS 200675 CKT 3
END
```

Bus Number	Bus Name	Full Contribution
907481	X1-109	233.97
909021	X2-012 C	10.33
915771	Y3-092	24.37

Appendix 66

(FE - FE) The 02SBRNQ4-02SP Q-4 138 kV line (from bus 239098 to bus 239115 ckt 1) loads from 8.51% to 62.02% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.79 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	43.95
200828	HNSMLK 1	0.13
200829	HNSMLK 2	0.13
200830	HNSMLK 3	0.13
200831	HNSMLK 4	0.13
200832	HNSMLK 5	0.13
200849	LAKVU GN	0.02
901211	W1-070A_AT4	1.15
903651	W3-099 C OP1	0.84
910651	X3-039	5.92
913401	Y1-012	0.06
915331	Y3-062 C	0.15
915771	Y3-092	80.79

Appendix 67

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 55.5% to 85.47% (**DC power flow**) of its emergency rating (437 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2E'. This project contributes approximately 130.94 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2E'
STUCK CB - CB7

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1

END

Bus Number	Bus Name	Full Contribution
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
293271	N-036 E	2.99
200888	P-047 E	5.59
292391	T-121C	1.11
292392	T-121E	4.45
293416	V3-042C	0.64
293417	V3-042E	4.29
903651	W3-099 C OP1	1.38
903652	W3-099 E OP1	9.25
910651	X3-039	10.66
X3-050	X3-050	9.32
913131	Y1-032 C	0.96
913132	Y1-032 E	6.41
Y2-044	Y2-044	15.08
914131	Y2-055	4.
915331	Y3-062 C	0.25
915332	Y3-062 E	1.72
915771	Y3-092	130.94

Appendix 68

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 55.5% to 85.47% (**DC power flow**) of its emergency rating (437 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2E'. This project contributes approximately 130.94 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2E'
STUCK CB - CB7

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1

END

Bus Number	Bus Name	Full Contribution
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
293271	N-036 E	2.99
200888	P-047 E	5.59
292391	T-121C	1.11
292392	T-121E	4.45
293416	V3-042C	0.64
293417	V3-042E	4.29
903651	W3-099 C OP1	1.38
903652	W3-099 E OP1	9.25
910651	X3-039	10.66
X3-050	X3-050	9.32
913131	Y1-032 C	0.96
913132	Y1-032 E	6.41
Y2-044	Y2-044	15.08
914131	Y2-055	4.
915331	Y3-062 C	0.25
915332	Y3-062 E	1.72
915771	Y3-092	130.94

Appendix 69

(FE - FE) The 02PERRY-02EASTLK 345 kV line (from bus 239036 to bus 238684 ckt 1) loads from 71.26% to 93.66% (**DC power flow**) of its emergency rating (1793 MVA) for the tower line contingency outage of 'C5-TWL-NR057A'. This project contributes approximately 401.52 MW to the thermal violation.

CONTINGENCY 'C5-TWL-NR057A'

/* PERRY-LRCR AND

PERRY-NRFD 345KV LINE OUTAGES

OPEN BRANCH FROM BUS 239334 TO BUS 239036 CKT 1 / 239334

02L.CENTER 345 239036 02PERRY 345 1

OPEN BRANCH FROM BUS 239358 TO BUS 239036 CKT 1 / 239358

02NFIELD 345.00 239036 02PERRY 345

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	38.52
239035	02PERRG1	36.33
200887	ARMNA MT P47	0.12
235567	ARMSTRONG 1	19.94
235569	ARMSTRONG 2	19.82
203261	BLOSSBCT	0.11
200828	HNSMLK 1	0.66
200829	HNSMLK 2	0.66
200830	HNSMLK 3	0.66
200831	HNSMLK 4	0.66
200832	HNSMLK 5	0.66
200849	LAKVU GN	0.08
200857	LAURHILL	8.32
293270	N-036 C	1.51
293271	N-036 E	6.04
200888	P-047 E	10.65
200649	PENNTECH	0.29
200608	PINEY #1	0.19
200657	PINEY CK	0.21
290113	Q-063 C	0.15
296914	R-092 C	1.81
296915	R-092 E	7.22
291011	S-103	0.63
200662	SCRUB GR	0.87
200642	SENECA#1	1.96
200643	SENECA#2	1.82
200644	SENECA#3	0.28
200715	SHAWVL 1	14.53
200722	SHAWVL 2	14.88

200665	SHAWVL 3	21.07
292391	T-121C	2.38
292392	T-121E	9.53
292984	U2-055C	1.26
292985	U2-055E	8.52
297050	V2-019 E	< 0.01
293416	V3-042C	1.44
293417	V3-042E	9.64
901211	W1-070A_AT4	1.01
901212	W1-070A_AT4	6.73
903651	W3-099 C OP1	4.15
903652	W3-099 E OP1	27.79
905071	W4-004B_AT11	10.29
905072	W4-004B_AT11	8.87
907481	X1-109	87.6
910651	X3-039	29.31
X3-050	X3-050	17.9
913131	Y1-032 C	1.99
913132	Y1-032 E	13.31
913311	Y1-071	0.04
Y2-044	Y2-044	28.98
914131	Y2-055	12.24
915331	Y3-062 C	0.75
915332	Y3-062 E	5.12
915771	Y3-092	401.52

Appendix 70

(AP - AP) The KISKI VALLEY-GARRETTS R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.9% to 81.19% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 67.69 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	1.28
884781	S-058 E	4.23
907481	X1-109	-25.65
915771	Y3-092	67.69

Appendix 71

(AP - AP) The KISKI VALLEY-GARRETTS R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.9% to 81.19% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 67.69 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
884780	S-058 C	1.28
884781	S-058 E	4.23
907481	X1-109	-25.65
915771	Y3-092	67.69

Appendix 72

(AP - AP) The KISKI VALLEY-GARRETTS R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.9% to 81.19% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 67.69 MW to the thermal violation.

CONTINGENCY 'DQE_163' /* LINE ERIE W TO
02PERRY 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	1.28
884781	S-058 E	4.23
907481	X1-109	-25.65
915771	Y3-092	67.69

Appendix 73

(FE - FE) The 02SBRNQ1-02ASH_1 138 kV line (from bus 239095 to bus 238542 ckt 1) loads from 24.2% to 71.15% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 75.05 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.45
884781	S-058 E	1.48
907481	X1-109	-16.91
913401	Y1-012	0.03
913161	Y1-035	10.6
913171	Y1-036	9.38
914301	Y2-085 OP1	8.51
915771	Y3-092	75.05

Appendix 74

(FE - FE) The 02ASH_1-02SBRNQ1 138 kV line (from bus 238542 to bus 239095 ckt 1) loads from 19.84% to 69.54% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 75.05 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	44.54
200849	LAKVU GN	0.01
901211	W1-070A_AT4	1.28
903651	W3-099 C OP1	0.78
910651	X3-039	5.5
915331	Y3-062 C	0.14
915771	Y3-092	75.05

Appendix 75

(FE - FE) The 02SBRNQ2-02AUSTQ2 138 kV line (from bus 239096 to bus 239212 ckt 1) loads from 17.91% to 69.38% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	45.85
200849	LAKVU GN	0.01
901211	W1-070A_AT4	1.2
903651	W3-099 C OP1	0.81
910651	X3-039	5.7
913401	Y1-012	0.04
915331	Y3-062 C	0.15
915771	Y3-092	77.72

Appendix 76

(FE - FE) The 02ASH_2-02SBRNQ2 138 kV line (from bus 238543 to bus 239096 ckt 1) loads from 17.91% to 69.38% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	45.85
200849	LAKVU GN	0.01
901211	W1-070A_AT4	1.2
903651	W3-099 C OP1	0.81
910651	X3-039	5.7
913401	Y1-012	0.04
915331	Y3-062 C	0.15
915771	Y3-092	77.72

Appendix 77

(PENELEC - PENELEC) The CNYO&G-N.MESHPN 230 kV line (from bus 200924 to bus 200706 ckt 1F) loads from 99.99% to 110.77% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 52.63 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.2
203261	BLOSSBCT	0.2
94106	GRAYMONT	0.1
200828	HNSMLK 1	0.14
200829	HNSMLK 2	0.14
200830	HNSMLK 3	0.14
200831	HNSMLK 4	0.14
200832	HNSMLK 5	0.14
200838	HOMER C2	1.61
200839	HOMER C3	1.7
200849	LAKVU GN	0.02
203283	MANOR	0.02
293270	N-036 C	1.55
200649	PENNTech	0.18
290085	Q-036 C	0.03
295247	Q-046	0.03
290113	Q-063 C	0.07
296914	R-092 C	1.27
291011	S-103	0.24
200662	SCRUB GR	0.2
200642	SENECA#1	0.85
200643	SENECA#2	0.79
200644	SENECA#3	0.12
200715	SHAWVL 1	11.52
200722	SHAWVL 2	11.73
200665	SHAWVL 3	17.55
200666	SHAWVL 4	17.38
292391	T-121C	1.92
292984	U2-055C	1.08
293416	V3-042C	0.94
903651	W3-099 C OP1	1.07
907481	X1-109	303.98
910651	X3-039	5.45
X3-050	X3-050	19.59

913131	Y1-032 C	1.83
Y2-044	Y2-044	31.72
914131	Y2-055	4.6
Y2-068	Y2-068	46.54
915011	Y3-010 C	0.72
915331	Y3-062 C	0.2
915771	Y3-092	52.63

Appendix 78

(FE - FE) The 02SBRNQ4-02ASH_3 138 kV line (from bus 239098 to bus 238544 ckt 1) loads from 21.93% to 72.23% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.37 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.48
884781	S-058 E	1.59
907481	X1-109	-18.11
913401	Y1-012	0.03
913161	Y1-035	11.35
913171	Y1-036	10.04
914301	Y2-085 OP1	9.1
915771	Y3-092	80.37

Appendix 79

(PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 1) loads from 83.14% to 102.74% (**DC power flow**) of its emergency rating (807 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-9E'. This project contributes approximately 158.14 MW to the thermal violation.

CONTINGENCY 'C2_PN230-SB-9E' /* HOMER CITY 230
KV STUCK CB - CB206
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200769 CKT 2
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200837 CKT 1
REMOVE MACHINE 1 FROM BUS 200837 /* 0
END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	19.44
200887	ARMNA MT P47	0.24
235567	ARMSTRONG 1	29.47
235569	ARMSTRONG 2	29.3
203261	BLOSSBCT	0.21
200828	HNSMLK 1	0.72
200829	HNSMLK 2	0.72
200830	HNSMLK 3	0.72
200831	HNSMLK 4	0.72
200832	HNSMLK 5	0.72
200838	HOMER C2	14.74
200839	HOMER C3	15.6
200849	LAKVU GN	0.04
200857	LAURHILL	8.75
203283	MANOR	0.01
293270	N-036 C	2.92
293271	N-036 E	11.69
294573	P-028 E	16.64
200888	P-047 E	21.04
200649	PENNTECH	0.32
290113	Q-063 C	0.16
296914	R-092 C	1.42
296915	R-092 E	5.67
291011	S-103	0.55
200662	SCRUB GR	0.62
200642	SENECA#1	2.11
200643	SENECA#2	1.96
200644	SENECA#3	0.3
200715	SHAWVL 1	9.77

200722	SHAWVL 2	9.97
200665	SHAWVL 3	16.18
292391	T-121C	4.42
292392	T-121E	17.67
297050	V2-019 E	< 0.01
293416	V3-042C	2.13
293417	V3-042E	14.31
901211	W1-070A_AT4	0.52
901212	W1-070A_AT4	3.45
903651	W3-099 C OP1	2.47
903652	W3-099 E OP1	16.55
907481	X1-109	123.12
910522	X3-003 E	2.77
910651	X3-039	18.63
X3-050	X3-050	25.38
913131	Y1-032 C	3.77
913132	Y1-032 E	25.25
913191	Y1-047 OP1	2.14
914061	Y2-042	1.88
Y2-044	Y2-044	41.1
914131	Y2-055	10.73
914151	Y2-060	0.49
914421	Y2-104	0.89
915331	Y3-062 C	0.46
915332	Y3-062 E	3.14
915771	Y3-092	158.14

Appendix 80

(FE - FE) The 02AUSTQ2-02SBRNQ2 138 kV line (from bus 239212 to bus 239096 ckt 1) loads from 27.44% to 76.07% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.47
884781	S-058 E	1.54
907481	X1-109	-17.5
913161	Y1-035	11.
913171	Y1-036	9.72
914301	Y2-085 OP1	8.82
915771	Y3-092	77.72

Appendix 81

(FE - FE) The 02SBRNQ2-02ASH_2 138 kV line (from bus 239096 to bus 238543 ckt 1) loads from 27.44% to 76.07% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.47
884781	S-058 E	1.54
907481	X1-109	-17.5
913161	Y1-035	11.
913171	Y1-036	9.72
914301	Y2-085 OP1	8.82
915771	Y3-092	77.72

Appendix 82

(PENELEC - PENELEC) The WARREN-ERIE S TIE 230 kV line (from bus 200811 to bus 200918 ckt 1) loads from 25.85% to 75.99% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 311.36 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'

/* ERIE WEST 345 KV

STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
290113	Q-063 C	0.12
296914	R-092 C	0.73
296915	R-092 E	2.92
291011	S-103	0.33
200642	SENECA#1	1.58
200643	SENECA#2	1.46
200644	SENECA#3	0.23
914131	Y2-055	6.52
915771	Y3-092	311.36

Appendix 83

(FE - FE) The 02PERRY-02L.CENTER 345 kV line (from bus 239036 to bus 239334 ckt 1) loads from 77.91% to 102.12% (**DC power flow**) of its emergency rating (1673 MVA) for the tower line contingency outage of 'C5-TWL-NR63A'. This project contributes approximately 404.97 MW to the thermal violation.

CONTINGENCY 'C5-TWL-NR63A' /* PERRY-EASTLAKE
AND PERRY-NORTHFIELD 345KV LINE OUTAGES

DISCONNECT BRANCH FROM BUS 238684 TO BUS 239036 CKT 1 /*
02EASTLK 345.00 02PERRY 345.00

DISCONNECT BRANCH FROM BUS 239358 TO BUS 239036 CKT 1 /*
02NFIELD 345.00 02PERRY 345.00

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	26.86
239035	02PERRG1	37.22
200887	ARMNA MT P47	0.12
235567	ARMSTRONG 1	20.11
235569	ARMSTRONG 2	20.
203261	BLOSSBCT	0.11
200828	HNSMLK 1	0.66
200829	HNSMLK 2	0.66
200830	HNSMLK 3	0.66
200831	HNSMLK 4	0.66
200832	HNSMLK 5	0.66
200849	LAKVU GN	0.08
200857	LAURHILL	8.4
293270	N-036 C	1.52
293271	N-036 E	6.09
200888	P-047 E	10.74
200649	PENNTECH	0.29
200608	PINEY #1	0.19
200657	PINEY CK	0.21
290113	Q-063 C	0.15
296914	R-092 C	1.82
296915	R-092 E	7.28
291011	S-103	0.63
200662	SCRUB GR	0.88
200642	SENECA#1	1.98
200643	SENECA#2	1.84
200644	SENECA#3	0.28
200715	SHAWVL 1	14.65
200722	SHAWVL 2	15.01

200665	SHAWVL 3	21.25
292391	T-121C	2.4
292392	T-121E	9.61
292984	U2-055C	1.28
292985	U2-055E	8.59
297050	V2-019 E	< 0.01
293416	V3-042C	1.45
293417	V3-042E	9.72
901211	W1-070A_AT4	0.69
901212	W1-070A_AT4	4.62
903651	W3-099 C OP1	4.19
903652	W3-099 E OP1	28.02
905071	W4-004B_AT11	10.54
905072	W4-004B_AT11	9.09
907481	X1-109	88.36
910651	X3-039	29.56
X3-050	X3-050	18.05
913131	Y1-032 C	2.01
913132	Y1-032 E	13.43
913311	Y1-071	0.04
Y2-044	Y2-044	29.23
914131	Y2-055	12.35
915331	Y3-062 C	0.76
915332	Y3-062 E	5.16
915771	Y3-092	404.97

Appendix 84

(PENELEC - PENELEC) The E.TWANDA-CNYO&G 230 kV line (from bus 200675 to bus 200924 ckt 1F) loads from 107.99% to 117.57% (**DC power flow**) of its emergency rating (549 MVA) for the single line contingency outage of 'SUSQ 1'. This project contributes approximately 52.63 MW to the thermal violation.

CONTINGENCY 'SUSQ 1'

REMOVE MACHINE 1 FROM BUS 208918

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.2
203261	BLOSSBCT	0.2
94106	GRAYMONT	0.1
200828	HNSMLK 1	0.14
200829	HNSMLK 2	0.14
200830	HNSMLK 3	0.14
200831	HNSMLK 4	0.14
200832	HNSMLK 5	0.14
200838	HOMER C2	1.61
200839	HOMER C3	1.7
200849	LAKVU GN	0.02
203283	MANOR	0.02
293270	N-036 C	1.55
200649	PENNTECH	0.18
290085	Q-036 C	0.03
295247	Q-046	0.03
290113	Q-063 C	0.07
296914	R-092 C	1.27
291011	S-103	0.24
200662	SCRUB GR	0.2
200642	SENECA#1	0.85
200643	SENECA#2	0.79
200644	SENECA#3	0.12
200715	SHAWVL 1	11.52
200722	SHAWVL 2	11.73
200665	SHAWVL 3	17.55
200666	SHAWVL 4	17.38
292391	T-121C	1.92
292984	U2-055C	1.08
293416	V3-042C	0.94
903651	W3-099 C OP1	1.07
907481	X1-109	303.98

910651	X3-039	5.45
X3-050	X3-050	19.59
913131	Y1-032 C	1.83
Y2-044	Y2-044	31.72
914131	Y2-055	4.6
Y2-068	Y2-068	46.54
915011	Y3-010 C	0.72
915331	Y3-062 C	0.2
915771	Y3-092	52.63

Appendix 85

(PENELEC - PENELEC) The ROCKWOOD-Q34 115 kV line (from bus 200746 to bus 290079 ckt 1) loads from 124.28% to 125.77% (**DC power flow**) of its emergency rating (166 MVA) for the bus fault outage of 'AP_C1_11'. This project contributes approximately 9.77 MW to the thermal violation.

CONTINGENCY 'AP_C1_11'
 OPEN BUS 235454
 OPEN BUS 237027
 END

/CUMBERLAND_138

Bus Number	Bus Name	Full Contribution
200854	BERKLY H	20.71
200840	DEEPCRK1	0.12
200841	DEEPCRK2	0.12
200835	DSGENWIN	0.46
292350	K-023	0.19
292542	L-013 1	22.09
200856	L-013 C	0.25
293901	O-048 C	0.22
293902	O-048 E	19.88
293431	R-040 C	0.01
293432	R-040 E	1.24
290228	S-014 C	0.08
290229	S-014 E	6.85
293023	U2-073C OP1	0.12
293024	U2-073E OP1	17.45
236001	WARRIOR RUN	0.9
900404	X3-028 C	1.
900405	X3-028 E	1.34
913001	Y1-003 C OP1	2.7
913002	Y1-003 E OP1	18.05
913141	Y1-033 C OP1	2.95
913142	Y1-033 E OP1	19.74
Y2-068	Y2-068	12.07
915771	Y3-092	9.77
200813	YOUGH	0.13

Appendix 86

(PENELEC - PENELEC) The E.TWANDA-CNYO&G 230 kV line (from bus 200675 to bus 200924 ckt 1F) loads from 106.03% to 116.82% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 52.63 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.2
203261	BLOSSBCT	0.2
94106	GRAYMONT	0.1
200828	HNSMLK 1	0.14
200829	HNSMLK 2	0.14
200830	HNSMLK 3	0.14
200831	HNSMLK 4	0.14
200832	HNSMLK 5	0.14
200838	HOMER C2	1.61
200839	HOMER C3	1.7
200849	LAKVU GN	0.02
203283	MANOR	0.02
293270	N-036 C	1.55
200649	PENNTech	0.18
290085	Q-036 C	0.03
295247	Q-046	0.03
290113	Q-063 C	0.07
296914	R-092 C	1.27
291011	S-103	0.24
200662	SCRUB GR	0.2
200642	SENECA#1	0.85
200643	SENECA#2	0.79
200644	SENECA#3	0.12
200715	SHAWVL 1	11.52
200722	SHAWVL 2	11.73
200665	SHAWVL 3	17.55
200666	SHAWVL 4	17.38
292391	T-121C	1.92
292984	U2-055C	1.08
293416	V3-042C	0.94
903651	W3-099 C OP1	1.07
907481	X1-109	303.98
910651	X3-039	5.45
X3-050	X3-050	19.59

913131	Y1-032 C	1.83
Y2-044	Y2-044	31.72
914131	Y2-055	4.6
Y2-068	Y2-068	46.54
915011	Y3-010 C	0.72
915331	Y3-062 C	0.2
915771	Y3-092	52.63

Appendix 87

(FE - FE) The 02ASH_3-02SBRNQ4 138 kV line (from bus 238544 to bus 239098 ckt 1) loads from 22.31% to 75.53% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.37 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	42.91
200828	HNSMLK 1	0.13
200829	HNSMLK 2	0.13
200830	HNSMLK 3	0.13
200831	HNSMLK 4	0.13
200832	HNSMLK 5	0.13
200849	LAKVU GN	0.02
901211	W1-070A_AT4	1.11
903651	W3-099 C OP1	0.83
910651	X3-039	5.89
915331	Y3-062 C	0.15
915771	Y3-092	80.37

Appendix 88

(PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 60.71% to 94.5% (**DC power flow**) of its emergency rating (558 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 188.52 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'
STUCK CB - CB8

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.04
293270	N-036 C	0.72
293271	N-036 E	2.89
290113	Q-063 C	0.26
291011	S-103	0.73
200642	SENECA#1	3.45
200643	SENECA#2	3.2
200644	SENECA#3	0.49
292391	T-121C	1.32
292392	T-121E	5.27
903651	W3-099 C OP1	2.43
903652	W3-099 E OP1	16.26
910651	X3-039	8.68
X3-050	X3-050	10.37
913131	Y1-032 C	1.02
913132	Y1-032 E	6.85
Y2-044	Y2-044	16.79
914131	Y2-055	14.33
915331	Y3-062 C	0.44
915332	Y3-062 E	3.01
915771	Y3-092	188.52

Appendix 89

(FE - FE) The 02SP Q-2-02AUSTQ2 138 kV line (from bus 239113 to bus 239212 ckt 1) loads from 33.93% to 82.56% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.47
884781	S-058 E	1.54
907481	X1-109	-17.5
913161	Y1-035	11.
913171	Y1-036	9.72
914301	Y2-085 OP1	8.82
915771	Y3-092	77.72

Appendix 90

(PENELEC - PL) The OXBOW-LACK 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 110.22% to 121.46% (**DC power flow**) of its emergency rating (624 MVA) for the single line contingency outage of 'PJM SUSQ-LACK 500'. This project contributes approximately 70.19 MW to the thermal violation.

CONTINGENCY 'PJM SUSQ-LACK 500'

OPEN BRANCH FROM BUS 200022 TO BUS 200074 CKT 1
500 74 LACKAW 500 1

/* 22 SUSQ

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.27
235567	ARMSTRONG 1	10.11
235569	ARMSTRONG 2	10.05
203261	BLOSSBCT	0.25
200503	C.SLOPE	0.33
200805	COLVER13	0.29
99210	G07_NEW	5.68
94106	GRAYMONT	0.12
200828	HNSMLK 1	0.18
200829	HNSMLK 2	0.18
200830	HNSMLK 3	0.18
200831	HNSMLK 4	0.18
200832	HNSMLK 5	0.18
200837	HOMER C1	1.62
200838	HOMER C2	2.13
200839	HOMER C3	2.26
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
203283	MANOR	0.03
200851	MEHOOP3	1.37
293270	N-036 C	2.06
293602	O-018 C	0.03
94130	O66_NONFIRM	21.23
294572	P-028 C	0.7
200649	PENNTech	0.23
200608	PINEY #1	0.08
200657	PINEY CK	0.09
290085	Q-036 C	0.04
295247	Q-046	0.04
200882	Q-053 C	0.03
290113	Q-063 C	0.08
296322	R-032 C	0.03

296914	R-092 C	1.54
291011	S-103	0.31
200662	SCRUB GR	0.27
200642	SENECA#1	1.1
200643	SENECA#2	1.02
200644	SENECA#3	0.16
200715	SHAWVL 1	13.71
200722	SHAWVL 2	13.97
200665	SHAWVL 3	20.75
200666	SHAWVL 4	20.57
200809	SITHE	0.09
292391	T-121C	2.54
292984	U2-055C	1.27
292078	V1-034	0.18
293392	V3-030C	0.01
293416	V3-042C	4.29
903651	W3-099 C OP1	1.45
907991	X1-078	27.21
907481	X1-109	334.08
909091	X2-031 C	0.34
910651	X3-039	7.23
X3-050	X3-050	28.1
913131	Y1-032 C	2.44
913191	Y1-047 OP1	7.97
913311	Y1-071	0.02
914061	Y2-042	12.63
Y2-044	Y2-044	45.5
914131	Y2-055	6.07
914151	Y2-060	1.81
Y2-068	Y2-068	62.09
914421	Y2-104	3.48
915011	Y3-010 C	0.85
915331	Y3-062 C	0.28
915771	Y3-092	70.19

Appendix 91

(PENELEC - PENELEC) The N.MESHPN-OXBOW 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 110.42% to 121.62% (**DC power flow**) of its emergency rating (617 MVA) for the single line contingency outage of 'PJM SUSQ-LACK 500'. This project contributes approximately 69.1 MW to the thermal violation.

CONTINGENCY 'PJM SUSQ-LACK 500'

OPEN BRANCH FROM BUS 200022 TO BUS 200074 CKT 1

/* 22 SUSQ

500 74 LACKAW 500 1

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.27
235567	ARMSTRONG 1	9.96
235569	ARMSTRONG 2	9.9
203261	BLOSSBCT	0.25
200503	C.SLOPE	0.32
200805	COLVER13	0.29
99210	G07_NEW	5.6
94106	GRAYMONT	0.12
200828	HNSMLK 1	0.18
200829	HNSMLK 2	0.18
200830	HNSMLK 3	0.18
200831	HNSMLK 4	0.18
200832	HNSMLK 5	0.18
200837	HOMER C1	1.59
200838	HOMER C2	2.1
200839	HOMER C3	2.22
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
203283	MANOR	0.03
200851	MEHOOP3	1.32
293270	N-036 C	2.03
293602	O-018 C	0.03
94130	O66_NONFIRM	20.9
294572	P-028 C	0.67
200649	PENNTech	0.22
200608	PINEY #1	0.08
200657	PINEY CK	0.09
290085	Q-036 C	0.04
295247	Q-046	0.04
200882	Q-053 C	0.03
290113	Q-063 C	0.08
296322	R-032 C	0.03

296914	R-092 C	1.52
291011	S-103	0.31
200662	SCRUB GR	0.26
200642	SENECA#1	1.09
200643	SENECA#2	1.01
200644	SENECA#3	0.16
200715	SHAWVL 1	13.53
200722	SHAWVL 2	13.78
200665	SHAWVL 3	20.48
200666	SHAWVL 4	20.3
200809	SITHE	0.09
292391	T-121C	2.5
292984	U2-055C	1.26
292078	V1-034	0.18
293392	V3-030C	0.01
293416	V3-042C	4.18
903651	W3-099 C OP1	1.42
907991	X1-078	26.79
907481	X1-109	330.17
909091	X2-031 C	0.33
910651	X3-039	7.12
X3-050	X3-050	27.63
913131	Y1-032 C	2.4
913191	Y1-047 OP1	7.71
913311	Y1-071	0.02
Y2-044	Y2-044	44.74
914131	Y2-055	5.98
914151	Y2-060	1.75
Y2-068	Y2-068	61.19
914421	Y2-104	2.51
915011	Y3-010 C	0.84
915331	Y3-062 C	0.27
915771	Y3-092	69.1

Appendix 92

(FE - FE) The 02AUSTQ1-02SBRNQ1 138 kV line (from bus 239213 to bus 239095 ckt 1) loads from 37.8% to 85.88% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 76.85 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.46
884781	S-058 E	1.52
907481	X1-109	-17.3
913161	Y1-035	10.86
913171	Y1-036	9.61
914301	Y2-085 OP1	8.73
915771	Y3-092	76.85

Appendix 93

(FE - FE) The 02LRCRQ1-02AUSTQ1 138 kV line (from bus 239112 to bus 239213 ckt 1) loads from 37.8% to 85.88% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 76.85 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.46
884781	S-058 E	1.52
907481	X1-109	-17.3
913161	Y1-035	10.86
913171	Y1-036	9.61
914301	Y2-085 OP1	8.73
915771	Y3-092	76.85

Appendix 94

(FE - FE) The 02SP Q-4-02SBRNQ4 138 kV line (from bus 239115 to bus 239098 ckt 1) loads from 36.56% to 87.11% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.79 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.49
884781	S-058 E	1.6
907481	X1-109	-18.19
913161	Y1-035	11.42
913171	Y1-036	10.1
914301	Y2-085 OP1	9.17
915771	Y3-092	80.79

Appendix 95

(PENELEC - PENELEC) The ERIE W-ERIE SO 345 kV line (from bus 200599 to bus 200600 ckt 1) loads from 4.11% to 70.91% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 807.63 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
910651	X3-039	12.
915771	Y3-092	807.63

Appendix 96

(PENELEC - PL) The OXBOW-LACK 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 114.1% to 128.41% (**DC power flow**) of its normal rating (494 MVA) for non-contingency condition. This project contributes approximately 70.71 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.28
235567	ARMSTRONG 1	10.14
235569	ARMSTRONG 2	10.08
203261	BLOSSBCT	0.26
200503	C.SLOPE	0.33
200805	COLVER13	0.29
99210	G07_NEW	5.25
94106	GRAYMONT	0.12
200828	HNSMLK 1	0.18
200829	HNSMLK 2	0.18
200830	HNSMLK 3	0.18
200831	HNSMLK 4	0.18
200832	HNSMLK 5	0.18
200837	HOMER C1	1.62
200838	HOMER C2	2.15
200839	HOMER C3	2.27
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
203283	MANOR	0.03
200851	MEHOOP3	1.4
293270	N-036 C	2.09
293602	O-018 C	0.03
94130	O66_NONFIRM	19.25
294572	P-028 C	0.71
200649	PENNTech	0.23
200608	PINEY #1	0.08
200657	PINEY CK	0.09
290085	Q-036 C	0.04
295247	Q-046	0.04
200882	Q-053 C	0.03
290113	Q-063 C	0.08
296322	R-032 C	0.03
296914	R-092 C	1.56
884780	S-058 C	1.42

884781	S-058 E	4.68
291011	S-103	0.31
200662	SCRUB GR	0.27
200642	SENECA#1	1.12
200643	SENECA#2	1.04
200644	SENECA#3	0.16
200715	SHAWVL 1	13.87
200722	SHAWVL 2	14.13
200665	SHAWVL 3	21.
200666	SHAWVL 4	20.81
200809	SITHE	0.09
292391	T-121C	2.58
292984	U2-055C	1.29
292078	V1-034	0.16
293392	V3-030C	0.01
293416	V3-042C	4.37
903651	W3-099 C OP1	1.46
907991	X1-078	25.3
907481	X1-109	340.49
909091	X2-031 C	0.34
910651	X3-039	7.29
X3-050	X3-050	28.6
913131	Y1-032 C	2.47
913191	Y1-047 OP1	8.13
913311	Y1-071	0.02
914061	Y2-042	12.88
Y2-044	Y2-044	46.3
914131	Y2-055	6.15
914151	Y2-060	1.85
914301	Y2-085 OP1	24.79
914421	Y2-104	3.55
915011	Y3-010 C	0.86
915331	Y3-062 C	0.28
915771	Y3-092	70.71

Appendix 97

(PENELEC - PENELEC) The N.MESHPN-OXBOW 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 115.73% to 130.29% (**DC power flow**) of its normal rating (478 MVA) for non-contingency condition. This project contributes approximately 69.61 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.27
235567	ARMSTRONG 1	9.99
235569	ARMSTRONG 2	9.93
203261	BLOSSBCT	0.25
200503	C.SLOPE	0.32
200805	COLVER13	0.29
94106	GRAYMONT	0.12
200828	HNSMLK 1	0.18
200829	HNSMLK 2	0.18
200830	HNSMLK 3	0.18
200831	HNSMLK 4	0.18
200832	HNSMLK 5	0.18
200837	HOMER C1	1.59
200838	HOMER C2	2.11
200839	HOMER C3	2.24
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
203283	MANOR	0.03
200851	MEHOOP3	1.35
293270	N-036 C	2.06
293602	O-018 C	0.03
94130	O66_NONFIRM	18.95
294572	P-028 C	0.69
200649	PENNTech	0.23
200608	PINEY #1	0.08
200657	PINEY CK	0.09
290085	Q-036 C	0.04
295247	Q-046	0.04
200882	Q-053 C	0.03
290113	Q-063 C	0.08
296322	R-032 C	0.03
296914	R-092 C	1.54
884780	S-058 C	1.4
884781	S-058 E	4.61

291011	S-103	0.31
200662	SCRUB GR	0.26
200642	SENECA#1	1.1
200643	SENECA#2	1.02
200644	SENECA#3	0.16
200715	SHAWVL 1	13.68
200722	SHAWVL 2	13.94
200665	SHAWVL 3	20.72
200666	SHAWVL 4	20.53
200809	SITHE	0.09
292391	T-121C	2.54
292984	U2-055C	1.27
292078	V1-034	0.16
293392	V3-030C	0.01
293416	V3-042C	4.26
903651	W3-099 C OP1	1.44
907991	X1-078	24.91
907481	X1-109	336.49
909091	X2-031 C	0.33
910651	X3-039	7.18
X3-050	X3-050	28.12
913131	Y1-032 C	2.43
913191	Y1-047 OP1	7.86
913311	Y1-071	0.02
Y2-044	Y2-044	45.52
914131	Y2-055	6.06
914151	Y2-060	1.79
914301	Y2-085 OP1	24.41
914421	Y2-104	2.57
915011	Y3-010 C	0.85
915331	Y3-062 C	0.28
915771	Y3-092	69.61

Appendix 98

(AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.7% to 108.0% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 84.33 MW to the thermal violation.

