# *Generation Interconnection Feasibility Study Report*

# *For*

# *PJM Generation Interconnection Request Queue Position Z1-109*

# *Tosco-VFT 230 kV*

**March 2014**

# Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

# General

The Interconnection Customer (IC), has proposed a natural gas generating facility located in Linden, New Jersey. The installed facilities will have a total capability of 208 MW with 208 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is June 30, 2016. **This study does not imply a PSE&G commitment to this in-service date.**

## Point of Interconnection

Z1-109 will interconnect with the PSE&G transmission system at one of the two following points of interconnection:

Option 1 will connect via a new three breaker ring bus that connects on the S-2271 230 kV line between the Tosco and VFT substations. **Please note that this option was studied prior to the approval of the conversion of the 138 kV system to 345 kV in the PSE&G zone. As a result, the new topology was not included in the model**. If this option is selected, it will be studied with the new topology in the System Impact Study.

Option 2 will connect via a new three breaker ring bus that connects on the X-1324 345 kV line between the Linden and Bayway substations.

## Cost Summary

The Z1-109 project will be responsible for the following costs:

| Description | Total Cost |
|---|---|
| Attachment Facilities | $ 0 |

| Description | Total Cost |
|---|---|
| Direct Connection Network Upgrades | $ 16,600,000 |
| Non Direct Connection Network Upgrades | $ 0 |
| **Total Costs** | **$ 16,600,000** |

In addition, the Z1-109 project may be responsible for a contribution to the following costs:

| Description | Total Cost |
|---|---|
| New System Upgrades | $ 969,800,000 |
| Previously Identified Upgrades | $ 0 |
| **Total Costs** | **$ 969,800,000** |

Cost allocations for these upgrades will be provided in the System Impact Study Report.

## Attachment Facilities

The Interconnection Customer will construct the attachment lines into the proposed Point of Interconnection as depicted in the one-line diagram.

## Direct Connection Cost Estimate

The total preliminary cost estimate for Direct Connection work is given in the table below:

| Description | Total Cost |
|---|---|
| **Construct new 3 breaker 230 kV ring bus substation that breaks the S-2271 230 kV line between Tosco and VFT substations.** | $ 16,600,000 |
| **Total** | **$ 16,600,000** |

Estimate Assumptions:

- Single breaker station for the point of interconnection station includes all breaker controls
- Breaker connects to PSE&G
- This is a planning level estimate with 30% confidence level
- No escalation is included
- Expected cost of the project is stated above
- Property is available

## Revenue Metering and SCADA Requirements

### PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

### Public Service Electric and Gas Requirements

The Interconnection Customer will be required to comply with all PSE&G Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Information and Requirements for Electric Service" document located at the following links:

http://www.pseg.com/business/builders/new_service/before/
http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

# Option 1

## Network Impacts

The Queue Project #Z1-109 was studied as a 208.0 MW (Capacity 208.0 MW) injection as a tap of the G22_MTX – Tosco 230 kV line in the PSEG area. Project #Z1-109 was evaluated for compliance with reliability criteria for summer peak conditions in 2017. Potential network impacts were as follows:

### Contingency Descriptions

The following contingencies resulted in overloads:

| Contingency Name | Description |
|---|---|
| H-2286 + G-2207 | CONTINGENCY 'H-2286 + G-2207'<br>DISCONNECT BUS 218357<br>DISCONNECT BUS 218355<br>MOVE 100 PERCENT LOAD FROM BUS 218381 TO BUS 218380<br>MOVE 100 PERCENT LOAD FROM BUS 218398 TO BUS 218399<br>DISCONNECT BRANCH FROM BUS 218320 TO BUS 218524 CKT 2<br>DISCONNECT BRANCH FROM BUS 218354 TO BUS 218306 CKT 2 /* PRSN AVG DEANS 230 230<br>DISCONNECT BRANCH FROM BUS 218354 TO BUS 218300 CKT 1 /* MINUESTG LINDEN 230 230<br>MOVE 52 PERCENT LOAD FROM BUS 218396 TO BUS 218397 /* MINUESTR T2 T1<br>MOVE 24 PERCENT LOAD FROM BUS 218396 TO BUS 218410 /* MINUESTR T2 WARINAN T1<br>MOVE 24 PERCENT LOAD FROM BUS 218396 TO BUS 218414 /* MINUESTR T2 WDBRDG T1<br>END |
| PS51B | CONTINGENCY 'PS51B' /* METUCHEN - FANWOOD 230 (NEW O-1315)<br>DISCONNECT BRANCH FROM BUS 218469 TO BUS 218357 CKT 1 /* METUCHEN PRSN AVG 230 230<br>DISCONNECT BRANCH FROM BUS 218357 TO BUS 218355 CKT 1 /* PRSN AVG NEW DOVER 230 230<br>DISCONNECT BRANCH FROM BUS 218355 TO BUS 218320 CKT 1 /* NEW DOVER FANWOOD 230 230<br>MOVE 49 PERCENT LOAD FROM BUS 218401 TO BUS 218402 /* PRSN AVG T1 T2<br>MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218384 /* PRSN AVG T1 KILMER T2<br>MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218399 /* PRSN AVG T1 NEWDVR T2<br>MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218390 /* PRSN AVG T1 LAFAYET T2<br>END |

| Contingency Name | Description |
|---|---|
| PS61 | CONTINGENCY 'PS61' /* WARINANCO BUS BREAKER TO ALDENE<br>DISCONNECT BRANCH FROM BUS 218307 TO BUS 217122 CKT 1 /* ALDENE ALDENE 230 230<br>DISCONNECT BRANCH FROM BUS 217122 TO BUS 218376 CKT 1 /* ALDENE1 ALDENEAB 230 26<br>DISCONNECT BRANCH FROM BUS 217122 TO BUS 218316 CKT 1 /* ALDENE1 WARINANC 230 230<br>DISCONNECT BRANCH FROM BUS 218316 TO BUS 218441 CKT 1 /* WARINANC VFT 230 230<br>DISCONNECT BRANCH FROM BUS 218316 TO BUS 218410 CKT 1 /* WARINANC T1<br>DISCONNECT BRANCH FROM BUS 218316 TO BUS 218411 CKT 1 /* WARINANC T2<br>MOVE 13 MW LOAD FROM BUS 218410 TO BUS 218374 /* WARINANC T1 ALDENE T1<br>MOVE 5 MW LOAD FROM BUS 218410 TO BUS 218375 /* WARINANC T1 ALDENE T2<br>MOVE 5 MW LOAD FROM BUS 218410 TO BUS 218413 /* WARINANC T1 WOODBRDG T3<br>MOVE 8 MW LOAD FROM BUS 218411 TO BUS 216924 /* WARINANC T2 NORTHAV T1<br>MOVE 5 MW LOAD FROM BUS 218411 TO BUS 216925 /* WARINANC T2 NORTHAV T2<br>MOVE 8 MW LOAD FROM BUS 218411 TO BUS 218397 /* WARINANC T2 MINUEST T1<br>END |
| PS8C_B | CONTINGENCY 'PS8C_B'<br>DISCONNECT BRANCH FROM BUS 916600 TO BUS 218441 CKT 1 /* TOSCO G22 230 230<br>END |

## Generator Deliverability

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

| | Contingency | | Affected | | Bus | | | Power | Loading % | | Rating | | MW | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # | Type | Name | Area | Facility Description | From | To | Circuit | Flow | Initial | Final | Type | MVA | Contribution | Ref |
| 1 | N-1 | PS8C_B | PSEG - PSEG | LINDEN-MINUESTR 230 kV line | 218300 | 218353 | 1 | DC | 90.14 | 104.66 | ER | 740 | 107.44 | 1 |
| 2 | Non | Non | PSEG - PSEG | SPRINGRD-W.ORANGE 230 kV line | 216911 | 216914 | 1 | DC | 88.47 | 100.75 | NR | 512 | 62.89 | 2 |
| 3 | Non | Non | PSEG - PSEG | WARINANC-ALDENE1 230 kV line | 218316 | 217122 | 1 | DC | 97.59 | 111 | NR | 732 | 98.21 | 4 |
| 4 | N-1 | PS8C_B | PSEG - PSEG | NEWDOVRO-FANWOODO 230 kV line | 218355 | 218320 | 1 | DC | 99.28 | 105.34 | ER | 870 | 52.72 | 7 |

## Multiple Facility Contingency

*(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)*

None.

