#U2-100 Bergen 230kV Phase Angle Regulator

Merchant Transmission Interconnection

This analysis was completed to assess the reliability impact for the new Phase Angle Regulated transmission line interconnecting to the PJM system.

Network Impacts

The U2-100 project is a Merchant Transmission request that was studied as a 1000MW non-firm withdrawal from the PSEG system at the Bergen 230kV substation. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Potential network impacts were as follows:

Generator Deliverability

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

No problems identified.

Multiple Facility Contingency

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

1. (FE) The Portland-Pequest River 115kV line (from bus 1657 to bus 2539 ckt 1) loads from 96.70% to 102.59% (DC power flow) of its emergency rating (279MVA) for the tower line outage (14JC). This project contributes approximately 16.4MW to cause this thermal violation.

2. (FE) The Belvidere-Flanders 115kV line (from bus 2518 to bus 2521 ckt 1) loads from 92.52% to 100.40% (DC power flow) of its emergency rating (240MVA) for the tower line outage (14JC). This project contributes approximately 18.9MW to cause this thermal violation.

3. (FE) The Pequest River-Belvidere 115kV line (from bus 2539 to bus 2518 ckt 1) loads from 96.85% to 103.97% (DC power flow) of its emergency rating (225MVA) for the tower line outage (14JC). This project contributes approximately 16.0MW to cause this thermal violation.

4. (PSEG) The Roseland-West Caldwell “D” 230kV line (from bus 5017 to bus 5088 ckt 1) loads from 63.75% to 107.19% (DC power flow) of its emergency rating (1000MVA) for the tower line outage (22PS). This project contributes approximately 434.4MW to cause this thermal violation.

5. (PSEG) The Roseland-West Caldwell “G” 138kV line (from bus 5019 to bus 5089 ckt 1) loads from 77.17% to 127.30% (DC power flow) of its emergency rating (271MVA) for the tower line outage (22PS). This project contributes approximately 135.9MW to cause this thermal violation.

6. (FE) The Greystone-Whippany "Q" 230kV line (from bus 2534 to bus 2550 ckt 1) loads from 92.47% to 102.24% (DC power flow) of its emergency rating (854MVA) for the tower line outage (6JC). This project contributes approximately 83.4MW to cause this thermal violation.

7. (PSEG) The Somerville-Bridgewater 230kV line (from bus 5035 to bus 4964 ckt 1) loads from 91.85% to 101.81% (DC power flow) of its emergency rating (1000MVA) for the tower line outage (31JCA_Q08OP1A). This project contributes approximately 99.5MW to cause this thermal violation.

8. (PSEG) The West Caldwell-Cook Road "D" 230kV line (from bus 5088 to bus 5091 ckt 1) loads from 56.94% to 100.38% (DC power flow) of its emergency rating (1000MVA) for the tower line outage (22PS). This project contributes approximately 434.4MW to cause this thermal violation.

Short Circuit Analysis

Short circuit analysis will be completed in the Facilities Study after all of the network upgrades required are modeled in the short circuit case. Under the "Contributions to Previously Identified Reinforcements Section" there are listed circuit breakers that the Q75 will have cost responsibility for replacing.

Contribution to Previously Identified Problems

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

9. (PSEG) The South Waterfront-Newport "Y" 230kV line (from bus 5176 to bus 5048 ckt 1) loads from 106.11% to 138.69% (DC power flow) of its emergency rating (565MVA) for the tower line outage (25PS_with_49st_rack_B). This project contributes approximately 184.1MW to cause this thermal violation.

10. (PSEG) The Newport-Hoboken "Y" 230kV line (from bus 5048 to bus 5046 ckt 1) loads from 103.75% to 139.15% (DC power flow) of its emergency rating (520MVA) for the tower line outage (25PS_with_49st_rack_B). This project contributes approximately 184.1MW to cause this thermal violation.