```

CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
  
```

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.66
884781	S-058 E	2.18
907481	X1-109	-33.19
913041	Y1-015 C	12.81
914301	Y2-085 OP1	10.76
915771	Y3-092	84.33

Appendix 99

(AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.7% to 108.0% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 84.33 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.66
884781	S-058 E	2.18
907481	X1-109	-33.19
913041	Y1-015 C	12.81
914301	Y2-085 OP1	10.76
915771	Y3-092	84.33

Appendix 100

(AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.7% to 108.0% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 84.33 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.66
884781	S-058 E	2.18
907481	X1-109	-33.19
913041	Y1-015 C	12.81
914301	Y2-085 OP1	10.76
915771	Y3-092	84.33

Appendix 101

(AP - AP) The BUTLER-PARADISE JCT 138 kV line (from bus 235152 to bus 235141 ckt 1) loads from 70.97% to 108.28% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 84.33 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.66
884781	S-058 E	2.18
907481	X1-109	-33.19
913041	Y1-015 C	12.81
914301	Y2-085 OP1	10.76
915771	Y3-092	84.33

Appendix 102

(AP - AP) The BUTLER-PARADISE JCT 138 kV line (from bus 235152 to bus 235141 ckt 1) loads from 70.97% to 108.28% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 84.33 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.66
884781	S-058 E	2.18
907481	X1-109	-33.19
913041	Y1-015 C	12.81
914301	Y2-085 OP1	10.76
915771	Y3-092	84.33

Appendix 103

(FE - FE) The 02LRCRQ2-02SP Q-2 138 kV line (from bus 238913 to bus 239113 ckt 1) loads from 48.69% to 97.33% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 77.72 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.47
884781	S-058 E	1.54
907481	X1-109	-17.5
913161	Y1-035	11.
913171	Y1-036	9.72
914301	Y2-085 OP1	8.82
915771	Y3-092	77.72

Appendix 104

(FE - FE) The 02LRCRQ4-02SP Q-4 138 kV line (from bus 239057 to bus 239115 ckt 1) loads from 45.37% to 95.92% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 80.79 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.49
884781	S-058 E	1.6
907481	X1-109	-18.19
913161	Y1-035	11.42
913171	Y1-036	10.1
914301	Y2-085 OP1	9.17
915771	Y3-092	80.79

Appendix 105

(PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 5.16% to 76.07% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 807.63 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
915771	Y3-092	807.63

Appendix 106

(PENELEC - PENELEC) The VENGO JT-MRGAN ST 115 kV line (from bus 200573 to bus 200575 ckt 1) loads from 35.51% to 95.36% (**DC power flow**) of its emergency rating (149 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 139.91 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'
STUCK CB - CB8

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.03
903651	W3-099 C OP1	1.51
903652	W3-099 E OP1	10.1
914131	Y2-055	3.8
915331	Y3-062 C	0.27
915332	Y3-062 E	1.84
915771	Y3-092	139.91

Appendix 107

(PENELEC - PENELEC) The WAYNE 345/115 kV transformer (from bus 200595 to bus 200598 ckt 2) loads from 79.67% to 120.11% (**DC power flow**) of its emergency rating (324 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 131.02 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'

/* ERIE WEST 345 KV

STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
200828	HNSMLK 1	0.47
200829	HNSMLK 2	0.47
200830	HNSMLK 3	0.47
200831	HNSMLK 4	0.47
200832	HNSMLK 5	0.47
915771	Y3-092	131.02

Appendix 108

(PENELEC - PENELEC) The GLADE-WARREN 230 kV line (from bus 200593 to bus 200811 ckt 1) loads from 49.19% to 105.29% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 348.36 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'
STUCK CB - CB8

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
200649	PENNTech	0.24
290113	Q-063 C	0.2
296914	R-092 C	1.22
296915	R-092 E	4.89
200642	SENECA#1	2.62
200643	SENECA#2	2.43
200644	SENECA#3	0.37
200715	SHAWVL 1	8.83
200722	SHAWVL 2	9.06
200665	SHAWVL 3	13.28
292391	T-121C	0.98
292392	T-121E	3.93
292984	U2-055C	0.75
292985	U2-055E	5.02
915011	Y3-010 C	0.52
915012	Y3-010 E	3.46
915771	Y3-092	348.36

Appendix 109

(PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line (from bus 200928 to bus 200819 ckt 1) loads from 37.82% to 102.42% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 377.28 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
293416	V3-042C	0.63
293417	V3-042E	4.22
903651	W3-099 C OP1	5.56
903652	W3-099 E OP1	37.18
X3-050	X3-050	12.05
Y2-044	Y2-044	19.5
915331	Y3-062 C	0.99
915332	Y3-062 E	6.72
915771	Y3-092	377.28

Appendix 110

(PENELEC - PENELEC) The Q34-SOMERST 115 kV line (from bus 290079 to bus 200744 ckt 1) loads from 166.54% to 168.03% (**DC power flow**) of its emergency rating (166 MVA) for the bus fault outage of 'AP_C1_11'. This project contributes approximately 9.77 MW to the thermal violation.

CONTINGENCY 'AP_C1_11'

/CUMBERLAND_138

OPEN BUS 235454

OPEN BUS 237027

END

Bus Number	Bus Name	Full Contribution
200854	BERKLY H	20.71
200840	DEEPCRK1	0.12
200841	DEEPCRK2	0.12
200835	DSGENWIN	0.46
292350	K-023	0.19
292542	L-013 1	22.09
200856	L-013 C	0.25
293901	O-048 C	0.22
293902	O-048 E	19.88
290081	Q-034 C	14.11
290082	Q-034 E	56.44
293431	R-040 C	0.01
293432	R-040 E	1.24
290228	S-014 C	0.08
290229	S-014 E	6.85
293023	U2-073C OP1	0.12
293024	U2-073E OP1	17.45
236001	WARRIOR RUN	0.9
900404	X3-028 C	1.
900405	X3-028 E	1.34
913001	Y1-003 C OP1	2.7
913002	Y1-003 E OP1	18.05
913141	Y1-033 C OP1	2.95
913142	Y1-033 E OP1	19.74
Y2-068	Y2-068	12.07
915771	Y3-092	9.77
200813	YOUGH	0.13

Appendix 111

(FE - FE) The 02S8-ATT 345/138 kV transformer (from bus 238544 to bus 239082 ckt 8) loads from 38.76% to 104.57% (**DC power flow**) of its emergency rating (371 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 281.88 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	81.63
239203	02EASTG6	0.09
239035	02PERRG1	4.44
901211	W1-070A_AT4	2.15
905071	W4-004B_AT11	1.26
907481	X1-109	-63.5
913401	Y1-012	0.08
913161	Y1-035	39.85
913171	Y1-036	35.24
914301	Y2-085 OP1	19.09
915771	Y3-092	281.88

Appendix 112

(NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 51.43% to 115.84% (**DC power flow**) of its emergency rating (607 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 375.46 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
293416	V3-042C	0.81
293417	V3-042E	5.43
907481	X1-109	36.43
X3-050	X3-050	13.09
Y2-044	Y2-044	21.19
915771	Y3-092	375.46

Appendix 113

(PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 49.9% to 115.9% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 375.46 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
293416	V3-042C	0.81
293417	V3-042E	5.43
907481	X1-109	36.43
X3-050	X3-050	13.09
Y2-044	Y2-044	21.19
915331	Y3-062 C	1.26
915332	Y3-062 E	8.57
915771	Y3-092	375.46

Appendix 114

(PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 59.11% to 125.11% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 375.46 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'

/* ERIE WEST 345 KV

STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
293416	V3-042C	0.81
293417	V3-042E	5.43
903651	W3-099 C OP1	7.09
903652	W3-099 E OP1	47.43
907481	X1-109	36.43
X3-050	X3-050	13.09
Y2-044	Y2-044	21.19
915331	Y3-062 C	1.26
915332	Y3-062 E	8.57
915771	Y3-092	375.46

Appendix 115

(PENELEC - PENELEC) The GENEVA-PPGAPI 115 kV line (from bus 200590 to bus 200822 ckt 1) loads from 83.91% to 141.47% (**DC power flow**) of its emergency rating (239 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 144.48 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
907481	X1-109	-16.24
910651	X3-039	34.43
915771	Y3-092	144.48

Appendix 116

(PENELEC - PENELEC) The PPGAPI-MRGAN ST 115 kV line (from bus 200822 to bus 200575 ckt 1) loads from 84.11% to 144.72% (**DC power flow**) of its emergency rating (227 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 144.48 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
907481	X1-109	-16.24
910651	X3-039	34.43
915771	Y3-092	144.48

Appendix 117

(PENELEC - PENELEC) The WAYNE-GENEVA 115 kV line (from bus 200598 to bus 200590 ckt 1) loads from 87.04% to 150.73% (**DC power flow**) of its emergency rating (216 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 144.48 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
907481	X1-109	-16.24
915771	Y3-092	144.48

Appendix 118

(FE - FE) The 02S8-ATT 345/138 kV transformer (from bus 239082 to bus 238544 ckt 8) loads from 76.25% to 152.23% (**DC power flow**) of its emergency rating (371 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 281.88 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.09
235567	ARMSTRONG 1	14.45
235569	ARMSTRONG 2	14.37
203261	BLOSSBCT	0.08
200503	C.SLOPE	0.36
200805	COLVER13	0.35
94106	GRAYMONT	0.09
200828	HNSMLK 1	0.46
200829	HNSMLK 2	0.46
200830	HNSMLK 3	0.46
200831	HNSMLK 4	0.46
200832	HNSMLK 5	0.46
200837	HOMER C1	1.84
200838	HOMER C2	2.37
200839	HOMER C3	2.51
200636	IUP CO-G	0.04
200864	K-013	0.02
200849	LAKVU GN	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.2
293270	N-036 C	1.08
293300	N-039 C	0.04
293602	O-018 C	0.03
293801	O-038 C	0.03
294512	P-022 C	0.01
294572	P-028 C	0.1
200649	PENNTECH	0.21
200608	PINEY #1	0.13
200657	PINEY CK	0.15
290085	Q-036 C	0.03
295247	Q-046	0.04
200882	Q-053 C	0.03

290113	Q-063 C	0.11
296322	R-032 C	0.04
296914	R-092 C	1.3
291011	S-103	0.44
200662	SCRUB GR	0.62
200642	SENECA#1	1.39
200643	SENECA#2	1.29
200644	SENECA#3	0.2
200715	SHAWVL 1	10.52
200722	SHAWVL 2	10.77
200665	SHAWVL 3	15.24
200666	SHAWVL 4	15.26
200809	SITHE	0.11
292391	T-121C	1.71
292548	T-155	0.02
292984	U2-055C	0.92
293392	V3-030C	0.01
293416	V3-042C	1.04
903651	W3-099 C OP1	2.92
907481	X1-109	63.5
909091	X2-031 C	0.37
910651	X3-039	20.66
X3-050	X3-050	12.8
913131	Y1-032 C	1.43
913191	Y1-047 OP1	1.16
913311	Y1-071	0.03
914061	Y2-042	1.21
Y2-044	Y2-044	20.72
914131	Y2-055	8.67
914151	Y2-060	0.26
914421	Y2-104	0.49
915011	Y3-010 C	0.67
915331	Y3-062 C	0.53
915771	Y3-092	281.88

Appendix 119

(PENELEC - PENELEC) The MRGAN ST-VENGO JT 115 kV line (from bus 200575 to bus 200573 ckt 1) loads from 65.84% to 155.27% (**DC power flow**) of its emergency rating (149 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 139.91 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
907481	X1-109	-15.67
910651	X3-039	33.21
915771	Y3-092	139.91

Secondary POI report

Network Impacts

The Queue Project #Y3-092 was studied as a 1000.0 MW (Capacity 1000.0 MW) injection at the Erie South 345 kV substation in the Penelec area. Project #Y3-092 was evaluated for compliance with reliability criteria for summer peak conditions in 2017. Potential network impacts were as follows:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

1. (PENELEC - PENELEC) The GESG TAP-ERIE SO. 115 kV line (from bus 200850 to bus 200567 ckt 1) loads from 7.38% to 54.07% (**DC power flow**) of its emergency rating (245 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 145.4 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                      /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

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

2. (PENELEC - PENELEC) The MRGAN ST-VENGO JT 115 kV line (from bus 200575 to bus 200573 ckt 1) loads from 20.69% to 61.09% (**DC power flow**) of its emergency rating (149 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 60.2 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                      /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 9 for a table containing the generators having contribution to this flowgate.

3. (AEP - AEP) The 05KAMMER-05WBELLA 345 kV line (from bus 242937 to bus 242948 ckt 1) loads from 95.64% to 99.57% (**DC power flow**) of its emergency rating (1176 MVA) for the single line contingency outage of '41_B2_TOR544'. This project contributes approximately 68.75 MW to the thermal violation.

CONTINGENCY '41_B2_TOR544'
 OPEN BRANCH FROM BUS 242925 TO BUS 242930 CKT 1 / 242925
 05KAMMER 765 242930 05SCANTO 765 1
 OPEN BRANCH FROM BUS 242930 TO BUS 242943 CKT 3 / 242930
 05SCANTO 765 242943 05SCANTO 345 3
 OPEN BRANCH FROM BUS 242943 TO BUS 243092 CKT 4 / 242943
 05SCANTO 345 243092 05SCANTE 138 4
 END

Please refer to Appendix 10 for a table containing the generators having contribution to this flowgate.

4. (AP - AP) The BURMA 138/115 kV transformer (from bus 235150 to bus 235151 ckt 1) loads from 54.5% to 79.11% (**DC power flow**) of its emergency rating (254 MVA) for the single line contingency outage of 'B_PN345-SX-#6'. This project contributes approximately 62.5 MW to the thermal violation.

CONTINGENCY 'B_PN345-SX-#6' /* HANDSOME LAKE -
 WAYNE (WHL) 345 KV - (PJM-PN33A)
 DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
 END

Please refer to Appendix 11 for a table containing the generators having contribution to this flowgate.

5. (PENELEC - PENELEC) The GORE JCT-FRVIEW E 115 kV line (from bus 200577 to bus 200578 ckt 1) loads from 11.24% to 58.31% (**DC power flow**) of its emergency rating (333 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 193.72 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
 ERIE SO 345.00 LINE OUTAGE
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
 ERIE W 345.00 ERIE SO 345.00
 END

Please refer to Appendix 13 for a table containing the generators having contribution to this flowgate.

6. (PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 119.67 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Please refer to Appendix 14 for a table containing the generators having contribution to this flowgate.

7. (PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 119.67 MW to the thermal violation.

CONTINGENCY 'DQE_163' /* LINE ERIE W TO
02PERRY 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END

Please refer to Appendix 15 for a table containing the generators having contribution to this flowgate.

8. (PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 119.67 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
02PERRY 345.00 02AT 345.00
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
02AT 345.00 02S8-ATT 345.00
DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
02S8-ATT 345.00 02ASH_3 138.00
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Please refer to Appendix 16 for a table containing the generators having contribution to this flowgate.

9. (PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating

(437 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 119.67 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                /* LINE ERIE W TO
02PERRY 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
  END
```

Please refer to Appendix 17 for a table containing the generators having contribution to this flowgate.

10. (PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 119.67 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                          /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
  END
```

Please refer to Appendix 18 for a table containing the generators having contribution to this flowgate.

11. (PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 119.67 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                          /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
  END
```

Please refer to Appendix 19 for a table containing the generators having contribution to this flowgate.

12. (FE - FE) The 02AUSTQ2-02SP Q-2 138 kV line (from bus 239212 to bus 239113 ckt 1) loads from 11.0% to 58.27% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```

Please refer to Appendix 20 for a table containing the generators having contribution to this flowgate.

13. (FE - FE) The 02SBRNQ4-02SP Q-4 138 kV line (from bus 239098 to bus 239115 ckt 1) loads from 7.61% to 56.75% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 74.2 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```

Please refer to Appendix 21 for a table containing the generators having contribution to this flowgate.

14. (PENELEC - PENELEC) The 4MILE_115-ERIE SE 115 kV line (from bus 200927 to bus 200820 ckt 1) loads from 40.09% to 73.06% (**DC power flow**) of its emergency rating (228 MVA) for the single line contingency outage of 'B_PN230-SX-#17A'. This project contributes approximately 67.96 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#17A'                        /* ERIE EAST -
FOURMILE 230 KV
  DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1      /*
ERIE SE 230.00 FOURMILE 230.00
  END
```

Please refer to Appendix 22 for a table containing the generators having contribution to this flowgate.

15. (AP - PENELEC) The BURMA-PINEY 115 kV line (from bus 235151 to bus 200583 ckt 1) loads from 56.05% to 81.35% (**DC power flow**) of its emergency rating (247 MVA) for the single line contingency outage of 'B_PN345-SX-#6'. This project contributes approximately 62.5 MW to the thermal violation.

CONTINGENCY 'B_PN345-SX-#6' /* HANDSOME LAKE -
 WAYNE (WHL) 345 KV - (PJM-PN33A)
 DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
 END

Please refer to Appendix 23 for a table containing the generators having contribution to this flowgate.

16. (AP - PENELEC) The BURMA-PINEY 115 kV line (from bus 235151 to bus 200583 ckt 1) loads from 56.05% to 81.35% (**DC power flow**) of its emergency rating (247 MVA) for the single line contingency outage of 'B_PN345-SX-#6'. This project contributes approximately 62.5 MW to the thermal violation.

CONTINGENCY 'B_PN345-SX-#6' /* HANDSOME LAKE -
 WAYNE (WHL) 345 KV - (PJM-PN33A)
 DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
 END

Please refer to Appendix 24 for a table containing the generators having contribution to this flowgate.

17. (PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200599 to bus 200632 ckt 1) loads from 35.37% to 71.1% (**DC power flow**) of its emergency rating (328 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 127.35 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
 ERIE SO 345.00 LINE OUTAGE
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
 ERIE W 345.00 ERIE SO 345.00
 END

Please refer to Appendix 25 for a table containing the generators having contribution to this flowgate.

18. (AP - AP) The PARADISE JCT-BUTLER 138 kV line (from bus 235141 to bus 235152 ckt 1) loads from 16.17% to 61.63% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
 PERRY-AT-ERIE W 345 CK 1
 DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
 02PERRY 345.00 02AT 345.00
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
 02AT 345.00 02S8-ATT 345.00

DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
 02S8-ATT 345.00 02ASH_3 138.00
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
 02AT 345.00 ERIE W 345.00
 END

Please refer to Appendix 26 for a table containing the generators having contribution to this flowgate.

19. (AP - AP) The PARADISE JCT-BUTLER 138 kV line (from bus 235141 to bus 235152 ckt 1) loads from 16.17% to 61.63% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
 W 345 CK 1
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
 02AT 345.00 ERIE W 345.00
 END

Please refer to Appendix 27 for a table containing the generators having contribution to this flowgate.

20. (AP - AP) The PARADISE JCT-BUTLER 138 kV line (from bus 235141 to bus 235152 ckt 1) loads from 16.17% to 61.63% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'DQE_163' /* LINE ERIE W TO
 02PERRY 345 CK 1
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
 END

Please refer to Appendix 28 for a table containing the generators having contribution to this flowgate.

21. (PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 56.26% to 81.8% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 111.7 MW to the thermal violation.

Please refer to Appendix 29 for a table containing the generators having contribution to this flowgate.

22. (AP - AP) The KARNS CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.39% to 61.85% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                /* LINE ERIE W TO
02PERRY 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END
```

Please refer to Appendix 30 for a table containing the generators having contribution to this flowgate.

23. (AP - AP) The KARNS CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.39% to 61.85% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                          /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 31 for a table containing the generators having contribution to this flowgate.

24. (AP - AP) The KARNS CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.39% to 61.85% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                          /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 32 for a table containing the generators having contribution to this flowgate.

25. (PENELEC - PENELEC) The WARREN-ERIE S TIE 230 kV line (from bus 200811 to bus 200918 ckt 1) loads from 23.25% to 65.57% (**DC power flow**) of its emergency rating (621 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 262.8 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 33 for a table containing the generators having contribution to this flowgate.

26. (FE - FE) The 02SBRNQ1-02ASH_1 138 kV line (from bus 239095 to bus 238542 ckt 1) loads from 23.79% to 66.61% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 68.91 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                       /* LINE 02AT TO 02PERRY  
345 CK 1  
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1  
END
```

Please refer to Appendix 36 for a table containing the generators having contribution to this flowgate.

27. (NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 59.37% to 84.94% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 111.7 MW to the thermal violation.

Please refer to Appendix 38 for a table containing the generators having contribution to this flowgate.

28. (PENELEC - PENELEC) The CNYO&G-N.MESHNP 230 kV line (from bus 200924 to bus 200706 ckt 1F) loads from 91.42% to 101.51% (**DC power flow**) of its emergency rating (617 MVA) for the single line contingency outage of 'SUSQ 1'. This project contributes approximately 62.24 MW to the thermal violation.

```
CONTINGENCY 'SUSQ 1'
```

REMOVE MACHINE 1 FROM BUS 208918
END

Please refer to Appendix 44 for a table containing the generators having contribution to this flowgate.

29. (FE - FE) The 02ASH_1-02SBRNQ1 138 kV line (from bus 238542 to bus 239095 ckt 1) loads from 20.37% to 66.0% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 68.91 MW to the thermal violation.

CONTINGENCY 'DQE_161' /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 45 for a table containing the generators having contribution to this flowgate.

30. (FE - FE) The 02SBRNQ2-02AUSTQ2 138 kV line (from bus 239096 to bus 239212 ckt 1) loads from 17.42% to 64.69% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

CONTINGENCY 'DQE_161' /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 47 for a table containing the generators having contribution to this flowgate.

31. (FE - FE) The 02ASH_2-02SBRNQ2 138 kV line (from bus 238543 to bus 239096 ckt 1) loads from 17.42% to 64.69% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

CONTINGENCY 'DQE_161' /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 48 for a table containing the generators having contribution to this flowgate.

32. (FE - FE) The 02SBRNQ4-02ASH_3 138 kV line (from bus 239098 to bus 238544 ckt 1) loads from 21.57% to 67.42% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 73.8 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Please refer to Appendix 51 for a table containing the generators having contribution to this flowgate.

33. (PENELEC - PENELEC) The EDINB S.-VENGO JT 115 kV line (from bus 200572 to bus 200573 ckt 1) loads from 27.06% to 70.24% (**DC power flow**) of its emergency rating (179 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 125.44 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                          /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*
ERIE W 345.00 ERIE SO 345.00
END
```

Please refer to Appendix 52 for a table containing the generators having contribution to this flowgate.

34. (PENELEC - PENELEC) The GENEVA-PPGAPI 115 kV line (from bus 200590 to bus 200822 ckt 1) loads from 71.54% to 92.98% (**DC power flow**) of its emergency rating (239 MVA) for the single line contingency outage of 'B_LINE_TIE_035'. This project contributes approximately 51.24 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_035'                          /* ERIE W 345.00 -
WAYNE 345.00 LINE OUTAGE
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1      /*
ERIE W 345.00 WAYNE 345.00
END
```

Please refer to Appendix 54 for a table containing the generators having contribution to this flowgate.

35. (PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 84.9% to 100.22% (**DC power flow**) of its emergency rating (505 MVA) for the single line contingency outage of 'B_PN115-LX-#161'. This project contributes approximately 77.35 MW to the thermal violation.

CONTINGENCY 'B_PN115-LX-#161' /* RIDGWAY -
WHETSTONE (DR) 115 KV & WHETSTONE XF#1
DISCONNECT BRANCH FROM BUS 200582 TO BUS 200711 CKT 1
DISCONNECT BRANCH FROM BUS 200711 TO BUS 200596 CKT 1
END

Please refer to Appendix 56 for a table containing the generators having contribution to this flowgate.

36. (PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 84.9% to 100.22% (**DC power flow**) of its emergency rating (505 MVA) for the single line contingency outage of 'B_PN115-LX-#161'. This project contributes approximately 77.35 MW to the thermal violation.

CONTINGENCY 'B_PN115-LX-#161' /* RIDGWAY -
WHETSTONE (DR) 115 KV & WHETSTONE XF#1
DISCONNECT BRANCH FROM BUS 200582 TO BUS 200711 CKT 1
DISCONNECT BRANCH FROM BUS 200711 TO BUS 200596 CKT 1
END

Please refer to Appendix 57 for a table containing the generators having contribution to this flowgate.

37. (PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200600 to bus 200819 ckt 8) loads from .2% to 57.98% (**DC power flow**) of its emergency rating (868 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 503.23 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Please refer to Appendix 58 for a table containing the generators having contribution to this flowgate.

38. (PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 82.43% to 99.1% (**DC power flow**) of its normal rating (426 MVA) for non-contingency condition. This project contributes approximately 70.99 MW to the thermal violation.

Please refer to Appendix 61 for a table containing the generators having contribution to this flowgate.

39. (PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 82.43% to 99.1% (**DC power flow**) of its normal rating (426 MVA) for non-contingency condition. This project contributes approximately 70.99 MW to the thermal violation.

Please refer to Appendix 62 for a table containing the generators having contribution to this flowgate.

40. (PENELEC - PENELEC) The ERIE SE-4MILE_230 230 kV line (from bus 200819 to bus 200928 ckt 1) loads from 15.33% to 65.62% (**DC power flow**) of its emergency rating (584 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 383.23 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*
ERIE W 345.00 ERIE SO 345.00
END
```

Please refer to Appendix 63 for a table containing the generators having contribution to this flowgate.

41. (PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200819 to bus 200600 ckt 8) loads from .2% to 58.17% (**DC power flow**) of its emergency rating (868 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 503.23 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*
ERIE W 345.00 ERIE SO 345.00
END
```

Please refer to Appendix 66 for a table containing the generators having contribution to this flowgate.

42. (FE - FE) The 02SBRNQ2-02ASH_2 138 kV line (from bus 239096 to bus 238543 ckt 1) loads from 28.04% to 72.41% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                       /* LINE 02AT TO 02PERRY
345 CK 1
```


DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 71 for a table containing the generators having contribution to this flowgate.

43. (FE - FE) The 02AUSTQ2-02SBRNQ2 138 kV line (from bus 239212 to bus 239096 ckt 1) loads from 28.04% to 72.41% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

CONTINGENCY 'DQE_161' /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 72 for a table containing the generators having contribution to this flowgate.

44. (PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 60.41% to 88.74% (**DC power flow**) of its emergency rating (558 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 158.05 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Please refer to Appendix 73 for a table containing the generators having contribution to this flowgate.

45. (AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.73% to 85.08% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 56.02 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Please refer to Appendix 74 for a table containing the generators having contribution to this flowgate.

46. (AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.73% to 85.08% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 56.02 MW to the thermal violation.

```

CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END

```

Please refer to Appendix 75 for a table containing the generators having contribution to this flowgate.

47. (AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.73% to 85.08% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 56.02 MW to the thermal violation.

```

CONTINGENCY 'DQE_163'                                       /* LINE ERIE W TO
02PERRY 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END

```

Please refer to Appendix 76 for a table containing the generators having contribution to this flowgate.

48. (PENELEC - PENELEC) The 4MILE_230 230/115 kV transformer (from bus 200928 to bus 200927 ckt 6) loads from 70.38% to 94.71% (**DC power flow**) of its emergency rating (323 MVA) for the single line contingency outage of 'B_PN230-SX-#17A'. This project contributes approximately 69.5 MW to the thermal violation.

```

CONTINGENCY 'B_PN230-SX-#17A'                               /* ERIE EAST -
FOURMILE 230 KV
  DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1      /*
ERIE SE 230.00 FOURMILE 230.00
END

```

Please refer to Appendix 78 for a table containing the generators having contribution to this flowgate.

49. (AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.88% to 88.02% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 56.05 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 79 for a table containing the generators having contribution to this flowgate.

50. (AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.88% to 88.02% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 56.05 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 80 for a table containing the generators having contribution to this flowgate.

51. (AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.88% to 88.02% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 56.05 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                      /* LINE ERIE W TO
02PERRY 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
```

END

Please refer to Appendix 81 for a table containing the generators having contribution to this flowgate.

52. (PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200599 to bus 200632 ckt 3) loads from 39.18% to 79.75% (**DC power flow**) of its emergency rating (306 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 131.61 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 82 for a table containing the generators having contribution to this flowgate.

53. (PENELEC - PENELEC) The PPGAPI-MRGAN ST 115 kV line (from bus 200822 to bus 200575 ckt 1) loads from 71.1% to 95.82% (**DC power flow**) of its emergency rating (227 MVA) for the single line contingency outage of 'B_LINE_TIE_035'. This project contributes approximately 51.24 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_035'                /* ERIE W 345.00 -  
WAYNE 345.00 LINE OUTAGE  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1      /*  
ERIE W 345.00 WAYNE 345.00  
END
```

Please refer to Appendix 83 for a table containing the generators having contribution to this flowgate.

54. (FE - FE) The 02ASH_3-02SBRNQ4 138 kV line (from bus 238544 to bus 239098 ckt 1) loads from 22.83% to 71.71% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 73.8 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                      /* LINE 02AT TO 02PERRY  
345 CK 1  
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1  
END
```

Please refer to Appendix 84 for a table containing the generators having contribution to this flowgate.

55. (AP - AP) The KISKI VALLEY-GARRETTS R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.96% to 84.35% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 66.13 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                /* LINE ERIE W TO
02PERRY 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END
```

Please refer to Appendix 90 for a table containing the generators having contribution to this flowgate.

56. (AP - AP) The KISKI VALLEY-GARRETTS R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.96% to 84.35% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 66.13 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                          /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 91 for a table containing the generators having contribution to this flowgate.

57. (AP - AP) The KISKI VALLEY-GARRETTS R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.96% to 84.35% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 66.13 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                          /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 92 for a table containing the generators having contribution to this flowgate.

58. (FE - FE) The 02SP Q-2-02AUSTQ2 138 kV line (from bus 239113 to bus 239212 ckt 1) loads from 34.47% to 78.83% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
  END
```

Please refer to Appendix 93 for a table containing the generators having contribution to this flowgate.

59. (PENELEC - PENELEC) The WAYNE-GENEVA 115 kV line (from bus 200598 to bus 200590 ckt 1) loads from 71.29% to 97.27% (**DC power flow**) of its emergency rating (216 MVA) for the single line contingency outage of 'B_LINE_TIE_035'. This project contributes approximately 51.24 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_035'                          /* ERIE W 345.00 -
WAYNE 345.00 LINE OUTAGE
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1      /*
ERIE W 345.00 WAYNE 345.00
  END
```

Please refer to Appendix 94 for a table containing the generators having contribution to this flowgate.

60. (PENELEC - PENELEC) The GORE JCT-GESG TAP 115 kV line (from bus 200577 to bus 200850 ckt 1) loads from 10.81% to 67.18% (**DC power flow**) of its emergency rating (308 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 193.72 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                          /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*
ERIE W 345.00 ERIE SO 345.00
  END
```

Please refer to Appendix 95 for a table containing the generators having contribution to this flowgate.

61. (FE - FE) The 02AUSTQ1-02SBRNQ1 138 kV line (from bus 239213 to bus 239095 ckt 1) loads from 38.71% to 82.58% (**DC power flow**) of its emergency rating (151

MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 70.58 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Please refer to Appendix 98 for a table containing the generators having contribution to this flowgate.

62. (FE - FE) The 02LRCRQ1-02AUSTQ1 138 kV line (from bus 239112 to bus 239213 ckt 1) loads from 38.71% to 82.58% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 70.58 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Please refer to Appendix 99 for a table containing the generators having contribution to this flowgate.

63. (PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200600 to bus 200568 ckt 5) loads from .14% to 64.02% (**DC power flow**) of its emergency rating (776 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 496.77 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                          /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*
ERIE W 345.00 ERIE SO 345.00
END
```

Please refer to Appendix 101 for a table containing the generators having contribution to this flowgate.

64. (PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200568 to bus 200600 ckt 5) loads from .14% to 64.16% (**DC power flow**) of its emergency rating (776 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 496.77 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                          /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
```

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Please refer to Appendix 102 for a table containing the generators having contribution to this flowgate.

65. (FE - FE) The 02SP Q-4-02SBRNQ4 138 kV line (from bus 239115 to bus 239098 ckt 1) loads from 37.57% to 83.68% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 74.2 MW to the thermal violation.

CONTINGENCY 'DQE_161' /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END

Please refer to Appendix 104 for a table containing the generators having contribution to this flowgate.

66. (PENELEC - PENELEC) The ERIE SO.-EDINB S. 115 kV line (from bus 200567 to bus 200572 ckt 1) loads from 8.39% to 69.84% (**DC power flow**) of its emergency rating (185 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 128.92 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Please refer to Appendix 107 for a table containing the generators having contribution to this flowgate.

67. (PENELEC - PENELEC) The FRVIEW E-GORE JCT 115 kV line (from bus 200578 to bus 200577 ckt 1) loads from 27.54% to 79.67% (**DC power flow**) of its emergency rating (333 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 193.72 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Please refer to Appendix 109 for a table containing the generators having contribution to this flowgate.

68. (PENELEC - PENELEC) The GESG TAP-GORE JCT 115 kV line (from bus 200850 to bus 200577 ckt 1) loads from 7.07% to 69.96% (**DC power flow**) of its emergency rating (308 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 193.72 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 111 for a table containing the generators having contribution to this flowgate.

69. (PENELEC - PENELEC) The ERIE SO.-GESG TAP 115 kV line (from bus 200567 to bus 200850 ckt 1) loads from 15.32% to 74.67% (**DC power flow**) of its emergency rating (245 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 145.4 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 112 for a table containing the generators having contribution to this flowgate.

70. (PENELEC - PENELEC) The GLADE-WARREN 230 kV line (from bus 200593 to bus 200811 ckt 1) loads from 41.96% to 88.39% (**DC power flow**) of its emergency rating (621 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 288.34 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 113 for a table containing the generators having contribution to this flowgate.

71. (PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 1.07% to 67.91% (**DC power flow**) of its emergency rating (1139 MVA) for the single line contingency outage of 'B_PN230-LS-#21'. This project contributes approximately 761.27 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-LS-#21'                                /* ERIE SOUTH 230/115
KV BANK 1 FAULT
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200820 CKT 1
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200625 CKT 4
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200600 CKT 8
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200918 CKT 1
REDUCE BUS 200819 SHUNT BY 100 PERCENT
DISCONNECT BUS 200819
END
```

Please refer to Appendix 114 for a table containing the generators having contribution to this flowgate.

72. (PENELEC - PENELEC) The ERIE SE 230/115 kV transformer (from bus 200819 to bus 200820 ckt 1) loads from 28.73% to 83.2% (**DC power flow**) of its emergency rating (306 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 166.68 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*
ERIE W 345.00 ERIE SO 345.00
END
```

Please refer to Appendix 117 for a table containing the generators having contribution to this flowgate.

73. (FE - FE) The 02LRCRQ2-02SP Q-2 138 kV line (from bus 238913 to bus 239113 ckt 1) loads from 49.3% to 93.66% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                       /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Please refer to Appendix 118 for a table containing the generators having contribution to this flowgate.

74. (PENELEC - PENELEC) The ERIE SO. 230/115 kV transformer (from bus 200568 to bus 200567 ckt 6) loads from 21.75% to 80.09% (**DC power flow**) of its emergency rating (321 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 187.27 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 119 for a table containing the generators having contribution to this flowgate.

75. (FE - FE) The 02LRCRQ4-02SP Q-4 138 kV line (from bus 239057 to bus 239115 ckt 1) loads from 46.31% to 92.42% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 74.2 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                      /* LINE 02AT TO 02PERRY  
345 CK 1  
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1  
END
```

Please refer to Appendix 120 for a table containing the generators having contribution to this flowgate.

76. (PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 2.95% to 72.48% (**DC power flow**) of its normal rating (982 MVA) for non-contingency condition. This project contributes approximately 682.77 MW to the thermal violation.