## Short Circuit

*(Summary of impacted circuit breakers)*

New circuit breakers found to be over-duty:

**Due to the changes to the PSE&G topology regarding the conversion of multiple 138 kV facilities to 345 kV, the short circuit analysis will be run during the System Impact Study.**

Contributions to previously identified circuit breakers found to be over-duty:

**Due to the changes to the PSE&G topology regarding the conversion of multiple 138 kV facilities to 345 kV, the short circuit analysis will be run during the System Impact Study.**

## 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)*

| | Contingency | | Affected | | Bus | | | Power | Loading % | | Rating | | MW | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # | Type | Name | Area | Facility Description | From | To | Circuit | Flow | Initial | Final | Type | MVA | Contrib. | Ref |
| 5 | Non | Non | PSEG - PSEG | ALDENE2-SPRINGRD 230 kV line | 218345 | 216911 | 1 | DC | 102.16 | 114.44 | NR | 512 | 62.89 | 3 |
| 6 | DCTL | H-2286 + G-2207 | PSEG - PSEG | SPRINGRD-W.ORANGE 230 kV line | 216911 | 216914 | 1 | DC | 111.15 | 121.02 | ER | 789 | 77.87 | 5 |
| 7 | LFFB | PS61 | PSEG - PSEG | LINDEN-MINUESTR 230 kV line | 218300 | 218353 | 1 | DC | 117.01 | 131.62 | ER | 740 | 108.11 | 6 |
| 8 | Non | Non | PSEG - PSEG | Z1-109 TAP-G22_MTX5 230 kV line | 916600 | 218441 | 1 | DC | 115.01 | 125.5 | NR | 936 | 98.21 | 8 |
| 9 | N-1 | PS51B | PSEG - PSEG | WARINANC-ALDENE1 230 kV line | 218316 | 217122 | 1 | DC | 104.44 | 116.53 | ER | 887 | 107.24 | 9 |
| 10 | N-1 | PS8C_B | PSEG - PSEG | PRSN AVG-NEWDOVRO 230 kV line | 218357 | 218355 | 1 | DC | 102.97 | 109.03 | ER | 870 | 52.72 | 10 |
| 11 | DCTL | H-2286 + G-2207 | PSEG - PSEG | ALDENE2-SPRINGRD 230 kV line | 218345 | 216911 | 1 | DC | 120.04 | 129.91 | ER | 789 | 77.87 | 11 |
| 12 | N-1 | PS51B | PSEG - PSEG | Z1-109 TAP-G22_MTX5 230 kV line | 916600 | 218441 | 1 | DC | 115.6 | 125.2 | ER | 1120 | 107.53 | 12 |
| 13 | N-1 | PS8C_B | PSEG - PSEG | METUCHEN-PRSN AVG 230 kV line | 218469 | 218357 | 1 | DC | 107.15 | 113.21 | ER | 870 | 52.72 | 13 |
| 14 | Non | Non | PSEG - PSEG | G22_MTX5-WARINANC 230 kV line | 218441 | 218316 | 1 | DC | 112.66 | 127.38 | NR | 667 | 98.21 | 14 |
| 15 | N-1 | PS51B | PSEG - PSEG | G22_MTX5-WARINANC 230 kV line | 218441 | 218316 | 1 | DC | 117.36 | 130.42 | ER | 821 | 107.24 | 15 |
| 16 | DCTL | H-2286 + G-2207 | PSEG - PSEG | WARINANC-ALDENE1 230 kV line | 218316 | 217122 | 1 | DC | 152.55 | 166.59 | ER | 887 | 125.17 | 16 |
| 17 | DCTL | H-2286 + G-2207 | PSEG - PSEG | G22_MTX5-WARINANC 230 kV line | 218441 | 218316 | 1 | DC | 170.16 | 185.33 | ER | 821 | 125.17 | 17 |

## Steady-State Voltage Requirements

*(Summary of the VAR requirements based upon the results of the steady-state voltage studies)*

To be determined.

## Stability and Reactive Power Requirement for Low Voltage Ride Through

*(Summary of the VAR requirements based upon the results of the dynamic studies)*

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)*

| Violation # | Overloaded Facility | Upgrade Description | Network Upgrade Number | Upgrade Cost |
|---|---|---|---|---|
| #1, 4 | LINDEN-MINUESTR 230 kV line | New 230 kV Tosco – Aldene overhead circuit parallel to S-2271, U-2273 and N-2240. Estimated Cost: $126.6M; Estimated Time: 48 months | Pending | **$ 126,600,000** |
| #2, 3 | SPRINGRD-W.ORANGE 230 kV line | 1. Re-conductor the Warinanco – VFT (U-2273) 230 kV overhead line. Estimated Cost: $35.8M; Estimated Time: 38 months<br>2. Re-conductor the Aldene – Warinanco (N-2240) 230 kV overhead line. Estimated Cost: $64M; Estimated Time: 42 months<br>3. Re-conductor the Linden – Tosco (B-2254) 230 kV overhead line. Estimated Cost: $15.8M; Estimated Time: 35 months<br>4. New 230 kV Tosco – Aldene overhead circuit parallel to S-2271, U-2273 and N-2240. Estimated Cost: $126.6M; Estimated Time: 48 months (included above)<br>5. New 230 kV Aldene – Springfield Rd. underground cable parallel to G-2285. Estimated Cost: $237.6M; Estimated Time: 48 months<br>6. New 230 kV Springfield Rd. – W. Orange underground cable parallel to N-2292. Estimated Cost: $490M; Estimated Time: 48 months | Pending | **$ 843,200,000** |
| | | | **Total New Network Upgrades** | **$ 969,800,000** |

## 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)*

| Violation # | Overloaded Facility | Upgrade Description | Network Upgrade Number | Upgrade Cost |
|---|---|---|---|---|
| #5, 6, 9, 11, 12, 15, 16, 17 | Multiple Facilities | Same reinforcement identified above: New 230 kV Tosco – Aldene overhead circuit parallel to S-2271, U-2273 and N-2240. Estimated Cost: $126.6M; Estimated Time: 48 months | Pending | **$ 0** |
| #7, 8, 10, 13, 14 | Multiple Facilities | Same reinforcement identified above:<br>1. Re-conductor the Warinanco – VFT (U-2273) 230 kV overhead line. Estimated Cost: $35.8M; Estimated Time: 38 months<br>2. Re-conductor the Aldene – Warinanco (N-2240) 230 kV overhead line. Estimated Cost: $64M; Estimated Time: 42 months<br>3. Re-conductor the Linden – Tosco (B-2254) 230 kV overhead line. Estimated Cost: $15.8M; Estimated Time: 35 months<br>4. New 230 kV Tosco – Aldene overhead circuit parallel to S-2271, U-2273 and N-2240. Estimated Cost: $126.6M; Estimated Time: 48 months<br>5. New 230 kV Aldene – Springfield Rd. underground cable parallel to G-2285. Estimated Cost: $237.6M; Estimated Time: 48 months<br>New 230 kV Springfield Rd. – W. Orange underground cable parallel to N-2292. Estimated Cost: $490M; Estimated Time: 48 months | Pending | **$ 0** |
| | | | **Total New Network Upgrades** | **$ 0** |

## Potential Congestion due to Local Energy Deliverability

*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.*

*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.*

None.