11. (FE) The Portland-Kittatinny 230kV line (from bus 1162 to bus 2535 ckt 1) loads from 111.73% to 119.16% (DC power flow) of its emergency rating (1068MVA) for the tower line outage (15JC). This project contributes approximately 79.3MW to the thermal violation.

12. (FE) The Kittatinny-Newton 230kV line (from bus 2535 to bus 2553 ckt 1) loads from 109.09% to 118.13% (DC power flow) of its emergency rating (925MVA) for the tower line outage (5JC). This project contributes approximately 83.6MW to the thermal violation.

13. (FE) The Lake Iliff-Montville 230kV line (from bus 2557 to bus 2537 ckt 1) loads from 102.32% to 112.31% (DC power flow) of its emergency rating (783MVA) for the tower line outage (5JC). This project contributes approximately 78.2MW to the thermal violation.

14. (FE) The Newton-Lake Iliff 230kV line (from bus 2553 to bus 2557 ckt 1) loads from 103.74% to 113.73% (DC power flow) of its emergency rating (783MVA) for the tower line outage (5JC). This project contributes approximately 78.2MW to the thermal violation.

15. (PSEG) The Upgrade (49th street)-Bergen 230kV line (from bus 92148 to bus 5037 ckt 1) loads from 104.87% to 129.75% (DC power flow) of its emergency rating (873MVA) for the tower line outage (30PS). This project contributes approximately 217.2MW to the thermal violation.

16. (FE) The Morris Park-Gilbert 230kV line (from bus 2556 to bus 2528 ckt 1) loads from 109.11% to 113.13% (DC power flow) of its emergency rating (1386MVA) for the tower line outage (14JC). This project contributes approximately 55.6MW to the thermal violation.

17. (PSEG) The Hudson-South Waterfront 230kV line (from bus 5040 to bus 5176 ckt 1) loads from 131.02% to 164.47% (DC power flow) of its emergency rating (790MVA) for the tower line outage (24PS_49ST_RACK_A). This project contributes approximately 264.2MW to the thermal violation.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation.

1. The overload on the Portland – Pequest River 115kV line can be mitigated by building a new 22 mile 230 kV line from PPL's Martins Creek 230kV Switchyard to a new 500/230 kV yard at a location near the intersection of the proposed Branchburg - Jefferson 500 kV line with the Pequest River – Flanders 115 kV line.

   For PPL's portion, build a new 230 kV single circuit line in a new 200 ft ROW for approximately 0.5 mi from Martins Creek east across the river to a point near FirstEnergy's 115 kV line to Pequest River. The line will be built using bundled 2493 ACAR for ratings of 1382 (SN) and 1717 (SE). FirstEnergy will be responsible for the remainder of the line to the new substation. Install a new 230kV breaker and a half line bay at Martins Creek with two breakers initially. The total estimated cost for the PPL portion of the upgrade is **$3,000,000**. The estimated time to complete PPL's portion of the project is 36 months.

   The estimated cost for First Energy's portion of the new 230 kV line (approximately 21.5 miles) is $96,229,100. The estimated cost to build the new 500/230 kV switchyard is estimated to be $50,000,000. It must be noted that the substation cost is a very rough estimate that involved little engineering review. The total estimated cost of this upgrade is **$149,229,100** and the construction will take **60-72 months**. **This reinforcement also mitigates Network Impact numbers 2, 3, 6, 11, 13, 14, and 16.**

4. The Roseland – West Caldwell D 230kV line overload can be mitigated by the proposed 2013 RTEP upgrades b0830, b0831, b0832, b0834, b0835, and b0836. These upgrades are all related to a single large project to construct a new Hudson 500kV switching station, and build a new 500kV transmission line from Roseland to Hudson. The cost breakdown of each portion of this project is shown below.