Please refer to Appendix 123 for a table containing the generators having contribution to this flowgate.

77. (AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.76% to 107.36% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                      /* LINE ERIE W TO  
02PERRY 345 CK 1  
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
```

END

Please refer to Appendix 124 for a table containing the generators having contribution to this flowgate.

78. (AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.76% to 107.36% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 125 for a table containing the generators having contribution to this flowgate.

79. (AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.76% to 107.36% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Please refer to Appendix 126 for a table containing the generators having contribution to this flowgate.

80. (AP - AP) The BUTLER-PARADISE JCT 138 kV line (from bus 235152 to bus 235141 ckt 1) loads from 70.98% to 107.57% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
```

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
 02AT 345.00 ERIE W 345.00
 END

Please refer to Appendix 127 for a table containing the generators having contribution to this flowgate.

81. (AP - AP) The BUTLER-PARADISE JCT 138 kV line (from bus 235152 to bus 235141 ckt 1) loads from 70.98% to 107.57% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
 PERRY-AT-ERIE W 345 CK 1
 DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
 02PERRY 345.00 02AT 345.00
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
 02AT 345.00 02S8-ATT 345.00
 DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
 02S8-ATT 345.00 02ASH_3 138.00
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
 02AT 345.00 ERIE W 345.00
 END

Please refer to Appendix 128 for a table containing the generators having contribution to this flowgate.

82. (AP - AP) The BUTLER-PARADISE JCT 138 kV line (from bus 235152 to bus 235141 ckt 1) loads from 70.98% to 107.57% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'DQE_163' /* LINE ERIE W TO
 02PERRY 345 CK 1
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
 END

Please refer to Appendix 129 for a table containing the generators having contribution to this flowgate.

83. (PENELEC - PENELEC) The GRANDVW-TITUSVIL 115 kV line (from bus 200584 to bus 200585 ckt 1) loads from 46.84% to 96.61% (**DC power flow**) of its emergency rating (149 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 78.48 MW to the thermal violation.

```

CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*
ERIE W 345.00 ERIE SO 345.00
END

```

Please refer to Appendix 130 for a table containing the generators having contribution to this flowgate.

84. (PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 48.48% to 97.54% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 290.4 MW to the thermal violation.

```

CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*
ERIE W 345.00 ERIE SO 345.00
END

```

Please refer to Appendix 131 for a table containing the generators having contribution to this flowgate.

85. (NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 51.49% to 99.34% (**DC power flow**) of its emergency rating (607 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 290.4 MW to the thermal violation.

```

CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*
ERIE W 345.00 ERIE SO 345.00
END

```

Please refer to Appendix 133 for a table containing the generators having contribution to this flowgate.

86. (PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 49.85% to 98.9% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 290.4 MW to the thermal violation.

```

CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE

```

```
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 134 for a table containing the generators having contribution to this flowgate.

87. (PENELEC - PENELEC) The EDINB S.-ERIE SO. 115 kV line (from bus 200572 to bus 200567 ckt 1) loads from 27.22% to 90.55% (**DC power flow**) of its emergency rating (185 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 128.92 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 142 for a table containing the generators having contribution to this flowgate.

88. (PENELEC - PENELEC) The ERIE WST-FRVIEW E 115 kV line (from bus 200632 to bus 200578 ckt 1) loads from 49.82% to 101.96% (**DC power flow**) of its emergency rating (333 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 193.72 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 143 for a table containing the generators having contribution to this flowgate.

89. (PENELEC - PENELEC) The TITUSVIL-UNION CY 115 kV line (from bus 200585 to bus 200571 ckt 1) loads from 32.91% to 94.71% (**DC power flow**) of its emergency rating (120 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 78.48 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 147 for a table containing the generators having contribution to this flowgate.

90. (FE - FE) The 02S8-ATT 345/138 kV transformer (from bus 238544 to bus 239082 ckt 8) loads from 38.45% to 97.89% (**DC power flow**) of its emergency rating (371 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 258.85 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Please refer to Appendix 148 for a table containing the generators having contribution to this flowgate.

91. (PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line (from bus 200928 to bus 200819 ckt 1) loads from 23.09% to 91.35% (**DC power flow**) of its emergency rating (584 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 383.23 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                          /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*
ERIE W 345.00 ERIE SO 345.00
END
```

Please refer to Appendix 151 for a table containing the generators having contribution to this flowgate.

92. (PENELEC - PENELEC) The ERIE W-ERIE SO 345 kV line (from bus 200599 to bus 200600 ckt 1) loads from 33.56% to 96.7% (**DC power flow**) of its emergency rating (1139 MVA) for the single line contingency outage of 'B_PN230-SX-#18'. This project contributes approximately 742.39 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#18'                          /* ERIE EAST - SOUTH
RIPLEY (EED) 230 KV - (PJM-PN04)
DISCONNECT BRANCH FROM BUS 200654 TO BUS 135251 CKT 1
END
```

Please refer to Appendix 152 for a table containing the generators having contribution to this flowgate.

93. (PENELEC - PENELEC) The ERIE W-ERIE SO 345 kV line (from bus 200599 to bus 200600 ckt 1) loads from 33.0% to 99.96% (**DC power flow**) of its normal rating

(982 MVA) for non-contingency condition. This project contributes approximately 682.77 MW to the thermal violation.

Please refer to Appendix 156 for a table containing the generators having contribution to this flowgate.

94. (PENELEC - PENELEC) The VENGO JT-EDINB S. 115 kV line (from bus 200573 to bus 200572 ckt 1) loads from 45.67% to 109.33% (**DC power flow**) of its emergency rating (179 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 125.44 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_036'                                /* ERIE W 345.00 -  
ERIE SO 345.00 LINE OUTAGE  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1      /*  
ERIE W 345.00 ERIE SO 345.00  
END
```

Please refer to Appendix 161 for a table containing the generators having contribution to this flowgate.

95. (FE - FE) The 02S8-ATT 345/138 kV transformer (from bus 239082 to bus 238544 ckt 8) loads from 76.85% to 146.63% (**DC power flow**) of its emergency rating (371 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 258.85 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                       /* LINE 02AT TO 02PERRY  
345 CK 1  
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1  
END
```

Please refer to Appendix 173 for a table containing the generators having contribution to this flowgate.

Light Load Analysis

Light Load Studies to be conducted during later study phases (applicable to wind, coal, nuclear, and pumped storage projects).

Multiple Facility Contingency

(Double Circuit Tower Line, Failed Breaker and Bus Fault contingencies for the full energy output)

1. (FE - FE) The 02WELNGT 138/69 kV transformer (from bus 239168 to bus 239167 ckt 3) loads from 96.93% to 98.54% (**DC power flow**) of its emergency rating (93 MVA)

for the bus fault outage of 'C1-BUS-SR006'. This project contributes approximately 5.43 MW to the thermal violation.

```

CONTINGENCY 'C1-BUS-SR006'                                /* BROOKSIDE 138
SOUTH BUS FAULT, B-28 FAILURE TO TRIP, B-5 FAILURE TO TRIP
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3      /*
02BRKSID 138.00 02BRKSID 69.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4      /*
02BRKSID 138.00 02BRKSID 69.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5      /*
02BRKSID 138.00 02BRKSID 69.00
  DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1      /*
05HOWARD 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1      /*
02LNGVIEW 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 239076 TO BUS 238586 CKT 1      /*
02ROSS 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 239216 TO BUS 238586 CKT 1      /*
02TROY 138.00 02BRKSID 138.00
END

```

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

2. (FE - FE) The 02WELNGT 138/69 kV transformer (from bus 239168 to bus 239167 ckt 3) loads from 96.93% to 98.54% (**DC power flow**) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'C2-BRK-SR054'. This project contributes approximately 5.43 MW to the thermal violation.

```

CONTINGENCY 'C2-BRK-SR054'                                /* BROOKSIDE B-30
FAILURE TO TRIP
  DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1      /*
02LNGVIEW 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1      /*
05HOWARD 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 239216 CKT 1      /*
02BRKSID 138.00 02TROY 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 239076 CKT 1      /*
02BRKSID 138.00 02ROSS 138.00
  DISCONNECT BRANCH FROM BUS 239076 TO BUS 239237 CKT 1      /*
02ROSS 138.00 02CLVR-S 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3      /*
02BRKSID 138.00 02BRKSID 69.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4      /*
02BRKSID 138.00 02BRKSID 69.00

```

```

DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5      /*
02BRKSID 138.00 02BRKSID 69.00
REDUCE BUS 239076 LOAD BY 100 PERCENT                        /* 02ROSS 138.00
DISCONNECT BUS 239076                                       /* 02ROSS 138.00
END

```

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

3. (PENELEC - PENELEC) The Y1-033 TAP-ROCKWOOD 115 kV line (from bus 913140 to bus 200746 ckt 1) loads from 97.37% to 98.92% (**DC power flow**) of its emergency rating (174 MVA) for the bus fault outage of 'AP_C1_5'. This project contributes approximately 10.46 MW to the thermal violation.

```

CONTINGENCY 'AP_C1_5'                                       /BLACKOAK_138_A
OPEN BRANCH FROM BUS 235446 TO BUS 235103 CKT 3
OPEN BUS 237025
END

```

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

4. (PENELEC - PENELEC) The Y1-033 TAP-ROCKWOOD 115 kV line (from bus 913140 to bus 200746 ckt 1) loads from 97.37% to 98.92% (**DC power flow**) of its emergency rating (174 MVA) for the bus fault outage of 'AP_C1_4'. This project contributes approximately 10.46 MW to the thermal violation.

```

CONTINGENCY 'AP_C1_4'                                       /BLACKOAK_500_A
OPEN BRANCH FROM BUS 235103 TO BUS 235446 CKT 3
OPEN BUS 237001
OPEN BUS 237004
OPEN BUS 235130
END

```

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

5. (PENELEC - PENELEC) The Y1-033 TAP-ROCKWOOD 115 kV line (from bus 913140 to bus 200746 ckt 1) loads from 97.37% to 98.92% (**DC power flow**) of its emergency rating (174 MVA) for the bus fault outage of '4'. This project contributes approximately 10.46 MW to the thermal violation.

```

CONTINGENCY '4'                                             /BLACKOAK_500_A
OPEN BRANCH FROM BUS 235103 TO BUS 235446 CKT 3          / BUS
253103 -> 235103.
OPEN BUS 237001

```

END

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

6. (FE - FE) The 02HANNA-02JUNIPER 345 kV line (from bus 238781 to bus 238850 ckt 1) loads from 80.15% to 90.61% (**DC power flow**) of its emergency rating (1554 MVA) for the tower line contingency outage of 'C5-TWL-NR066'. This project contributes approximately 162.51 MW to the thermal violation.

```
CONTINGENCY 'C5-TWL-NR066'                                /* STAR-JUNIPER &
MANSFIELD-NORTHFIELD 345KV
  DISCONNECT BRANCH FROM BUS 238850 TO BUS 239122 CKT 1    /*
02JUNIPER 345.00 02STAR 345.00
  DISCONNECT BRANCH FROM BUS 239358 TO BUS 238941 CKT 1    /*
02NFIELD 345.00 02MANSFD 345.00
END
```

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

7. (FE - FE) The 02WELNGT 138/69 kV transformer (from bus 239168 to bus 239167 ckt 3) loads from 98.0% to 99.62% (**DC power flow**) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'C2-BRK-SR055'. This project contributes approximately 5.43 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-SR055'                                /* BROOKSIDE B-59
FAILURE TO TRIP
  DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1    /*
02LNGVIEW 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1    /*
05HOWARD 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 239216 CKT 1    /*
02BRKSID 138.00 02TROY 138.00
  DISCONNECT BRANCH FROM BUS 239319 TO BUS 239318 CKT 1    /*
02CAMDEN 138.00 02HENRTA 138.00
  DISCONNECT BRANCH FROM BUS 239318 TO BUS 238570 CKT 1    /*
02HENRTA 138.00 02BEAVER 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 239076 CKT 1    /*
02BRKSID 138.00 02ROSS 138.00
  DISCONNECT BRANCH FROM BUS 239216 TO BUS 239215 CKT 1    /*
02TROY 138.00 02BRIGHT 138.00
  DISCONNECT BRANCH FROM BUS 239215 TO BUS 239319 CKT 1    /*
02BRIGHT 138.00 02CAMDEN 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3    /*
02BRKSID 138.00 02BRKSID 69.00
```

```

DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4      /*
02BRKSID 138.00 02BRKSID 69.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5      /*
02BRKSID 138.00 02BRKSID 69.00
REDUCE BUS 239319 LOAD BY 100 PERCENT                        /* 02CAMDEN
138.00
REDUCE BUS 239215 LOAD BY 100 PERCENT                        /* 02BRIGHT
138.00
REDUCE BUS 239216 LOAD BY 100 PERCENT                        /* 02TROY 138.00
DISCONNECT BUS 239216                                        /* 02TROY 138.00
DISCONNECT BUS 239215                                        /* 02BRIGHT 138.00
DISCONNECT BUS 239319                                        /* 02CAMDEN 138.00
END

```

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

8. (PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 63.4% to 84.0% (**DC power flow**) of its emergency rating (824 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-9I'. This project contributes approximately 169.74 MW to the thermal violation.

```

CONTINGENCY 'C2_PN230-SB-9I'                                /* HOMER CITY 230 KV
STUCK CB - CB210
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200807 CKT 1
DISCONNECT BRANCH FROM BUS 200807 TO BUS 200808 CKT 1
DISCONNECT BRANCH FROM BUS 200808 TO BUS 200809 CKT 1
REMOVE MACHINE 1 FROM BUS 200809                            /* 0
DISCONNECT BUS 200807
DISCONNECT BUS 200808
DISCONNECT BUS 200809
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200769 CKT 1
END

```

Please refer to Appendix 12 for a table containing the generators having contribution to this flowgate.

9. (PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 55.57% to 82.98% (**DC power flow**) of its emergency rating (437 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2E'. This project contributes approximately 119.8 MW to the thermal violation.

```

CONTINGENCY 'C2_PN345-SB-2E'                                /* ERIE WEST 345 KV
STUCK CB - CB7

```

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Please refer to Appendix 39 for a table containing the generators having contribution to this flowgate.

10. (PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 55.57% to 82.98% (**DC power flow**) of its emergency rating (437 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2E'. This project contributes approximately 119.8 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2E' /* ERIE WEST 345 KV
STUCK CB - CB7
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Please refer to Appendix 40 for a table containing the generators having contribution to this flowgate.

11. (PENELEC - PENELEC) The WARREN-ERIE S TIE 230 kV line (from bus 200811 to bus 200918 ckt 1) loads from 23.69% to 67.37% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 271.22 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A' /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Please refer to Appendix 41 for a table containing the generators having contribution to this flowgate.

12. (PENELEC - PENELEC) The WARREN-ERIE S TIE 230 kV line (from bus 200811 to bus 200918 ckt 1) loads from 23.74% to 67.5% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 271.71 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B' /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END

Please refer to Appendix 43 for a table containing the generators having contribution to this flowgate.

13. (PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 71.65% to 91.63% (**DC power flow**) of its emergency rating (824 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-4G'. This project contributes approximately 164.69 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-4G' /* HOMER CITY 345
KV STUCK CB - CB307
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 1
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200930 CKT 1 /*
HOMER CITY-MAINESBRG 345
END

Please refer to Appendix 46 for a table containing the generators having contribution to this flowgate.

14. (FE - FE) The 02PERRY-02EASTLK 345 kV line (from bus 239036 to bus 238684 ckt 1) loads from 71.25% to 91.79% (**DC power flow**) of its emergency rating (1793 MVA) for the tower line contingency outage of 'C5-TWL-NR057A'. This project contributes approximately 368.29 MW to the thermal violation.

CONTINGENCY 'C5-TWL-NR057A' /* PERRY-LRCR AND
PERRY-NRFD 345KV LINE OUTAGES
OPEN BRANCH FROM BUS 239334 TO BUS 239036 CKT 1 / 239334
02L.CENTER 345 239036 02PERRY 345 1
OPEN BRANCH FROM BUS 239358 TO BUS 239036 CKT 1 / 239358
02NFIELD 345.00 239036 02PERRY 345
END

Please refer to Appendix 49 for a table containing the generators having contribution to this flowgate.

15. (PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 88.75% to 101.11% (**DC power flow**) of its emergency rating (824 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-4A'. This project contributes approximately 101.85 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-4A' /* HOMER CITY 345
KV STUCK CB - CB301

DISCONNECT BRANCH FROM BUS 200769 TO BUS 235999 CKT 1
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 1
END

Please refer to Appendix 53 for a table containing the generators having contribution to this flowgate.

16. (PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 1) loads from 73.55% to 94.06% (**DC power flow**) of its emergency rating (807 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-4H'. This project contributes approximately 165.58 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-4H' /* HOMER CITY 345
KV STUCK CB - CB308
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 2
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200930 CKT 1 /*
HOMER CITY-MAINESBRG 345
END

Please refer to Appendix 55 for a table containing the generators having contribution to this flowgate.

17. (PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200600 to bus 200819 ckt 8) loads from .23% to 58.01% (**DC power flow**) of its emergency rating (868 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 503.55 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B' /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END

Please refer to Appendix 59 for a table containing the generators having contribution to this flowgate.

18. (PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200600 to bus 200819 ckt 8) loads from .23% to 58.01% (**DC power flow**) of its emergency rating (868 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 503.53 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A' /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1

END

Please refer to Appendix 60 for a table containing the generators having contribution to this flowgate.

19. (PENELEC - PENELEC) The ERIE SE-4MILE_230 230 kV line (from bus 200819 to bus 200928 ckt 1) loads from 16.83% to 66.51% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 388.42 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2A'                /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END
```

Please refer to Appendix 67 for a table containing the generators having contribution to this flowgate.

20. (PENELEC - PENELEC) The ERIE SE-4MILE_230 230 kV line (from bus 200819 to bus 200928 ckt 1) loads from 16.88% to 66.56% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 388.72 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2B'                /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END
```

Please refer to Appendix 68 for a table containing the generators having contribution to this flowgate.

21. (PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200819 to bus 200600 ckt 8) loads from .23% to 58.24% (**DC power flow**) of its emergency rating (868 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 503.53 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2A'                /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END
```

Please refer to Appendix 69 for a table containing the generators having contribution to this flowgate.

22. (PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200819 to bus 200600 ckt 8) loads from .23% to 58.24% (**DC power flow**) of its emergency rating (868 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 503.55 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2B'                                /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END
```

Please refer to Appendix 70 for a table containing the generators having contribution to this flowgate.

23. (PENELEC - PENELEC) The UNION CY-ERIE SO. 115 kV line (from bus 200571 to bus 200567 ckt 1) loads from 18.02% to 67.96% (**DC power flow**) of its emergency rating (191 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 101.06 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 77 for a table containing the generators having contribution to this flowgate.

24. (PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200632 to bus 200599 ckt 1) loads from 16.16% to 68.45% (**DC power flow**) of its emergency rating (328 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 220.58 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2B'                                /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END
```

Please refer to Appendix 85 for a table containing the generators having contribution to this flowgate.

25. (PENELEC - PENELEC) The UNION CY-TITUSVIL 115 kV line (from bus 200571 to bus 200585 ckt 1) loads from 48.58% to 84.88% (**DC power flow**) of its emergency rating (120 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 101.06 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 86 for a table containing the generators having contribution to this flowgate.

26. (PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 63.54% to 92.79% (**DC power flow**) of its emergency rating (558 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 163.18 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2A'                                /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END
```

Please refer to Appendix 87 for a table containing the generators having contribution to this flowgate.

27. (PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 63.52% to 92.81% (**DC power flow**) of its emergency rating (558 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 163.47 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2B'                                /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END
```

Please refer to Appendix 88 for a table containing the generators having contribution to this flowgate.

28. (FE - FE) The 02PERRY-02L.CENTER 345 kV line (from bus 239036 to bus 239334 ckt 1) loads from 77.92% to 100.12% (**DC power flow**) of its emergency rating (1673 MVA) for the tower line contingency outage of 'C5-TWL-NR63A'. This project contributes approximately 371.46 MW to the thermal violation.

```
CONTINGENCY 'C5-TWL-NR63A'                                /* PERRY-EASTLAKE
AND PERRY-NORTHFIELD 345KV LINE OUTAGES
  DISCONNECT BRANCH FROM BUS 238684 TO BUS 239036 CKT 1      /*
02EASTLK 345.00 02PERRY 345.00
  DISCONNECT BRANCH FROM BUS 239358 TO BUS 239036 CKT 1      /*
02NFIELD 345.00 02PERRY 345.00
END
```

Please refer to Appendix 89 for a table containing the generators having contribution to this flowgate.

29. (PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 1) loads from 83.17% to 104.23% (**DC power flow**) of its emergency rating (807 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-9E'. This project contributes approximately 169.93 MW to the thermal violation.

```
CONTINGENCY 'C2_PN230-SB-9E'                                /* HOMER CITY 230
KV STUCK CB - CB206
  DISCONNECT BRANCH FROM BUS 200767 TO BUS 200769 CKT 2
  DISCONNECT BRANCH FROM BUS 200767 TO BUS 200837 CKT 1
  REMOVE MACHINE 1 FROM BUS 200837                            /* 0
END
```

Please refer to Appendix 97 for a table containing the generators having contribution to this flowgate.

30. (PENELEC - PENELEC) The WARREN-ERIE S TIE 230 kV line (from bus 200811 to bus 200918 ckt 1) loads from 25.82% to 77.09% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 318.4 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 103 for a table containing the generators having contribution to this flowgate.

31. (PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 60.79% to 95.57% (**DC power flow**) of its emergency rating (558 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 194.1 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 106 for a table containing the generators having contribution to this flowgate.

32. (PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200632 to bus 200599 ckt 3) loads from 17.49% to 74.06% (**DC power flow**) of its emergency rating (306 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 222.68 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2A'                                /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END
```

Please refer to Appendix 110 for a table containing the generators having contribution to this flowgate.

33. (PENELEC - PENELEC) The GLADE-WARREN 230 kV line (from bus 200593 to bus 200811 ckt 1) loads from 42.72% to 91.2% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 298.35 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2A'                                /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END
```

Please refer to Appendix 121 for a table containing the generators having contribution to this flowgate.

34. (PENELEC - PENELEC) The GLADE-WARREN 230 kV line (from bus 200593 to bus 200811 ckt 1) loads from 42.8% to 91.37% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 298.93 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2B'                                /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END
```

Please refer to Appendix 122 for a table containing the generators having contribution to this flowgate.

35. (PENELEC - PENELEC) The VENGO JT-MRGAN ST 115 kV line (from bus 200573 to bus 200575 ckt 1) loads from 35.35% to 90.57% (**DC power flow**) of its emergency rating (149 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 132.77 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 132 for a table containing the generators having contribution to this flowgate.

36. (PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 19.86% to 85.25% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-#8I'. This project contributes approximately 744.75 MW to the thermal violation.

```
CONTINGENCY 'C2_PN230-SB-#8I'                                /* GLADE 230 KV
STUCK CB - CB5 (LEWIS RUN/FOREST)
DISCONNECT BRANCH FROM BUS 200704 TO BUS 200593 CKT 1
DISCONNECT BRANCH FROM BUS 200581 TO BUS 200593 CKT 1
DISCONNECT BRANCH FROM BUS 200704 TO BUS 200097 CKT 1
DISCONNECT BRANCH FROM BUS 200704 TO BUS 200705 CKT 2
DISCONNECT BUS 200704
DISCONNECT BUS 200705
END
```

Please refer to Appendix 137 for a table containing the generators having contribution to this flowgate.

37. (PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 19.86% to 85.25% (**DC power flow**) of its emergency rating (1139 MVA) for the tower line contingency outage of 'C5_PN230-TW-#2'. This project contributes approximately 744.75 MW to the thermal violation.

```
CONTINGENCY 'C5_PN230-TW-#2'                                /* GLADE-FOREST &  
GLADE-LEWIS RUN 230 KV  
DISCONNECT BRANCH FROM BUS 200581 TO BUS 200593 CKT 1  
DISCONNECT BRANCH FROM BUS 200593 TO BUS 200704 CKT 1  
DISCONNECT BRANCH FROM BUS 200704 TO BUS 200097 CKT 1  
DISCONNECT BRANCH FROM BUS 200704 TO BUS 200705 CKT 2  
DISCONNECT BUS 200704  
END
```

Please refer to Appendix 138 for a table containing the generators having contribution to this flowgate.

38. (NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 54.22% to 103.91% (**DC power flow**) of its emergency rating (607 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 301.63 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2A'                                /* ERIE WEST 345 KV  
STUCK CB - CB5  
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1  
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1  
END
```

Please refer to Appendix 139 for a table containing the generators having contribution to this flowgate.

39. (PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 22.14% to 87.51% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN115-SB-23D'. This project contributes approximately 744.56 MW to the thermal violation.

```
CONTINGENCY 'C2_PN115-SB-23D'                                /* ERIE SOUTH 115  
KV STUCK CB - CBD (ERIE SOUTH - ERIE SOUTH XFMR 6)  
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6  
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200600 CKT 5  
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200624 CKT 3  
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200641 CKT 7
```


REDUCE BUS 200568 SHUNT BY 100 PERCENT
 DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
 DISCONNECT BRANCH FROM BUS 200567 TO BUS 200571 CKT 1
 DISCONNECT BRANCH FROM BUS 200572 TO BUS 200567 CKT 1
 DISCONNECT BRANCH FROM BUS 200567 TO BUS 200850 CKT 1
 DISCONNECT BRANCH FROM BUS 200567 TO BUS 200589 CKT 1
 DISCONNECT BUS 200589
 END

Please refer to Appendix 140 for a table containing the generators having contribution to this flowgate.

40. (NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 54.28% to 104.08% (**DC power flow**) of its emergency rating (607 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 302.28 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B' /* ERIE WEST 345 KV
 STUCK CB - CB6
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
 END

Please refer to Appendix 141 for a table containing the generators having contribution to this flowgate.

41. (PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 52.92% to 103.87% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 301.63 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A' /* ERIE WEST 345 KV
 STUCK CB - CB5
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
 END

Please refer to Appendix 144 for a table containing the generators having contribution to this flowgate.

42. (PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 52.98% to 104.05% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 302.28 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B' /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END

Please refer to Appendix 145 for a table containing the generators having contribution to this flowgate.

43. (PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 26.98% to 90.72% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN115-SB-23F'. This project contributes approximately 726.05 MW to the thermal violation.

CONTINGENCY 'C2_PN115-SB-23F' /* ERIE SOUTH 115 KV
STUCK CB - CBF (ERIE SOUTH BUS SECTION CB)
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200571 CKT 1
DISCONNECT BRANCH FROM BUS 200572 TO BUS 200567 CKT 1
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200850 CKT 1
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200589 CKT 1
DISCONNECT BUS 200589
DISCONNECT BRANCH FROM BUS 200927 TO BUS 200820 CKT 1 /*
ERIE S - FOUR MILE
DISCONNECT BRANCH FROM BUS 200820 TO BUS 200819 CKT 1
DISCONNECT BRANCH FROM BUS 200820 TO BUS 200565 CKT 1
DISCONNECT BUS 200565
END

Please refer to Appendix 146 for a table containing the generators having contribution to this flowgate.

44. (PENELEC - PENELEC) The WAYNE 345/115 kV transformer (from bus 200595 to bus 200598 ckt 2) loads from 79.61% to 118.67% (**DC power flow**) of its emergency rating (324 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 126.54 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Please refer to Appendix 149 for a table containing the generators having contribution to this flowgate.

45. (PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 28.61% to 93.37% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN115-SB-23B'. This project contributes approximately 737.59 MW to the thermal violation.

```
CONTINGENCY 'C2_PN115-SB-23B'                                /* ERIE SOUTH 115
KV STUCK CB - CBB (ERIE SOUTH - GESG TAP)
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200850 CKT 1
DISCONNECT BRANCH FROM BUS 200577 TO BUS 200850 CKT 1
DISCONNECT BRANCH FROM BUS 200842 TO BUS 200850 CKT 1
DISCONNECT BUS 200850
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200571 CKT 1
DISCONNECT BRANCH FROM BUS 200572 TO BUS 200567 CKT 1
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200589 CKT 1
DISCONNECT BUS 200589
END
```

Please refer to Appendix 150 for a table containing the generators having contribution to this flowgate.

46. (PENELEC - PENELEC) The GLADE-WARREN 230 kV line (from bus 200593 to bus 200811 ckt 1) loads from 49.13% to 106.52% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 356.42 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 153 for a table containing the generators having contribution to this flowgate.

47. (PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 63.35% to 114.31% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 301.63 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2A'                /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END
```

Please refer to Appendix 154 for a table containing the generators having contribution to this flowgate.

48. (PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 63.41% to 114.47% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 302.28 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2B'                /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END
```

Please refer to Appendix 155 for a table containing the generators having contribution to this flowgate.

49. (PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line (from bus 200928 to bus 200819 ckt 1) loads from 32.48% to 101.53% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 388.42 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2A'                /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END
```

Please refer to Appendix 158 for a table containing the generators having contribution to this flowgate.

50. (PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line (from bus 200928 to bus 200819 ckt 1) loads from 32.52% to 101.62% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 388.72 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B'

/* ERIE WEST 345 KV

STUCK CB - CB6

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

END

Please refer to Appendix 159 for a table containing the generators having contribution to this flowgate.

51. (PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line (from bus 200928 to bus 200819 ckt 1) loads from 37.9% to 105.34% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 393.89 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'

/* ERIE WEST 345 KV

STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Please refer to Appendix 160 for a table containing the generators having contribution to this flowgate.

52. (PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from .25% to 87.8% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-6G'. This project contributes approximately 1000.0 MW to the thermal violation.

CONTINGENCY 'C2_PN230-SB-6G'

/* ERIE SOUTH 230 KV

STUCK CB - CBBS (BUS SECTION BREAKER)

DISCONNECT BRANCH FROM BUS 200819 TO BUS 200820 CKT 1

DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1

DISCONNECT BRANCH FROM BUS 200819 TO BUS 200625 CKT 4

DISCONNECT BRANCH FROM BUS 200819 TO BUS 200600 CKT 8

REDUCE BUS 200819 SHUNT BY 100 PERCENT

DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6

DISCONNECT BRANCH FROM BUS 200568 TO BUS 200600 CKT 5

DISCONNECT BRANCH FROM BUS 200568 TO BUS 200624 CKT 3

DISCONNECT BRANCH FROM BUS 200568 TO BUS 200641 CKT 7

REDUCE BUS 200568 SHUNT BY 100 PERCENT

END

Please refer to Appendix 162 for a table containing the generators having contribution to this flowgate.

53. (PENELEC - PENELEC) The ERIE W-ERIE SO 345 kV line (from bus 200599 to bus 200600 ckt 1) loads from .25% to 88.04% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-6G'. This project contributes approximately 1000.0 MW to the thermal violation.

```
CONTINGENCY 'C2_PN230-SB-6G'                                /* ERIE SOUTH 230 KV
STUCK CB - CBBS (BUS SECTION BREAKER)
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200820 CKT 1
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200625 CKT 4
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200600 CKT 8
REDUCE BUS 200819 SHUNT BY 100 PERCENT
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200600 CKT 5
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200624 CKT 3
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200641 CKT 7
REDUCE BUS 200568 SHUNT BY 100 PERCENT
END
```

Please refer to Appendix 163 for a table containing the generators having contribution to this flowgate.

54. (NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 51.52% to 115.81% (**DC power flow**) of its emergency rating (607 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 374.74 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 164 for a table containing the generators having contribution to this flowgate.

55. (PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 49.99% to 115.88% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 374.74 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
```

END

Please refer to Appendix 165 for a table containing the generators having contribution to this flowgate.

56. (PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200599 to bus 200632 ckt 1) loads from 57.69% to 122.99% (**DC power flow**) of its emergency rating (328 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 220.58 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2B'                /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END
```

Please refer to Appendix 166 for a table containing the generators having contribution to this flowgate.

57. (PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 59.2% to 125.08% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 374.74 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 167 for a table containing the generators having contribution to this flowgate.

58. (PENELEC - PENELEC) The GENEVA-PPGAPI 115 kV line (from bus 200590 to bus 200822 ckt 1) loads from 83.82% to 138.41% (**DC power flow**) of its emergency rating (239 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 137.38 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 168 for a table containing the generators having contribution to this flowgate.

59. (PENELEC - PENELEC) The GRANDVW-TITUSVIL 115 kV line (from bus 200584 to bus 200585 ckt 1) loads from 65.99% to 130.01% (**DC power flow**) of its emergency rating (149 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 101.06 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 169 for a table containing the generators having contribution to this flowgate.

60. (PENELEC - PENELEC) The PPGAPI-MRGAN ST 115 kV line (from bus 200822 to bus 200575 ckt 1) loads from 84.02% to 141.5% (**DC power flow**) of its emergency rating (227 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 137.38 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 170 for a table containing the generators having contribution to this flowgate.

61. (PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200599 to bus 200632 ckt 3) loads from 62.42% to 133.09% (**DC power flow**) of its emergency rating (306 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 222.68 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2A'                                /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END
```


Please refer to Appendix 171 for a table containing the generators having contribution to this flowgate.

62. (PENELEC - PENELEC) The WAYNE-GENEVA 115 kV line (from bus 200598 to bus 200590 ckt 1) loads from 86.94% to 147.35% (**DC power flow**) of its emergency rating (216 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 137.38 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 172 for a table containing the generators having contribution to this flowgate.

63. (PENELEC - PENELEC) The TITUSVIL-UNION CY 115 kV line (from bus 200585 to bus 200571 ckt 1) loads from 56.68% to 138.43% (**DC power flow**) of its emergency rating (120 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 101.06 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```

Please refer to Appendix 174 for a table containing the generators having contribution to this flowgate.

64. (PENELEC - PENELEC) The MRGAN ST-VENGO JT 115 kV line (from bus 200575 to bus 200573 ckt 1) loads from 65.71% to 150.35% (**DC power flow**) of its emergency rating (149 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 132.77 MW to the thermal violation.