# Option 2

## Network Impacts

The Queue Project #Z1-109 was studied as a 208.0 MW (Capacity 208.0 MW) injection as a tap of the Bayway – Linden 345 kV line in the PSEG area. Project #Z1-109 was evaluated for compliance with reliability criteria for summer peak conditions in 2018. Potential network impacts were as follows:

### Contingency Descriptions

The following contingencies resulted in overloads:

None.

## Generator Deliverability

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

None.

## Multiple Facility Contingency

*(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)*

None.

## Short Circuit

*(Summary of impacted circuit breakers)*

New circuit breakers found to be over-duty:

**Due to the changes to the PSE&G topology regarding the conversion of multiple 138 kV facilities to 345 kV, the short circuit analysis will be run during the System Impact Study.**

Contributions to previously identified circuit breakers found to be over-duty:

**Due to the changes to the PSE&G topology regarding the conversion of multiple 138 kV facilities to 345 kV, the short circuit analysis will be run during the System Impact Study.**

## Contribution to Previously Identified Overloads

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

None.

## Steady-State Voltage Requirements

*(Summary of the VAR requirements based upon the results of the steady-state voltage studies)*

To be determined.

## Stability and Reactive Power Requirement for Low Voltage Ride Through

*(Summary of the VAR requirements based upon the results of the dynamic studies)*

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)*

None.

## Potential Congestion due to Local Energy Deliverability

*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.*

*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.*

Not applicable.

# Attachment 1

***Option 1 System Configuration***

# Option 1 Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.

It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

# Appendix 1

(PSEG - PSEG) The LINDEN-MINUESTR 230 kV line (from bus 218300 to bus 218353 ckt 1) loads from 90.14% to 104.66% (**DC power flow**) of its emergency rating (740 MVA) for the single line contingency outage of 'PS8C_B'. This project contributes approximately 107.44 MW to the thermal violation.

CONTINGENCY 'PS8C_B'
  DISCONNECT BRANCH FROM BUS 916600 TO BUS 218441 CKT 1  /* TOSCO G22 230 230
  END

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218423 | LINDNCT1 | 2.93 |
| 218424 | LINDNCT2 | 2.93 |
| 218425 | LINDNCT3 | 2.93 |
| 218426 | LINDNST1 | 5.73 |
| 290745 | S-061 | 0.38 |
| 218344 | TOSCONUG | 2.25 |
| 292094 | V1-030 C1 | 0.02 |
| 900801 | W1-001 | 1.4 |
| 913101 | Y1-026 | 82.91 |
| 915271 | Y3-051 C | 3.17 |
| 915272 | Y3-051 E1 | 40.11 |
| 916191 | Z1-059 C | 9.5 |
| 916601 | Z1-109 | 107.44 |

# Appendix 2

(PSEG - PSEG) The SPRINGRD-W.ORANGE 230 kV line (from bus 216911 to bus 216914 ckt 1) loads from 88.47% to 100.75% (**DC power flow**) of its normal rating (512 MVA) for non-contingency condition. This project contributes approximately 62.89 MW to the thermal violation.

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218307 | ALDENE | 0.02 |
| 218376 | ALDENEAB | 12.14 |
| 218326 | EDISON 1 | 15.72 |
| 218327 | EDISON 2 | 15.73 |
| 218328 | EDISON 3 | 15.72 |
| 218423 | LINDNCT1 | 1.52 |
| 218424 | LINDNCT2 | 1.52 |
| 218425 | LINDNCT3 | 1.52 |
| 218426 | LINDNST1 | 2.97 |
| 290745 | S-061 | 0.22 |
| 218360 | SEWAREN1 | 15.75 |
| 218361 | SEWAREN2 | 17.87 |
| 218362 | SEWAREN3 | 16.2 |
| 218363 | SEWAREN4 | 18.78 |
| 218364 | SEWAREN6 | 16.79 |
| 218344 | TOSCONUG | 1.3 |
| 292094 | V1-030 C1 | < 0.01 |
| 292078 | V1-034 | 0.35 |
| 900801 | W1-001 | 4.6 |
| 902251 | W2-023 | 94.65 |
| 912221 | X4-044 C | 4.46 |
| 913101 | Y1-026 | 47.7 |
| 915271 | Y3-051 C | 1.64 |
| 915272 | Y3-051 E1 | 20.81 |
| 916251 | Z1-033 | 47.32 |
| 916191 | Z1-059 C | 4.93 |
| 916601 | Z1-109 | 62.89 |

# Appendix 3

(PSEG - PSEG) The ALDENE2-SPRINGRD 230 kV line (from bus 218345 to bus 216911 ckt 1) loads from 102.16% to 114.44% (**DC power flow**) of its normal rating (512 MVA) for non-contingency condition. This project contributes approximately 62.89 MW to the thermal violation.

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218307 | ALDENE | 0.02 |
| 218376 | ALDENEAB | 12.14 |
| 218326 | EDISON 1 | 15.72 |
| 218327 | EDISON 2 | 15.73 |
| 218328 | EDISON 3 | 15.72 |
| 218423 | LINDNCT1 | 1.52 |
| 218424 | LINDNCT2 | 1.52 |
| 218425 | LINDNCT3 | 1.52 |
| 218426 | LINDNST1 | 2.97 |
| 290745 | S-061 | 0.22 |
| 218360 | SEWAREN1 | 15.75 |
| 218361 | SEWAREN2 | 17.87 |
| 218362 | SEWAREN3 | 16.2 |
| 218363 | SEWAREN4 | 18.78 |
| 218364 | SEWAREN6 | 16.79 |
| 218344 | TOSCONUG | 1.3 |
| 292094 | V1-030 C1 | < 0.01 |
| 292078 | V1-034 | 0.35 |
| 900801 | W1-001 | 4.6 |
| 902251 | W2-023 | 94.65 |
| 912221 | X4-044 C | 4.46 |
| 913101 | Y1-026 | 47.7 |
| 915271 | Y3-051 C | 1.64 |
| 915272 | Y3-051 E1 | 20.81 |
| 916251 | Z1-033 | 47.32 |
| 916191 | Z1-059 C | 4.93 |
| 916601 | Z1-109 | 62.89 |

# Appendix 4

(PSEG - PSEG) The WARINANC-ALDENE1 230 kV line (from bus 218316 to bus 217122 ckt 1) loads from 97.59% to 111.0% (**DC power flow**) of its normal rating (732 MVA) for non-contingency condition. This project contributes approximately 98.21 MW to the thermal violation.