Build Roseland to Hudson 500kV line:	**$342M**
Replace 138/13kV transformers:	**$34M**
Build Hudson 500kV switching station:	**$122M**
Convert E-1305/F-1306 to single 230kV circuit:	**$7.3M**
Build Hudson 230kV transmission lines:	**$7M**
Install transformers at new Hudson 500kV:	**$100M**
Total upgrade cost:	**$612.3M**

If it was possible to advance this upgrades the U2-100 project would be allocated the cost of advancement from 2013 to December 2011. Since it is extremely unlikely that the baseline projects can be advanced, The U2-100 project will not have full capability or may be prevented from operating at all until the baseline projects are completed. The U2-100 project will not be allocated any of the costs for the baseline upgrades. The upgrades are estimated to be completed and in service in the year 2013. **This reinforcement also mitigates Network Impact numbers 5, 7, 8, 9, 10, 15, and 17.**

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)

12. The Kittatinny – Newton 230kV circuit overload will be partially mitigated by the 2011 RTEP upgrade b0276. The upgrade will reconductor the Kittatinny – Newton line and replace a disconnect switch at Kittatinny. In addition, the overload will require a 2000 amp wave trap at Newton to be replaced with a 3000 amp wave trap, thereby increasing the line rating to 901N/1052E MVA. The estimated cost to replace the wave trap is **$100,000**.

Delivery of Energy Portion of Interconnection Request

(PJM also studied the delivery of the energy portion of this Interconnection Request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with Network Upgrades to eliminate the operational restriction at their discretion by submitting a Transmission Interconnection Request. Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified:

18. The Branchburg-Jefferson 500kV line (from bus 2 to bus 91 ckt 1) loads from 105.8% to 120.5% (DC power flow) of its emergency rating (1373MVA) for the single line contingency outage (PJM JEFF-LACK 500). This project contributes approximately 201.7MW to the thermal congestion.

19. The Whippany-Roseland 230kV line (from bus 2550 to bus 5017 ckt 1) loads from 85.3% to 117.7% (DC power flow) of its emergency rating (1601MVA) for the single line contingency outage (PJM JEFF-MONT 500). This project contributes approximately 518.1MW to the thermal congestion.

20. The Red Oak A-Raritan River 230kV line (from bus 2881 to bus 2872 ckt 1) loads from 187.2% to 197.7% (DC power flow) of its emergency rating (805MVA) for the single line contingency outage (JC31A_Q08OP1A). This project contributes approximately 84.8MW to the thermal congestion.

21. The Red Oak B-Raritan River 230kV line (from bus 2882 to bus 2872 ckt 1) loads from 187.1% to 197.7% (DC power flow) of its emergency rating (805MVA) for the single line contingency outage (JC30A_Q08OP1A). This project contributes approximately 84.8MW to the thermal congestion.

22. The Nottingham-Daleville 230kV line (from bus 4225 to bus 4092 ckt 1) loads from 99.7% to 106.3% (DC power flow) of its emergency rating (631MVA) for the single line contingency outage (CKT22088). This project contributes approximately 41.6MW to the thermal congestion.

23. The Nottingham-Daleville 230kV line (from bus 4225 to bus 4092 ckt 1) loads from 93.2% to 100.5% (DC power flow) of its normal rating (467MVA) for non-contingency condition. This project contributes approximately 34.4MW to the thermal congestion.

24. The Bradford-Plain Brook 230kV line (from bus 4372 to bus 4809 ckt 1) loads from 101.6% to 109.0% (DC power flow) of its emergency rating (621MVA) for the single line contingency outage (PE31). This project contributes approximately 46.0MW to the thermal congestion.

25. The Aldene-Springfield Road 138kV line (from bus 4951 to bus 5023 ckt 1) loads from 115.1% to 133.4% (DC power flow) of its normal rating (266MVA) for non-contingency condition. This project contributes approximately 48.6MW to the thermal congestion.