```
CONTINGENCY 'C2_PN345-SB-2C'                                /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END
```


Please refer to Appendix 175 for a table containing the generators having contribution to this flowgate.

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

To be determined

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. (FE - FE) The 02BRKSID-02WELNGT 138 kV line (from bus 238586 to bus 239168 ckt 1) loads from 104.81% to 106.56% (**DC power flow**) of its emergency rating (86 MVA) for the bus fault outage of 'C1-BUS-SR006'. This project contributes approximately 5.43 MW to the thermal violation.

CONTINGENCY 'C1-BUS-SR006'	/* BROOKSIDE 138
SOUTH BUS FAULT, B-28 FAILURE TO TRIP, B-5 FAILURE TO TRIP	
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3	/*
02BRKSID 138.00 02BRKSID 69.00	
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4	/*
02BRKSID 138.00 02BRKSID 69.00	
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5	/*
02BRKSID 138.00 02BRKSID 69.00	
DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1	/*
05HOWARD 138.00 02BRKSID 138.00	
DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1	/*
02LNGVEW 138.00 02BRKSID 138.00	
DISCONNECT BRANCH FROM BUS 239076 TO BUS 238586 CKT 1	/*
02ROSS 138.00 02BRKSID 138.00	
DISCONNECT BRANCH FROM BUS 239216 TO BUS 238586 CKT 1	/*
02TROY 138.00 02BRKSID 138.00	
END	

Please refer to Appendix 34 for a table containing the generators having contribution to this flowgate.

2. (FE - FE) The 02BRKSID-02WELNGT 138 kV line (from bus 238586 to bus 239168 ckt 1) loads from 104.81% to 106.56% (**DC power flow**) of its emergency rating (86 MVA) for the line fault with failed breaker contingency outage of 'C2-BRK-SR054'. This project contributes approximately 5.43 MW to the thermal violation.

CONTINGENCY 'C2-BRK-SR054'	/* BROOKSIDE B-30
FAILURE TO TRIP	

```

DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1      /*
02LNGVIEW 138.00 02BRKSID 138.00
DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1      /*
05HOWARD 138.00 02BRKSID 138.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 239216 CKT 1      /*
02BRKSID 138.00 02TROY 138.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 239076 CKT 1      /*
02BRKSID 138.00 02ROSS 138.00
DISCONNECT BRANCH FROM BUS 239076 TO BUS 239237 CKT 1      /*
02ROSS 138.00 02CLVR-S 138.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3      /*
02BRKSID 138.00 02BRKSID 69.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4      /*
02BRKSID 138.00 02BRKSID 69.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5      /*
02BRKSID 138.00 02BRKSID 69.00
REDUCE BUS 239076 LOAD BY 100 PERCENT                        /* 02ROSS 138.00
DISCONNECT BUS 239076                                       /* 02ROSS 138.00
END

```

Please refer to Appendix 35 for a table containing the generators having contribution to this flowgate.

3. (FE - FE) The 02BRKSID-02WELNGT 138 kV line (from bus 238586 to bus 239168 ckt 1) loads from 105.98% to 107.73% (**DC power flow**) of its emergency rating (86 MVA) for the line fault with failed breaker contingency outage of 'C2-BRK-SR055'. This project contributes approximately 5.43 MW to the thermal violation.

```

CONTINGENCY 'C2-BRK-SR055'                                /* BROOKSIDE B-59
FAILURE TO TRIP
DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1      /*
02LNGVIEW 138.00 02BRKSID 138.00
DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1      /*
05HOWARD 138.00 02BRKSID 138.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 239216 CKT 1      /*
02BRKSID 138.00 02TROY 138.00
DISCONNECT BRANCH FROM BUS 239319 TO BUS 239318 CKT 1      /*
02CAMDEN 138.00 02HENRTA 138.00
DISCONNECT BRANCH FROM BUS 239318 TO BUS 238570 CKT 1      /*
02HENRTA 138.00 02BEAVER 138.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 239076 CKT 1      /*
02BRKSID 138.00 02ROSS 138.00
DISCONNECT BRANCH FROM BUS 239216 TO BUS 239215 CKT 1      /*
02TROY 138.00 02BRIGHT 138.00
DISCONNECT BRANCH FROM BUS 239215 TO BUS 239319 CKT 1      /*
02BRIGHT 138.00 02CAMDEN 138.00

```

DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3 /*
 02BRKSID 138.00 02BRKSID 69.00
 DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4 /*
 02BRKSID 138.00 02BRKSID 69.00
 DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5 /*
 02BRKSID 138.00 02BRKSID 69.00
 REDUCE BUS 239319 LOAD BY 100 PERCENT /* 02CAMDEN
 138.00
 REDUCE BUS 239215 LOAD BY 100 PERCENT /* 02BRIGHT
 138.00
 REDUCE BUS 239216 LOAD BY 100 PERCENT /* 02TROY 138.00
 DISCONNECT BUS 239216 /* 02TROY 138.00
 DISCONNECT BUS 239215 /* 02BRIGHT 138.00
 DISCONNECT BUS 239319 /* 02CAMDEN 138.00
 END

Please refer to Appendix 37 for a table containing the generators having contribution to this flowgate.

4. (PENELEC - PENELEC) The SHAWVL 1 230/1 kV transformer (from bus 999456 to bus 200710 ckt 1A) loads from 109.21% to 110.19% (**DC power flow**) of its emergency rating (143 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-14B_A'. This project contributes approximately 7.35 MW to the thermal violation.

CONTINGENCY 'C2_PN230-SB-14B_A' /* LEWISTOWN 230
 KV STUCK CB - CB (LEWISTOWN - RAYSTOWN)
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 914320 CKT 1
 DISCONNECT BRANCH FROM BUS 200517 TO BUS 200539 CKT 1
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 235248 CKT 1
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548
 CKT 2
 END

Please refer to Appendix 42 for a table containing the generators having contribution to this flowgate.

5. (FE - FE) The 02AVON 345/138 kV transformer (from bus 238551 to bus 238552 ckt 91) loads from 113.12% to 113.17% (**DC power flow**) of its emergency rating (627 MVA) for the line fault with failed breaker contingency outage of 'C2-BRK-NR04A'. This project contributes approximately 46.39 MW to the thermal violation.

CONTINGENCY 'C2-BRK-NR04A' /* BREAKER FAILURE
 ON Q-92-AV-T @ AV

DISCONNECT BRANCH FROM BUS 238551 TO BUS 238552 CKT 92 /*
02AVON 345.00 02AVON 138.00
REMOVE MACHINE 9 FROM BUS 238555 /* 02AVONG9 20.00
DISCONNECT BRANCH FROM BUS 238551 TO BUS 238850 CKT 1 /*
02AVON 345.00 02JUNIPER 345.00
END

Please refer to Appendix 50 for a table containing the generators having contribution to this flowgate.

6. (PENELEC - PENELEC) The E.TWANDA 230/115 kV transformer (from bus 200675 to bus 200674 ckt 4) loads from 107.79% to 111.89% (**DC power flow**) of its emergency rating (241 MVA) for the bus fault outage of 'C1_PN230-BS-#5A'. This project contributes approximately 28.92 MW to the thermal violation.

CONTINGENCY 'C1_PN230-BS-#5A' /* EAST TOWANDA
#1 230 KV BUS FAULT
DISCONNECT BRANCH FROM BUS 200701 TO BUS 200675 CKT 1
DISCONNECT BRANCH FROM BUS 200675 TO BUS 130763 CKT 1
DISCONNECT BRANCH FROM BUS 200674 TO BUS 200675 CKT 3
END

Please refer to Appendix 64 for a table containing the generators having contribution to this flowgate.

7. (PENELEC - PENELEC) The E.TWANDA 230/115 kV transformer (from bus 200675 to bus 200674 ckt 4) loads from 107.79% to 111.89% (**DC power flow**) of its emergency rating (241 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-#3F'. This project contributes approximately 28.92 MW to the thermal violation.

CONTINGENCY 'C2_PN230-SB-#3F' /* EAST TOWANDA
230 KV STUCK CB - (#3 XF)
DISCONNECT BRANCH FROM BUS 200675 TO BUS 130763 CKT 1
DISCONNECT BRANCH FROM BUS 200701 TO BUS 200675 CKT 1
DISCONNECT BRANCH FROM BUS 200674 TO BUS 200675 CKT 3
END

Please refer to Appendix 65 for a table containing the generators having contribution to this flowgate.

8. (PENELEC - PENELEC) The CNYO&G-N.MESHPN 230 kV line (from bus 200924 to bus 200706 ckt 1F) loads from 100.15% to 112.91% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 62.24 MW to the thermal violation.

Please refer to Appendix 96 for a table containing the generators having contribution to this flowgate.

9. (PENELEC - PENELEC) The ROCKWOOD-Q34 115 kV line (from bus 200746 to bus 290079 ckt 1) loads from 124.37% to 126.02% (**DC power flow**) of its emergency rating (166 MVA) for the bus fault outage of 'AP_C1_11'. This project contributes approximately 11.06 MW to the thermal violation.

CONTINGENCY 'AP_C1_11' /CUMBERLAND_138
OPEN BUS 235454
OPEN BUS 237027
END

Please refer to Appendix 100 for a table containing the generators having contribution to this flowgate.

10. (PENELEC - PENELEC) The E.TWANDA-CNYO&G 230 kV line (from bus 200675 to bus 200924 ckt 1F) loads from 108.13% to 119.47% (**DC power flow**) of its emergency rating (549 MVA) for the single line contingency outage of 'SUSQ 1'. This project contributes approximately 62.24 MW to the thermal violation.

CONTINGENCY 'SUSQ 1'
REMOVE MACHINE 1 FROM BUS 208918
END

Please refer to Appendix 105 for a table containing the generators having contribution to this flowgate.

11. (PENELEC - PENELEC) The E.TWANDA-CNYO&G 230 kV line (from bus 200675 to bus 200924 ckt 1F) loads from 106.22% to 118.97% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 62.24 MW to the thermal violation.

Please refer to Appendix 108 for a table containing the generators having contribution to this flowgate.

12. (PENELEC - PL) The OXBOW-LACK 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 110.4% to 123.72% (**DC power flow**) of its emergency rating (624 MVA) for the single line contingency outage of 'PJM SUSQ-LACK 500'. This project contributes approximately 83.16 MW to the thermal violation.

CONTINGENCY 'PJM SUSQ-LACK 500'

OPEN BRANCH FROM BUS 200022 TO BUS 200074 CKT 1 /* 22 SUSQ
500 74 LACKAW 500 1
END

Please refer to Appendix 115 for a table containing the generators having contribution to this flowgate.

13. (PENELEC - PENELEC) The N.MESHPN-OXBOW 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 110.6% to 123.87% (**DC power flow**) of its emergency rating (617 MVA) for the single line contingency outage of 'PJM SUSQ-LACK 500'. This project contributes approximately 81.87 MW to the thermal violation.

CONTINGENCY 'PJM SUSQ-LACK 500'
OPEN BRANCH FROM BUS 200022 TO BUS 200074 CKT 1 /* 22 SUSQ
500 74 LACKAW 500 1
END

Please refer to Appendix 116 for a table containing the generators having contribution to this flowgate.

14. (PENELEC - PL) The OXBOW-LACK 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 114.16% to 131.16% (**DC power flow**) of its normal rating (494 MVA) for non-contingency condition. This project contributes approximately 83.94 MW to the thermal violation.

Please refer to Appendix 135 for a table containing the generators having contribution to this flowgate.

15. (PENELEC - PENELEC) The N.MESHPN-OXBOW 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 115.79% to 133.08% (**DC power flow**) of its normal rating (478 MVA) for non-contingency condition. This project contributes approximately 82.64 MW to the thermal violation.

Please refer to Appendix 136 for a table containing the generators having contribution to this flowgate.

16. (PENELEC - PENELEC) The Q34-SOMERST 115 kV line (from bus 290079 to bus 200744 ckt 1) loads from 166.63% to 168.28% (**DC power flow**) of its emergency rating (166 MVA) for the bus fault outage of 'AP_C1_11'. This project contributes approximately 11.06 MW to the thermal violation.

CONTINGENCY 'AP_C1_11' /CUMBERLAND_138

OPEN BUS 235454
OPEN BUS 237027
END

Please refer to Appendix 157 for a table containing the generators having contribution to this flowgate.

Steady-State Voltage Requirements

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

To be determined

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined

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)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)*

None

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.

Not Applicable

Appendices for secondary POI

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 gauge 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

(FE - FE) The 02WELNGT 138/69 kV transformer (from bus 239168 to bus 239167 ckt 3) loads from 96.93% to 98.54% (**DC power flow**) of its emergency rating (93 MVA) for the bus fault outage of 'C1-BUS-SR006'. This project contributes approximately 5.43 MW to the thermal violation.

CONTINGENCY 'C1-BUS-SR006' /* BROOKSIDE 138
SOUTH BUS FAULT, B-28 FAILURE TO TRIP, B-5 FAILURE TO TRIP
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3 /*
02BRKSID 138.00 02BRKSID 69.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4 /*
02BRKSID 138.00 02BRKSID 69.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5 /*
02BRKSID 138.00 02BRKSID 69.00
DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1 /*
05HOWARD 138.00 02BRKSID 138.00
DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1 /*
02LNGVEW 138.00 02BRKSID 138.00
DISCONNECT BRANCH FROM BUS 239076 TO BUS 238586 CKT 1 /*
02ROSS 138.00 02BRKSID 138.00
DISCONNECT BRANCH FROM BUS 239216 TO BUS 238586 CKT 1 /*
02TROY 138.00 02BRKSID 138.00
END

Bus Number	Bus Name	Full Contribution
900404	X3-028 C	0.76
900405	X3-028 E	1.02
Y2-068	Y2-068	8.99
915771	Y3-092 OP2	5.43

Appendix 2

(FE - FE) The 02WELNGT 138/69 kV transformer (from bus 239168 to bus 239167 ckt 3) loads from 96.93% to 98.54% (**DC power flow**) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'C2-BRK-SR054'. This project contributes approximately 5.43 MW to the thermal violation.

```

CONTINGENCY 'C2-BRK-SR054'                                /* BROOKSIDE B-30
FAILURE TO TRIP
  DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1    /*
02LNGVEW 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1    /*
05HOWARD 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 239216 CKT 1    /*
02BRKSID 138.00 02TROY 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 239076 CKT 1    /*
02BRKSID 138.00 02ROSS 138.00
  DISCONNECT BRANCH FROM BUS 239076 TO BUS 239237 CKT 1    /*
02ROSS 138.00 02CLVR-S 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3    /*
02BRKSID 138.00 02BRKSID 69.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4    /*
02BRKSID 138.00 02BRKSID 69.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5    /*
02BRKSID 138.00 02BRKSID 69.00
  REDUCE BUS 239076 LOAD BY 100 PERCENT                      /* 02ROSS 138.00
  DISCONNECT BUS 239076                                     /* 02ROSS 138.00
END
  
```

Bus Number	Bus Name	Full Contribution
900404	X3-028 C	0.76
900405	X3-028 E	1.02
Y2-068	Y2-068	8.99
915771	Y3-092 OP2	5.43

Appendix 3

(PENELEC - PENELEC) The Y1-033 TAP-ROCKWOOD 115 kV line (from bus 913140 to bus 200746 ckt 1) loads from 97.37% to 98.92% (**DC power flow**) of its emergency rating (174 MVA) for the bus fault outage of 'AP_C1_5'. This project contributes approximately 10.46 MW to the thermal violation.

CONTINGENCY 'AP_C1_5' /BLACKOAK_138_A
OPEN BRANCH FROM BUS 235446 TO BUS 235103 CKT 3
OPEN BUS 237025
END

Bus Number	Bus Name	Full Contribution
235564	ALBRIGHT 1	5.56
235565	ALBRIGHT 2	5.56
235566	ALBRIGHT 3	10.43
200840	DEEPCRK1	0.12
200841	DEEPCRK2	0.12
292090	J-007	9.49
292380	K-026	2.37
292401	K--28 C2	6.66
293381	N-047 E	6.54
290228	S-014 C	0.08
290229	S-014 E	7.23
885641	T-016 C	0.5
885642	T-016 E	1.99
929522	U2-030 E	5.14
293023	U2-073C OP1	0.13
293024	U2-073E OP1	18.64
236001	WARRIOR RUN	0.95
900404	X3-028 C	1.16
900405	X3-028 E	1.55
913001	Y1-003 C OP1	2.76
913002	Y1-003 E OP1	18.49
913141	Y1-033 C OP1	2.98
913142	Y1-033 E OP1	19.93
Y2-068	Y2-068	14.1
915771	Y3-092 OP2	10.46
200813	YOUGH	0.13

Appendix 4

(PENELEC - PENELEC) The Y1-033 TAP-ROCKWOOD 115 kV line (from bus 913140 to bus 200746 ckt 1) loads from 97.37% to 98.92% (**DC power flow**) of its emergency rating (174 MVA) for the bus fault outage of 'AP_C1_4'. This project contributes approximately 10.46 MW to the thermal violation.

CONTINGENCY 'AP_C1_4' /BLACKOAK_500_A
OPEN BRANCH FROM BUS 235103 TO BUS 235446 CKT 3
OPEN BUS 237001
OPEN BUS 237004
OPEN BUS 235130
END

Bus Number	Bus Name	Full Contribution
235564	ALBRIGHT 1	5.56
235565	ALBRIGHT 2	5.56
235566	ALBRIGHT 3	10.43
200840	DEEPCRK1	0.12
200841	DEEPCRK2	0.12
292090	J-007	9.49
292380	K-026	2.37
292401	K--28 C2	6.66
293381	N-047 E	6.54
290228	S-014 C	0.08
290229	S-014 E	7.23
885641	T-016 C	0.5
885642	T-016 E	1.99
929522	U2-030 E	5.14
293023	U2-073C OP1	0.13
293024	U2-073E OP1	18.64
236001	WARRIOR RUN	0.95
900404	X3-028 C	1.16
900405	X3-028 E	1.55
913001	Y1-003 C OP1	2.76
913002	Y1-003 E OP1	18.49
913141	Y1-033 C OP1	2.98
913142	Y1-033 E OP1	19.93
Y2-068	Y2-068	14.1
915771	Y3-092 OP2	10.46
200813	YOUGH	0.13

Appendix 5

(PENELEC - PENELEC) The Y1-033 TAP-ROCKWOOD 115 kV line (from bus 913140 to bus 200746 ckt 1) loads from 97.37% to 98.92% (**DC power flow**) of its emergency rating (174 MVA) for the bus fault outage of '4'. This project contributes approximately 10.46 MW to the thermal violation.

CONTINGENCY '4' /BLACKOAK_500_A
 OPEN BRANCH FROM BUS 235103 TO BUS 235446 CKT 3 / BUS
 253103 -> 235103.
 OPEN BUS 237001
 END

Bus Number	Bus Name	Full Contribution
235564	ALBRIGHT 1	5.56
235565	ALBRIGHT 2	5.56
235566	ALBRIGHT 3	10.43
200840	DEEPCRK1	0.12
200841	DEEPCRK2	0.12
292090	J-007	9.49
292380	K-026	2.37
292401	K--28 C2	6.66
293381	N-047 E	6.54
290228	S-014 C	0.08
290229	S-014 E	7.23
885641	T-016 C	0.5
885642	T-016 E	1.99
929522	U2-030 E	5.14
293023	U2-073C OP1	0.13
293024	U2-073E OP1	18.64
236001	WARRIOR RUN	0.95
900404	X3-028 C	1.16
900405	X3-028 E	1.55
913001	Y1-003 C OP1	2.76
913002	Y1-003 E OP1	18.49
913141	Y1-033 C OP1	2.98
913142	Y1-033 E OP1	19.93
Y2-068	Y2-068	14.1
915771	Y3-092 OP2	10.46
200813	YOUGH	0.13

Appendix 6

(PENELEC - PENELEC) The GESG TAP-ERIE SO. 115 kV line (from bus 200850 to bus 200567 ckt 1) loads from 7.38% to 54.07% (**DC power flow**) of its emergency rating (245 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 145.4 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	1.33
884781	S-058 E	4.37
907481	X1-109	-22.42
915771	Y3-092 OP2	145.4

Appendix 7

(FE - FE) The 02HANNA-02JUNIPER 345 kV line (from bus 238781 to bus 238850 ckt 1) loads from 80.15% to 90.61% (**DC power flow**) of its emergency rating (1554 MVA) for the tower line contingency outage of 'C5-TWL-NR066'. This project contributes approximately 162.51 MW to the thermal violation.

```
CONTINGENCY 'C5-TWL-NR066'                                /* STAR-JUNIPER &
MANSFIELD-NORTHFIELD 345KV
  DISCONNECT BRANCH FROM BUS 238850 TO BUS 239122 CKT 1    /*
02JUNIPER 345.00 02STAR 345.00
  DISCONNECT BRANCH FROM BUS 239358 TO BUS 238941 CKT 1    /*
02NFIELD 345.00 02MANSFD 345.00
END
```

Bus Number	Bus Name	Full Contribution
240967	02-G689	26.67
240213	02-H093	0.54
239006	02NILEG1	9.35
239007	02NILEG2	9.26
253922	15STJOE1	5.89
905031	W4-001A_AT9	0.22
905061	W4-004A_AT10	1.31
913041	Y1-015 C	68.21
913042	Y1-015 E	10.19
915771	Y3-092 OP2	162.51

Appendix 8

(FE - FE) The 02WELNGT 138/69 kV transformer (from bus 239168 to bus 239167 ckt 3) loads from 98.0% to 99.62% (**DC power flow**) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'C2-BRK-SR055'. This project contributes approximately 5.43 MW to the thermal violation.