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218326 | EDISON 1 | 18.84 |
| 218327 | EDISON 2 | 18.83 |
| 218328 | EDISON 3 | 18.84 |
| 218423 | LINDNCT1 | 2.34 |
| 218424 | LINDNCT2 | 2.34 |
| 218425 | LINDNCT3 | 2.34 |
| 218426 | LINDNST1 | 4.58 |
| 290745 | S-061 | 0.34 |
| 218360 | SEWAREN1 | 23.85 |
| 218361 | SEWAREN2 | 27.06 |
| 218362 | SEWAREN3 | 24.54 |
| 218363 | SEWAREN4 | 28.44 |
| 218364 | SEWAREN6 | 25.44 |
| 218344 | TOSCONUG | 2.02 |
| 292094 | V1-030 C1 | 0.01 |
| 292096 | V1-030 C2 | < 0.01 |
| 292078 | V1-034 | 0.23 |
| 292680 | V3-069 C | < 0.01 |
| 900801 | W1-001 | 7.19 |
| 902251 | W2-023 | 143.35 |
| 902651 | W2-052 C | < 0.01 |
| 905641 | W4-080 C | 0.05 |
| 909461 | X2-089 C | < 0.01 |
| 913101 | Y1-026 | 74.35 |
| 915251 | Y3-049 1 | 0.02 |
| 915253 | Y3-049 3 | 0.02 |
| 915271 | Y3-051 C | 2.53 |
| 915272 | Y3-051 E1 | 32.07 |
| 916251 | Z1-033 | 31.82 |
| 916191 | Z1-059 C | 7.6 |
| 916601 | Z1-109 | 98.21 |

# Appendix 5

(PSEG - PSEG) The SPRINGRD-W.ORANGE 230 kV line (from bus 216911 to bus 216914 ckt 1) loads from 111.15% to 121.02% (**DC power flow**) of its emergency rating (789 MVA) for the tower line contingency outage of 'H-2286 + G-2207'. This project contributes approximately 77.87 MW to the thermal violation.

CONTINGENCY 'H-2286 + G-2207'
  DISCONNECT BUS 218357
  DISCONNECT BUS 218355
  MOVE 100 PERCENT LOAD FROM BUS 218381 TO BUS 218380
  MOVE 100 PERCENT LOAD FROM BUS 218398 TO BUS 218399
  DISCONNECT BRANCH FROM BUS 218320 TO BUS 218524 CKT 2
  DISCONNECT BRANCH FROM BUS 218354 TO BUS 218306 CKT 2 /* PRSN AVG DEANS 230 230
  DISCONNECT BRANCH FROM BUS 218354 TO BUS 218300 CKT 1 /* MINUESTG LINDEN 230 230
  MOVE 52 PERCENT LOAD FROM BUS 218396 TO BUS 218397 /* MINUESTR T2 T1
  MOVE 24 PERCENT LOAD FROM BUS 218396 TO BUS 218410 /* MINUESTR T2 WARINAN T1
  MOVE 24 PERCENT LOAD FROM BUS 218396 TO BUS 218414 /* MINUESTR T2 WDBRDG T1
  END

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218307 | ALDENE | 0.02 |
| 218376 | ALDENEAB | 12.8 |
| 218326 | EDISON 1 | 26.88 |
| 218327 | EDISON 2 | 26.87 |
| 218328 | EDISON 3 | 26.88 |
| 218423 | LINDNCT1 | 1.97 |
| 218424 | LINDNCT2 | 1.97 |
| 218425 | LINDNCT3 | 1.97 |
| 218426 | LINDNST1 | 3.86 |
| 206679 | M&M S721 | -0.82 |
| 94130 | O66_NONFIRM | 49.21 |
| 206638 | PEAPACK | -0.32 |
| 290745 | S-061 | 0.27 |
| 218360 | SEWAREN1 | 26.85 |
| 218361 | SEWAREN2 | 30.47 |
| 218362 | SEWAREN3 | 27.63 |
| 218363 | SEWAREN4 | 32.02 |
| 218364 | SEWAREN6 | 28.63 |
| 218344 | TOSCONUG | 1.62 |
| 293093 | U2-077 | 237.68 |

| | | |
|---|---|---|
| 299906 | U3-032 E | -0.87 |
| 292094 | V1-030 C1 | 0.01 |
| 292095 | V1-030 E1 | 0.51 |
| 292185 | V1-030 E2 | 0.61 |
| 292101 | V1-030 E4 | 0.06 |
| 292103 | V1-030 E5 | 0.14 |
| 292107 | V1-030 E7 | 0.09 |
| 292111 | V1-030 E9 | -0.13 |
| 292189 | V1-030 EA | 0.48 |
| 292191 | V1-030 EC | -0.64 |
| 292092 | V1-030 ED | -0.37 |
| 292078 | V1-034 | 0.42 |
| 297021 | V2-009 E1 | 0.18 |
| 297023 | V2-009 E2 | 0.36 |
| 297025 | V2-009 E3 | 0.3 |
| 297027 | V2-009 E4 | 0.24 |
| 297069 | V2-025 E | -0.34 |
| 293378 | V3-024 E | 0.72 |
| 292666 | V3-058 E | 0.18 |
| 292668 | V3-059 E | 0.18 |
| 293444 | V3-065 E | -0.05 |
| 293440 | V3-066 E | -0.04 |
| 293434 | V3-067 E | -0.07 |
| 293429 | V3-068 E | -0.04 |
| 292681 | V3-069 E | 0.3 |
| 904002 | V4-001 E | -0.11 |
| 900801 | W1-001 | 5.66 |
| 901802 | W1-101 E | -0.12 |
| 902002 | W1-121 E | 0.26 |
| 901512 | W1-122 E | -0.29 |
| 902251 | W2-023 | 161.37 |
| 902652 | W2-052 E | 0.11 |
| 903042 | W2-091 E | -0.56 |
| 903502 | W3-032 E | -0.27 |
| 903952 | W3-076 E | -0.65 |
| 903962 | W3-077 E | -0.52 |
| 904142 | W3-095 E | -0.52 |
| 903672 | W3-106 E | -0.56 |
| 903682 | W3-110 E | -0.42 |
| 904452 | W3-126 E | -0.94 |
| 904582 | W3-139 E | -0.56 |
| 904592 | W3-140 E | -0.45 |
| 904642 | W3-145 E | -0.94 |
| 904652 | W3-146 E | -0.48 |
| 904732 | W3-154 E | -0.06 |

| | | |
|---|---|---|
| 905142 | W4-014 E | -0.57 |
| 905442 | W4-046 E | -0.38 |
| 905492 | W4-059 E | -0.07 |
| 905542 | W4-064 E | -0.17 |
| 905552 | W4-065 E | -0.35 |
| 905582 | W4-068 E | -0.31 |
| 905642 | W4-080 E | 2.86 |
| 907002 | X1-005 E | -0.39 |
| 907012 | X1-012 E | -0.55 |
| 907132 | X1-046 E | -0.44 |
| 907402 | X1-072 E | -0.09 |
| 907462 | X1-082 E | -0.46 |
| 907302 | X1-094 E | -0.91 |
| 907522 | X1-114 E | -0.11 |
| 907412 | X1-116 E | -0.38 |
| 909442 | X2-087 E | -0.09 |
| 909452 | X2-088 E | 0.17 |
| 910582 | X3-011 E | -0.18 |
| 910612 | X3-029 E | -0.7 |
| 910712 | X3-052 E | -0.42 |
| 910722 | X3-054 E | -0.27 |
| 910852 | X3-083 E | -0.48 |
| 912221 | X4-044 C | 4.7 |
| 912222 | X4-044 E | 3.8 |
| 913101 | Y1-026 | 59.44 |
| 913322 | Y1-072 E | -0.07 |
| 914042 | Y2-018 E | -0.08 |
| 915271 | Y3-051 C | 2.13 |
| 915272 | Y3-051 E1 | 26.99 |
| 916251 | Z1-033 | 57.15 |
| 916191 | Z1-059 C | 6.39 |
| 916192 | Z1-059 E | 1.78 |
| 916471 | Z1-096 C | 0.18 |
| 916472 | Z1-096 E | 0.3 |
| 916601 | Z1-109 | 77.87 |

# Appendix 6

(PSEG - PSEG) The LINDEN-MINUESTR 230 kV line (from bus 218300 to bus 218353 ckt 1) loads from 117.01% to 131.62% (**DC power flow**) of its emergency rating (740 MVA) for the line fault with failed breaker contingency outage of 'PS61'. This project contributes approximately 108.11 MW to the thermal violation.