26. The Aldene 230/138kV transformer (from bus 5192 to bus 4951 ckt 1) loads from 116.4% to 134.9% (DC power flow) of its normal rating (263MVA) for non-contingency condition. This project contributes approximately 48.6MW to the thermal congestion.

27. The Athenia-Bergen 230kV line (from bus 4954 to bus 5037 ckt 1) loads from 54.7% to 139.7% (DC power flow) of its normal rating (500MVA) for non-contingency condition. This project contributes approximately 425.0MW to the thermal congestion.

28. The Athenia-Bergan 230kV line (from bus 4954 to bus 5037 ckt 1) loads from 54.4% to 127.0% (DC power flow) of its emergency rating (750MVA) for the single line contingency outage (PS12). This project contributes approximately 544.9MW to the thermal congestion.

29. The Clifton-Athenia "B" 230kV line (from bus 5041 to bus 4954 ckt 1) loads from 66.2% to 125.9% (DC power flow) of its emergency rating (865MVA) for the single line contingency outage (PS1). This project contributes approximately 515.8MW to the thermal congestion.

30. The Clifton-Athenia "B" 230kV line (from bus 5041 to bus 4954 ckt 1) loads from 54.8% to 102.7% (DC power flow) of its normal rating (735MVA) for non-contingency condition. This project contributes approximately 351.6MW to the thermal congestion.

31. The Roseland-Cedar Grove "B" 230kV line (from bus 5017 to bus 4974 ckt 1) loads from 78.3% to 137.4% (DC power flow) of its emergency rating (873MVA) for the single line contingency outage (PS1). This project contributes approximately 515.8MW to the thermal congestion.

32. The Roseland-Cedar Grove "B" 230kV line (from bus 5017 to bus 4974 ckt 1) loads from 64.6% to 112.4% (DC power flow) of its normal rating (735MVA) for non-contingency condition. This project contributes approximately 351.6MW to the thermal congestion.

33. The Cedar Grove-Clifton "B" 230kV line (from bus 4974 to bus 5041 ckt 1) loads from 71.5% to 130.6% (DC power flow) of its emergency rating (873MVA) for the single line contingency outage (PS1). This project contributes approximately 515.8MW to the thermal congestion.

34. The Cedar Grove-Clifton "B" 230kV line (from bus 4974 to bus 5041 ckt 1) loads from 59.3% to 107.2% (DC power flow) of its normal rating (735MVA) for non-contingency condition. This project contributes approximately 351.6MW to the thermal congestion.

35. The Roseland-Cedar Grove "F" 230kV line (from bus 5017 to bus 4975 ckt 1) loads from 76.2% to 135.7% (DC power flow) of its emergency rating (873MVA) for the single line contingency outage (PS2). This project contributes approximately 518.8MW to the thermal congestion.

36. The Roseland-Cedar Grove "F" 230kV line (from bus 5017 to bus 4975 ckt 1) loads from 61.0% to 109.1% (DC power flow) of its normal rating (735MVA) for non-contingency condition. This project contributes approximately 353.8MW to the thermal congestion.

37. The Cedar Grove-Clifton "K" 230kV line (from bus 4975 to bus 5042 ckt 1) loads from 79.2% to 137.9% (DC power flow) of its emergency rating (873MVA) for the single line contingency outage (PS2). This project contributes approximately 512.8MW to the thermal congestion.

38. The Cedar Grove-Clifton “K” 230kV line (from bus 4975 to bus 5042 ckt 1) loads from 68.1% to 116.2% (DC power flow) of its normal rating (735MVA) for non-contingency condition. This project contributes approximately 353.8MW to the thermal congestion.

39. The Saddle Brook-Maywood 230kV line (from bus 5020 to bus 5036 ckt 1) loads from 49.4% to 100.9% (DC power flow) of its normal rating (400MVA) for non-contingency condition. This project contributes approximately 205.9MW to the thermal congestion.