```

CONTINGENCY 'C2-BRK-SR055'                                /* BROOKSIDE B-59
FAILURE TO TRIP
  DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1    /*
02LNGVIEW 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1    /*
05HOWARD 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 239216 CKT 1    /*
02BRKSID 138.00 02TROY 138.00
  DISCONNECT BRANCH FROM BUS 239319 TO BUS 239318 CKT 1    /*
02CAMDEN 138.00 02HENRTA 138.00
  DISCONNECT BRANCH FROM BUS 239318 TO BUS 238570 CKT 1    /*
02HENRTA 138.00 02BEAVER 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 239076 CKT 1    /*
02BRKSID 138.00 02ROSS 138.00
  DISCONNECT BRANCH FROM BUS 239216 TO BUS 239215 CKT 1    /*
02TROY 138.00 02BRIGHT 138.00
  DISCONNECT BRANCH FROM BUS 239215 TO BUS 239319 CKT 1    /*
02BRIGHT 138.00 02CAMDEN 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3    /*
02BRKSID 138.00 02BRKSID 69.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4    /*
02BRKSID 138.00 02BRKSID 69.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5    /*
02BRKSID 138.00 02BRKSID 69.00
  REDUCE BUS 239319 LOAD BY 100 PERCENT                      /* 02CAMDEN
138.00
  REDUCE BUS 239215 LOAD BY 100 PERCENT                      /* 02BRIGHT
138.00
  REDUCE BUS 239216 LOAD BY 100 PERCENT                      /* 02TROY 138.00
  DISCONNECT BUS 239216                                       /* 02TROY 138.00
  DISCONNECT BUS 239215                                       /* 02BRIGHT 138.00
  DISCONNECT BUS 239319                                       /* 02CAMDEN 138.00
END

```

Bus Number	Bus Name	Full Contribution
900404	X3-028 C	0.76
900405	X3-028 E	1.02
Y2-068	Y2-068	8.99
915771	Y3-092 OP2	5.43

Appendix 9

(PENELEC - PENELEC) The MRGAN ST-VENGO JT 115 kV line (from bus 200575 to bus 200573 ckt 1) loads from 20.69% to 61.09% (**DC power flow**) of its emergency rating (149 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 60.2 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200662	SCRUB GR	0.26
910651	X3-039	34.17
915771	Y3-092 OP2	60.2

Appendix 10

(AEP - AEP) The 05KAMMER-05WBELLA 345 kV line (from bus 242937 to bus 242948 ckt 1) loads from 95.64% to 99.57% (**DC power flow**) of its emergency rating (1176 MVA) for the single line contingency outage of '41_B2_TOR544'. This project contributes approximately 68.75 MW to the thermal violation.

CONTINGENCY '41_B2_TOR544'

OPEN BRANCH FROM BUS 242925 TO BUS 242930 CKT 1 / 242925
05KAMMER 765 242930 05SCANTO 765 1

OPEN BRANCH FROM BUS 242930 TO BUS 242943 CKT 3 / 242930
05SCANTO 765 242943 05SCANTO 345 3

OPEN BRANCH FROM BUS 242943 TO BUS 243092 CKT 4 / 242943
05SCANTO 345 243092 05SCANTE 138 4

END

Bus Number	Bus Name	Full Contribution
243192	05KMG1H	20.06
243193	05KMG1L	17.09
243194	05KMG2H	20.06
243195	05KMG2L	17.09
243196	05KMG3H	20.06
243197	05KMG3L	17.09
243188	05MLG1	3.36
243189	05MLG2	8.27
242894	05MTG1	3.11
253922	15STJOE1	-9.83
235344	HANNIBAL	0.1
235590	PLEASANTS 1	1.5
235591	PLEASANTS 2	1.5
290784	S-070 1	0.04
290785	S-070 2	0.04
235577	WILLOW I 1	2.76
235578	WILLOW I 2	8.55
900404	X3-028 C	1.44
900405	X3-028 E	1.92
910701	X3-051	31.37
913181	Y1-044	0.35
914121	Y2-054	0.7
915131	Y3-036	1.85
915481	Y3-068 OP2	143.33
915771	Y3-092 OP2	68.75

Appendix 11

(AP - AP) The BURMA 138/115 kV transformer (from bus 235150 to bus 235151 ckt 1) loads from 54.5% to 79.11% (**DC power flow**) of its emergency rating (254 MVA) for the single line contingency outage of 'B_PN345-SX-#6'. This project contributes approximately 62.5 MW to the thermal violation.

CONTINGENCY 'B_PN345-SX-#6' /* HANDSOME LAKE -
WAYNE (WHL) 345 KV - (PJM-PN33A)
DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
235567	ARMSTRONG 1	20.82
235569	ARMSTRONG 2	20.7
292548	T-155	0.02
913311	Y1-071	0.08
915771	Y3-092 OP2	62.5

Appendix 12

(PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 63.4% to 84.0% (**DC power flow**) of its emergency rating (824 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-9I'. This project contributes approximately 169.74 MW to the thermal violation.

CONTINGENCY 'C2_PN230-SB-9I'
STUCK CB - CB210

/* HOMER CITY 230 KV

DISCONNECT BRANCH FROM BUS 200767 TO BUS 200807 CKT 1
DISCONNECT BRANCH FROM BUS 200807 TO BUS 200808 CKT 1
DISCONNECT BRANCH FROM BUS 200808 TO BUS 200809 CKT 1
REMOVE MACHINE 1 FROM BUS 200809 /* 0
DISCONNECT BUS 200807
DISCONNECT BUS 200808
DISCONNECT BUS 200809
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200769 CKT 1
END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	19.52
200887	ARMNA MT P47	0.24
235567	ARMSTRONG 1	29.43
235569	ARMSTRONG 2	29.26
203261	BLOSSBCT	0.21
200828	HNSMLK 1	0.72
200829	HNSMLK 2	0.72
200830	HNSMLK 3	0.72
200831	HNSMLK 4	0.72
200832	HNSMLK 5	0.72
200838	HOMER C2	14.67
200839	HOMER C3	15.53
200849	LAKVU GN	0.04
200857	LAURHILL	8.75
203283	MANOR	0.01
293270	N-036 C	2.91
293271	N-036 E	11.65
294573	P-028 E	16.64
200888	P-047 E	20.98
200649	PENNTECH	0.32
290113	Q-063 C	0.16
296914	R-092 C	1.42
296915	R-092 E	5.68
291011	S-103	0.55
200662	SCRUB GR	0.62

200642	SENECA#1	2.1
200643	SENECA#2	1.95
200644	SENECA#3	0.3
200715	SHAWVL 1	9.81
200722	SHAWVL 2	10.01
200665	SHAWVL 3	16.23
292391	T-121C	4.4
292392	T-121E	17.61
297050	V2-019 E	< 0.01
293416	V3-042C	2.13
293417	V3-042E	14.28
901211	W1-070A_AT4	0.52
901212	W1-070A_AT4	3.47
903651	W3-099 C OP1	2.47
903652	W3-099 E OP1	16.52
907481	X1-109	123.
910522	X3-003 E	2.77
910651	X3-039	18.59
X3-050	X3-050	25.33
913401	Y1-012	0.07
913131	Y1-032 C	3.76
913132	Y1-032 E	25.17
913191	Y1-047 OP1	2.14
914061	Y2-042	1.89
Y2-044	Y2-044	41.
914131	Y2-055	10.71
914151	Y2-060	0.49
914421	Y2-104	0.89
915331	Y3-062 C	0.46
915332	Y3-062 E	3.14
915771	Y3-092 OP2	169.74

Appendix 13

(PENELEC - PENELEC) The GORE JCT-FRVIEW E 115 kV line (from bus 200577 to bus 200578 ckt 1) loads from 11.24% to 58.31% (**DC power flow**) of its emergency rating (333 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 193.72 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
 ERIE SO 345.00 LINE OUTAGE
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
 ERIE W 345.00 ERIE SO 345.00
 END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.04
203261	BLOSSBCT	0.04
200849	LAKVU GN	0.04
293270	N-036 C	0.58
200649	PENNTECH	0.12
290113	Q-063 C	0.07
291011	S-103	0.33
200642	SENECA#1	0.94
200643	SENECA#2	0.87
200644	SENECA#3	0.13
292391	T-121C	0.94
293416	V3-042C	0.61
903651	W3-099 C OP1	2.39
X3-050	X3-050	8.16
913401	Y1-012	0.03
913131	Y1-032 C	0.78
Y2-044	Y2-044	13.21
914131	Y2-055	6.54
915331	Y3-062 C	0.43
915771	Y3-092 OP2	193.72

Appendix 14

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 119.67 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.91
913401	Y1-012	0.02
913131	Y1-032 C	0.96
Y2-044	Y2-044	12.81
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092 OP2	119.67

Appendix 15

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 119.67 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.91
913401	Y1-012	0.02
913131	Y1-032 C	0.96
Y2-044	Y2-044	12.81
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092 OP2	119.67

Appendix 16

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 119.67 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.91
913401	Y1-012	0.02

913131	Y1-032 C	0.96
Y2-044	Y2-044	12.81
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092 OP2	119.67

Appendix 17

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 119.67 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.91
913401	Y1-012	0.02
913131	Y1-032 C	0.96
Y2-044	Y2-044	12.81
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092 OP2	119.67

Appendix 18

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 119.67 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00
END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.91
913401	Y1-012	0.02
913131	Y1-032 C	0.96
Y2-044	Y2-044	12.81
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092 OP2	119.67

Appendix 19

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 50.8% to 78.18% (**DC power flow**) of its emergency rating (437 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 119.67 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200837	HOMER C1	2.21
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.61
200643	SENECA#2	0.57
200644	SENECA#3	0.09
200833	SEWRDB34	1.35
200809	SITHE	0.13
292391	T-121C	1.11
293416	V3-042C	0.64
903651	W3-099 C OP1	1.38
910651	X3-039	10.72
X3-050	X3-050	7.91
913401	Y1-012	0.02

913131	Y1-032 C	0.96
Y2-044	Y2-044	12.81
914131	Y2-055	4.01
915331	Y3-062 C	0.25
915771	Y3-092 OP2	119.67

Appendix 20

(FE - FE) The 02AUSTQ2-02SP Q-2 138 kV line (from bus 239212 to bus 239113 ckt 1) loads from 11.0% to 58.27% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	45.85
200849	LAKVU GN	0.01
901211	W1-070A_AT4	1.2
903651	W3-099 C OP1	0.81
910651	X3-039	5.7
915331	Y3-062 C	0.15
915771	Y3-092 OP2	71.38

Appendix 21

(FE - FE) The 02SBRNQ4-02SP Q-4 138 kV line (from bus 239098 to bus 239115 ckt 1) loads from 7.61% to 56.75% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 74.2 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	43.95
200828	HNSMLK 1	0.13
200829	HNSMLK 2	0.13
200830	HNSMLK 3	0.13
200831	HNSMLK 4	0.13
200832	HNSMLK 5	0.13
200849	LAKVU GN	0.02
901211	W1-070A_AT4	1.15
903651	W3-099 C OP1	0.84
910651	X3-039	5.92
915331	Y3-062 C	0.15
915771	Y3-092 OP2	74.2

Appendix 22

(PENELEC - PENELEC) The 4MILE_115-ERIE SE 115 kV line (from bus 200927 to bus 200820 ckt 1) loads from 40.09% to 73.06% (**DC power flow**) of its emergency rating (228 MVA) for the single line contingency outage of 'B_PN230-SX-#17A'. This project contributes approximately 67.96 MW to the thermal violation.

CONTINGENCY 'B_PN230-SX-#17A'
FOURMILE 230 KV

/* ERIE EAST -

DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1 /*
ERIE SE 230.00 FOURMILE 230.00
END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.06
203261	BLOSSBCT	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.14
293270	N-036 C	0.57
294572	P-028 C	0.07
291011	S-103	0.29
292391	T-121C	0.81
293416	V3-042C	0.84
903651	W3-099 C OP1	4.7
907481	X1-109	44.87
X3-050	X3-050	12.23
912251	X4-048 OP1	17.21
913401	Y1-012	0.04
913131	Y1-032 C	0.72
913191	Y1-047 OP1	0.83
Y2-044	Y2-044	19.81
914131	Y2-055	5.6
914151	Y2-060	0.19
914421	Y2-104	0.35
915331	Y3-062 C	0.84
915771	Y3-092 OP2	67.96

Appendix 23

(AP - PENELEC) The BURMA-PINEY 115 kV line (from bus 235151 to bus 200583 ckt 1) loads from 56.05% to 81.35% (**DC power flow**) of its emergency rating (247 MVA) for the single line contingency outage of 'B_PN345-SX-#6'. This project contributes approximately 62.5 MW to the thermal violation.

CONTINGENCY 'B_PN345-SX-#6' /* HANDSOME LAKE -
WAYNE (WHL) 345 KV - (PJM-PN33A)
DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
235567	ARMSTRONG 1	20.82
235569	ARMSTRONG 2	20.7
292548	T-155	0.02
913311	Y1-071	0.08
915771	Y3-092 OP2	62.5

Appendix 24

(AP - PENELEC) The BURMA-PINEY 115 kV line (from bus 235151 to bus 200583 ckt 1) loads from 56.05% to 81.35% (**DC power flow**) of its emergency rating (247 MVA) for the single line contingency outage of 'B_PN345-SX-#6'. This project contributes approximately 62.5 MW to the thermal violation.

CONTINGENCY 'B_PN345-SX-#6' /* HANDSOME LAKE -
WAYNE (WHL) 345 KV - (PJM-PN33A)
DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
235567	ARMSTRONG 1	20.82
235569	ARMSTRONG 2	20.7
292548	T-155	0.02
913311	Y1-071	0.08
915771	Y3-092 OP2	62.5

Appendix 25

(PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200599 to bus 200632 ckt 1) loads from 35.37% to 71.1% (**DC power flow**) of its emergency rating (328 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 127.35 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
907481	X1-109	-23.88
915771	Y3-092 OP2	127.35

Appendix 26

(AP - AP) The PARADISE JCT-BUTLER 138 kV line (from bus 235141 to bus 235152 ckt 1) loads from 16.17% to 61.63% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
 PERRY-AT-ERIE W 345 CK 1
 DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
 02PERRY 345.00 02AT 345.00
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
 02AT 345.00 02S8-ATT 345.00
 DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
 02S8-ATT 345.00 02ASH_3 138.00
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
 02AT 345.00 ERIE W 345.00
 END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
200887	ARMNA MT P47	0.05
235567	ARMSTRONG 1	28.95
235569	ARMSTRONG 2	28.78
203261	BLOSSBCT	0.04
200805	COLVER13	0.36
94106	GRAYMONT	0.07
200828	HNSMLK 1	0.24
200829	HNSMLK 2	0.24
200830	HNSMLK 3	0.24
200831	HNSMLK 4	0.24
200832	HNSMLK 5	0.24
200838	HOMER C2	1.52
200839	HOMER C3	1.61
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
293270	N-036 C	0.59
200649	PENNTech	0.14
200608	PINEY #1	0.21
200657	PINEY CK	0.24
290085	Q-036 C	0.02
295247	Q-046	0.03
290113	Q-063 C	0.05
296914	R-092 C	0.95
291011	S-103	0.19

200662	SCRUB GR	0.51
200642	SENECA#1	0.69
200643	SENECA#2	0.64
200644	SENECA#3	0.1
200715	SHAWVL 1	8.08
200722	SHAWVL 2	8.28
200665	SHAWVL 3	11.69
200666	SHAWVL 4	11.72
292391	T-121C	0.93
292548	T-155	0.03
292984	U2-055C	0.68
293392	V3-030C	< 0.01
903651	W3-099 C OP1	1.03
910651	X3-039	9.55
X3-050	X3-050	5.92
913401	Y1-012	0.02
913131	Y1-032 C	0.77
913311	Y1-071	0.06
Y2-044	Y2-044	9.58
914131	Y2-055	3.74
915011	Y3-010 C	0.49
915331	Y3-062 C	0.19
915771	Y3-092 OP2	83.19

Appendix 27

(AP - AP) The PARADISE JCT-BUTLER 138 kV line (from bus 235141 to bus 235152 ckt 1) loads from 16.17% to 61.63% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
200887	ARMNA MT P47	0.05
235567	ARMSTRONG 1	28.95
235569	ARMSTRONG 2	28.78
203261	BLOSSBCT	0.04
200805	COLVER13	0.36
94106	GRAYMONT	0.07
200828	HNSMLK 1	0.24
200829	HNSMLK 2	0.24
200830	HNSMLK 3	0.24
200831	HNSMLK 4	0.24
200832	HNSMLK 5	0.24
200838	HOMER C2	1.52
200839	HOMER C3	1.61
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
293270	N-036 C	0.59
200649	PENNTECH	0.14
200608	PINEY #1	0.21
200657	PINEY CK	0.24
290085	Q-036 C	0.02
295247	Q-046	0.03
290113	Q-063 C	0.05
296914	R-092 C	0.95
291011	S-103	0.19
200662	SCRUB GR	0.51
200642	SENECA#1	0.69
200643	SENECA#2	0.64
200644	SENECA#3	0.1
200715	SHAWVL 1	8.08
200722	SHAWVL 2	8.28

200665	SHAWVL 3	11.69
200666	SHAWVL 4	11.72
292391	T-121C	0.93
292548	T-155	0.03
292984	U2-055C	0.68
293392	V3-030C	< 0.01
903651	W3-099 C OP1	1.03
910651	X3-039	9.55
X3-050	X3-050	5.92
913401	Y1-012	0.02
913131	Y1-032 C	0.77
913311	Y1-071	0.06
Y2-044	Y2-044	9.58
914131	Y2-055	3.74
915011	Y3-010 C	0.49
915331	Y3-062 C	0.19
915771	Y3-092 OP2	83.19

Appendix 28

(AP - AP) The PARADISE JCT-BUTLER 138 kV line (from bus 235141 to bus 235152 ckt 1) loads from 16.17% to 61.63% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
200887	ARMNA MT P47	0.05
235567	ARMSTRONG 1	28.95
235569	ARMSTRONG 2	28.78
203261	BLOSSBCT	0.04
200805	COLVER13	0.36
94106	GRAYMONT	0.07
200828	HNSMLK 1	0.24
200829	HNSMLK 2	0.24
200830	HNSMLK 3	0.24
200831	HNSMLK 4	0.24
200832	HNSMLK 5	0.24
200838	HOMER C2	1.52
200839	HOMER C3	1.61
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
293270	N-036 C	0.59
200649	PENNTECH	0.14
200608	PINEY #1	0.21
200657	PINEY CK	0.24
290085	Q-036 C	0.02
295247	Q-046	0.03
290113	Q-063 C	0.05
296914	R-092 C	0.95
291011	S-103	0.19
200662	SCRUB GR	0.51
200642	SENECA#1	0.69
200643	SENECA#2	0.64
200644	SENECA#3	0.1
200715	SHAWVL 1	8.08
200722	SHAWVL 2	8.28

200665	SHAWVL 3	11.69
200666	SHAWVL 4	11.72
292391	T-121C	0.93
292548	T-155	0.03
292984	U2-055C	0.68
293392	V3-030C	< 0.01
903651	W3-099 C OP1	1.03
910651	X3-039	9.55
X3-050	X3-050	5.92
913401	Y1-012	0.02
913131	Y1-032 C	0.77
913311	Y1-071	0.06
Y2-044	Y2-044	9.58
914131	Y2-055	3.74
915011	Y3-010 C	0.49
915331	Y3-062 C	0.19
915771	Y3-092 OP2	83.19

Appendix 29

(PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 56.26% to 81.8% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 111.7 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.1
203261	BLOSSBCT	0.09
203283	MANOR	< 0.01
200851	MEHOOP3	0.26
293270	N-036 C	0.94
294572	P-028 C	0.13
292391	T-121C	1.21
293416	V3-042C	1.58
903651	W3-099 C OP1	9.93
907481	X1-109	82.03
X3-050	X3-050	23.28
912251	X4-048 OP1	30.79
913401	Y1-012	0.08
913131	Y1-032 C	1.13
913191	Y1-047 OP1	1.53
914061	Y2-042	1.47
Y2-044	Y2-044	37.69
914151	Y2-060	0.35
914421	Y2-104	0.64
915331	Y3-062 C	1.78
915771	Y3-092 OP2	111.7

Appendix 30

(AP - AP) The KARNs CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.39% to 61.85% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
200887	ARMNA MT P47	0.05
235567	ARMSTRONG 1	28.95
235569	ARMSTRONG 2	28.78
203261	BLOSSBCT	0.04
200805	COLVER13	0.36
94106	GRAYMONT	0.07
200828	HNSMLK 1	0.24
200829	HNSMLK 2	0.24
200830	HNSMLK 3	0.24
200831	HNSMLK 4	0.24
200832	HNSMLK 5	0.24
200838	HOMER C2	1.52
200839	HOMER C3	1.61
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
293270	N-036 C	0.59
200649	PENNTECH	0.14
200608	PINEY #1	0.21
200657	PINEY CK	0.24
290085	Q-036 C	0.02
295247	Q-046	0.03
290113	Q-063 C	0.05
296914	R-092 C	0.95
291011	S-103	0.19
200662	SCRUB GR	0.51
200642	SENECA#1	0.69
200643	SENECA#2	0.64
200644	SENECA#3	0.1
200715	SHAWVL 1	8.08
200722	SHAWVL 2	8.28

200665	SHAWVL 3	11.69
200666	SHAWVL 4	11.72
292391	T-121C	0.93
292548	T-155	0.03
292984	U2-055C	0.68
293392	V3-030C	< 0.01
903651	W3-099 C OP1	1.03
910651	X3-039	9.55
X3-050	X3-050	5.92
913401	Y1-012	0.02
913131	Y1-032 C	0.77
913311	Y1-071	0.06
Y2-044	Y2-044	9.58
914131	Y2-055	3.74
915011	Y3-010 C	0.49
915331	Y3-062 C	0.19
915771	Y3-092 OP2	83.19

Appendix 31

(AP - AP) The KARNs CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.39% to 61.85% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
200887	ARMNA MT P47	0.05
235567	ARMSTRONG 1	28.95
235569	ARMSTRONG 2	28.78
203261	BLOSSBCT	0.04
200805	COLVER13	0.36
94106	GRAYMONT	0.07
200828	HNSMLK 1	0.24
200829	HNSMLK 2	0.24
200830	HNSMLK 3	0.24
200831	HNSMLK 4	0.24
200832	HNSMLK 5	0.24
200838	HOMER C2	1.52
200839	HOMER C3	1.61
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
293270	N-036 C	0.59
200649	PENNTECH	0.14
200608	PINEY #1	0.21
200657	PINEY CK	0.24
290085	Q-036 C	0.02
295247	Q-046	0.03
290113	Q-063 C	0.05
296914	R-092 C	0.95
291011	S-103	0.19
200662	SCRUB GR	0.51
200642	SENECA#1	0.69
200643	SENECA#2	0.64
200644	SENECA#3	0.1
200715	SHAWVL 1	8.08
200722	SHAWVL 2	8.28

200665	SHAWVL 3	11.69
200666	SHAWVL 4	11.72
292391	T-121C	0.93
292548	T-155	0.03
292984	U2-055C	0.68
293392	V3-030C	< 0.01
903651	W3-099 C OP1	1.03
910651	X3-039	9.55
X3-050	X3-050	5.92
913401	Y1-012	0.02
913131	Y1-032 C	0.77
913311	Y1-071	0.06
Y2-044	Y2-044	9.58
914131	Y2-055	3.74
915011	Y3-010 C	0.49
915331	Y3-062 C	0.19
915771	Y3-092 OP2	83.19

Appendix 32

(AP - AP) The KARNs CITY-PARADISE JCT 138 kV line (from bus 235197 to bus 235141 ckt 1) loads from 16.39% to 61.85% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1

DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
02PERRY 345.00 02AT 345.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
02AT 345.00 02S8-ATT 345.00

DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
02S8-ATT 345.00 02ASH_3 138.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.02
200887	ARMNA MT P47	0.05
235567	ARMSTRONG 1	28.95
235569	ARMSTRONG 2	28.78
203261	BLOSSBCT	0.04
200805	COLVER13	0.36
94106	GRAYMONT	0.07
200828	HNSMLK 1	0.24
200829	HNSMLK 2	0.24
200830	HNSMLK 3	0.24
200831	HNSMLK 4	0.24
200832	HNSMLK 5	0.24
200838	HOMER C2	1.52
200839	HOMER C3	1.61
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
293270	N-036 C	0.59
200649	PENNTech	0.14
200608	PINEY #1	0.21
200657	PINEY CK	0.24
290085	Q-036 C	0.02
295247	Q-046	0.03
290113	Q-063 C	0.05
296914	R-092 C	0.95
291011	S-103	0.19

200662	SCRUB GR	0.51
200642	SENECA#1	0.69
200643	SENECA#2	0.64
200644	SENECA#3	0.1
200715	SHAWVL 1	8.08
200722	SHAWVL 2	8.28
200665	SHAWVL 3	11.69
200666	SHAWVL 4	11.72
292391	T-121C	0.93
292548	T-155	0.03
292984	U2-055C	0.68
293392	V3-030C	< 0.01
903651	W3-099 C OP1	1.03
910651	X3-039	9.55
X3-050	X3-050	5.92
913401	Y1-012	0.02
913131	Y1-032 C	0.77
913311	Y1-071	0.06
Y2-044	Y2-044	9.58
914131	Y2-055	3.74
915011	Y3-010 C	0.49
915331	Y3-062 C	0.19
915771	Y3-092 OP2	83.19

Appendix 33

(PENELEC - PENELEC) The WARREN-ERIE S TIE 230 kV line (from bus 200811 to bus 200918 ckt 1) loads from 23.25% to 65.57% (**DC power flow**) of its emergency rating (621 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 262.8 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200649	PENNTech	0.19
290113	Q-063 C	0.14
296914	R-092 C	0.98
291011	S-103	0.44
200642	SENECA#1	1.89
200643	SENECA#2	1.75
200644	SENECA#3	0.27
200715	SHAWVL 1	7.25
200722	SHAWVL 2	7.44
200665	SHAWVL 3	10.87
200666	SHAWVL 4	10.92
292391	T-121C	0.99
292984	U2-055C	0.62
913131	Y1-032 C	0.71
914131	Y2-055	8.64
915771	Y3-092 OP2	262.8

Appendix 34

(FE - FE) The 02BRKSID-02WELNGT 138 kV line (from bus 238586 to bus 239168 ckt 1) loads from 104.81% to 106.56% (**DC power flow**) of its emergency rating (86 MVA) for the bus fault outage of 'C1-BUS-SR006'. This project contributes approximately 5.43 MW to the thermal violation.

CONTINGENCY 'C1-BUS-SR006' /* BROOKSIDE 138
SOUTH BUS FAULT, B-28 FAILURE TO TRIP, B-5 FAILURE TO TRIP
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3 /*
02BRKSID 138.00 02BRKSID 69.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4 /*
02BRKSID 138.00 02BRKSID 69.00
DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5 /*
02BRKSID 138.00 02BRKSID 69.00
DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1 /*
05HOWARD 138.00 02BRKSID 138.00
DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1 /*
02LNGVEW 138.00 02BRKSID 138.00
DISCONNECT BRANCH FROM BUS 239076 TO BUS 238586 CKT 1 /*
02ROSS 138.00 02BRKSID 138.00
DISCONNECT BRANCH FROM BUS 239216 TO BUS 238586 CKT 1 /*
02TROY 138.00 02BRKSID 138.00
END

Bus Number	Bus Name	Full Contribution
900404	X3-028 C	0.76
900405	X3-028 E	1.02
Y2-068	Y2-068	8.99
915771	Y3-092 OP2	5.43

Appendix 35

(FE - FE) The 02BRKSID-02WELNGT 138 kV line (from bus 238586 to bus 239168 ckt 1) loads from 104.81% to 106.56% (**DC power flow**) of its emergency rating (86 MVA) for the line fault with failed breaker contingency outage of 'C2-BRK-SR054'. This project contributes approximately 5.43 MW to the thermal violation.

CONTINGENCY 'C2-BRK-SR054' /* BROOKSIDE B-30
 FAILURE TO TRIP
 DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1 /*
 02LNGVIEW 138.00 02BRKSID 138.00
 DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1 /*
 05HOWARD 138.00 02BRKSID 138.00
 DISCONNECT BRANCH FROM BUS 238586 TO BUS 239216 CKT 1 /*
 02BRKSID 138.00 02TROY 138.00
 DISCONNECT BRANCH FROM BUS 238586 TO BUS 239076 CKT 1 /*
 02BRKSID 138.00 02ROSS 138.00
 DISCONNECT BRANCH FROM BUS 239076 TO BUS 239237 CKT 1 /*
 02ROSS 138.00 02CLVR-S 138.00
 DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3 /*
 02BRKSID 138.00 02BRKSID 69.00
 DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4 /*
 02BRKSID 138.00 02BRKSID 69.00
 DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5 /*
 02BRKSID 138.00 02BRKSID 69.00
 REDUCE BUS 239076 LOAD BY 100 PERCENT /* 02ROSS 138.00
 DISCONNECT BUS 239076 /* 02ROSS 138.00
 END

Bus Number	Bus Name	Full Contribution
900404	X3-028 C	0.76
900405	X3-028 E	1.02
Y2-068	Y2-068	8.99
915771	Y3-092 OP2	5.43

Appendix 36

(FE - FE) The 02SBRNQ1-02ASH_1 138 kV line (from bus 239095 to bus 238542 ckt 1) loads from 23.79% to 66.61% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 68.91 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.45
884781	S-058 E	1.48
907481	X1-109	-16.91
913161	Y1-035	10.6
913171	Y1-036	9.38
914301	Y2-085 OP1	8.51
915771	Y3-092 OP2	68.91

Appendix 37

(FE - FE) The 02BRKSID-02WELNGT 138 kV line (from bus 238586 to bus 239168 ckt 1) loads from 105.98% to 107.73% (**DC power flow**) of its emergency rating (86 MVA) for the line fault with failed breaker contingency outage of 'C2-BRK-SR055'. This project contributes approximately 5.43 MW to the thermal violation.

```

CONTINGENCY 'C2-BRK-SR055'                                /* BROOKSIDE B-59
FAILURE TO TRIP
  DISCONNECT BRANCH FROM BUS 238906 TO BUS 238586 CKT 1    /*
02LNGVIEW 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 243024 TO BUS 238586 CKT 1    /*
05HOWARD 138.00 02BRKSID 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 239216 CKT 1    /*
02BRKSID 138.00 02TROY 138.00
  DISCONNECT BRANCH FROM BUS 239319 TO BUS 239318 CKT 1    /*
02CAMDEN 138.00 02HENRTA 138.00
  DISCONNECT BRANCH FROM BUS 239318 TO BUS 238570 CKT 1    /*
02HENRTA 138.00 02BEAVER 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 239076 CKT 1    /*
02BRKSID 138.00 02ROSS 138.00
  DISCONNECT BRANCH FROM BUS 239216 TO BUS 239215 CKT 1    /*
02TROY 138.00 02BRIGHT 138.00
  DISCONNECT BRANCH FROM BUS 239215 TO BUS 239319 CKT 1    /*
02BRIGHT 138.00 02CAMDEN 138.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 3    /*
02BRKSID 138.00 02BRKSID 69.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 4    /*
02BRKSID 138.00 02BRKSID 69.00
  DISCONNECT BRANCH FROM BUS 238586 TO BUS 238587 CKT 5    /*
02BRKSID 138.00 02BRKSID 69.00
  REDUCE BUS 239319 LOAD BY 100 PERCENT                      /* 02CAMDEN
138.00
  REDUCE BUS 239215 LOAD BY 100 PERCENT                      /* 02BRIGHT
138.00
  REDUCE BUS 239216 LOAD BY 100 PERCENT                      /* 02TROY 138.00
  DISCONNECT BUS 239216                                       /* 02TROY 138.00
  DISCONNECT BUS 239215                                       /* 02BRIGHT 138.00
  DISCONNECT BUS 239319                                       /* 02CAMDEN 138.00
END

```

Bus Number	Bus Name	Full Contribution
900404	X3-028 C	0.76
900405	X3-028 E	1.02
Y2-068	Y2-068	8.99
915771	Y3-092 OP2	5.43

Appendix 38

(NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 59.37% to 84.94% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 111.7 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.1
203261	BLOSSBCT	0.09
203283	MANOR	< 0.01
200851	MEHOOP3	0.26
293270	N-036 C	0.94
294572	P-028 C	0.13
292391	T-121C	1.21
293416	V3-042C	1.58
907481	X1-109	82.03
X3-050	X3-050	23.28
912251	X4-048 OP1	30.79
913401	Y1-012	0.08
913131	Y1-032 C	1.13
913191	Y1-047 OP1	1.53
914061	Y2-042	1.47
Y2-044	Y2-044	37.69
914151	Y2-060	0.35
914421	Y2-104	0.64
915771	Y3-092 OP2	111.7

Appendix 39

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 55.57% to 82.98% (**DC power flow**) of its emergency rating (437 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2E'. This project contributes approximately 119.8 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2E'
STUCK CB - CB7

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Bus Number	Bus Name	Full Contribution
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
293271	N-036 E	2.99
200888	P-047 E	5.59
292391	T-121C	1.11
292392	T-121E	4.45
293416	V3-042C	0.64
293417	V3-042E	4.29
903651	W3-099 C OP1	1.38
903652	W3-099 E OP1	9.25
910651	X3-039	10.66
X3-050	X3-050	9.3
913131	Y1-032 C	0.96
913132	Y1-032 E	6.41
Y2-044	Y2-044	15.06
914131	Y2-055	4.
915331	Y3-062 C	0.25
915332	Y3-062 E	1.72
915771	Y3-092 OP2	119.8

Appendix 40

(PENELEC - AP) The 01ARMSTRONG 345/138 kV transformer (from bus 235999 to bus 235121 ckt 1) loads from 55.57% to 82.98% (**DC power flow**) of its emergency rating (437 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2E'. This project contributes approximately 119.8 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2E'
STUCK CB - CB7

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Bus Number	Bus Name	Full Contribution
200828	HNSMLK 1	0.52
200829	HNSMLK 2	0.52
200830	HNSMLK 3	0.52
200831	HNSMLK 4	0.52
200832	HNSMLK 5	0.52
200838	HOMER C2	3.38
200839	HOMER C3	3.58
200849	LAKVU GN	0.02
293270	N-036 C	0.75
293271	N-036 E	2.99
200888	P-047 E	5.59
292391	T-121C	1.11
292392	T-121E	4.45
293416	V3-042C	0.64
293417	V3-042E	4.29
903651	W3-099 C OP1	1.38
903652	W3-099 E OP1	9.25
910651	X3-039	10.66
X3-050	X3-050	9.3
913131	Y1-032 C	0.96
913132	Y1-032 E	6.41
Y2-044	Y2-044	15.06
914131	Y2-055	4.
915331	Y3-062 C	0.25
915332	Y3-062 E	1.72
915771	Y3-092 OP2	119.8

Appendix 41

(PENELEC - PENELEC) The WARREN-ERIE S TIE 230 kV line (from bus 200811 to bus 200918 ckt 1) loads from 23.69% to 67.37% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 271.22 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A'

/* ERIE WEST 345 KV

STUCK CB - CB5

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1

END

Bus Number	Bus Name	Full Contribution
290113	Q-063 C	0.14
296914	R-092 C	0.95
296915	R-092 E	3.81
291011	S-103	0.43
200642	SENECA#1	1.85
200643	SENECA#2	1.72
200644	SENECA#3	0.26
200715	SHAWVL 1	7.02
200722	SHAWVL 2	7.19
200665	SHAWVL 3	10.52
292391	T-121C	0.95
292392	T-121E	3.8
292984	U2-055C	0.6
292985	U2-055E	4.05
913131	Y1-032 C	0.67
913132	Y1-032 E	4.51
914131	Y2-055	8.35
915771	Y3-092 OP2	271.22

Appendix 42

(PENELEC - PENELEC) The SHAWVL 1 230/1 kV transformer (from bus 999456 to bus 200710 ckt 1A) loads from 109.21% to 110.19% (**DC power flow**) of its emergency rating (143 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-14B_A'. This project contributes approximately 7.35 MW to the thermal violation.

CONTINGENCY 'C2_PN230-SB-14B_A' /* LEWISTOWN 230
KV STUCK CB - CB (LEWISTOWN - RAYSTOWN)

DISCONNECT BRANCH FROM BUS 200513 TO BUS 914320 CKT 1

DISCONNECT BRANCH FROM BUS 200517 TO BUS 200539 CKT 1

DISCONNECT BRANCH FROM BUS 200513 TO BUS 235248 CKT 1

DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2

DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3

DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548

CKT 2

END

Bus Number	Bus Name	Full Contribution
290085	Q-036 C	0.07
290086	Q-036 E	7.78
295247	Q-046	0.08
200883	Q-053 E	3.04
296914	R-092 C	2.5
296915	R-092 E	10.
200715	SHAWVL 1	69.58
200722	SHAWVL 2	8.9
293393	V3-030E	1.56
915771	Y3-092 OP2	7.35

Appendix 43

(PENELEC - PENELEC) The WARREN-ERIE S TIE 230 kV line (from bus 200811 to bus 200918 ckt 1) loads from 23.74% to 67.5% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 271.71 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B'
STUCK CB - CB6

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END

Bus Number	Bus Name	Full Contribution
290113	Q-063 C	0.14
296914	R-092 C	0.95
296915	R-092 E	3.8
291011	S-103	0.43
200642	SENECA#1	1.85
200643	SENECA#2	1.71
200644	SENECA#3	0.26
200715	SHAWVL 1	7.
200722	SHAWVL 2	7.18
200665	SHAWVL 3	10.5
292391	T-121C	0.95
292392	T-121E	3.79
292984	U2-055C	0.6
292985	U2-055E	4.05
913131	Y1-032 C	0.67
913132	Y1-032 E	4.5
914131	Y2-055	8.34
915771	Y3-092 OP2	271.71

Appendix 44

(PENELEC - PENELEC) The CNYO&G-N.MESHPN 230 kV line (from bus 200924 to bus 200706 ckt 1F) loads from 91.42% to 101.51% (**DC power flow**) of its emergency rating (617 MVA) for the single line contingency outage of 'SUSQ 1'. This project contributes approximately 62.24 MW to the thermal violation.

CONTINGENCY 'SUSQ 1'

REMOVE MACHINE 1 FROM BUS 208918

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.2
203261	BLOSSBCT	0.2
94106	GRAYMONT	0.1
200828	HNSMLK 1	0.14
200829	HNSMLK 2	0.14
200830	HNSMLK 3	0.14
200831	HNSMLK 4	0.14
200832	HNSMLK 5	0.14
200838	HOMER C2	1.61
200839	HOMER C3	1.7
200849	LAKVU GN	0.02
203283	MANOR	0.02
293270	N-036 C	1.55
200649	PENNTECH	0.18
290085	Q-036 C	0.03
295247	Q-046	0.03
290113	Q-063 C	0.07
296914	R-092 C	1.27
291011	S-103	0.24
200662	SCRUB GR	0.2
200642	SENECA#1	0.85
200643	SENECA#2	0.79
200644	SENECA#3	0.12
200715	SHAWVL 1	11.52
200722	SHAWVL 2	11.73
200665	SHAWVL 3	17.55
200666	SHAWVL 4	17.37
292391	T-121C	1.92
292984	U2-055C	1.08
293416	V3-042C	0.94
903651	W3-099 C OP1	1.07
907481	X1-109	303.98

910651	X3-039	5.45
X3-050	X3-050	19.62
913401	Y1-012	0.04
913131	Y1-032 C	1.83
Y2-044	Y2-044	31.76
914131	Y2-055	4.6
Y2-068	Y2-068	47.27
915011	Y3-010 C	0.72
915331	Y3-062 C	0.2
915771	Y3-092 OP2	62.24

Appendix 45

(FE - FE) The 02ASH_1-02SBRNQ1 138 kV line (from bus 238542 to bus 239095 ckt 1) loads from 20.37% to 66.0% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 68.91 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	44.54
200849	LAKVU GN	0.01
901211	W1-070A_AT4	1.28
903651	W3-099 C OP1	0.78
910651	X3-039	5.5
915331	Y3-062 C	0.14
915771	Y3-092 OP2	68.91

Appendix 46

(PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 71.65% to 91.63% (**DC power flow**) of its emergency rating (824 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-4G'. This project contributes approximately 164.69 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-4G' /* HOMER CITY 345
KV STUCK CB - CB307
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 1
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200930 CKT 1 /*
HOMER CITY-MAINESBRG 345
END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	19.82
200887	ARMNA MT P47	0.1
235567	ARMSTRONG 1	31.53
235569	ARMSTRONG 2	31.35
203261	BLOSSBCT	0.1
200828	HNSMLK 1	0.76
200829	HNSMLK 2	0.76
200830	HNSMLK 3	0.76
200831	HNSMLK 4	0.76
200832	HNSMLK 5	0.76
200838	HOMER C2	15.85
200839	HOMER C3	16.78
200849	LAKVU GN	0.04
200857	LAURHILL	5.83
293270	N-036 C	1.91
293271	N-036 E	7.63
200888	P-047 E	8.92
200649	PENNTech	0.3
200608	PINEY #1	0.15
200657	PINEY CK	0.18
290113	Q-063 C	0.15
296914	R-092 C	1.28
296915	R-092 E	5.13
291011	S-103	0.51
200662	SCRUB GR	0.65
200642	SENECA#1	2.
200643	SENECA#2	1.85
200644	SENECA#3	0.29
200665	SHAWVL 3	13.94

292391	T-121C	3.49
292392	T-121E	13.98
292548	T-155	0.03
297050	V2-019 E	< 0.01
293416	V3-042C	1.1
293417	V3-042E	7.36
901211	W1-070A_AT4	0.53
901212	W1-070A_AT4	3.52
903651	W3-099 C OP1	2.25
903652	W3-099 E OP1	15.05
905071	W4-004B_AT11	1.12
905072	W4-004B_AT11	0.96
907481	X1-109	61.58
910651	X3-039	18.93
X3-050	X3-050	15.28
913401	Y1-012	0.05
913131	Y1-032 C	2.7
913132	Y1-032 E	18.1
913311	Y1-071	0.04
Y2-044	Y2-044	24.74
914131	Y2-055	9.88
915331	Y3-062 C	0.42
915332	Y3-062 E	2.83
915771	Y3-092 OP2	164.69

Appendix 47

(FE - FE) The 02SBRNQ2-02AUSTQ2 138 kV line (from bus 239096 to bus 239212 ckt 1) loads from 17.42% to 64.69% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	45.85
200849	LAKVU GN	0.01
901211	W1-070A_AT4	1.2
903651	W3-099 C OP1	0.81
910651	X3-039	5.7
915331	Y3-062 C	0.15
915771	Y3-092 OP2	71.38

Appendix 48

(FE - FE) The 02ASH_2-02SBRNQ2 138 kV line (from bus 238543 to bus 239096 ckt 1) loads from 17.42% to 64.69% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	45.85
200849	LAKVU GN	0.01
901211	W1-070A_AT4	1.2
903651	W3-099 C OP1	0.81
910651	X3-039	5.7
915331	Y3-062 C	0.15
915771	Y3-092 OP2	71.38

Appendix 49

(FE - FE) The 02PERRY-02EASTLK 345 kV line (from bus 239036 to bus 238684 ckt 1) loads from 71.25% to 91.79% (**DC power flow**) of its emergency rating (1793 MVA) for the tower line contingency outage of 'C5-TWL-NR057A'. This project contributes approximately 368.29 MW to the thermal violation.

CONTINGENCY 'C5-TWL-NR057A'

/* PERRY-LRCR AND

PERRY-NRFD 345KV LINE OUTAGES

OPEN BRANCH FROM BUS 239334 TO BUS 239036 CKT 1 / 239334

02L.CENTER 345 239036 02PERRY 345 1

OPEN BRANCH FROM BUS 239358 TO BUS 239036 CKT 1 / 239358

02NFIELD 345.00 239036 02PERRY 345

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	38.52
239035	02PERRG1	36.33
200887	ARMNA MT P47	0.12
235567	ARMSTRONG 1	19.94
235569	ARMSTRONG 2	19.82
203261	BLOSSBCT	0.11
200828	HNSMLK 1	0.66
200829	HNSMLK 2	0.66
200830	HNSMLK 3	0.66
200831	HNSMLK 4	0.66
200832	HNSMLK 5	0.66
200849	LAKVU GN	0.08
200857	LAURHILL	8.32
293270	N-036 C	1.51
293271	N-036 E	6.04
200888	P-047 E	10.65
200649	PENNTECH	0.29
200608	PINEY #1	0.19
200657	PINEY CK	0.21
290113	Q-063 C	0.15
296914	R-092 C	1.81
296915	R-092 E	7.22
291011	S-103	0.63
200662	SCRUB GR	0.87
200642	SENECA#1	1.96
200643	SENECA#2	1.82
200644	SENECA#3	0.28
200715	SHAWVL 1	14.53
200722	SHAWVL 2	14.88

200665	SHAWVL 3	21.07
292391	T-121C	2.38
292392	T-121E	9.53
292984	U2-055C	1.26
292985	U2-055E	8.52
297050	V2-019 E	< 0.01
293416	V3-042C	1.44
293417	V3-042E	9.64
901211	W1-070A_AT4	1.
901212	W1-070A_AT4	6.73
903651	W3-099 C OP1	4.15
903652	W3-099 E OP1	27.79
905071	W4-004B_AT11	10.29
905072	W4-004B_AT11	8.87
907481	X1-109	87.6
910651	X3-039	29.31
X3-050	X3-050	17.85
913401	Y1-012	0.06
913131	Y1-032 C	1.99
913132	Y1-032 E	13.31
913311	Y1-071	0.04
Y2-044	Y2-044	28.9
914131	Y2-055	12.24
915331	Y3-062 C	0.75
915332	Y3-062 E	5.12
915771	Y3-092 OP2	368.29

Appendix 50

(FE - FE) The 02AVON 345/138 kV transformer (from bus 238551 to bus 238552 ckt 91) loads from 113.12% to 113.17% (**DC power flow**) of its emergency rating (627 MVA) for the line fault with failed breaker contingency outage of 'C2-BRK-NR04A'. This project contributes approximately 46.39 MW to the thermal violation.

CONTINGENCY 'C2-BRK-NR04A' /* BREAKER FAILURE
ON Q-92-AV-T @ AV

DISCONNECT BRANCH FROM BUS 238551 TO BUS 238552 CKT 92 /*
02AVON 345.00 02AVON 138.00

REMOVE MACHINE 9 FROM BUS 238555 /* 02AVONG9 20.00

DISCONNECT BRANCH FROM BUS 238551 TO BUS 238850 CKT 1 /*
02AVON 345.00 02JUNIP 345.00

END

Bus Number	Bus Name	Full Contribution
238565	02BAYSG2	9.51
238566	02BAYSG3	9.79
238567	02BAYSG4	14.82
240968	02BG2 GEN	0.47
240969	02BG4 G1	0.12
240970	02BG4 G2&3	0.24
240971	02BG4 G4&5	0.24
240973	02BG6 AMPO	2.1
240975	02PGE GEN	3.25
239171	02WLORG-2	0.58
239172	02WLORG-3	0.58
239173	02WLORG-4	0.58
239174	02WLORG-5	0.58
884780	S-058 C	1.82
884781	S-058 E	6.01
889031	U2-028A_AT1	9.27
247548	V4-010 C	1.38
247947	V4-010 E	9.26
247546	V4-015 C	0.45
247938	V4-015 E	2.98
247571	W2-001 C	0.44
247945	W2-001 E	2.98
903511	W3-059A_AT6	0.98
903512	W3-059A_AT6	6.54
907061	X1-027A C1	1.95
907064	X1-027A C2	1.95
907066	X1-027A C3	1.95
907068	X1-027A C4	1.95

907062	X1-027A E1	13.02
907065	X1-027A E2	13.02
907067	X1-027A E3	13.02
907069	X1-027A E4	13.02
909161	X2-058 C	1.
909162	X2-058 E	6.7
913441	Y1-069 OP1	52.72
Y2-040	Y2-040	38.25
914111	Y2-053	2.41
Y2-082	Y2-082	43.31
Y3-032	Y3-032	17.35
Y3-083	Y3-083	17.35
915771	Y3-092 OP2	46.39

Appendix 51

(FE - FE) The 02SBRNQ4-02ASH_3 138 kV line (from bus 239098 to bus 238544 ckt 1) loads from 21.57% to 67.42% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 73.8 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.48
884781	S-058 E	1.59
907481	X1-109	-18.1
913161	Y1-035	11.35
913171	Y1-036	10.05
914301	Y2-085 OP1	9.11
915771	Y3-092 OP2	73.8

Appendix 52

(PENELEC - PENELEC) The EDINB S.-VENGO JT 115 kV line (from bus 200572 to bus 200573 ckt 1) loads from 27.06% to 70.24% (**DC power flow**) of its emergency rating (179 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 125.44 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.03
290113	Q-063 C	0.04
291011	S-103	0.21
200642	SENECA#1	0.58
200643	SENECA#2	0.54
200644	SENECA#3	0.08
903651	W3-099 C OP1	1.52
913401	Y1-012	0.02
914131	Y2-055	4.03
915331	Y3-062 C	0.27
915771	Y3-092 OP2	125.44

Appendix 53

(PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 88.75% to 101.11% (**DC power flow**) of its emergency rating (824 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-4A'. This project contributes approximately 101.85 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-4A'
KV STUCK CB - CB301

/* HOMER CITY 345

DISCONNECT BRANCH FROM BUS 200769 TO BUS 235999 CKT 1
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 1
END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.29
203261	BLOSSBCT	0.25
200838	HOMER C2	19.31
200839	HOMER C3	20.45
200849	LAKVU GN	0.03
200857	LAURHILL	10.08
203283	MANOR	0.01
200851	MEHOOP3	0.46
293270	N-036 C	3.57
293271	N-036 E	14.26
294572	P-028 C	0.23
294573	P-028 E	20.68
200888	P-047 E	26.11
200649	PENNTECH	0.35
290113	Q-063 C	0.17
296914	R-092 C	1.61
296915	R-092 E	6.44
291011	S-103	0.53
200642	SENECA#1	2.22
200643	SENECA#2	2.06
200644	SENECA#3	0.32
200715	SHAWVL 1	11.03
200722	SHAWVL 2	11.26
200665	SHAWVL 3	17.57
292391	T-121C	5.33
292392	T-121E	21.32
292984	U2-055C	1.
292985	U2-055E	6.74
297050	V2-019 E	< 0.01
293416	V3-042C	2.58

293417	V3-042E	17.28
903651	W3-099 C OP1	1.9
903652	W3-099 E OP1	12.74
907481	X1-109	150.63
910522	X3-003 E	3.45
X3-050	X3-050	29.45
913401	Y1-012	0.08
913131	Y1-032 C	4.58
913132	Y1-032 E	30.67
913191	Y1-047 OP1	2.65
914061	Y2-042	2.44
Y2-044	Y2-044	47.69
914131	Y2-055	10.44
914151	Y2-060	0.6
914421	Y2-104	1.11
915331	Y3-062 C	0.37
915332	Y3-062 E	2.48
915771	Y3-092 OP2	101.85

Appendix 54

(PENELEC - PENELEC) The GENEVA-PPGAPI 115 kV line (from bus 200590 to bus 200822 ckt 1) loads from 71.54% to 92.98% (**DC power flow**) of its emergency rating (239 MVA) for the single line contingency outage of 'B_LINE_TIE_035'. This project contributes approximately 51.24 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_TIE_035'                                /* ERIE W 345.00 -  
WAYNE 345.00 LINE OUTAGE  
  DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1      /*  
ERIE W 345.00 WAYNE 345.00  
END
```

Bus Number	Bus Name	Full Contribution
200828	HNSMLK 1	0.23
200829	HNSMLK 2	0.23
200830	HNSMLK 3	0.23
200831	HNSMLK 4	0.23
200832	HNSMLK 5	0.23
200608	PINEY #1	0.06
200657	PINEY CK	0.07
200662	SCRUB GR	0.42
910651	X3-039	38.9
915771	Y3-092 OP2	51.24

Appendix 55

(PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 1) loads from 73.55% to 94.06% (**DC power flow**) of its emergency rating (807 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-4H'. This project contributes approximately 165.58 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-4H' /* HOMER CITY 345
KV STUCK CB - CB308
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 2
DISCONNECT BRANCH FROM BUS 200769 TO BUS 200930 CKT 1 /*
HOMER CITY-MAINESBRG 345
END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	19.93
200887	ARMNA MT P47	0.1
235567	ARMSTRONG 1	31.7
235569	ARMSTRONG 2	31.52
203261	BLOSSBCT	0.1
200828	HNSMLK 1	0.77
200829	HNSMLK 2	0.77
200830	HNSMLK 3	0.77
200831	HNSMLK 4	0.77
200832	HNSMLK 5	0.77
200838	HOMER C2	15.94
200839	HOMER C3	16.87
200849	LAKVU GN	0.04
200857	LAURHILL	5.87
293270	N-036 C	1.92
293271	N-036 E	7.67
200888	P-047 E	8.96
200649	PENNTech	0.3
200608	PINEY #1	0.15
200657	PINEY CK	0.18
290113	Q-063 C	0.15
296914	R-092 C	1.29
296915	R-092 E	5.16
291011	S-103	0.51
200662	SCRUB GR	0.65
200642	SENECA#1	2.01
200643	SENECA#2	1.86
200644	SENECA#3	0.29
200665	SHAWVL 3	14.02

292391	T-121C	3.51
292392	T-121E	14.05
292548	T-155	0.03
297050	V2-019 E	< 0.01
293416	V3-042C	1.1
293417	V3-042E	7.4
901211	W1-070A_AT4	0.53
901212	W1-070A_AT4	3.54
903651	W3-099 C OP1	2.26
903652	W3-099 E OP1	15.13
905071	W4-004B_AT11	1.12
905072	W4-004B_AT11	0.97
907481	X1-109	61.92
910651	X3-039	19.04
X3-050	X3-050	15.36
913401	Y1-012	0.05
913131	Y1-032 C	2.72
913132	Y1-032 E	18.2
913311	Y1-071	0.04
Y2-044	Y2-044	24.87
914131	Y2-055	9.93
915331	Y3-062 C	0.42
915332	Y3-062 E	2.85
915771	Y3-092 OP2	165.58

Appendix 56

(PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 84.9% to 100.22% (**DC power flow**) of its emergency rating (505 MVA) for the single line contingency outage of 'B_PN115-LX-#161'. This project contributes approximately 77.35 MW to the thermal violation.