CONTINGENCY 'PS61' /* WARINANCO BUS BREAKER TO ALDENE
DISCONNECT BRANCH FROM BUS 218307 TO BUS 217122 CKT 1 /* ALDENE ALDENE 230 230
DISCONNECT BRANCH FROM BUS 217122 TO BUS 218376 CKT 1 /* ALDENE1 ALDENEAB 230 26
DISCONNECT BRANCH FROM BUS 217122 TO BUS 218316 CKT 1 /* ALDENE1 WARINANC 230 230
DISCONNECT BRANCH FROM BUS 218316 TO BUS 218441 CKT 1 /* WARINANC VFT 230 230
DISCONNECT BRANCH FROM BUS 218316 TO BUS 218410 CKT 1 /* WARINANC T1
DISCONNECT BRANCH FROM BUS 218316 TO BUS 218411 CKT 1 /* WARINANC T2
MOVE 13 MW LOAD FROM BUS 218410 TO BUS 218374 /* WARINANC T1 ALDENE T1
MOVE 5 MW LOAD FROM BUS 218410 TO BUS 218375 /* WARINANC T1 ALDENE T2
MOVE 5 MW LOAD FROM BUS 218410 TO BUS 218413 /* WARINANC T1 WOODBRDG T3
MOVE 8 MW LOAD FROM BUS 218411 TO BUS 216924 /* WARINANC T2 NORTHAV T1
MOVE 5 MW LOAD FROM BUS 218411 TO BUS 216925 /* WARINANC T2 NORTHAV T2
MOVE 8 MW LOAD FROM BUS 218411 TO BUS 218397 /* WARINANC T2 MINUEST T1
END

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218423 | LINDNCT1 | 2.95 |
| 218424 | LINDNCT2 | 2.95 |
| 218425 | LINDNCT3 | 2.95 |
| 218426 | LINDNST1 | 5.76 |
| 290745 | S-061 | 0.38 |
| 218344 | TOSCONUG | 2.27 |
| 293093 | U2-077 | 326.43 |
| 292094 | V1-030 C1 | 0.02 |
| 292095 | V1-030 E1 | 0.76 |
| 292185 | V1-030 E2 | -0.37 |
| 292681 | V3-069 E | -0.27 |

| | | |
|---|---|---|
| 900801 | W1-001 | 7.77 |
| 902652 | W2-052 E | -0.09 |
| 905642 | W4-080 E | -2.37 |
| 909462 | X2-089 E | -0.32 |
| 913101 | Y1-026 | 83.42 |
| 915271 | Y3-051 C | 3.18 |
| 915272 | Y3-051 E1 | 40.33 |
| 916191 | Z1-059 C | 9.55 |
| 916192 | Z1-059 E | 2.65 |
| 916601 | Z1-109 | 108.11 |

# Appendix 7

(PSEG - PSEG) The NEWDOVRO-FANWOODO 230 kV line (from bus 218355 to bus 218320 ckt 1) loads from 99.28% to 105.34% (**DC power flow**) of its emergency rating (870 MVA) for the single line contingency outage of 'PS8C_B'. This project contributes approximately 52.72 MW to the thermal violation.

CONTINGENCY 'PS8C_B'
  DISCONNECT BRANCH FROM BUS 916600 TO BUS 218441 CKT 1  /* TOSCO G22 230 230
  END

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218326 | EDISON 1 | 39.03 |
| 218327 | EDISON 2 | 39.02 |
| 218328 | EDISON 3 | 39.03 |
| 218423 | LINDNCT1 | 1.45 |
| 218424 | LINDNCT2 | 1.45 |
| 218425 | LINDNCT3 | 1.45 |
| 218426 | LINDNST1 | 2.83 |
| 290745 | S-061 | 0.19 |
| 218360 | SEWAREN1 | 36.2 |
| 218361 | SEWAREN2 | 41.08 |
| 218362 | SEWAREN3 | 37.25 |
| 218363 | SEWAREN4 | 43.17 |
| 218364 | SEWAREN6 | 38.61 |
| 218344 | TOSCONUG | 1.11 |
| 292094 | V1-030 C1 | < 0.01 |
| 292096 | V1-030 C2 | 0.02 |
| 292078 | V1-034 | 0.39 |
| 292680 | V3-069 C | 0.01 |
| 902251 | W2-023 | 217.57 |
| 902651 | W2-052 C | < 0.01 |
| 905641 | W4-080 C | 0.1 |
| 909461 | X2-089 C | 0.01 |
| 913101 | Y1-026 | 40.73 |
| 915251 | Y3-049 1 | 0.03 |
| 915253 | Y3-049 3 | 0.03 |
| 915271 | Y3-051 C | 1.57 |
| 915272 | Y3-051 E1 | 19.83 |
| 916251 | Z1-033 | 53.31 |
| 916191 | Z1-059 C | 4.7 |
| 916471 | Z1-096 C | 0.22 |
| 916601 | Z1-109 | 52.72 |

# Appendix 8

(PSEG - PSEG) The Z1-109 TAP-G22_MTX5 230 kV line (from bus 916600 to bus 218441 ckt 1) loads from 115.01% to 125.5% (**DC power flow**) of its normal rating (936 MVA) for non-contingency condition. This project contributes approximately 98.21 MW to the thermal violation.

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218326 | EDISON 1 | 18.84 |
| 218327 | EDISON 2 | 18.83 |
| 218328 | EDISON 3 | 18.84 |
| 218423 | LINDNCT1 | 2.34 |
| 218424 | LINDNCT2 | 2.34 |
| 218425 | LINDNCT3 | 2.34 |
| 218426 | LINDNST1 | 4.58 |
| 290745 | S-061 | 0.34 |
| 218360 | SEWAREN1 | 23.85 |
| 218361 | SEWAREN2 | 27.06 |
| 218362 | SEWAREN3 | 24.54 |
| 218363 | SEWAREN4 | 28.44 |
| 218364 | SEWAREN6 | 25.44 |
| 218344 | TOSCONUG | 2.02 |
| 292094 | V1-030 C1 | 0.01 |
| 292096 | V1-030 C2 | < 0.01 |
| 292078 | V1-034 | 0.23 |
| 292680 | V3-069 C | < 0.01 |
| 902251 | W2-023 | 143.35 |
| 902651 | W2-052 C | < 0.01 |
| 905641 | W4-080 C | 0.05 |
| 909461 | X2-089 C | < 0.01 |
| 913101 | Y1-026 | 74.35 |
| 915251 | Y3-049 1 | 0.02 |
| 915253 | Y3-049 3 | 0.02 |
| 915271 | Y3-051 C | 2.53 |
| 915272 | Y3-051 E1 | 32.07 |
| 916251 | Z1-033 | 31.82 |
| 916191 | Z1-059 C | 7.6 |
| 916601 | Z1-109 | 98.21 |