40. The Clifton-Athenia “K” 230kV line (from bus 5042 to bus 5187 ckt 1) loads from 74.0% to 133.3% (DC power flow) of its emergency rating (865MVA) for the single line contingency outage (PS2). This project contributes approximately 512.8MW to the thermal congestion.

41. The Clifton-Athenia “K” 230kV line (from bus 5042 to bus 5187 ckt 1) loads from 63.6% to 111.7% (DC power flow) of its normal rating (735MVA) for non-contingency condition. This project contributes approximately 353.8MW to the thermal congestion.

42. The New Dover road-Fanwood “O” 138kV line (from bus 5115 to bus 5093 ckt 1) loads from 101.6% to 120.4% (DC power flow) of its normal rating (249MVA) for non-contingency condition. This project contributes approximately 46.8MW to the thermal congestion.

43. The North Temple-Hosensack 230kV line (from bus 1159 to bus 3066 ckt 1) loads from 112.1% to 118.1% (DC power flow) of its emergency rating (624MVA) for the single line contingency outage (ME28). This project contributes approximately 37.5MW to the thermal congestion.

44. The Y40C-Middlesex 230kV line (from bus 92957 to bus 4963 ckt 1) loads from 96.1% to 105.9% (DC power flow) of its normal rating (734MVA) for non-contingency condition. This project contributes approximately 71.9MW to the thermal congestion.

45. The New Dover road-Fanwood “O” 138kV line (from bus 5115 to bus 5093 ckt 1) loads from 99.2% to 115.0% (DC power flow) of its emergency rating (304MVA) for the single line contingency outage (PS8A). This project contributes approximately 47.9MW to the thermal congestion.

46. The Martins Creek-Portland 230kV line (from bus 3076 to bus 1162 ckt 1) loads from 98.3% to 106.6% (DC power flow) of its normal rating (1300MVA) for non-contingency condition. This project contributes approximately 107.8MW to the thermal congestion.

47. The North Temple-Hosensack 230kV line (from bus 1159 to bus 3066 ckt 1) loads from 104.0% to 109.9% (DC power flow) of its normal rating (492MVA) for non-contingency condition. This project contributes approximately 29.1MW to the thermal congestion.

48. The South River-R39OPT1 230kV line (from bus 2891 to bus 96377 ckt 1) loads from 107.4% to 114.5% (DC power flow) of its normal rating (650MVA) for non-contingency condition. This project contributes approximately 46.3MW to the thermal congestion.

49. The South River-R39OPT1 230kV line (from bus 2891 to bus 96377 ckt 1) loads from 104.0% to 109.7% (DC power flow) of its emergency rating (805MVA) for the single line contingency outage (JC30C_WITH_Q08OP1C). This project contributes approximately 46.3MW to the thermal congestion.

50. The Red Oak A-Raritan River 230kV line (from bus 2881 to bus 2872 ckt 1) loads from 110.1% to 116.9% (DC power flow) of its normal rating (650MVA) for non-contingency condition. This project contributes approximately 44.1MW to the thermal congestion.

51. The Red Oak B-Raritan River 230kV line (from bus 2882 to bus 2872 ckt 1) loads from 109.6% to 116.3% (DC power flow) of its normal rating (650MVA) for non-contingency condition. This project contributes approximately 43.9MW to the thermal congestion.

52. The Raritan River 115/230kV transformer (from bus 2870 to bus 2872 ckt 1) loads from 164.4% to 170.2% (DC power flow) of its emergency rating (322MVA) for the single line contingency outage (JCPL109). This project contributes approximately 18.9MW to the thermal congestion.

53. The Towanda-North Meshoppen 115kV line (from bus 381 to bus 384 ckt 1) loads from 106.4% to 114.7% (DC power flow) of its emergency rating (159MVA) for the single line contingency outage (PN47B). This project contributes approximately 13.2MW to the thermal congestion.