CONTINGENCY 'B_PN115-LX-#161' /* RIDGWAY -
WHETSTONE (DR) 115 KV & WHETSTONE XF#1
DISCONNECT BRANCH FROM BUS 200582 TO BUS 200711 CKT 1
DISCONNECT BRANCH FROM BUS 200711 TO BUS 200596 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.02
293270	N-036 C	1.27
200649	PENNTECH	0.96
290113	Q-063 C	0.22
291011	S-103	0.55
200642	SENECA#1	2.86
200643	SENECA#2	2.66
200644	SENECA#3	0.41
292391	T-121C	2.66
903651	W3-099 C OP1	1.21
X3-050	X3-050	5.74
913401	Y1-012	0.02
913131	Y1-032 C	1.93
Y2-044	Y2-044	9.3
914131	Y2-055	10.81
915331	Y3-062 C	0.22
915771	Y3-092 OP2	77.35

Appendix 57

(PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 84.9% to 100.22% (**DC power flow**) of its emergency rating (505 MVA) for the single line contingency outage of 'B_PN115-LX-#161'. This project contributes approximately 77.35 MW to the thermal violation.

CONTINGENCY 'B_PN115-LX-#161' /* RIDGWAY -
WHETSTONE (DR) 115 KV & WHETSTONE XF#1
DISCONNECT BRANCH FROM BUS 200582 TO BUS 200711 CKT 1
DISCONNECT BRANCH FROM BUS 200711 TO BUS 200596 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.02
293270	N-036 C	1.27
200649	PENNTECH	0.96
290113	Q-063 C	0.22
291011	S-103	0.55
200642	SENECA#1	2.86
200643	SENECA#2	2.66
200644	SENECA#3	0.41
292391	T-121C	2.66
903651	W3-099 C OP1	1.21
X3-050	X3-050	5.74
913401	Y1-012	0.02
913131	Y1-032 C	1.93
Y2-044	Y2-044	9.3
914131	Y2-055	10.81
915331	Y3-062 C	0.22
915771	Y3-092 OP2	77.35

Appendix 58

(PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200600 to bus 200819 ckt 8) loads from .2% to 57.98% (**DC power flow**) of its emergency rating (868 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 503.23 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
915771	Y3-092 OP2	503.23

Appendix 59

(PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200600 to bus 200819 ckt 8) loads from .23% to 58.01% (**DC power flow**) of its emergency rating (868 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 503.55 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B' /* ERIE WEST 345 KV
STUCK CB - CB6

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

END

Bus Number	Bus Name	Full Contribution
915771	Y3-092 OP2	503.55

Appendix 60

(PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200600 to bus 200819 ckt 8) loads from .23% to 58.01% (**DC power flow**) of its emergency rating (868 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 503.53 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A' /* ERIE WEST 345 KV
STUCK CB - CB5

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1

END

Bus Number	Bus Name	Full Contribution
915771	Y3-092 OP2	503.53

Appendix 61

(PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 82.43% to 99.1% (**DC power flow**) of its normal rating (426 MVA) for non-contingency condition. This project contributes approximately 70.99 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.02
293270	N-036 C	1.08
200649	PENNTECH	0.74
290113	Q-063 C	0.2
296914	R-092 C	0.86
291011	S-103	0.51
200642	SENECA#1	2.66
200643	SENECA#2	2.47
200644	SENECA#3	0.38
292391	T-121C	2.26
903651	W3-099 C OP1	1.11
913401	Y1-012	0.02
913131	Y1-032 C	1.64
914131	Y2-055	10.
915331	Y3-062 C	0.21
915771	Y3-092 OP2	70.99

Appendix 62

(PENELEC - AP) The FOREST-ELKO 230 kV line (from bus 200581 to bus 235175 ckt 1) loads from 82.43% to 99.1% (**DC power flow**) of its normal rating (426 MVA) for non-contingency condition. This project contributes approximately 70.99 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.02
293270	N-036 C	1.08
200649	PENNTECH	0.74
290113	Q-063 C	0.2
296914	R-092 C	0.86
291011	S-103	0.51
200642	SENECA#1	2.66
200643	SENECA#2	2.47
200644	SENECA#3	0.38
292391	T-121C	2.26
903651	W3-099 C OP1	1.11
913401	Y1-012	0.02
913131	Y1-032 C	1.64
914131	Y2-055	10.
915331	Y3-062 C	0.21
915771	Y3-092 OP2	70.99

Appendix 63

(PENELEC - PENELEC) The ERIE SE-4MILE_230 230 kV line (from bus 200819 to bus 200928 ckt 1) loads from 15.33% to 65.62% (**DC power flow**) of its emergency rating (584 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 383.23 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.09
290113	Q-063 C	0.05
200642	SENECA#1	0.68
200643	SENECA#2	0.63
200644	SENECA#3	0.1
910651	X3-039	4.8
915771	Y3-092 OP2	383.23

Appendix 64

(PENELEC - PENELEC) The E.TWANDA 230/115 kV transformer (from bus 200675 to bus 200674 ckt 4) loads from 107.79% to 111.89% (**DC power flow**) of its emergency rating (241 MVA) for the bus fault outage of 'C1_PN230-BS-#5A'. This project contributes approximately 28.92 MW to the thermal violation.

CONTINGENCY 'C1_PN230-BS-#5A'

/* EAST TOWANDA

#1 230 KV BUS FAULT

DISCONNECT BRANCH FROM BUS 200701 TO BUS 200675 CKT 1

DISCONNECT BRANCH FROM BUS 200675 TO BUS 130763 CKT 1

DISCONNECT BRANCH FROM BUS 200674 TO BUS 200675 CKT 3

END

Bus Number	Bus Name	Full Contribution
907481	X1-109	233.97
909021	X2-012 C	10.33
915771	Y3-092 OP2	28.92

Appendix 65

(PENELEC - PENELEC) The E.TWANDA 230/115 kV transformer (from bus 200675 to bus 200674 ckt 4) loads from 107.79% to 111.89% (**DC power flow**) of its emergency rating (241 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-#3F'. This project contributes approximately 28.92 MW to the thermal violation.

```
CONTINGENCY 'C2_PN230-SB-#3F'                                /* EAST TOWANDA
230 KV STUCK CB - (#3 XF)
DISCONNECT BRANCH FROM BUS 200675 TO BUS 130763 CKT 1
DISCONNECT BRANCH FROM BUS 200701 TO BUS 200675 CKT 1
DISCONNECT BRANCH FROM BUS 200674 TO BUS 200675 CKT 3
END
```

Bus Number	Bus Name	Full Contribution
907481	X1-109	233.97
909021	X2-012 C	10.33
915771	Y3-092 OP2	28.92

Appendix 66

(PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200819 to bus 200600 ckt 8) loads from .2% to 58.17% (**DC power flow**) of its emergency rating (868 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 503.23 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
915771	Y3-092 OP2	503.23

Appendix 67

(PENELEC - PENELEC) The ERIE SE-4MILE_230 230 kV line (from bus 200819 to bus 200928 ckt 1) loads from 16.83% to 66.51% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 388.42 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A' /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.09
910651	X3-039	5.16
915771	Y3-092 OP2	388.42

Appendix 68

(PENELEC - PENELEC) The ERIE SE-4MILE_230 230 kV line (from bus 200819 to bus 200928 ckt 1) loads from 16.88% to 66.56% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 388.72 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B' /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.09
910651	X3-039	5.18
915771	Y3-092 OP2	388.72

Appendix 69

(PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200819 to bus 200600 ckt 8) loads from .23% to 58.24% (**DC power flow**) of its emergency rating (868 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 503.53 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A' /* ERIE WEST 345 KV
STUCK CB - CB5

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1

END

Bus Number	Bus Name	Full Contribution
915771	Y3-092 OP2	503.53

Appendix 70

(PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200819 to bus 200600 ckt 8) loads from .23% to 58.24% (**DC power flow**) of its emergency rating (868 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 503.55 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B' /* ERIE WEST 345 KV
STUCK CB - CB6

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

END

Bus Number	Bus Name	Full Contribution
915771	Y3-092 OP2	503.55

Appendix 71

(FE - FE) The 02SBRNQ2-02ASH_2 138 kV line (from bus 239096 to bus 238543 ckt 1) loads from 28.04% to 72.41% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.47
884781	S-058 E	1.54
907481	X1-109	-17.51
913161	Y1-035	11.
913171	Y1-036	9.72
914301	Y2-085 OP1	8.81
915771	Y3-092 OP2	71.38

Appendix 72

(FE - FE) The 02AUSTQ2-02SBRNQ2 138 kV line (from bus 239212 to bus 239096 ckt 1) loads from 28.04% to 72.41% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.47
884781	S-058 E	1.54
907481	X1-109	-17.51
913161	Y1-035	11.
913171	Y1-036	9.72
914301	Y2-085 OP1	8.81
915771	Y3-092 OP2	71.38

Appendix 73

(PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 60.41% to 88.74% (**DC power flow**) of its emergency rating (558 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 158.05 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.04
293270	N-036 C	0.59
290113	Q-063 C	0.25
291011	S-103	0.66
200642	SENECA#1	3.25
200643	SENECA#2	3.02
200644	SENECA#3	0.46
292391	T-121C	1.1
903651	W3-099 C OP1	1.96
910651	X3-039	5.16
X3-050	X3-050	7.06
913401	Y1-012	0.03
913131	Y1-032 C	0.84
Y2-044	Y2-044	11.43
914131	Y2-055	13.
915331	Y3-062 C	0.36
915771	Y3-092 OP2	158.05

Appendix 74

(AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.73% to 85.08% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 56.02 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
298466	B-018	0.07
884780	S-058 C	1.11
884781	S-058 E	3.66
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.48
Y2-068	Y2-068	13.27
915771	Y3-092 OP2	56.02

Appendix 75

(AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.73% to 85.08% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 56.02 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1

DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
02PERRY 345.00 02AT 345.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
02AT 345.00 02S8-ATT 345.00

DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
02S8-ATT 345.00 02ASH_3 138.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
298466	B-018	0.07
884780	S-058 C	1.11
884781	S-058 E	3.66
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.48
Y2-068	Y2-068	13.27
915771	Y3-092 OP2	56.02

Appendix 76

(AP - AP) The A LUDLUM 4 J-ALL L&D 6 T 138 kV line (from bus 235138 to bus 235139 ckt 1) loads from 52.73% to 85.08% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 56.02 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
298466	B-018	0.07
884780	S-058 C	1.11
884781	S-058 E	3.66
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.48
Y2-068	Y2-068	13.27
915771	Y3-092 OP2	56.02

Appendix 77

(PENELEC - PENELEC) The UNION CY-ERIE SO. 115 kV line (from bus 200571 to bus 200567 ckt 1) loads from 18.02% to 67.96% (**DC power flow**) of its emergency rating (191 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 101.06 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
200662	SCRUB GR	0.42
907481	X1-109	-13.34
915771	Y3-092 OP2	101.06

Appendix 78

(PENELEC - PENELEC) The 4MILE_230 230/115 kV transformer (from bus 200928 to bus 200927 ckt 6) loads from 70.38% to 94.71% (**DC power flow**) of its emergency rating (323 MVA) for the single line contingency outage of 'B_PN230-SX-#17A'. This project contributes approximately 69.5 MW to the thermal violation.

CONTINGENCY 'B_PN230-SX-#17A'
FOURMILE 230 KV

/* ERIE EAST -

DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1 /*
ERIE SE 230.00 FOURMILE 230.00
END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.07
203261	BLOSSBCT	0.06
203283	MANOR	< 0.01
200851	MEHOOP3	0.19
293270	N-036 C	0.66
294572	P-028 C	0.09
292391	T-121C	0.84
293416	V3-042C	1.12
903651	W3-099 C OP1	7.16
907481	X1-109	58.08
X3-050	X3-050	16.58
912251	X4-048 OP1	21.63
913401	Y1-012	0.06
913131	Y1-032 C	0.79
913191	Y1-047 OP1	1.08
914061	Y2-042	1.04
Y2-044	Y2-044	26.85
914151	Y2-060	0.25
914421	Y2-104	0.45
915331	Y3-062 C	1.28
915771	Y3-092 OP2	69.5

Appendix 79

(AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.88% to 88.02% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 56.05 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.15
298466	B-018	0.07
884780	S-058 C	1.1
884781	S-058 E	3.63
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.5
Y2-068	Y2-068	13.12
915771	Y3-092 OP2	56.05

Appendix 80

(AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.88% to 88.02% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 56.05 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_018' /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1

DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /*
02PERRY 345.00 02AT 345.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /*
02AT 345.00 02S8-ATT 345.00

DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /*
02S8-ATT 345.00 02ASH_3 138.00

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.15
298466	B-018	0.07
884780	S-058 C	1.1
884781	S-058 E	3.63
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.5
Y2-068	Y2-068	13.12
915771	Y3-092 OP2	56.05

Appendix 81

(AP - AP) The ALL L&D 6 T-KITTANNING 138 kV line (from bus 235139 to bus 235204 ckt 1) loads from 55.88% to 88.02% (**DC power flow**) of its emergency rating (152 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 56.05 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
235134	ALL L&D 6	0.15
298466	B-018	0.07
884780	S-058 C	1.1
884781	S-058 E	3.63
235610	SPRINGDALE 1	0.19
235611	SPRINGDALE 2	0.19
235612	SPRINGDALE 3	0.72
235613	SPRINGDALE 4	0.72
235614	SPRINGDALE 5	0.75
907481	X1-109	-22.5
Y2-068	Y2-068	13.12
915771	Y3-092 OP2	56.05

Appendix 82

(PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200599 to bus 200632 ckt 3) loads from 39.18% to 79.75% (**DC power flow**) of its emergency rating (306 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 131.61 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
907481	X1-109	-24.68
900404	X3-028 C	4.86
900405	X3-028 E	6.48
915771	Y3-092 OP2	131.61

Appendix 83

(PENELEC - PENELEC) The PPGAPI-MRGAN ST 115 kV line (from bus 200822 to bus 200575 ckt 1) loads from 71.1% to 95.82% (**DC power flow**) of its emergency rating (227 MVA) for the single line contingency outage of 'B_LINE_TIE_035'. This project contributes approximately 51.24 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_035' /* ERIE W 345.00 -
WAYNE 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1 /*
ERIE W 345.00 WAYNE 345.00
END

Bus Number	Bus Name	Full Contribution
235567	ARMSTRONG 1	5.76
235569	ARMSTRONG 2	5.72
200828	HNSMLK 1	0.23
200829	HNSMLK 2	0.23
200830	HNSMLK 3	0.23
200831	HNSMLK 4	0.23
200832	HNSMLK 5	0.23
200608	PINEY #1	0.06
200657	PINEY CK	0.07
200662	SCRUB GR	0.42
910651	X3-039	38.9
915771	Y3-092 OP2	51.24

Appendix 84

(FE - FE) The 02ASH_3-02SBRNQ4 138 kV line (from bus 238544 to bus 239098 ckt 1) loads from 22.83% to 71.71% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 73.8 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'                                /* LINE 02AT TO 02PERRY
345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	42.91
200828	HNSMLK 1	0.13
200829	HNSMLK 2	0.13
200830	HNSMLK 3	0.13
200831	HNSMLK 4	0.13
200832	HNSMLK 5	0.13
200849	LAKVU GN	0.02
901211	W1-070A_AT4	1.11
903651	W3-099 C OP1	0.83
910651	X3-039	5.89
915331	Y3-062 C	0.15
915771	Y3-092 OP2	73.8

Appendix 85

(PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200632 to bus 200599 ckt 1) loads from 16.16% to 68.45% (**DC power flow**) of its emergency rating (328 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 220.58 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B'
STUCK CB - CB6

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.05
200857	LAURHILL	3.77
293270	N-036 C	0.68
293271	N-036 E	2.74
200888	P-047 E	4.72
290113	Q-063 C	0.08
296914	R-092 C	0.8
296915	R-092 E	3.19
291011	S-103	0.38
200642	SENECA#1	1.09
200643	SENECA#2	1.01
200644	SENECA#3	0.16
200715	SHAWVL 1	6.24
200722	SHAWVL 2	6.39
200665	SHAWVL 3	9.22
292391	T-121C	1.1
292392	T-121E	4.4
293416	V3-042C	0.71
293417	V3-042E	4.73
903651	W3-099 C OP1	2.71
903652	W3-099 E OP1	18.13
907481	X1-109	41.36
910651	X3-039	15.4
X3-050	X3-050	11.09
913401	Y1-012	0.03
913131	Y1-032 C	0.91
913132	Y1-032 E	6.09
Y2-044	Y2-044	17.95
914131	Y2-055	7.45
915331	Y3-062 C	0.49
915332	Y3-062 E	3.32

915771	Y3-092 OP2	220.58

Appendix 86

(PENELEC - PENELEC) The UNION CY-TITUSVIL 115 kV line (from bus 200571 to bus 200585 ckt 1) loads from 48.58% to 84.88% (**DC power flow**) of its emergency rating (120 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 101.06 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.02
903651	W3-099 C OP1	1.22
903652	W3-099 E OP1	8.18
914131	Y2-055	3.11
915331	Y3-062 C	0.22
915332	Y3-062 E	1.5
915771	Y3-092 OP2	101.06

Appendix 87

(PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 63.54% to 92.79% (**DC power flow**) of its emergency rating (558 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 163.18 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A'
STUCK CB - CB5

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.04
293270	N-036 C	0.6
293271	N-036 E	2.42
290113	Q-063 C	0.25
291011	S-103	0.67
200642	SENECA#1	3.27
200643	SENECA#2	3.04
200644	SENECA#3	0.47
292391	T-121C	1.13
292392	T-121E	4.52
903651	W3-099 C OP1	2.02
903652	W3-099 E OP1	13.55
910651	X3-039	5.52
X3-050	X3-050	8.56
913131	Y1-032 C	0.87
913132	Y1-032 E	5.79
Y2-044	Y2-044	13.86
914131	Y2-055	13.17
915331	Y3-062 C	0.37
915332	Y3-062 E	2.51
915771	Y3-092 OP2	163.18

Appendix 88

(PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 63.52% to 92.81% (**DC power flow**) of its emergency rating (558 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 163.47 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B'
STUCK CB - CB6

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.04
293270	N-036 C	0.61
293271	N-036 E	2.42
290113	Q-063 C	0.25
291011	S-103	0.67
200642	SENECA#1	3.27
200643	SENECA#2	3.04
200644	SENECA#3	0.47
292391	T-121C	1.13
292392	T-121E	4.52
903651	W3-099 C OP1	2.03
903652	W3-099 E OP1	13.57
910651	X3-039	5.54
X3-050	X3-050	8.58
913401	Y1-012	0.03
913131	Y1-032 C	0.87
913132	Y1-032 E	5.8
Y2-044	Y2-044	13.89
914131	Y2-055	13.18
915331	Y3-062 C	0.37
915332	Y3-062 E	2.51
915771	Y3-092 OP2	163.47

Appendix 89

(FE - FE) The 02PERRY-02L.CENTER 345 kV line (from bus 239036 to bus 239334 ckt 1) loads from 77.92% to 100.12% (**DC power flow**) of its emergency rating (1673 MVA) for the tower line contingency outage of 'C5-TWL-NR63A'. This project contributes approximately 371.46 MW to the thermal violation.

CONTINGENCY 'C5-TWL-NR63A' /* PERRY-EASTLAKE
AND PERRY-NORTHFIELD 345KV LINE OUTAGES

DISCONNECT BRANCH FROM BUS 238684 TO BUS 239036 CKT 1 /*
02EASTLK 345.00 02PERRY 345.00

DISCONNECT BRANCH FROM BUS 239358 TO BUS 239036 CKT 1 /*
02NFIELD 345.00 02PERRY 345.00

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	26.86
239035	02PERRG1	37.22
200887	ARMNA MT P47	0.12
235567	ARMSTRONG 1	20.11
235569	ARMSTRONG 2	20.
203261	BLOSSBCT	0.11
200828	HNSMLK 1	0.66
200829	HNSMLK 2	0.66
200830	HNSMLK 3	0.66
200831	HNSMLK 4	0.66
200832	HNSMLK 5	0.66
200849	LAKVU GN	0.08
200857	LAURHILL	8.4
293270	N-036 C	1.52
293271	N-036 E	6.09
200888	P-047 E	10.74
200649	PENNTECH	0.29
200608	PINEY #1	0.19
200657	PINEY CK	0.21
290113	Q-063 C	0.15
296914	R-092 C	1.82
296915	R-092 E	7.28
291011	S-103	0.63
200662	SCRUB GR	0.88
200642	SENECA#1	1.98
200643	SENECA#2	1.84
200644	SENECA#3	0.28
200715	SHAWVL 1	14.65
200722	SHAWVL 2	15.01

200665	SHAWVL 3	21.25
292391	T-121C	2.4
292392	T-121E	9.61
292984	U2-055C	1.28
292985	U2-055E	8.59
297050	V2-019 E	< 0.01
293416	V3-042C	1.45
293417	V3-042E	9.72
901211	W1-070A_AT4	0.69
901212	W1-070A_AT4	4.62
903651	W3-099 C OP1	4.19
903652	W3-099 E OP1	28.02
905071	W4-004B_AT11	10.54
905072	W4-004B_AT11	9.09
907481	X1-109	88.35
910651	X3-039	29.56
X3-050	X3-050	18.
913401	Y1-012	0.06
913131	Y1-032 C	2.01
913132	Y1-032 E	13.43
913311	Y1-071	0.04
Y2-044	Y2-044	29.15
914131	Y2-055	12.35
915331	Y3-062 C	0.76
915332	Y3-062 E	5.16
915771	Y3-092 OP2	371.46

Appendix 90

(AP - AP) The KISKI VALLEY-GARRETT'S R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.96% to 84.35% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 66.13 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                /* LINE ERIE W TO
02PERRY 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END
```

Bus Number	Bus Name	Full Contribution
884780	S-058 C	1.28
884781	S-058 E	4.23
907481	X1-109	-25.65
Y2-068	Y2-068	14.93
915771	Y3-092 OP2	66.13

Appendix 91

(AP - AP) The KISKI VALLEY-GARRETTS R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.96% to 84.35% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 66.13 MW to the thermal violation.

CONTINGENCY 'B_LINE_SY_017' /* LINE 02AT TO ERIE
W 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /*
02AT 345.00 ERIE W 345.00

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	1.28
884781	S-058 E	4.23
907481	X1-109	-25.65
Y2-068	Y2-068	14.93
915771	Y3-092 OP2	66.13

Appendix 92

(AP - AP) The KISKI VALLEY-GARRETTS R J 138 kV line (from bus 235202 to bus 235282 ckt 1) loads from 45.96% to 84.35% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 66.13 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
884780	S-058 C	1.28
884781	S-058 E	4.23
907481	X1-109	-25.65
Y2-068	Y2-068	14.93
915771	Y3-092 OP2	66.13

Appendix 93

(FE - FE) The 02SP Q-2-02AUSTQ2 138 kV line (from bus 239113 to bus 239212 ckt 1) loads from 34.47% to 78.83% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.47
884781	S-058 E	1.54
907481	X1-109	-17.51
913161	Y1-035	11.
913171	Y1-036	9.72
914301	Y2-085 OP1	8.81
915771	Y3-092 OP2	71.38

Appendix 94

(PENELEC - PENELEC) The WAYNE-GENEVA 115 kV line (from bus 200598 to bus 200590 ckt 1) loads from 71.29% to 97.27% (**DC power flow**) of its emergency rating (216 MVA) for the single line contingency outage of 'B_LINE_TIE_035'. This project contributes approximately 51.24 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_035' /* ERIE W 345.00 -
WAYNE 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1 /*
ERIE W 345.00 WAYNE 345.00
END

Bus Number	Bus Name	Full Contribution
235567	ARMSTRONG 1	5.76
235569	ARMSTRONG 2	5.72
200828	HNSMLK 1	0.23
200829	HNSMLK 2	0.23
200830	HNSMLK 3	0.23
200831	HNSMLK 4	0.23
200832	HNSMLK 5	0.23
200608	PINEY #1	0.06
200657	PINEY CK	0.07
200662	SCRUB GR	0.42
915771	Y3-092 OP2	51.24

Appendix 95

(PENELEC - PENELEC) The GORE JCT-GESG TAP 115 kV line (from bus 200577 to bus 200850 ckt 1) loads from 10.81% to 67.18% (**DC power flow**) of its emergency rating (308 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 193.72 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	1.99
884781	S-058 E	6.58
907481	X1-109	-35.27
915771	Y3-092 OP2	193.72

Appendix 96

(PENELEC - PENELEC) The CNYO&G-N.MESHPN 230 kV line (from bus 200924 to bus 200706 ckt 1F) loads from 100.15% to 112.91% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 62.24 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.2
203261	BLOSSBCT	0.2
94106	GRAYMONT	0.1
200828	HNSMLK 1	0.14
200829	HNSMLK 2	0.14
200830	HNSMLK 3	0.14
200831	HNSMLK 4	0.14
200832	HNSMLK 5	0.14
200838	HOMER C2	1.61
200839	HOMER C3	1.7
200849	LAKVU GN	0.02
203283	MANOR	0.02
293270	N-036 C	1.55
200649	PENNTTECH	0.18
290085	Q-036 C	0.03
295247	Q-046	0.03
290113	Q-063 C	0.07
296914	R-092 C	1.27
291011	S-103	0.24
200662	SCRUB GR	0.2
200642	SENECA#1	0.85
200643	SENECA#2	0.79
200644	SENECA#3	0.12
200715	SHAWVL 1	11.52
200722	SHAWVL 2	11.73
200665	SHAWVL 3	17.55
200666	SHAWVL 4	17.37
292391	T-121C	1.92
292984	U2-055C	1.08
293416	V3-042C	0.94
903651	W3-099 C OP1	1.07
907481	X1-109	303.98
910651	X3-039	5.45
X3-050	X3-050	19.62

913401	Y1-012	0.04
913131	Y1-032 C	1.83
Y2-044	Y2-044	31.76
914131	Y2-055	4.6
Y2-068	Y2-068	47.27
915011	Y3-010 C	0.72
915331	Y3-062 C	0.2
915771	Y3-092 OP2	62.24

Appendix 97

(PENELEC - PENELEC) The HOMER CY 345/230 kV transformer (from bus 200769 to bus 200767 ckt 1) loads from 83.17% to 104.23% (**DC power flow**) of its emergency rating (807 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-9E'. This project contributes approximately 169.93 MW to the thermal violation.