# Appendix 9

(PSEG - PSEG) The WARINANC-ALDENE1 230 kV line (from bus 218316 to bus 217122 ckt 1) loads from 104.44% to 116.53% (**DC power flow**) of its emergency rating (887 MVA) for the single line contingency outage of 'PS51B'. This project contributes approximately 107.24 MW to the thermal violation.

```
CONTINGENCY 'PS51B'                                  /* METUCHEN - FANWOOD 230
(NEW O-1315)
  DISCONNECT BRANCH FROM BUS 218469 TO BUS 218357 CKT 1          /*
METUCHEN PRSN AVG 230 230
  DISCONNECT BRANCH FROM BUS 218357 TO BUS 218355 CKT 1          /* PRSN AVG
NEW DOVER 230 230
  DISCONNECT BRANCH FROM BUS 218355 TO BUS 218320 CKT 1          /* NEW
DOVER FANWOOD 230 230
  MOVE 49 PERCENT LOAD FROM BUS 218401 TO BUS 218402             /* PRSN AVG
T1 T2
  MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218384             /* PRSN AVG
T1 KILMER T2
  MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218399             /* PRSN AVG
T1 NEWDVR T2
  MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218390             /* PRSN AVG
T1 LAFAYET T2
  END
```

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218326 | EDISON 1 | 30.47 |
| 218327 | EDISON 2 | 30.46 |
| 218328 | EDISON 3 | 30.47 |
| 218423 | LINDNCT1 | 2.62 |
| 218424 | LINDNCT2 | 2.62 |
| 218425 | LINDNCT3 | 2.62 |
| 218426 | LINDNST1 | 5.13 |
| 290745 | S-061 | 0.37 |
| 218360 | SEWAREN1 | 34.05 |
| 218361 | SEWAREN2 | 38.64 |
| 218362 | SEWAREN3 | 35.04 |
| 218363 | SEWAREN4 | 40.6 |
| 218364 | SEWAREN6 | 36.31 |
| 218344 | TOSCONUG | 2.21 |
| 292094 | V1-030 C1 | 0.02 |
| 292096 | V1-030 C2 | 0.02 |
| 292078 | V1-034 | 0.35 |
| 292680 | V3-069 C | 0.01 |
| 900801 | W1-001 | 7.83 |
| 902251 | W2-023 | 204.66 |

| | | |
|---|---|---|
| 902651 | W2-052 C | < 0.01 |
| 905641 | W4-080 C | 0.08 |
| 913101 | Y1-026 | 81.47 |
| 915251 | Y3-049 1 | 0.03 |
| 915253 | Y3-049 3 | 0.03 |
| 915271 | Y3-051 C | 2.84 |
| 915272 | Y3-051 E1 | 35.92 |
| 916251 | Z1-033 | 47.15 |
| 916191 | Z1-059 C | 8.51 |
| 916471 | Z1-096 C | 0.17 |
| 916601 | Z1-109 | 107.24 |

# Appendix 10

(PSEG - PSEG) The PRSN AVG-NEWDOVRO 230 kV line (from bus 218357 to bus 218355 ckt 1) loads from 102.97% to 109.03% (**DC power flow**) of its emergency rating (870 MVA) for the single line contingency outage of 'PS8C_B'. This project contributes approximately 52.72 MW to the thermal violation.

CONTINGENCY 'PS8C_B'
  DISCONNECT BRANCH FROM BUS 916600 TO BUS 218441 CKT 1  /* TOSCO G22 230 230
  END

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218326 | EDISON 1 | 39.03 |
| 218327 | EDISON 2 | 39.02 |
| 218328 | EDISON 3 | 39.03 |
| 218423 | LINDNCT1 | 1.45 |
| 218424 | LINDNCT2 | 1.45 |
| 218425 | LINDNCT3 | 1.45 |
| 218426 | LINDNST1 | 2.83 |
| 290745 | S-061 | 0.19 |
| 218360 | SEWAREN1 | 36.2 |
| 218361 | SEWAREN2 | 41.08 |
| 218362 | SEWAREN3 | 37.25 |
| 218363 | SEWAREN4 | 43.17 |
| 218364 | SEWAREN6 | 38.61 |
| 218344 | TOSCONUG | 1.11 |
| 292094 | V1-030 C1 | < 0.01 |
| 292096 | V1-030 C2 | 0.02 |
| 292078 | V1-034 | 0.39 |
| 292680 | V3-069 C | 0.01 |
| 902251 | W2-023 | 217.57 |
| 902651 | W2-052 C | < 0.01 |
| 905641 | W4-080 C | 0.1 |
| 909461 | X2-089 C | 0.01 |
| 913101 | Y1-026 | 40.73 |
| 915251 | Y3-049 1 | 0.03 |
| 915253 | Y3-049 3 | 0.03 |
| 915271 | Y3-051 C | 1.57 |
| 915272 | Y3-051 E1 | 19.83 |
| 916251 | Z1-033 | 53.31 |
| 916191 | Z1-059 C | 4.7 |
| 916471 | Z1-096 C | 0.22 |
| 916601 | Z1-109 | 52.72 |

# Appendix 11

(PSEG - PSEG) The ALDENE2-SPRINGRD 230 kV line (from bus 218345 to bus 216911 ckt 1) loads from 120.04% to 129.91% (**DC power flow**) of its emergency rating (789 MVA) for the tower line contingency outage of 'H-2286 + G-2207'. This project contributes approximately 77.87 MW to the thermal violation.

CONTINGENCY 'H-2286 + G-2207'
  DISCONNECT BUS 218357
  DISCONNECT BUS 218355
  MOVE 100 PERCENT LOAD FROM BUS 218381 TO BUS 218380
  MOVE 100 PERCENT LOAD FROM BUS 218398 TO BUS 218399
  DISCONNECT BRANCH FROM BUS 218320 TO BUS 218524 CKT 2
  DISCONNECT BRANCH FROM BUS 218354 TO BUS 218306 CKT 2 /* PRSN AVG DEANS 230 230
  DISCONNECT BRANCH FROM BUS 218354 TO BUS 218300 CKT 1 /* MINUESTG LINDEN 230 230
  MOVE 52 PERCENT LOAD FROM BUS 218396 TO BUS 218397 /* MINUESTR T2 T1
  MOVE 24 PERCENT LOAD FROM BUS 218396 TO BUS 218410 /* MINUESTR T2 WARINAN T1
  MOVE 24 PERCENT LOAD FROM BUS 218396 TO BUS 218414 /* MINUESTR T2 WDBRDG T1
  END