54. The Springfield Road-West Orange 138kV line (from bus 5023 to bus 5026 ckt 1) loads from 92.7% to 112.7% (DC power flow) of its normal rating (243MVA) for non-contingency condition. This project contributes approximately 48.6MW to the thermal congestion.

55. The Hudson-South Waterfront 230kV line (from bus 5040 to bus 5176 ckt 1) loads from 102.9% to 124.4% (DC power flow) of its normal rating (514MVA) for non-contingency condition. This project contributes approximately 110.4MW to the thermal congestion.

56. The Roseland 500/230kV transformer (from bus 94 to bus 5017 ckt 2) loads from 108.6% to 127.0% (DC power flow) of its emergency rating (1078MVA) for the single line contingency outage (PJM ROSE 500). This project contributes approximately 197.7MW to the thermal congestion.

57. The Essex-Hudson 230kV line (from bus 5054 to bus 5040 ckt 2) loads from 106.6% to 112.4% (DC power flow) of its emergency rating (826MVA) for the single line contingency outage (PS72). This project contributes approximately 47.5MW to the thermal congestion.

58. The Martins Creek-Portland 230kV line (from bus 3076 to bus 1162 ckt 1) loads from 113.0% to 118.9% (DC power flow) of its emergency rating (1601MVA) for the single line contingency outage (PJM28A). This project contributes approximately 94.9MW to the thermal congestion.

59. The Raritan River-Kilmer “I” 230kV line (from bus 2872 to bus 5104 ckt 1) loads from 175.7% to 186.3% (DC power flow) of its emergency rating (742MVA) for the single line contingency outage (JC29). This project contributes approximately 78.4MW to the thermal congestion.

60. The Fanwood-Roseland “O” 138kV line (from bus 5093 to bus 5018 ckt 1) loads from 84.3% to 103.1% (DC power flow) of its normal rating (249MVA) for non-contingency condition. This project contributes approximately 46.8MW to the thermal congestion.

61. The S44COP1-Juniata 230kV line (from bus 90679 to bus 3069 ckt 1) loads from 126.8% to 132.2% (DC power flow) of its emergency rating (617MVA) for the single line contingency outage (GROVER_TWANDA_B). This project contributes approximately 33.1MW to the thermal congestion.

62. The R39OPT1-Red Oak “A” 230kV line (from bus 96377 to bus 2881 ckt 1) loads from 101.5% to 111.7% (DC power flow) of its emergency rating (805MVA) for the single line contingency outage (JC31B_Q08OP1B_Q11A). This project contributes approximately 82.6MW to the thermal congestion.

63. The North.Meshoppen 115/230kV transformer (from bus 560 to bus 414 ckt 3) loads from 114.6% to 127.0% (DC power flow) of its emergency rating (157MVA) for the single line contingency outage (PN47B). This project contributes approximately 19.5MW to the thermal congestion.

64. The S44COP1-Juniata 230kV line (from bus 90679 to bus 3069 ckt 1) loads from 127.0% to 133.0% (DC power flow) of its normal rating (499MVA) for non-contingency condition. This project contributes approximately 30.1MW to the thermal congestion.

65. The Raritan River-Kilmer “W” 230kV line (from bus 2872 to bus 5105 ckt 1) loads from 150.5% to 163.4% (DC power flow) of its emergency rating (793MVA) for the single line contingency outage (PS56A_U2-040). This project contributes approximately 102.4MW to the thermal congestion.

66. The Kilmer-Lake Nelson “I” 230kV line (from bus 5104 to bus 5106 ckt 1) loads from 158.5% to 169.1% (DC power flow) of its emergency rating (745MVA) for the single line contingency outage (PS56C). This project contributes approximately 78.8MW to the thermal congestion.

67. The Middlesex-Green Brook “I” 230kV line (from bus 4963 to bus 5000 ckt 1) loads from 119.9% to 136.8% (DC power flow) of its emergency rating (783MVA) for the single line contingency outage (PS56C). This project contributes approximately 131.7MW to the thermal congestion.