```
CONTINGENCY 'C2_PN230-SB-9E'                                /* HOMER CITY 230
KV STUCK CB - CB206
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200769 CKT 2
DISCONNECT BRANCH FROM BUS 200767 TO BUS 200837 CKT 1
REMOVE MACHINE 1 FROM BUS 200837                             /* 0
END
```

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	19.44
200887	ARMNA MT P47	0.24
235567	ARMSTRONG 1	29.47
235569	ARMSTRONG 2	29.3
203261	BLOSSBCT	0.21
200828	HNSMLK 1	0.72
200829	HNSMLK 2	0.72
200830	HNSMLK 3	0.72
200831	HNSMLK 4	0.72
200832	HNSMLK 5	0.72
200838	HOMER C2	14.74
200839	HOMER C3	15.6
200849	LAKVU GN	0.04
200857	LAURHILL	8.75
203283	MANOR	0.01
293270	N-036 C	2.92
293271	N-036 E	11.69
294573	P-028 E	16.64
200888	P-047 E	21.04
200649	PENNTech	0.32
290113	Q-063 C	0.16
296914	R-092 C	1.42
296915	R-092 E	5.67
291011	S-103	0.55
200662	SCRUB GR	0.62
200642	SENECA#1	2.11
200643	SENECA#2	1.96
200644	SENECA#3	0.3
200715	SHAWVL 1	9.76

200722	SHAWVL 2	9.97
200665	SHAWVL 3	16.18
292391	T-121C	4.42
292392	T-121E	17.67
297050	V2-019 E	< 0.01
293416	V3-042C	2.13
293417	V3-042E	14.31
901211	W1-070A_AT4	0.52
901212	W1-070A_AT4	3.45
903651	W3-099 C OP1	2.47
903652	W3-099 E OP1	16.55
907481	X1-109	123.11
910522	X3-003 E	2.77
910651	X3-039	18.63
X3-050	X3-050	25.39
913401	Y1-012	0.07
913131	Y1-032 C	3.77
913132	Y1-032 E	25.25
913191	Y1-047 OP1	2.14
914061	Y2-042	1.88
Y2-044	Y2-044	41.1
914131	Y2-055	10.73
914151	Y2-060	0.49
914421	Y2-104	0.89
915331	Y3-062 C	0.46
915332	Y3-062 E	3.14
915771	Y3-092 OP2	169.93

Appendix 98

(FE - FE) The 02AUSTQ1-02SBRNQ1 138 kV line (from bus 239213 to bus 239095 ckt 1) loads from 38.71% to 82.58% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 70.58 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.46
884781	S-058 E	1.52
907481	X1-109	-17.31
913161	Y1-035	10.86
913171	Y1-036	9.61
914301	Y2-085 OP1	8.72
915771	Y3-092 OP2	70.58

Appendix 99

(FE - FE) The 02LRCRQ1-02AUSTQ1 138 kV line (from bus 239112 to bus 239213 ckt 1) loads from 38.71% to 82.58% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 70.58 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.46
884781	S-058 E	1.52
907481	X1-109	-17.31
913161	Y1-035	10.86
913171	Y1-036	9.61
914301	Y2-085 OP1	8.72
915771	Y3-092 OP2	70.58

Appendix 100

(PENELEC - PENELEC) The ROCKWOOD-Q34 115 kV line (from bus 200746 to bus 290079 ckt 1) loads from 124.37% to 126.02% (**DC power flow**) of its emergency rating (166 MVA) for the bus fault outage of 'AP_C1_11'. This project contributes approximately 11.06 MW to the thermal violation.

CONTINGENCY 'AP_C1_11'

/CUMBERLAND_138

OPEN BUS 235454

OPEN BUS 237027

END

Bus Number	Bus Name	Full Contribution
200854	BERKLY H	20.71
200840	DEEPCRK1	0.12
200841	DEEPCRK2	0.12
200835	DSGENWIN	0.46
292350	K-023	0.19
292542	L-013 1	22.09
200856	L-013 C	0.25
293901	O-048 C	0.22
293902	O-048 E	19.88
293431	R-040 C	0.01
293432	R-040 E	1.24
290228	S-014 C	0.08
290229	S-014 E	6.85
293023	U2-073C OP1	0.12
293024	U2-073E OP1	17.45
236001	WARRIOR RUN	0.9
900404	X3-028 C	1.01
900405	X3-028 E	1.34
913001	Y1-003 C OP1	2.7
913002	Y1-003 E OP1	18.05
913141	Y1-033 C OP1	2.95
913142	Y1-033 E OP1	19.74
Y2-068	Y2-068	12.25
915771	Y3-092 OP2	11.06
200813	YOUGH	0.13

Appendix 101

(PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200600 to bus 200568 ckt 5) loads from .14% to 64.02% (**DC power flow**) of its emergency rating (776 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 496.77 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
915771	Y3-092 OP2	496.77

Appendix 102

(PENELEC - PENELEC) The ERIE SO 345/230 kV transformer (from bus 200568 to bus 200600 ckt 5) loads from .14% to 64.16% (**DC power flow**) of its emergency rating (776 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 496.77 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
915771	Y3-092 OP2	496.77

Appendix 103

(PENELEC - PENELEC) The WARREN-ERIE S TIE 230 kV line (from bus 200811 to bus 200918 ckt 1) loads from 25.82% to 77.09% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 318.4 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'

/* ERIE WEST 345 KV

STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
290113	Q-063 C	0.12
296914	R-092 C	0.73
296915	R-092 E	2.92
291011	S-103	0.33
200642	SENECA#1	1.58
200643	SENECA#2	1.46
200644	SENECA#3	0.22
914131	Y2-055	6.52
915771	Y3-092 OP2	318.4

Appendix 104

(FE - FE) The 02SP Q-4-02SBRNQ4 138 kV line (from bus 239115 to bus 239098 ckt 1) loads from 37.57% to 83.68% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 74.2 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.49
884781	S-058 E	1.6
907481	X1-109	-18.2
913161	Y1-035	11.41
913171	Y1-036	10.1
914301	Y2-085 OP1	9.17
915771	Y3-092 OP2	74.2

Appendix 105

(PENELEC - PENELEC) The E.TWANDA-CNYO&G 230 kV line (from bus 200675 to bus 200924 ckt 1F) loads from 108.13% to 119.47% (**DC power flow**) of its emergency rating (549 MVA) for the single line contingency outage of 'SUSQ 1'. This project contributes approximately 62.24 MW to the thermal violation.

CONTINGENCY 'SUSQ 1'

REMOVE MACHINE 1 FROM BUS 208918

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.2
203261	BLOSSBCT	0.2
94106	GRAYMONT	0.1
200828	HNSMLK 1	0.14
200829	HNSMLK 2	0.14
200830	HNSMLK 3	0.14
200831	HNSMLK 4	0.14
200832	HNSMLK 5	0.14
200838	HOMER C2	1.61
200839	HOMER C3	1.7
200849	LAKVU GN	0.02
203283	MANOR	0.02
293270	N-036 C	1.55
200649	PENNTECH	0.18
290085	Q-036 C	0.03
295247	Q-046	0.03
290113	Q-063 C	0.07
296914	R-092 C	1.27
291011	S-103	0.24
200662	SCRUB GR	0.2
200642	SENECA#1	0.85
200643	SENECA#2	0.79
200644	SENECA#3	0.12
200715	SHAWVL 1	11.52
200722	SHAWVL 2	11.73
200665	SHAWVL 3	17.55
200666	SHAWVL 4	17.37
292391	T-121C	1.92
292984	U2-055C	1.08
293416	V3-042C	0.94
903651	W3-099 C OP1	1.07
907481	X1-109	303.98

910651	X3-039	5.45
X3-050	X3-050	19.62
913401	Y1-012	0.04
913131	Y1-032 C	1.83
Y2-044	Y2-044	31.76
914131	Y2-055	4.6
Y2-068	Y2-068	47.27
915011	Y3-010 C	0.72
915331	Y3-062 C	0.2
915771	Y3-092 OP2	62.24

Appendix 106

(PENELEC - PENELEC) The GLADE-FOREST 230 kV line (from bus 200593 to bus 200581 ckt 1) loads from 60.79% to 95.57% (**DC power flow**) of its emergency rating (558 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 194.1 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'

/* ERIE WEST 345 KV

STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.04
293270	N-036 C	0.72
293271	N-036 E	2.89
290113	Q-063 C	0.26
291011	S-103	0.73
200642	SENECA#1	3.45
200643	SENECA#2	3.2
200644	SENECA#3	0.49
292391	T-121C	1.32
292392	T-121E	5.27
903651	W3-099 C OP1	2.43
903652	W3-099 E OP1	16.26
910651	X3-039	8.68
X3-050	X3-050	10.37
913401	Y1-012	0.03
913131	Y1-032 C	1.02
913132	Y1-032 E	6.85
Y2-044	Y2-044	16.79
914131	Y2-055	14.33
915331	Y3-062 C	0.44
915332	Y3-062 E	3.01
915771	Y3-092 OP2	194.1

Appendix 107

(PENELEC - PENELEC) The ERIE SO.-EDINB S. 115 kV line (from bus 200567 to bus 200572 ckt 1) loads from 8.39% to 69.84% (**DC power flow**) of its emergency rating (185 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 128.92 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.03
290113	Q-063 C	0.05
291011	S-103	0.21
200642	SENECA#1	0.59
200643	SENECA#2	0.55
200644	SENECA#3	0.08
903651	W3-099 C OP1	1.56
913401	Y1-012	0.02
914131	Y2-055	4.14
915331	Y3-062 C	0.28
915771	Y3-092 OP2	128.92

Appendix 108

(PENELEC - PENELEC) The E.TWANDA-CNYO&G 230 kV line (from bus 200675 to bus 200924 ckt 1F) loads from 106.22% to 118.97% (**DC power flow**) of its normal rating (488 MVA) for non-contingency condition. This project contributes approximately 62.24 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.2
203261	BLOSSBCT	0.2
94106	GRAYMONT	0.1
200828	HNSMLK 1	0.14
200829	HNSMLK 2	0.14
200830	HNSMLK 3	0.14
200831	HNSMLK 4	0.14
200832	HNSMLK 5	0.14
200838	HOMER C2	1.61
200839	HOMER C3	1.7
200849	LAKVU GN	0.02
203283	MANOR	0.02
293270	N-036 C	1.55
200649	PENNTech	0.18
290085	Q-036 C	0.03
295247	Q-046	0.03
290113	Q-063 C	0.07
296914	R-092 C	1.27
291011	S-103	0.24
200662	SCRUB GR	0.2
200642	SENECA#1	0.85
200643	SENECA#2	0.79
200644	SENECA#3	0.12
200715	SHAWVL 1	11.52
200722	SHAWVL 2	11.73
200665	SHAWVL 3	17.55
200666	SHAWVL 4	17.37
292391	T-121C	1.92
292984	U2-055C	1.08
293416	V3-042C	0.94
903651	W3-099 C OP1	1.07
907481	X1-109	303.98
910651	X3-039	5.45
X3-050	X3-050	19.62

913401	Y1-012	0.04
913131	Y1-032 C	1.83
Y2-044	Y2-044	31.76
914131	Y2-055	4.6
Y2-068	Y2-068	47.27
915011	Y3-010 C	0.72
915331	Y3-062 C	0.2
915771	Y3-092 OP2	62.24

Appendix 109

(PENELEC - PENELEC) The FRVIEW E-GORE JCT 115 kV line (from bus 200578 to bus 200577 ckt 1) loads from 27.54% to 79.67% (**DC power flow**) of its emergency rating (333 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 193.72 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	1.99
884781	S-058 E	6.58
907481	X1-109	-35.27
915771	Y3-092 OP2	193.72

Appendix 110

(PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200632 to bus 200599 ckt 3) loads from 17.49% to 74.06% (**DC power flow**) of its emergency rating (306 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 222.68 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A'
STUCK CB - CB5

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1

END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.05
200857	LAURHILL	3.81
293270	N-036 C	0.69
293271	N-036 E	2.76
200888	P-047 E	4.76
290113	Q-063 C	0.08
296914	R-092 C	0.8
296915	R-092 E	3.22
291011	S-103	0.38
200642	SENECA#1	1.1
200643	SENECA#2	1.02
200644	SENECA#3	0.16
200715	SHAWVL 1	6.3
200722	SHAWVL 2	6.45
200665	SHAWVL 3	9.31
292391	T-121C	1.11
292392	T-121E	4.44
293416	V3-042C	0.71
293417	V3-042E	4.78
903651	W3-099 C OP1	2.73
903652	W3-099 E OP1	18.3
907481	X1-109	41.75
910651	X3-039	15.54
X3-050	X3-050	11.2
913401	Y1-012	0.03
913131	Y1-032 C	0.92
913132	Y1-032 E	6.15
Y2-044	Y2-044	18.13
914131	Y2-055	7.52
915331	Y3-062 C	0.49
915332	Y3-062 E	3.36

915771	Y3-092 OP2	222.68

Appendix 111

(PENELEC - PENELEC) The GESG TAP-GORE JCT 115 kV line (from bus 200850 to bus 200577 ckt 1) loads from 7.07% to 69.96% (**DC power flow**) of its emergency rating (308 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 193.72 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
 ERIE SO 345.00 LINE OUTAGE
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
 ERIE W 345.00 ERIE SO 345.00
 END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.04
203261	BLOSSBCT	0.04
200849	LAKVU GN	0.04
293270	N-036 C	0.58
200649	PENNTECH	0.12
290113	Q-063 C	0.07
291011	S-103	0.33
200642	SENECA#1	0.94
200643	SENECA#2	0.87
200644	SENECA#3	0.13
292391	T-121C	0.94
293416	V3-042C	0.61
903651	W3-099 C OP1	2.39
X3-050	X3-050	8.16
913401	Y1-012	0.03
913131	Y1-032 C	0.78
Y2-044	Y2-044	13.21
914131	Y2-055	6.54
915331	Y3-062 C	0.43
915771	Y3-092 OP2	193.72

Appendix 112

(PENELEC - PENELEC) The ERIE SO.-GESG TAP 115 kV line (from bus 200567 to bus 200850 ckt 1) loads from 15.32% to 74.67% (**DC power flow**) of its emergency rating (245 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 145.4 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.03
290113	Q-063 C	0.05
291011	S-103	0.19
200642	SENECA#1	0.6
200643	SENECA#2	0.56
200644	SENECA#3	0.09
903651	W3-099 C OP1	1.51
913401	Y1-012	0.02
914131	Y2-055	3.63
915331	Y3-062 C	0.27
915771	Y3-092 OP2	145.4

Appendix 113

(PENELEC - PENELEC) The GLADE-WARREN 230 kV line (from bus 200593 to bus 200811 ckt 1) loads from 41.96% to 88.39% (**DC power flow**) of its emergency rating (621 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 288.34 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
94106	GRAYMONT	0.09
293270	N-036 C	0.57
200649	PENNTECH	0.29
290085	Q-036 C	0.03
295247	Q-046	0.03
290113	Q-063 C	0.23
296914	R-092 C	1.51
200642	SENECA#1	2.99
200643	SENECA#2	2.77
200644	SENECA#3	0.43
200715	SHAWVL 1	11.09
200722	SHAWVL 2	11.38
200665	SHAWVL 3	16.6
200666	SHAWVL 4	16.68
292391	T-121C	1.37
292984	U2-055C	0.94
913131	Y1-032 C	0.93
915011	Y3-010 C	0.66
915771	Y3-092 OP2	288.34

Appendix 114

(PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 1.07% to 67.91% (**DC power flow**) of its emergency rating (1139 MVA) for the single line contingency outage of 'B_PN230-LS-#21'. This project contributes approximately 761.27 MW to the thermal violation.

CONTINGENCY 'B_PN230-LS-#21'

/* ERIE SOUTH 230/115

KV BANK 1 FAULT

DISCONNECT BRANCH FROM BUS 200819 TO BUS 200820 CKT 1
 DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1
 DISCONNECT BRANCH FROM BUS 200819 TO BUS 200625 CKT 4
 DISCONNECT BRANCH FROM BUS 200819 TO BUS 200600 CKT 8
 DISCONNECT BRANCH FROM BUS 200819 TO BUS 200918 CKT 1
 REDUCE BUS 200819 SHUNT BY 100 PERCENT
 DISCONNECT BUS 200819
 END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.08
203261	BLOSSBCT	0.08
94106	GRAYMONT	0.1
203283	MANOR	< 0.01
200851	MEHOOP3	0.2
293270	N-036 C	1.21
294572	P-028 C	0.1
200649	PENNTech	0.28
290085	Q-036 C	0.03
295247	Q-046	0.03
290113	Q-063 C	0.18
296914	R-092 C	1.55
291011	S-103	0.75
200642	SENECA#1	2.35
200643	SENECA#2	2.18
200644	SENECA#3	0.34
200715	SHAWVL 1	11.97
200722	SHAWVL 2	12.26
200665	SHAWVL 3	17.79
200666	SHAWVL 4	17.82
292391	T-121C	2.04
292984	U2-055C	1.05
293416	V3-042C	1.08
903651	W3-099 C OP1	3.31
907481	X1-109	65.69
910651	X3-039	5.38

X3-050	X3-050	14.02
913401	Y1-012	0.05
913131	Y1-032 C	1.65
913191	Y1-047 OP1	1.18
914061	Y2-042	1.2
Y2-044	Y2-044	22.7
914131	Y2-055	14.65
914151	Y2-060	0.27
914421	Y2-104	0.5
915011	Y3-010 C	0.74
915331	Y3-062 C	0.6
915771	Y3-092 OP2	761.27

Appendix 115

(PENELEC - PL) The OXBOW-LACK 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 110.4% to 123.72% (**DC power flow**) of its emergency rating (624 MVA) for the single line contingency outage of 'PJM SUSQ-LACK 500'. This project contributes approximately 83.16 MW to the thermal violation.

CONTINGENCY 'PJM SUSQ-LACK 500'

OPEN BRANCH FROM BUS 200022 TO BUS 200074 CKT 1
500 74 LACKAW 500 1

/* 22 SUSQ

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.27
235567	ARMSTRONG 1	10.11
235569	ARMSTRONG 2	10.05
203261	BLOSSBCT	0.25
200503	C.SLOPE	0.33
200805	COLVER13	0.29
99210	G07_NEW	5.68
94106	GRAYMONT	0.12
200828	HNSMLK 1	0.18
200829	HNSMLK 2	0.18
200830	HNSMLK 3	0.18
200831	HNSMLK 4	0.18
200832	HNSMLK 5	0.18
200837	HOMER C1	1.62
200838	HOMER C2	2.13
200839	HOMER C3	2.26
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
203283	MANOR	0.03
200851	MEHOOP3	1.37
293270	N-036 C	2.06
293602	O-018 C	0.03
94130	O66_NONFIRM	21.23
294572	P-028 C	0.7
200649	PENNTech	0.23
200608	PINEY #1	0.08
200657	PINEY CK	0.09
290085	Q-036 C	0.04
295247	Q-046	0.04
200882	Q-053 C	0.03
290113	Q-063 C	0.08
296322	R-032 C	0.03

296914	R-092 C	1.54
291011	S-103	0.31
200662	SCRUB GR	0.27
200642	SENECA#1	1.1
200643	SENECA#2	1.02
200644	SENECA#3	0.16
200715	SHAWVL 1	13.71
200722	SHAWVL 2	13.97
200665	SHAWVL 3	20.75
200666	SHAWVL 4	20.57
200809	SITHE	0.09
292391	T-121C	2.54
292984	U2-055C	1.27
292078	V1-034	0.18
293392	V3-030C	0.01
293416	V3-042C	4.29
903651	W3-099 C OP1	1.45
907991	X1-078	27.21
907481	X1-109	334.08
909091	X2-031 C	0.34
910651	X3-039	7.23
X3-050	X3-050	28.13
913401	Y1-012	0.06
913131	Y1-032 C	2.43
913191	Y1-047 OP1	7.97
913311	Y1-071	0.02
914061	Y2-042	12.63
Y2-044	Y2-044	45.55
914131	Y2-055	6.07
914151	Y2-060	1.81
Y2-068	Y2-068	63.07
914421	Y2-104	3.48
915011	Y3-010 C	0.85
915331	Y3-062 C	0.28
915771	Y3-092 OP2	83.16

Appendix 116

(PENELEC - PENELEC) The N.MESHPN-OXBOW 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 110.6% to 123.87% (**DC power flow**) of its emergency rating (617 MVA) for the single line contingency outage of 'PJM SUSQ-LACK 500'. This project contributes approximately 81.87 MW to the thermal violation.

CONTINGENCY 'PJM SUSQ-LACK 500'

OPEN BRANCH FROM BUS 200022 TO BUS 200074 CKT 1
500 74 LACKAW 500 1

/* 22 SUSQ

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.27
235567	ARMSTRONG 1	9.96
235569	ARMSTRONG 2	9.9
203261	BLOSSBCT	0.25
200503	C.SLOPE	0.32
200805	COLVER13	0.29
99210	G07_NEW	5.6
94106	GRAYMONT	0.12
200828	HNSMLK 1	0.18
200829	HNSMLK 2	0.18
200830	HNSMLK 3	0.18
200831	HNSMLK 4	0.18
200832	HNSMLK 5	0.18
200837	HOMER C1	1.59
200838	HOMER C2	2.1
200839	HOMER C3	2.22
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
203283	MANOR	0.03
200851	MEHOOP3	1.32
293270	N-036 C	2.03
293602	O-018 C	0.03
94130	O66_NONFIRM	20.9
294572	P-028 C	0.67
200649	PENNTech	0.22
200608	PINEY #1	0.08
200657	PINEY CK	0.09
290085	Q-036 C	0.04
295247	Q-046	0.04
200882	Q-053 C	0.03
290113	Q-063 C	0.08
296322	R-032 C	0.03

296914	R-092 C	1.52
291011	S-103	0.31
200662	SCRUB GR	0.26
200642	SENECA#1	1.09
200643	SENECA#2	1.01
200644	SENECA#3	0.16
200715	SHAWVL 1	13.53
200722	SHAWVL 2	13.78
200665	SHAWVL 3	20.48
200666	SHAWVL 4	20.3
200809	SITHE	0.09
292391	T-121C	2.5
292984	U2-055C	1.26
292078	V1-034	0.18
293392	V3-030C	0.01
293416	V3-042C	4.18
903651	W3-099 C OP1	1.42
907991	X1-078	26.79
907481	X1-109	330.17
909091	X2-031 C	0.33
910651	X3-039	7.12
X3-050	X3-050	27.66
913401	Y1-012	0.06
913131	Y1-032 C	2.4
913191	Y1-047 OP1	7.71
913311	Y1-071	0.02
Y2-044	Y2-044	44.78
914131	Y2-055	5.98
914151	Y2-060	1.75
Y2-068	Y2-068	62.13
914421	Y2-104	2.51
915011	Y3-010 C	0.84
915331	Y3-062 C	0.27
915771	Y3-092 OP2	81.87

Appendix 117

(PENELEC - PENELEC) The ERIE SE 230/115 kV transformer (from bus 200819 to bus 200820 ckt 1) loads from 28.73% to 83.2% (**DC power flow**) of its emergency rating (306 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 166.68 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.04
290113	Q-063 C	0.04
291011	S-103	0.16
200642	SENECA#1	0.59
200643	SENECA#2	0.54
200644	SENECA#3	0.08
903651	W3-099 C OP1	1.72
X3-050	X3-050	5.3
913401	Y1-012	0.02
Y2-044	Y2-044	8.58
914131	Y2-055	3.13
915331	Y3-062 C	0.31
915771	Y3-092 OP2	166.68

Appendix 118

(FE - FE) The 02LRCRQ2-02SP Q-2 138 kV line (from bus 238913 to bus 239113 ckt 1) loads from 49.3% to 93.66% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 71.38 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.47
884781	S-058 E	1.54
907481	X1-109	-17.51
913161	Y1-035	11.
913171	Y1-036	9.72
914301	Y2-085 OP1	8.81
915771	Y3-092 OP2	71.38

Appendix 119

(PENELEC - PENELEC) The ERIE SO. 230/115 kV transformer (from bus 200568 to bus 200567 ckt 6) loads from 21.75% to 80.09% (**DC power flow**) of its emergency rating (321 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 187.27 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.04
290113	Q-063 C	0.05
291011	S-103	0.17
200642	SENECA#1	0.62
200643	SENECA#2	0.58
200644	SENECA#3	0.09
903651	W3-099 C OP1	1.45
913401	Y1-012	0.02
914131	Y2-055	3.26
915331	Y3-062 C	0.26
915771	Y3-092 OP2	187.27

Appendix 120

(FE - FE) The 02LRCRQ4-02SP Q-4 138 kV line (from bus 239057 to bus 239115 ckt 1) loads from 46.31% to 92.42% (**DC power flow**) of its emergency rating (151 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 74.2 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.49
884781	S-058 E	1.6
907481	X1-109	-18.2
913161	Y1-035	11.41
913171	Y1-036	10.1
914301	Y2-085 OP1	9.17
915771	Y3-092 OP2	74.2

Appendix 121

(PENELEC - PENELEC) The GLADE-WARREN 230 kV line (from bus 200593 to bus 200811 ckt 1) loads from 42.72% to 91.2% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 298.35 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A'
STUCK CB - CB5

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Bus Number	Bus Name	Full Contribution
200857	LAURHILL	3.67
293270	N-036 C	0.53
293271	N-036 E	2.14
200649	PENNTECH	0.28
290086	Q-036 E	2.73
290113	Q-063 C	0.22
296914	R-092 C	1.47
296915	R-092 E	5.89
200642	SENECA#1	2.94
200643	SENECA#2	2.73
200644	SENECA#3	0.42
200715	SHAWVL 1	10.81
200722	SHAWVL 2	11.09
200665	SHAWVL 3	16.18
292391	T-121C	1.32
292392	T-121E	5.28
292984	U2-055C	0.92
292985	U2-055E	6.19
913131	Y1-032 C	0.89
913132	Y1-032 E	5.97
915011	Y3-010 C	0.64
915012	Y3-010 E	4.29
915771	Y3-092 OP2	298.35

Appendix 122

(PENELEC - PENELEC) The GLADE-WARREN 230 kV line (from bus 200593 to bus 200811 ckt 1) loads from 42.8% to 91.37% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 298.93 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B'
STUCK CB - CB6

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END

Bus Number	Bus Name	Full Contribution
200857	LAURHILL	3.66
293270	N-036 C	0.53
293271	N-036 E	2.13
200649	PENNTECH	0.28
290086	Q-036 E	2.72
290113	Q-063 C	0.22
296914	R-092 C	1.47
296915	R-092 E	5.88
200642	SENECA#1	2.94
200643	SENECA#2	2.73
200644	SENECA#3	0.42
200715	SHAWVL 1	10.79
200722	SHAWVL 2	11.07
200665	SHAWVL 3	16.16
292391	T-121C	1.32
292392	T-121E	5.27
292984	U2-055C	0.92
292985	U2-055E	6.18
913131	Y1-032 C	0.89
913132	Y1-032 E	5.95
915011	Y3-010 C	0.64
915012	Y3-010 E	4.29
915771	Y3-092 OP2	298.93

Appendix 123

(PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 2.95% to 72.48% (**DC power flow**) of its normal rating (982 MVA) for non-contingency condition. This project contributes approximately 682.77 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200812	ALY HYDR	0.01
200887	ARMNA MT P47	0.13
203261	BLOSSBCT	0.12
200805	COLVER13	0.26
94106	GRAYMONT	0.13
200838	HOMER C2	1.44
200839	HOMER C3	1.52
200849	LAKVU GN	0.13
203283	MANOR	< 0.01
200851	MEHOOP3	0.31
293270	N-036 C	1.63
294572	P-028 C	0.16
200649	PENNTECH	0.33
200608	PINEY #1	0.07
200657	PINEY CK	0.08
290085	Q-036 C	0.04
295247	Q-046	0.04
200882	Q-053 C	0.02
290113	Q-063 C	0.2
296914	R-092 C	1.85
291011	S-103	0.9
200662	SCRUB GR	0.22
200642	SENECA#1	2.64
200643	SENECA#2	2.45
200644	SENECA#3	0.38
200715	SHAWVL 1	14.41
200722	SHAWVL 2	14.75
200665	SHAWVL 3	21.41
200666	SHAWVL 4	21.43
292391	T-121C	2.62
292984	U2-055C	1.27
293392	V3-030C	< 0.01
293416	V3-042C	1.69
904761	V4-077 C	0.01

903651	W3-099 C OP1	6.69
200852	WARR RDG	0.01
907481	X1-109	98.26
910651	X3-039	6.96
X3-050	X3-050	22.73
913401	Y1-012	0.08
913131	Y1-032 C	2.17
913191	Y1-047 OP1	1.78
914061	Y2-042	1.79
Y2-044	Y2-044	36.8
914131	Y2-055	17.59
914151	Y2-060	0.41
914321	Y2-087 C	1.07
914421	Y2-104	0.75
915011	Y3-010 C	0.9
915331	Y3-062 C	1.21
915771	Y3-092 OP2	682.77

Appendix 124

(AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.76% to 107.36% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 83.19 MW to the thermal violation.

CONTINGENCY 'DQE_163'

/* LINE ERIE W TO

02PERRY 345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.66
884781	S-058 E	2.18
907481	X1-109	-33.19
913041	Y1-015 C	12.81
914301	Y2-085 OP1	10.77
915771	Y3-092 OP2	83.19

Appendix 125

(AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.76% to 107.36% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.66
884781	S-058 E	2.18
907481	X1-109	-33.19
913041	Y1-015 C	12.81
914301	Y2-085 OP1	10.77
915771	Y3-092 OP2	83.19

Appendix 126

(AP - AP) The PARADISE JCT-KARNS CITY 138 kV line (from bus 235141 to bus 235197 ckt 1) loads from 70.76% to 107.36% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.66
884781	S-058 E	2.18
907481	X1-109	-33.19
913041	Y1-015 C	12.81
914301	Y2-085 OP1	10.77
915771	Y3-092 OP2	83.19

Appendix 127

(AP - AP) The BUTLER-PARADISE JCT 138 kV line (from bus 235152 to bus 235141 ckt 1) loads from 70.98% to 107.57% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_017'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_017'                                /* LINE 02AT TO ERIE
W 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.66
884781	S-058 E	2.18
907481	X1-109	-33.19
913041	Y1-015 C	12.81
914301	Y2-085 OP1	10.77
915771	Y3-092 OP2	83.19

Appendix 128

(AP - AP) The BUTLER-PARADISE JCT 138 kV line (from bus 235152 to bus 235141 ckt 1) loads from 70.98% to 107.57% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'B_LINE_SY_018'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'B_LINE_SY_018'                                /* 3-TERMINAL LINE
PERRY-AT-ERIE W 345 CK 1
  DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1      /*
02PERRY 345.00 02AT 345.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1      /*
02AT 345.00 02S8-ATT 345.00
  DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8      /*
02S8-ATT 345.00 02ASH_3 138.00
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1      /*
02AT 345.00 ERIE W 345.00
END
```

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.66
884781	S-058 E	2.18
907481	X1-109	-33.19
913041	Y1-015 C	12.81
914301	Y2-085 OP1	10.77
915771	Y3-092 OP2	83.19

Appendix 129

(AP - AP) The BUTLER-PARADISE JCT 138 kV line (from bus 235152 to bus 235141 ckt 1) loads from 70.98% to 107.57% (**DC power flow**) of its emergency rating (183 MVA) for the single line contingency outage of 'DQE_163'. This project contributes approximately 83.19 MW to the thermal violation.

```
CONTINGENCY 'DQE_163'                                /* LINE ERIE W TO
02PERRY 345 CK 1
DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
END
```

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.66
884781	S-058 E	2.18
907481	X1-109	-33.19
913041	Y1-015 C	12.81
914301	Y2-085 OP1	10.77
915771	Y3-092 OP2	83.19

Appendix 130

(PENELEC - PENELEC) The GRANDVW-TITUSVIL 115 kV line (from bus 200584 to bus 200585 ckt 1) loads from 46.84% to 96.61% (**DC power flow**) of its emergency rating (149 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 78.48 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200608	PINEY #1	0.08
200657	PINEY CK	0.1
200662	SCRUB GR	0.42
907481	X1-109	-10.18
915771	Y3-092 OP2	78.48

Appendix 131

(PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 48.48% to 97.54% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 290.4 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.07
203261	BLOSSBCT	0.06
203283	MANOR	< 0.01
200851	MEHOOP3	0.18
293270	N-036 C	0.51
294572	P-028 C	0.09
293416	V3-042C	1.14
907481	X1-109	56.31
X3-050	X3-050	17.33
913401	Y1-012	0.06
913191	Y1-047 OP1	1.06
914061	Y2-042	1.
Y2-044	Y2-044	28.06
914151	Y2-060	0.24
914421	Y2-104	0.44
915331	Y3-062 C	1.46
915771	Y3-092 OP2	290.4

Appendix 132

(PENELEC - PENELEC) The VENGO JT-MRGAN ST 115 kV line (from bus 200573 to bus 200575 ckt 1) loads from 35.35% to 90.57% (**DC power flow**) of its emergency rating (149 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 132.77 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
200849	LAKVU GN	0.03
903651	W3-099 C OP1	1.51
903652	W3-099 E OP1	10.1
914131	Y2-055	3.8
915331	Y3-062 C	0.27
915332	Y3-062 E	1.84
915771	Y3-092 OP2	132.77

Appendix 133

(NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 51.49% to 99.34% (**DC power flow**) of its emergency rating (607 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 290.4 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.07
203261	BLOSSBCT	0.06
203283	MANOR	< 0.01
200851	MEHOOP3	0.18
293270	N-036 C	0.51
294572	P-028 C	0.09
293416	V3-042C	1.14
907481	X1-109	56.31
X3-050	X3-050	17.33
913401	Y1-012	0.06
913191	Y1-047 OP1	1.06
914061	Y2-042	1.
Y2-044	Y2-044	28.06
914151	Y2-060	0.24
914421	Y2-104	0.44
915771	Y3-092 OP2	290.4

Appendix 134

(PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 49.85% to 98.9% (**DC power flow**) of its emergency rating (592 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 290.4 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
 ERIE SO 345.00 LINE OUTAGE
 DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
 ERIE W 345.00 ERIE SO 345.00
 END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.07
203261	BLOSSBCT	0.06
203283	MANOR	< 0.01
200851	MEHOOP3	0.18
293270	N-036 C	0.51
294572	P-028 C	0.09
293416	V3-042C	1.14
903651	W3-099 C OP1	8.18
907481	X1-109	56.31
X3-050	X3-050	17.33
913401	Y1-012	0.06
913191	Y1-047 OP1	1.06
914061	Y2-042	1.
Y2-044	Y2-044	28.06
914151	Y2-060	0.24
914421	Y2-104	0.44
915331	Y3-062 C	1.46
915771	Y3-092 OP2	290.4

Appendix 135

(PENELEC - PL) The OXBOW-LACK 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 114.16% to 131.16% (**DC power flow**) of its normal rating (494 MVA) for non-contingency condition. This project contributes approximately 83.94 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.28
235567	ARMSTRONG 1	10.14
235569	ARMSTRONG 2	10.08
203261	BLOSSBCT	0.26
200503	C.SLOPE	0.33
200805	COLVER13	0.29
99210	G07_NEW	5.25
94106	GRAYMONT	0.12
200828	HNSMLK 1	0.18
200829	HNSMLK 2	0.18
200830	HNSMLK 3	0.18
200831	HNSMLK 4	0.18
200832	HNSMLK 5	0.18
200837	HOMER C1	1.62
200838	HOMER C2	2.14
200839	HOMER C3	2.27
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
203283	MANOR	0.03
200851	MEHOOP3	1.4
293270	N-036 C	2.09
293602	O-018 C	0.03
94130	O66_NONFIRM	19.25
294572	P-028 C	0.71
200649	PENNTech	0.23
200608	PINEY #1	0.08
200657	PINEY CK	0.09
290085	Q-036 C	0.04
295247	Q-046	0.04
200882	Q-053 C	0.03
290113	Q-063 C	0.09
296322	R-032 C	0.03
296914	R-092 C	1.56
884780	S-058 C	1.42

884781	S-058 E	4.68
291011	S-103	0.31
200662	SCRUB GR	0.27
200642	SENECA#1	1.12
200643	SENECA#2	1.04
200644	SENECA#3	0.16
200715	SHAWVL 1	13.87
200722	SHAWVL 2	14.12
200665	SHAWVL 3	20.99
200666	SHAWVL 4	20.81
200809	SITHE	0.09
292391	T-121C	2.58
292984	U2-055C	1.29
292078	V1-034	0.16
293392	V3-030C	0.01
293416	V3-042C	4.37
903651	W3-099 C OP1	1.46
907991	X1-078	25.31
907481	X1-109	340.49
909091	X2-031 C	0.34
910651	X3-039	7.29
X3-050	X3-050	28.62
913401	Y1-012	0.06
913131	Y1-032 C	2.47
913191	Y1-047 OP1	8.13
913311	Y1-071	0.02
914061	Y2-042	12.88
Y2-044	Y2-044	46.34
914131	Y2-055	6.15
914151	Y2-060	1.85
914301	Y2-085 OP1	24.79
914421	Y2-104	3.55
915011	Y3-010 C	0.86
915331	Y3-062 C	0.28
915771	Y3-092 OP2	83.94

Appendix 136

(PENELEC - PENELEC) The N.MESHPN-OXBOW 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 115.79% to 133.08% (**DC power flow**) of its normal rating (478 MVA) for non-contingency condition. This project contributes approximately 82.64 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.27
235567	ARMSTRONG 1	9.99
235569	ARMSTRONG 2	9.93
203261	BLOSSBCT	0.25
200503	C.SLOPE	0.32
200805	COLVER13	0.29
94106	GRAYMONT	0.12
200828	HNSMLK 1	0.18
200829	HNSMLK 2	0.18
200830	HNSMLK 3	0.18
200831	HNSMLK 4	0.18
200832	HNSMLK 5	0.18
200837	HOMER C1	1.59
200838	HOMER C2	2.11
200839	HOMER C3	2.24
200636	IUP CO-G	0.03
200849	LAKVU GN	0.02
203283	MANOR	0.03
200851	MEHOOP3	1.35
293270	N-036 C	2.06
293602	O-018 C	0.03
94130	O66_NONFIRM	18.96
294572	P-028 C	0.69
200649	PENNTech	0.23
200608	PINEY #1	0.08
200657	PINEY CK	0.09
290085	Q-036 C	0.04
295247	Q-046	0.04
200882	Q-053 C	0.03
290113	Q-063 C	0.08
296322	R-032 C	0.03
296914	R-092 C	1.54
884780	S-058 C	1.4
884781	S-058 E	4.61

291011	S-103	0.31
200662	SCRUB GR	0.26
200642	SENECA#1	1.1
200643	SENECA#2	1.02
200644	SENECA#3	0.16
200715	SHAWVL 1	13.68
200722	SHAWVL 2	13.94
200665	SHAWVL 3	20.72
200666	SHAWVL 4	20.53
200809	SITHE	0.09
292391	T-121C	2.54
292984	U2-055C	1.27
292078	V1-034	0.16
293392	V3-030C	0.01
293416	V3-042C	4.26
903651	W3-099 C OP1	1.44
907991	X1-078	24.92
907481	X1-109	336.49
909091	X2-031 C	0.33
910651	X3-039	7.17
X3-050	X3-050	28.14
913401	Y1-012	0.06
913131	Y1-032 C	2.43
913191	Y1-047 OP1	7.86
913311	Y1-071	0.02
Y2-044	Y2-044	45.57
914131	Y2-055	6.06
914151	Y2-060	1.79
914301	Y2-085 OP1	24.41
914421	Y2-104	2.57
915011	Y3-010 C	0.85
915331	Y3-062 C	0.28
915771	Y3-092 OP2	82.64

Appendix 137

(PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 19.86% to 85.25% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-#8I'. This project contributes approximately 744.75 MW to the thermal violation.