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218307 | ALDENE | 0.02 |
| 218376 | ALDENEAB | 12.8 |
| 218326 | EDISON 1 | 26.88 |
| 218327 | EDISON 2 | 26.87 |
| 218328 | EDISON 3 | 26.88 |
| 218423 | LINDNCT1 | 1.97 |
| 218424 | LINDNCT2 | 1.97 |
| 218425 | LINDNCT3 | 1.97 |
| 218426 | LINDNST1 | 3.86 |
| 206679 | M&M S721 | -0.82 |
| 94130 | O66_NONFIRM | 49.21 |
| 206638 | PEAPACK | -0.32 |
| 290745 | S-061 | 0.27 |
| 218360 | SEWAREN1 | 26.85 |
| 218361 | SEWAREN2 | 30.47 |
| 218362 | SEWAREN3 | 27.63 |
| 218363 | SEWAREN4 | 32.02 |
| 218364 | SEWAREN6 | 28.63 |
| 218344 | TOSCONUG | 1.62 |
| 293093 | U2-077 | 237.68 |

| | | |
|---|---|---|
| 299906 | U3-032 E | -0.87 |
| 292094 | V1-030 C1 | 0.01 |
| 292095 | V1-030 E1 | 0.51 |
| 292185 | V1-030 E2 | 0.61 |
| 292101 | V1-030 E4 | 0.06 |
| 292103 | V1-030 E5 | 0.14 |
| 292107 | V1-030 E7 | 0.09 |
| 292111 | V1-030 E9 | -0.13 |
| 292189 | V1-030 EA | 0.48 |
| 292191 | V1-030 EC | -0.64 |
| 292092 | V1-030 ED | -0.37 |
| 292078 | V1-034 | 0.42 |
| 297021 | V2-009 E1 | 0.18 |
| 297023 | V2-009 E2 | 0.36 |
| 297025 | V2-009 E3 | 0.3 |
| 297027 | V2-009 E4 | 0.24 |
| 297069 | V2-025 E | -0.34 |
| 293378 | V3-024 E | 0.72 |
| 292666 | V3-058 E | 0.18 |
| 292668 | V3-059 E | 0.18 |
| 293444 | V3-065 E | -0.05 |
| 293440 | V3-066 E | -0.04 |
| 293434 | V3-067 E | -0.07 |
| 293429 | V3-068 E | -0.04 |
| 292681 | V3-069 E | 0.3 |
| 904002 | V4-001 E | -0.11 |
| 900801 | W1-001 | 5.66 |
| 901802 | W1-101 E | -0.12 |
| 902002 | W1-121 E | 0.26 |
| 901512 | W1-122 E | -0.29 |
| 902251 | W2-023 | 161.37 |
| 902652 | W2-052 E | 0.11 |
| 903042 | W2-091 E | -0.56 |
| 903502 | W3-032 E | -0.27 |
| 903952 | W3-076 E | -0.65 |
| 903962 | W3-077 E | -0.52 |
| 904142 | W3-095 E | -0.52 |
| 903672 | W3-106 E | -0.56 |
| 903682 | W3-110 E | -0.42 |
| 904452 | W3-126 E | -0.94 |
| 904582 | W3-139 E | -0.56 |
| 904592 | W3-140 E | -0.45 |
| 904642 | W3-145 E | -0.94 |
| 904652 | W3-146 E | -0.48 |
| 904732 | W3-154 E | -0.06 |

| | | |
|---|---|---|
| 905142 | W4-014 E | -0.57 |
| 905442 | W4-046 E | -0.38 |
| 905492 | W4-059 E | -0.07 |
| 905542 | W4-064 E | -0.17 |
| 905552 | W4-065 E | -0.35 |
| 905582 | W4-068 E | -0.31 |
| 905642 | W4-080 E | 2.86 |
| 907002 | X1-005 E | -0.39 |
| 907012 | X1-012 E | -0.55 |
| 907132 | X1-046 E | -0.44 |
| 907402 | X1-072 E | -0.09 |
| 907462 | X1-082 E | -0.46 |
| 907302 | X1-094 E | -0.91 |
| 907522 | X1-114 E | -0.11 |
| 907412 | X1-116 E | -0.38 |
| 909442 | X2-087 E | -0.09 |
| 909452 | X2-088 E | 0.17 |
| 910582 | X3-011 E | -0.18 |
| 910612 | X3-029 E | -0.7 |
| 910712 | X3-052 E | -0.42 |
| 910722 | X3-054 E | -0.27 |
| 910852 | X3-083 E | -0.48 |
| 912221 | X4-044 C | 4.7 |
| 912222 | X4-044 E | 3.8 |
| 913101 | Y1-026 | 59.44 |
| 913322 | Y1-072 E | -0.07 |
| 914042 | Y2-018 E | -0.08 |
| 915271 | Y3-051 C | 2.13 |
| 915272 | Y3-051 E1 | 26.99 |
| 916251 | Z1-033 | 57.15 |
| 916191 | Z1-059 C | 6.39 |
| 916192 | Z1-059 E | 1.78 |
| 916471 | Z1-096 C | 0.18 |
| 916472 | Z1-096 E | 0.3 |
| 916601 | Z1-109 | 77.87 |

# Appendix 12

(PSEG - PSEG) The Z1-109 TAP-G22_MTX5 230 kV line (from bus 916600 to bus 218441 ckt 1) loads from 115.6% to 125.2% (**DC power flow**) of its emergency rating (1120 MVA) for the single line contingency outage of 'PS51B'. This project contributes approximately 107.53 MW to the thermal violation.

CONTINGENCY 'PS51B' /* METUCHEN - FANWOOD 230 (NEW O-1315)
DISCONNECT BRANCH FROM BUS 218469 TO BUS 218357 CKT 1 /* METUCHEN PRSN AVG 230 230
DISCONNECT BRANCH FROM BUS 218357 TO BUS 218355 CKT 1 /* PRSN AVG NEW DOVER 230 230
DISCONNECT BRANCH FROM BUS 218355 TO BUS 218320 CKT 1 /* NEW DOVER FANWOOD 230 230
MOVE 49 PERCENT LOAD FROM BUS 218401 TO BUS 218402 /* PRSN AVG T1 T2
MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218384 /* PRSN AVG T1 KILMER T2
MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218399 /* PRSN AVG T1 NEWDVR T2
MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218390 /* PRSN AVG T1 LAFAYET T2
END

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218326 | EDISON 1 | 30.83 |
| 218327 | EDISON 2 | 30.82 |
| 218328 | EDISON 3 | 30.83 |
| 218423 | LINDNCT1 | 2.63 |
| 218424 | LINDNCT2 | 2.63 |
| 218425 | LINDNCT3 | 2.63 |
| 218426 | LINDNST1 | 5.15 |
| 290745 | S-061 | 0.37 |
| 218360 | SEWAREN1 | 34.38 |
| 218361 | SEWAREN2 | 39. |
| 218362 | SEWAREN3 | 35.37 |
| 218363 | SEWAREN4 | 40.99 |
| 218364 | SEWAREN6 | 36.66 |
| 218344 | TOSCONUG | 2.22 |
| 292094 | V1-030 C1 | 0.02 |
| 292096 | V1-030 C2 | 0.02 |
| 292078 | V1-034 | 0.35 |
| 292680 | V3-069 C | 0.01 |
| 902251 | W2-023 | 206.59 |
| 902651 | W2-052 C | < 0.01 |

| | | |
|---|---|---|
| 905641 | W4-080 C | 0.08 |
| 913101 | Y1-026 | 81.7 |
| 915251 | Y3-049 1 | 0.03 |
| 915253 | Y3-049 3 | 0.03 |
| 915271 | Y3-051 C | 2.85 |
| 915272 | Y3-051 E1 | 36.04 |
| 916251 | Z1-033 | 47.63 |
| 916191 | Z1-059 C | 8.54 |
| 916471 | Z1-096 C | 0.18 |
| 916601 | Z1-109 | 107.53 |

# Appendix 13

(PSEG - PSEG) The METUCHEN-PRSN AVG 230 kV line (from bus 218469 to bus 218357 ckt 1) loads from 107.15% to 113.21% (**DC power flow**) of its emergency rating (870 MVA) for the single line contingency outage of 'PS8C_B'. This project contributes approximately 52.72 MW to the thermal violation.