68. The Green Brook-Gillette “U” 230kV line (from bus 5000 to bus 2531 ckt 1) loads from 122.1% to 140.7% (DC power flow) of its emergency rating (717MVA) for the single line contingency outage (PS56D). This project contributes approximately 132.8MW to the thermal congestion.

69. The Kilmer-Lake Nelson “W” 230kV line (from bus 5105 to bus 5107 ckt 1) loads from 154.4% to 167.7% (DC power flow) of its emergency rating (793MVA) for the single line contingency outage (PS56A_U2-040). This project contributes approximately 105.5MW to the thermal congestion.

70. The Roseland 500/230kV transformer (from bus 94 to bus 5017 ckt 2) loads from 90.5% to 105.8% (DC power flow) of its normal rating (834MVA) for non-contingency condition. This project contributes approximately 127.4MW to the thermal congestion.

71. The Roseland 500/230kV transformer (from bus 94 to bus 5017 ckt 1) loads from 90.5% to 105.8% (DC power flow) of its normal rating (834MVA) for non-contingency condition. This project contributes approximately 127.4MW to the thermal congestion.

72. The Lewiston-S44COP1 230kV line (from bus 214 to bus 90679 ckt 1) loads from 114.4% to 119.7% (DC power flow) of its emergency rating (617MVA) for the single line contingency outage (GROVER_TWANDA_B). This project contributes approximately 33.1MW to the thermal congestion.

73. The Raritan River-Kilmer “W” 230kV line (from bus 2872 to bus 5105 ckt 1) loads from 112.0% to 124.5% (DC power flow) of its normal rating (653MVA) for non-contingency condition. This project contributes approximately 81.2MW to the thermal congestion.

74. The Lake Nelson “W”-Green Brook “W” 230kV line (from bus 5107 to bus 5001 ckt 1) loads from 147.9% to 161.3% (DC power flow) of its emergency rating (783MVA) for the single line contingency outage (PS56A_U2-040). This project contributes approximately 105.5MW to the thermal congestion.

75. The Whippany-Roseland 230kV line (from bus 2550 to bus 5017 ckt 1) loads from 82.2% to 115.2% (DC power flow) of its normal rating (1303MVA) for non-contingency condition. This project contributes approximately 430.0MW to the thermal congestion.

76. The Green Brook “W”-Gillette “W” 230kV line (from bus 5001 to bus 2532 ckt 1) loads from 149.4% to 164.1% (DC power flow) of its emergency rating (717MVA) for the single line contingency outage (PS56A_U2-040). This project contributes approximately 105.5MW to the thermal congestion.

77. The North Meshoppen-Oxbow 230kV line (from bus 414 to bus 417 ckt 1) loads from 130.0% to 140.7% (DC power flow) of its normal rating (499MVA) for non-contingency condition. This project contributes approximately 53.5MW to the thermal congestion.

78. The Lake Nelson-Middlesex “I” 230kV line (from bus 5106 to bus 4963 ckt 1) loads from 133.7% to 143.8% (DC power flow) of its emergency rating (783MVA) for the single line contingency outage (PS56C). This project contributes approximately 78.7MW to the thermal congestion.

79. The Oxbow-Lackawanna 230kV line (from bus 417 to bus 3070 ckt 1) loads from 130.6% to 141.5% (DC power flow) of its normal rating (499MVA) for non-contingency condition. This project contributes approximately 54.4MW to the thermal congestion.

80. The Lewistown-S44COP1 230kV line (from bus 214 to bus 90679 ckt 1) loads from 111.8% to 117.8% (DC power flow) of its normal rating (499MVA) for non-contingency condition. This project contributes approximately 30.1MW to the thermal congestion.

81. The North Meshoppen-Oxbow 230kV line (from bus 414 to bus 417 ckt 1) loads from 108.3% to 116.9% (DC power flow) of its emergency rating (617MVA) for the single line contingency outage (PL57). This project contributes approximately 53.5MW to the thermal congestion.