CONTINGENCY 'C2_PN230-SB-#8I'

/* GLADE 230 KV

STUCK CB - CB5 (LEWIS RUN/FOREST)

DISCONNECT BRANCH FROM BUS 200704 TO BUS 200593 CKT 1

DISCONNECT BRANCH FROM BUS 200581 TO BUS 200593 CKT 1

DISCONNECT BRANCH FROM BUS 200704 TO BUS 200097 CKT 1

DISCONNECT BRANCH FROM BUS 200704 TO BUS 200705 CKT 2

DISCONNECT BUS 200704

DISCONNECT BUS 200705

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.11
203261	BLOSSBCT	0.1
200849	LAKVU GN	0.14
203283	MANOR	< 0.01
200851	MEHOOP3	0.28
293270	N-036 C	1.18
293271	N-036 E	4.7
294572	P-028 C	0.14
294573	P-028 E	12.73
200888	P-047 E	10.01
290113	Q-063 C	0.42
291011	S-103	1.41
200642	SENECA#1	5.49
200643	SENECA#2	5.1
200644	SENECA#3	0.78
292391	T-121C	1.68
292392	T-121E	6.73
297050	V2-019 E	< 0.01
293416	V3-042C	1.65
293417	V3-042E	11.04
903651	W3-099 C OP1	7.58
903652	W3-099 E OP1	50.69
907481	X1-109	88.32
910522	X3-003 E	2.12
910651	X3-039	10.43
X3-050	X3-050	23.58
913401	Y1-012	0.08

913131	Y1-032 C	1.48
913132	Y1-032 E	9.91
913191	Y1-047 OP1	1.63
Y2-044	Y2-044	38.17
914131	Y2-055	27.67
914151	Y2-060	0.37
914421	Y2-104	0.68
915331	Y3-062 C	1.37
915332	Y3-062 E	9.29
915771	Y3-092 OP2	744.75

Appendix 138

(PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 19.86% to 85.25% (**DC power flow**) of its emergency rating (1139 MVA) for the tower line contingency outage of 'C5_PN230-TW-#2'. This project contributes approximately 744.75 MW to the thermal violation.

CONTINGENCY 'C5_PN230-TW-#2'

/* GLADE-FOREST &

GLADE-LEWIS RUN 230 KV

DISCONNECT BRANCH FROM BUS 200581 TO BUS 200593 CKT 1

DISCONNECT BRANCH FROM BUS 200593 TO BUS 200704 CKT 1

DISCONNECT BRANCH FROM BUS 200704 TO BUS 200097 CKT 1

DISCONNECT BRANCH FROM BUS 200704 TO BUS 200705 CKT 2

DISCONNECT BUS 200704

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.11
203261	BLOSSBCT	0.1
200849	LAKVU GN	0.14
203283	MANOR	< 0.01
200851	MEHOOP3	0.28
293270	N-036 C	1.18
293271	N-036 E	4.7
294572	P-028 C	0.14
294573	P-028 E	12.73
200888	P-047 E	10.01
290113	Q-063 C	0.42
291011	S-103	1.41
200642	SENECA#1	5.49
200643	SENECA#2	5.1
200644	SENECA#3	0.78
292391	T-121C	1.68
292392	T-121E	6.73
297050	V2-019 E	< 0.01
293416	V3-042C	1.65
293417	V3-042E	11.04
903651	W3-099 C OP1	7.58
903652	W3-099 E OP1	50.69
907481	X1-109	88.32
910522	X3-003 E	2.12
910651	X3-039	10.43
X3-050	X3-050	23.58
913401	Y1-012	0.08
913131	Y1-032 C	1.48

913132	Y1-032 E	9.91
913191	Y1-047 OP1	1.63
Y2-044	Y2-044	38.17
914131	Y2-055	27.67
914151	Y2-060	0.37
914421	Y2-104	0.68
915331	Y3-062 C	1.37
915332	Y3-062 E	9.29
915771	Y3-092 OP2	744.75

Appendix 139

(NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 54.22% to 103.91% (**DC power flow**) of its emergency rating (607 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 301.63 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A' /* ERIE WEST 345 KV
STUCK CB - CB5

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1

END

Bus Number	Bus Name	Full Contribution
294573	P-028 E	7.98
200888	P-047 E	6.
293416	V3-042C	1.1
293417	V3-042E	7.41
907481	X1-109	54.21
910522	X3-003 E	1.33
X3-050	X3-050	16.85
913401	Y1-012	0.06
913191	Y1-047 OP1	1.02
Y2-044	Y2-044	27.28
914151	Y2-060	0.23
914421	Y2-104	0.42
915771	Y3-092 OP2	301.63

Appendix 140

(PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 22.14% to 87.51% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN115-SB-23D'. This project contributes approximately 744.56 MW to the thermal violation.

CONTINGENCY 'C2_PN115-SB-23D' /* ERIE SOUTH 115
KV STUCK CB - CBD (ERIE SOUTH - ERIE SOUTH XFMR 6)

DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200600 CKT 5
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200624 CKT 3
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200641 CKT 7
REDUCE BUS 200568 SHUNT BY 100 PERCENT
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200571 CKT 1
DISCONNECT BRANCH FROM BUS 200572 TO BUS 200567 CKT 1
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200850 CKT 1
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200589 CKT 1
DISCONNECT BUS 200589
END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.12
203261	BLOSSBCT	0.12
200849	LAKVU GN	0.13
200857	LAURHILL	8.5
203283	MANOR	< 0.01
200851	MEHOOP3	0.3
293270	N-036 C	1.59
293271	N-036 E	6.37
294572	P-028 C	0.15
294573	P-028 E	13.61
200888	P-047 E	10.93
200649	PENNTech	0.31
290113	Q-063 C	0.2
296914	R-092 C	1.75
296915	R-092 E	7.02
291011	S-103	0.9
200642	SENECA#1	2.61
200643	SENECA#2	2.42
200644	SENECA#3	0.37
200715	SHAWVL 1	13.53
200722	SHAWVL 2	13.85
200665	SHAWVL 3	20.23

200666	SHAWVL 4	20.24
292391	T-121C	2.57
292392	T-121E	10.27
292984	U2-055C	1.2
292985	U2-055E	8.12
297050	V2-019 E	< 0.01
293416	V3-042C	1.67
293417	V3-042E	11.17
903651	W3-099 C OP1	6.78
903652	W3-099 E OP1	45.38
907481	X1-109	96.18
910522	X3-003 E	2.27
X3-050	X3-050	22.62
913401	Y1-012	0.08
913131	Y1-032 C	2.12
913132	Y1-032 E	14.18
913191	Y1-047 OP1	1.75
Y2-044	Y2-044	36.62
914131	Y2-055	17.52
914151	Y2-060	0.4
914421	Y2-104	0.73
915331	Y3-062 C	1.22
915332	Y3-062 E	8.31
915771	Y3-092 OP2	744.56

Appendix 141

(NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 54.28% to 104.08% (**DC power flow**) of its emergency rating (607 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 302.28 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B'
STUCK CB - CB6

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END

Bus Number	Bus Name	Full Contribution
294573	P-028 E	7.96
200888	P-047 E	5.99
293416	V3-042C	1.1
293417	V3-042E	7.39
907481	X1-109	54.09
910522	X3-003 E	1.33
X3-050	X3-050	16.82
913401	Y1-012	0.06
913191	Y1-047 OP1	1.02
Y2-044	Y2-044	27.23
914151	Y2-060	0.23
914421	Y2-104	0.42
915771	Y3-092 OP2	302.28

Appendix 142

(PENELEC - PENELEC) The EDINB S.-ERIE SO. 115 kV line (from bus 200572 to bus 200567 ckt 1) loads from 27.22% to 90.55% (**DC power flow**) of its emergency rating (185 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 128.92 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.92
884781	S-058 E	3.05
907481	X1-109	-21.18
910651	X3-039	18.39
915771	Y3-092 OP2	128.92

Appendix 143

(PENELEC - PENELEC) The ERIE WST-FRVIEW E 115 kV line (from bus 200632 to bus 200578 ckt 1) loads from 49.82% to 101.96% (**DC power flow**) of its emergency rating (333 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 193.72 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	1.99
884781	S-058 E	6.58
907481	X1-109	-35.27
915771	Y3-092 OP2	193.72

Appendix 144

(PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 52.92% to 103.87% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 301.63 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A' /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Bus Number	Bus Name	Full Contribution
294573	P-028 E	7.98
200888	P-047 E	6.
293416	V3-042C	1.1
293417	V3-042E	7.41
907481	X1-109	54.21
910522	X3-003 E	1.33
X3-050	X3-050	16.85
913401	Y1-012	0.06
913191	Y1-047 OP1	1.02
Y2-044	Y2-044	27.28
914151	Y2-060	0.23
914421	Y2-104	0.42
915331	Y3-062 C	1.44
915332	Y3-062 E	9.75
915771	Y3-092 OP2	301.63

Appendix 145

(PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 52.98% to 104.05% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 302.28 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B' /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END

Bus Number	Bus Name	Full Contribution
294573	P-028 E	7.96
200888	P-047 E	5.99
293416	V3-042C	1.1
293417	V3-042E	7.39
907481	X1-109	54.09
910522	X3-003 E	1.33
X3-050	X3-050	16.82
913401	Y1-012	0.06
913191	Y1-047 OP1	1.02
Y2-044	Y2-044	27.23
914151	Y2-060	0.23
914421	Y2-104	0.42
915331	Y3-062 C	1.43
915332	Y3-062 E	9.74
915771	Y3-092 OP2	302.28

Appendix 146

(PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 26.98% to 90.72% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN115-SB-23F'. This project contributes approximately 726.05 MW to the thermal violation.

CONTINGENCY 'C2_PN115-SB-23F' /* ERIE SOUTH 115 KV
STUCK CB - CBF (ERIE SOUTH BUS SECTION CB)

DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200571 CKT 1
DISCONNECT BRANCH FROM BUS 200572 TO BUS 200567 CKT 1
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200850 CKT 1
DISCONNECT BRANCH FROM BUS 200567 TO BUS 200589 CKT 1
DISCONNECT BUS 200589

DISCONNECT BRANCH FROM BUS 200927 TO BUS 200820 CKT 1 /*
ERIE S - FOUR MILE

DISCONNECT BRANCH FROM BUS 200820 TO BUS 200819 CKT 1
DISCONNECT BRANCH FROM BUS 200820 TO BUS 200565 CKT 1
DISCONNECT BUS 200565
END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.13
203261	BLOSSBCT	0.13
200849	LAKVU GN	0.14
200857	LAURHILL	9.21
203283	MANOR	< 0.01
200851	MEHOOP3	0.32
293270	N-036 C	1.72
293271	N-036 E	6.9
294572	P-028 C	0.16
294573	P-028 E	14.71
200888	P-047 E	11.82
200649	PENNTech	0.34
290113	Q-063 C	0.22
296914	R-092 C	1.91
296915	R-092 E	7.63
291011	S-103	0.96
200642	SENECA#1	2.84
200643	SENECA#2	2.64
200644	SENECA#3	0.41
200715	SHAWVL 1	14.7
200722	SHAWVL 2	15.05
200665	SHAWVL 3	21.98

200666	SHAWVL 4	21.99
292391	T-121C	2.78
292392	T-121E	11.14
292984	U2-055C	1.31
292985	U2-055E	8.82
297050	V2-019 E	< 0.01
293416	V3-042C	1.8
293417	V3-042E	12.06
903651	W3-099 C OP1	7.31
903652	W3-099 E OP1	48.9
907481	X1-109	103.94
910522	X3-003 E	2.45
X3-050	X3-050	24.4
913401	Y1-012	0.08
913131	Y1-032 C	2.3
913132	Y1-032 E	15.37
913191	Y1-047 OP1	1.89
Y2-044	Y2-044	39.5
914131	Y2-055	18.78
914151	Y2-060	0.43
914421	Y2-104	0.79
915331	Y3-062 C	1.32
915332	Y3-062 E	8.96
915771	Y3-092 OP2	726.05

Appendix 147

(PENELEC - PENELEC) The TITUSVIL-UNION CY 115 kV line (from bus 200585 to bus 200571 ckt 1) loads from 32.91% to 94.71% (**DC power flow**) of its emergency rating (120 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 78.48 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
200608	PINEY #1	0.08
200657	PINEY CK	0.1
200662	SCRUB GR	0.42
907481	X1-109	-10.18
915771	Y3-092 OP2	78.48

Appendix 148

(FE - FE) The 02S8-ATT 345/138 kV transformer (from bus 238544 to bus 239082 ckt 8) loads from 38.45% to 97.89% (**DC power flow**) of its emergency rating (371 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 258.85 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	81.64
239203	02EASTG6	0.09
239035	02PERRG1	4.44
901211	W1-070A_AT4	2.15
905071	W4-004B_AT11	1.26
907481	X1-109	-63.49
913161	Y1-035	39.85
913171	Y1-036	35.25
914301	Y2-085 OP1	19.16
915771	Y3-092 OP2	258.85

Appendix 149

(PENELEC - PENELEC) The WAYNE 345/115 kV transformer (from bus 200595 to bus 200598 ckt 2) loads from 79.61% to 118.67% (**DC power flow**) of its emergency rating (324 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 126.54 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
200828	HNSMLK 1	0.47
200829	HNSMLK 2	0.47
200830	HNSMLK 3	0.47
200831	HNSMLK 4	0.47
200832	HNSMLK 5	0.47
915771	Y3-092 OP2	126.54

Appendix 150

(PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from 28.61% to 93.37% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN115-SB-23B'. This project contributes approximately 737.59 MW to the thermal violation.

CONTINGENCY 'C2_PN115-SB-23B'

/* ERIE SOUTH 115

KV STUCK CB - CBB (ERIE SOUTH - GESG TAP)

DISCONNECT BRANCH FROM BUS 200567 TO BUS 200850 CKT 1

DISCONNECT BRANCH FROM BUS 200577 TO BUS 200850 CKT 1

DISCONNECT BRANCH FROM BUS 200842 TO BUS 200850 CKT 1

DISCONNECT BUS 200850

DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6

DISCONNECT BRANCH FROM BUS 200567 TO BUS 200571 CKT 1

DISCONNECT BRANCH FROM BUS 200572 TO BUS 200567 CKT 1

DISCONNECT BRANCH FROM BUS 200567 TO BUS 200589 CKT 1

DISCONNECT BUS 200589

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.14
203261	BLOSSBCT	0.14
200849	LAKVU GN	0.15
200857	LAURHILL	9.99
203283	MANOR	0.01
200851	MEHOOP3	0.35
293270	N-036 C	1.87
293271	N-036 E	7.49
294572	P-028 C	0.18
294573	P-028 E	15.99
200888	P-047 E	12.85
200649	PENNTECH	0.37
290113	Q-063 C	0.23
296914	R-092 C	2.06
296915	R-092 E	8.26
291011	S-103	1.08
200642	SENECA#1	3.08
200643	SENECA#2	2.86
200644	SENECA#3	0.44
200715	SHAWVL 1	15.91
200722	SHAWVL 2	16.29
200665	SHAWVL 3	23.8
200666	SHAWVL 4	23.81
292391	T-121C	3.02

292392	T-121E	12.09
292984	U2-055C	1.42
292985	U2-055E	9.55
297050	V2-019 E	< 0.01
293416	V3-042C	1.96
293417	V3-042E	13.13
903651	W3-099 C OP1	7.94
903652	W3-099 E OP1	53.14
907481	X1-109	113.04
910522	X3-003 E	2.67
X3-050	X3-050	26.59
913401	Y1-012	0.09
913131	Y1-032 C	2.5
913132	Y1-032 E	16.7
913191	Y1-047 OP1	2.05
Y2-044	Y2-044	43.05
914131	Y2-055	21.03
914151	Y2-060	0.47
914421	Y2-104	0.86
915331	Y3-062 C	1.43
915332	Y3-062 E	9.74
915771	Y3-092 OP2	737.59

Appendix 151

(PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line (from bus 200928 to bus 200819 ckt 1) loads from 23.09% to 91.35% (**DC power flow**) of its emergency rating (584 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 383.23 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00

END

Bus Number	Bus Name	Full Contribution
293416	V3-042C	0.76
903651	W3-099 C OP1	5.92
907481	X1-109	36.21
X3-050	X3-050	11.89
913401	Y1-012	0.04
Y2-044	Y2-044	19.25
915331	Y3-062 C	1.06
915771	Y3-092 OP2	383.23

Appendix 152

(PENELEC - PENELEC) The ERIE W-ERIE SO 345 kV line (from bus 200599 to bus 200600 ckt 1) loads from 33.56% to 96.7% (**DC power flow**) of its emergency rating (1139 MVA) for the single line contingency outage of 'B_PN230-SX-#18'. This project contributes approximately 742.39 MW to the thermal violation.

CONTINGENCY 'B_PN230-SX-#18' /* ERIE EAST - SOUTH
RIPLEY (EED) 230 KV - (PJM-PN04)
DISCONNECT BRANCH FROM BUS 200654 TO BUS 135251 CKT 1
END

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	17.2
239035	02PERRG1	3.48
901211	W1-070A_AT4	0.46
905071	W4-004B_AT11	0.99
907481	X1-109	-54.48
913171	Y1-036	24.01
915771	Y3-092 OP2	742.39

Appendix 153

(PENELEC - PENELEC) The GLADE-WARREN 230 kV line (from bus 200593 to bus 200811 ckt 1) loads from 49.13% to 106.52% (**DC power flow**) of its emergency rating (621 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 356.42 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'
STUCK CB - CB8

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
200649	PENNTech	0.24
290113	Q-063 C	0.2
296914	R-092 C	1.22
296915	R-092 E	4.89
200642	SENECA#1	2.62
200643	SENECA#2	2.43
200644	SENECA#3	0.37
200715	SHAWVL 1	8.83
200722	SHAWVL 2	9.06
200665	SHAWVL 3	13.28
292391	T-121C	0.98
292392	T-121E	3.93
292984	U2-055C	0.75
292985	U2-055E	5.02
915011	Y3-010 C	0.52
915012	Y3-010 E	3.46
915771	Y3-092 OP2	356.42

Appendix 154

(PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 63.35% to 114.31% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 301.63 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A'

/* ERIE WEST 345 KV

STUCK CB - CB5

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1

END

Bus Number	Bus Name	Full Contribution
294573	P-028 E	7.98
200888	P-047 E	6.
293416	V3-042C	1.1
293417	V3-042E	7.41
903651	W3-099 C OP1	8.04
903652	W3-099 E OP1	53.81
907481	X1-109	54.21
910522	X3-003 E	1.33
X3-050	X3-050	16.85
913401	Y1-012	0.06
913191	Y1-047 OP1	1.02
Y2-044	Y2-044	27.28
914151	Y2-060	0.23
914421	Y2-104	0.42
915331	Y3-062 C	1.44
915332	Y3-062 E	9.75
915771	Y3-092 OP2	301.63

Appendix 155

(PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 63.41% to 114.47% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 302.28 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B'
STUCK CB - CB6

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END

Bus Number	Bus Name	Full Contribution
294573	P-028 E	7.96
200888	P-047 E	5.99
293416	V3-042C	1.1
293417	V3-042E	7.39
903651	W3-099 C OP1	8.03
903652	W3-099 E OP1	53.76
907481	X1-109	54.09
910522	X3-003 E	1.33
X3-050	X3-050	16.82
913401	Y1-012	0.06
913191	Y1-047 OP1	1.02
Y2-044	Y2-044	27.23
914151	Y2-060	0.23
914421	Y2-104	0.42
915331	Y3-062 C	1.43
915332	Y3-062 E	9.74
915771	Y3-092 OP2	302.28

Appendix 156

(PENELEC - PENELEC) The ERIE W-ERIE SO 345 kV line (from bus 200599 to bus 200600 ckt 1) loads from 33.0% to 99.96% (**DC power flow**) of its normal rating (982 MVA) for non-contingency condition. This project contributes approximately 682.77 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	22.99
239203	02EASTG6	0.07
239035	02PERRG1	4.66
884780	S-058 C	0.42
884781	S-058 E	1.38
901211	W1-070A_AT4	0.61
905071	W4-004B_AT11	1.32
907481	X1-109	-98.26
913161	Y1-035	30.59
913171	Y1-036	32.22
915771	Y3-092 OP2	682.77

Appendix 157

(PENELEC - PENELEC) The Q34-SOMERST 115 kV line (from bus 290079 to bus 200744 ckt 1) loads from 166.63% to 168.28% (**DC power flow**) of its emergency rating (166 MVA) for the bus fault outage of 'AP_C1_11'. This project contributes approximately 11.06 MW to the thermal violation.

CONTINGENCY 'AP_C1_11'

/CUMBERLAND_138

OPEN BUS 235454

OPEN BUS 237027

END

Bus Number	Bus Name	Full Contribution
200854	BERKLY H	20.71
200840	DEEPCRK1	0.12
200841	DEEPCRK2	0.12
200835	DSGENWIN	0.46
292350	K-023	0.19
292542	L-013 1	22.09
200856	L-013 C	0.25
293901	O-048 C	0.22
293902	O-048 E	19.88
290081	Q-034 C	14.11
290082	Q-034 E	56.44
293431	R-040 C	0.01
293432	R-040 E	1.24
290228	S-014 C	0.08
290229	S-014 E	6.85
293023	U2-073C OP1	0.12
293024	U2-073E OP1	17.45
236001	WARRIOR RUN	0.9
900404	X3-028 C	1.01
900405	X3-028 E	1.34
913001	Y1-003 C OP1	2.7
913002	Y1-003 E OP1	18.05
913141	Y1-033 C OP1	2.95
913142	Y1-033 E OP1	19.74
Y2-068	Y2-068	12.25
915771	Y3-092 OP2	11.06
200813	YOUGH	0.13

Appendix 158

(PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line (from bus 200928 to bus 200819 ckt 1) loads from 32.48% to 101.53% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 388.42 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A' /* ERIE WEST 345 KV
STUCK CB - CB5
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1
END

Bus Number	Bus Name	Full Contribution
293416	V3-042C	0.75
293417	V3-042E	5.01
903651	W3-099 C OP1	5.86
903652	W3-099 E OP1	39.19
907481	X1-109	35.24
X3-050	X3-050	11.67
913401	Y1-012	0.04
Y2-044	Y2-044	18.9
915331	Y3-062 C	1.04
915332	Y3-062 E	7.09
915771	Y3-092 OP2	388.42

Appendix 159

(PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line (from bus 200928 to bus 200819 ckt 1) loads from 32.52% to 101.62% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 388.72 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B' /* ERIE WEST 345 KV
STUCK CB - CB6
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1
END

Bus Number	Bus Name	Full Contribution
293416	V3-042C	0.75
293417	V3-042E	5.
903651	W3-099 C OP1	5.85
903652	W3-099 E OP1	39.16
907481	X1-109	35.17
X3-050	X3-050	11.66
913401	Y1-012	0.04
Y2-044	Y2-044	18.87
915331	Y3-062 C	1.04
915332	Y3-062 E	7.09
915771	Y3-092 OP2	388.72

Appendix 160

(PENELEC - PENELEC) The 4MILE_230-ERIE SE 230 kV line (from bus 200928 to bus 200819 ckt 1) loads from 37.9% to 105.34% (**DC power flow**) of its emergency rating (584 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 393.89 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
293416	V3-042C	0.63
293417	V3-042E	4.22
903651	W3-099 C OP1	5.56
903652	W3-099 E OP1	37.18
X3-050	X3-050	12.05
913401	Y1-012	0.04
Y2-044	Y2-044	19.5
915331	Y3-062 C	0.99
915332	Y3-062 E	6.72
915771	Y3-092 OP2	393.89

Appendix 161

(PENELEC - PENELEC) The VENGO JT-EDINB S. 115 kV line (from bus 200573 to bus 200572 ckt 1) loads from 45.67% to 109.33% (**DC power flow**) of its emergency rating (179 MVA) for the single line contingency outage of 'B_LINE_TIE_036'. This project contributes approximately 125.44 MW to the thermal violation.

CONTINGENCY 'B_LINE_TIE_036' /* ERIE W 345.00 -
ERIE SO 345.00 LINE OUTAGE
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1 /*
ERIE W 345.00 ERIE SO 345.00
END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	0.91
884781	S-058 E	3.
907481	X1-109	-20.69
910651	X3-039	17.15
915771	Y3-092 OP2	125.44

Appendix 162

(PENELEC - PENELEC) The ERIE SO-ERIE W 345 kV line (from bus 200600 to bus 200599 ckt 1) loads from .25% to 87.8% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-6G'. This project contributes approximately 1000.0 MW to the thermal violation.

```
CONTINGENCY 'C2_PN230-SB-6G'                                /* ERIE SOUTH 230 KV
STUCK CB - CBBS (BUS SECTION BREAKER)
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200820 CKT 1
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200625 CKT 4
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200600 CKT 8
REDUCE BUS 200819 SHUNT BY 100 PERCENT
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200600 CKT 5
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200624 CKT 3
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200641 CKT 7
REDUCE BUS 200568 SHUNT BY 100 PERCENT
END
```

Bus Number	Bus Name	Full Contribution
915771	Y3-092 OP2	1000.

Appendix 163

(PENELEC - PENELEC) The ERIE W-ERIE SO 345 kV line (from bus 200599 to bus 200600 ckt 1) loads from .25% to 88.04% (**DC power flow**) of its emergency rating (1139 MVA) for the line fault with failed breaker contingency outage of 'C2_PN230-SB-6G'. This project contributes approximately 1000.0 MW to the thermal violation.

```
CONTINGENCY 'C2_PN230-SB-6G'                                /* ERIE SOUTH 230 KV
STUCK CB - CBBS (BUS SECTION BREAKER)
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200820 CKT 1
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200928 CKT 1
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200625 CKT 4
DISCONNECT BRANCH FROM BUS 200819 TO BUS 200600 CKT 8
REDUCE BUS 200819 SHUNT BY 100 PERCENT
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200600 CKT 5
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200624 CKT 3
DISCONNECT BRANCH FROM BUS 200568 TO BUS 200641 CKT 7
REDUCE BUS 200568 SHUNT BY 100 PERCENT
END
```

Bus Number	Bus Name	Full Contribution
915771	Y3-092 OP2	1000.

Appendix 164

(NYISO - PENELEC) The S RIPLEY-ERIE E 230 kV line (from bus 135251 to bus 200654 ckt 1) loads from 51.52% to 115.81% (**DC power flow**) of its emergency rating (607 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 374.74 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
293416	V3-042C	0.81
293417	V3-042E	5.43
907481	X1-109	36.43
X3-050	X3-050	13.09
913401	Y1-012	0.05
Y2-044	Y2-044	21.19
915771	Y3-092 OP2	374.74

Appendix 165

(PENELEC - PENELEC) The ERIE E-W3-099 TAP 230 kV line (from bus 200654 to bus 903650 ckt 1) loads from 49.99% to 115.88% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 374.74 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
293416	V3-042C	0.81
293417	V3-042E	5.43
907481	X1-109	36.43
X3-050	X3-050	13.09
913401	Y1-012	0.05
Y2-044	Y2-044	21.19
915331	Y3-062 C	1.26
915332	Y3-062 E	8.57
915771	Y3-092 OP2	374.74

Appendix 166

(PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200599 to bus 200632 ckt 1) loads from 57.69% to 122.99% (**DC power flow**) of its emergency rating (328 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2B'. This project contributes approximately 220.58 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2B' /* ERIE WEST 345 KV
STUCK CB - CB6

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 3

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	2.49
884781	S-058 E	8.21
907481	X1-109	-41.36
915771	Y3-092 OP2	220.58

Appendix 167

(PENELEC - PENELEC) The W3-099 TAP-4MILE_230 230 kV line (from bus 903650 to bus 200928 ckt 1) loads from 59.2% to 125.08% (**DC power flow**) of its emergency rating (592 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 374.74 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'

/* ERIE WEST 345 KV

STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
293416	V3-042C	0.81
293417	V3-042E	5.43
903651	W3-099 C OP1	7.09
903652	W3-099 E OP1	47.43
907481	X1-109	36.43
X3-050	X3-050	13.09
913401	Y1-012	0.05
Y2-044	Y2-044	21.19
915331	Y3-062 C	1.26
915332	Y3-062 E	8.57
915771	Y3-092 OP2	374.74

Appendix 168

(PENELEC - PENELEC) The GENEVA-PPGAPI 115 kV line (from bus 200590 to bus 200822 ckt 1) loads from 83.82% to 138.41% (**DC power flow**) of its emergency rating (239 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 137.38 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
907481	X1-109	-16.24
910651	X3-039	34.43
915771	Y3-092 OP2	137.38

Appendix 169

(PENELEC - PENELEC) The GRANDVW-TITUSVIL 115 kV line (from bus 200584 to bus 200585 ckt 1) loads from 65.99% to 130.01% (**DC power flow**) of its emergency rating (149 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 101.06 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
200662	SCRUB GR	0.42
907481	X1-109	-13.34
915771	Y3-092 OP2	101.06

Appendix 170

(PENELEC - PENELEC) The PPGAPI-MRGAN ST 115 kV line (from bus 200822 to bus 200575 ckt 1) loads from 84.02% to 141.5% (**DC power flow**) of its emergency rating (227 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 137.38 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
907481	X1-109	-16.24
910651	X3-039	34.43
915771	Y3-092 OP2	137.38

Appendix 171

(PENELEC - PENELEC) The ERIE W 345/115 kV transformer (from bus 200599 to bus 200632 ckt 3) loads from 62.42% to 133.09% (**DC power flow**) of its emergency rating (306 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2A'. This project contributes approximately 222.68 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2A' /* ERIE WEST 345 KV
STUCK CB - CB5

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200600 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200632 CKT 1

END

Bus Number	Bus Name	Full Contribution
884780	S-058 C	2.52
884781	S-058 E	8.3
907481	X1-109	-41.75
915771	Y3-092 OP2	222.68

Appendix 172

(PENELEC - PENELEC) The WAYNE-GENEVA 115 kV line (from bus 200598 to bus 200590 ckt 1) loads from 86.94% to 147.35% (**DC power flow**) of its emergency rating (216 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 137.38 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C'
STUCK CB - CB8

/* ERIE WEST 345 KV

DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1

DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1

END

Bus Number	Bus Name	Full Contribution
907481	X1-109	-16.24
915771	Y3-092 OP2	137.38

Appendix 173

(FE - FE) The 02S8-ATT 345/138 kV transformer (from bus 239082 to bus 238544 ckt 8) loads from 76.85% to 146.63% (**DC power flow**) of its emergency rating (371 MVA) for the single line contingency outage of 'DQE_161'. This project contributes approximately 258.85 MW to the thermal violation.

CONTINGENCY 'DQE_161'

/* LINE 02AT TO 02PERRY

345 CK 1

DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1

END

Bus Number	Bus Name	Full Contribution
200887	ARMNA MT P47	0.09
235567	ARMSTRONG 1	14.45
235569	ARMSTRONG 2	14.36
203261	BLOSSBCT	0.08
200503	C.SLOPE	0.36
200805	COLVER13	0.35
94106	GRAYMONT	0.09
200828	HNSMLK 1	0.46
200829	HNSMLK 2	0.46
200830	HNSMLK 3	0.46
200831	HNSMLK 4	0.46
200832	HNSMLK 5	0.46
200837	HOMER C1	1.84
200838	HOMER C2	2.37
200839	HOMER C3	2.51
200636	IUP CO-G	0.04
200864	K-013	0.02
200849	LAKVU GN	0.05
203283	MANOR	< 0.01
200851	MEHOOP3	0.2
293270	N-036 C	1.08
293300	N-039 C	0.04
293602	O-018 C	0.03
293801	O-038 C	0.03
294512	P-022 C	0.01
294572	P-028 C	0.1
200649	PENNTECH	0.21
200608	PINEY #1	0.13
200657	PINEY CK	0.15
290085	Q-036 C	0.03
295247	Q-046	0.04
200882	Q-053 C	0.03

290113	Q-063 C	0.11
296322	R-032 C	0.04
296914	R-092 C	1.3
291011	S-103	0.44
200662	SCRUB GR	0.62
200642	SENECA#1	1.39
200643	SENECA#2	1.29
200644	SENECA#3	0.2
200715	SHAWVL 1	10.51
200722	SHAWVL 2	10.77
200665	SHAWVL 3	15.24
200666	SHAWVL 4	15.26
200809	SITHE	0.11
292391	T-121C	1.71
292548	T-155	0.02
292984	U2-055C	0.92
293392	V3-030C	0.01
293416	V3-042C	1.04
903651	W3-099 C OP1	2.92
907481	X1-109	63.49
909091	X2-031 C	0.37
910651	X3-039	20.66
X3-050	X3-050	12.77
913401	Y1-012	0.04
913131	Y1-032 C	1.43
913191	Y1-047 OP1	1.16
913311	Y1-071	0.03
914061	Y2-042	1.21
Y2-044	Y2-044	20.67
914131	Y2-055	8.67
914151	Y2-060	0.26
914421	Y2-104	0.49
915011	Y3-010 C	0.67
915331	Y3-062 C	0.53
915771	Y3-092 OP2	258.85

Appendix 174

(PENELEC - PENELEC) The TITUSVIL-UNION CY 115 kV line (from bus 200585 to bus 200571 ckt 1) loads from 56.68% to 138.43% (**DC power flow**) of its emergency rating (120 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 101.06 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
235567	ARMSTRONG 1	3.2
235569	ARMSTRONG 2	3.18
200662	SCRUB GR	0.42
907481	X1-109	-13.34
915771	Y3-092 OP2	101.06

Appendix 175

(PENELEC - PENELEC) The MRGAN ST-VENGO JT 115 kV line (from bus 200575 to bus 200573 ckt 1) loads from 65.71% to 150.35% (**DC power flow**) of its emergency rating (149 MVA) for the line fault with failed breaker contingency outage of 'C2_PN345-SB-2C'. This project contributes approximately 132.77 MW to the thermal violation.

CONTINGENCY 'C2_PN345-SB-2C' /* ERIE WEST 345 KV
STUCK CB - CB8
DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1
DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1
END

Bus Number	Bus Name	Full Contribution
907481	X1-109	-15.67
910651	X3-039	33.21
915771	Y3-092 OP2	132.77