82. The Middlesex-Green Brook “I” 230kV line (from bus 4963 to bus 5000 ckt 1) loads from 102.9% to 118.5% (DC power flow) of its normal rating (653MVA) for non-contingency condition. This project contributes approximately 101.9MW to the thermal congestion.

83. The Roseland 500/230kV transformer (from bus 94 to bus 5017 ckt 1) loads from 97.9% to 106.1% (DC power flow) of its emergency rating (1078MVA) for the single line contingency outage (PJM12). This project contributes approximately 88.8MW to the thermal congestion.

84. The Kilmer-Lake Nelson “W” 230kV line (from bus 5105 to bus 5107 ckt 1) loads from 101.9% to 114.5% (DC power flow) of its normal rating (653MVA) for non-contingency condition. This project contributes approximately 82.8MW to the thermal congestion.

85. The Oxbow-Lackawanna 230kV line (from bus 417 to bus 3070 ckt 1) loads from 110.9% to 120.6% (DC power flow) of its emergency rating (617MVA) for the single line contingency outage (PJM SUSQ-LACK 500). This project contributes approximately 59.8MW to the thermal congestion.

86. The Lake Nelson-Green Brook “W” 230kV line (from bus 5107 to bus 5001 ckt 1) loads from 96.7% to 109.4% (DC power flow) of its normal rating (653MVA) for non-contingency condition. This project contributes approximately 82.8MW to the thermal congestion.

87. The Summit NJTtransit-Traynor “X” 230kV line (from bus 2541 to bus 2543 ckt 1) loads from 94.7% to 107.7% (DC power flow) of its emergency rating (737MVA) for the single line contingency outage (PS56B). This project contributes approximately 95.5MW to the thermal congestion.

88. The Green Brook-Gillette “U” 230kV line (from bus 5000 to bus 2531 ckt 1) loads from 96.2% to 111.8% (DC power flow) of its normal rating (653MVA) for non-contingency condition. This project contributes approximately 101.9MW to the thermal congestion.

89. The Gillette-Summit NJTransit “W” 230kV line (from bus 2532 to bus 2541 ckt 1) loads from 119.2% to 133.1% (DC power flow) of its emergency rating (737MVA) for the single line contingency outage (PS56A_U2-040). This project contributes approximately 102.1MW to the thermal congestion.

90. The Summit NJTransit-Traynor “X” 230kV line (from bus 2541 to bus 2543 ckt 1) loads from 118.8% to 132.7% (DC power flow) of its emergency rating (737MVA) for the single line contingency outage (PS56A_U2-040). This project contributes approximately 102.1MW to the thermal congestion.

91. The Gillette-Summit NJTransit “U” 230kV line (from bus 2531 to bus 2542 ckt 1) loads from 98.5% to 115.8% (DC power flow) of its emergency rating (737MVA) for the single line contingency outage (PS56D). This project contributes approximately 127.3MW to the thermal congestion.

92. The Summit NJTransit-Traynor “U” 230kV line (from bus 2542 to bus 2544 ckt 1) loads from 98.1% to 115.4% (DC power flow) of its emergency rating (737MVA) for the single line contingency outage (PS56D). This project contributes approximately 127.3MW to the thermal congestion.

93. The Green Brook-Gillette “W” 230kV line (from bus 5001 to bus 2532 ckt 1) loads from 90.1% to 102.7% (DC power flow) of its normal rating (653MVA) for non-contingency condition. This project contributes approximately 82.8MW to the thermal congestion.

94. The New Freedom-Windsor 500kV line (from bus 12 to bus 28 ckt 1) loads from 100.6% to 105.7% (DC power flow) of its normal rating (2650MVA) for non-contingency condition. This project contributes approximately 133.0MW to the thermal congestion.