CONTINGENCY 'PS8C_B'
DISCONNECT BRANCH FROM BUS 916600 TO BUS 218441 CKT 1 /* TOSCO G22 230 230
END

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218326 | EDISON 1 | 39.03 |
| 218327 | EDISON 2 | 39.02 |
| 218328 | EDISON 3 | 39.03 |
| 218423 | LINDNCT1 | 1.45 |
| 218424 | LINDNCT2 | 1.45 |
| 218425 | LINDNCT3 | 1.45 |
| 218426 | LINDNST1 | 2.83 |
| 290745 | S-061 | 0.19 |
| 218360 | SEWAREN1 | 36.2 |
| 218361 | SEWAREN2 | 41.08 |
| 218362 | SEWAREN3 | 37.25 |
| 218363 | SEWAREN4 | 43.17 |
| 218364 | SEWAREN6 | 38.61 |
| 218344 | TOSCONUG | 1.11 |
| 292094 | V1-030 C1 | < 0.01 |
| 292096 | V1-030 C2 | 0.02 |
| 292078 | V1-034 | 0.39 |
| 292680 | V3-069 C | 0.01 |
| 902251 | W2-023 | 217.57 |
| 902651 | W2-052 C | < 0.01 |
| 905641 | W4-080 C | 0.1 |
| 913101 | Y1-026 | 40.73 |
| 915251 | Y3-049 1 | 0.03 |
| 915253 | Y3-049 3 | 0.03 |
| 915271 | Y3-051 C | 1.57 |
| 915272 | Y3-051 E1 | 19.83 |
| 916251 | Z1-033 | 53.31 |
| 916191 | Z1-059 C | 4.7 |
| 916471 | Z1-096 C | 0.22 |
| 916601 | Z1-109 | 52.72 |

# Appendix 14

(PSEG - PSEG) The G22_MTX5-WARINANC 230 kV line (from bus 218441 to bus 218316 ckt 1) loads from 112.66% to 127.38% (**DC power flow**) of its normal rating (667 MVA) for non-contingency condition. This project contributes approximately 98.21 MW to the thermal violation.

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218326 | EDISON 1 | 18.84 |
| 218327 | EDISON 2 | 18.83 |
| 218328 | EDISON 3 | 18.84 |
| 218423 | LINDNCT1 | 2.34 |
| 218424 | LINDNCT2 | 2.34 |
| 218425 | LINDNCT3 | 2.34 |
| 218426 | LINDNST1 | 4.58 |
| 290745 | S-061 | 0.34 |
| 218360 | SEWAREN1 | 23.85 |
| 218361 | SEWAREN2 | 27.06 |
| 218362 | SEWAREN3 | 24.54 |
| 218363 | SEWAREN4 | 28.44 |
| 218364 | SEWAREN6 | 25.44 |
| 218344 | TOSCONUG | 2.02 |
| 292094 | V1-030 C1 | 0.01 |
| 292096 | V1-030 C2 | < 0.01 |
| 292078 | V1-034 | 0.23 |
| 292680 | V3-069 C | < 0.01 |
| 900801 | W1-001 | 7.19 |
| 902251 | W2-023 | 143.35 |
| 902651 | W2-052 C | < 0.01 |
| 905641 | W4-080 C | 0.05 |
| 909461 | X2-089 C | < 0.01 |
| 913101 | Y1-026 | 74.35 |
| 915251 | Y3-049 1 | 0.02 |
| 915253 | Y3-049 3 | 0.02 |
| 915271 | Y3-051 C | 2.53 |
| 915272 | Y3-051 E1 | 32.07 |
| 916251 | Z1-033 | 31.82 |
| 916191 | Z1-059 C | 7.6 |
| 916601 | Z1-109 | 98.21 |

# Appendix 15

(PSEG - PSEG) The G22_MTX5-WARINANC 230 kV line (from bus 218441 to bus 218316 ckt 1) loads from 117.36% to 130.42% (**DC power flow**) of its emergency rating (821 MVA) for the single line contingency outage of 'PS51B'. This project contributes approximately 107.24 MW to the thermal violation.

```
CONTINGENCY 'PS51B'                                  /* METUCHEN - FANWOOD 230
(NEW O-1315)
  DISCONNECT BRANCH FROM BUS 218469 TO BUS 218357 CKT 1          /*
METUCHEN PRSN AVG 230 230
  DISCONNECT BRANCH FROM BUS 218357 TO BUS 218355 CKT 1          /* PRSN AVG
NEW DOVER 230 230
  DISCONNECT BRANCH FROM BUS 218355 TO BUS 218320 CKT 1          /* NEW
DOVER FANWOOD 230 230
  MOVE 49 PERCENT LOAD FROM BUS 218401 TO BUS 218402             /* PRSN AVG
T1 T2
  MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218384             /* PRSN AVG
T1 KILMER T2
  MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218399             /* PRSN AVG
T1 NEWDVR T2
  MOVE 17 PERCENT LOAD FROM BUS 218401 TO BUS 218390             /* PRSN AVG
T1 LAFAYET T2
  END
```

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218326 | EDISON 1 | 30.47 |
| 218327 | EDISON 2 | 30.46 |
| 218328 | EDISON 3 | 30.47 |
| 218423 | LINDNCT1 | 2.62 |
| 218424 | LINDNCT2 | 2.62 |
| 218425 | LINDNCT3 | 2.62 |
| 218426 | LINDNST1 | 5.13 |
| 290745 | S-061 | 0.37 |
| 218360 | SEWAREN1 | 34.05 |
| 218361 | SEWAREN2 | 38.64 |
| 218362 | SEWAREN3 | 35.04 |
| 218363 | SEWAREN4 | 40.6 |
| 218364 | SEWAREN6 | 36.31 |
| 218344 | TOSCONUG | 2.21 |
| 292094 | V1-030 C1 | 0.02 |
| 292096 | V1-030 C2 | 0.02 |
| 292078 | V1-034 | 0.35 |
| 292680 | V3-069 C | 0.01 |
| 900801 | W1-001 | 7.83 |
| 902251 | W2-023 | 204.66 |

| | | |
|---|---|---|
| 902651 | W2-052 C | < 0.01 |
| 905641 | W4-080 C | 0.08 |
| 913101 | Y1-026 | 81.47 |
| 915251 | Y3-049 1 | 0.03 |
| 915253 | Y3-049 3 | 0.03 |
| 915271 | Y3-051 C | 2.84 |
| 915272 | Y3-051 E1 | 35.92 |
| 916251 | Z1-033 | 47.15 |
| 916191 | Z1-059 C | 8.51 |
| 916471 | Z1-096 C | 0.17 |
| 916601 | Z1-109 | 107.24 |

# Appendix 16

(PSEG - PSEG) The WARINANC-ALDENE1 230 kV line (from bus 218316 to bus 217122 ckt 1) loads from 152.55% to 166.59% (**DC power flow**) of its emergency rating (887 MVA) for the tower line contingency outage of 'H-2286 + G-2207'. This project contributes approximately 125.17 MW to the thermal violation.

```
CONTINGENCY 'H-2286 + G-2207'
  DISCONNECT BUS 218357
  DISCONNECT BUS 218355
  MOVE 100 PERCENT LOAD FROM BUS 218381 TO BUS 218380
  MOVE 100 PERCENT LOAD FROM BUS 218398 TO BUS 218399
  DISCONNECT BRANCH FROM BUS 218320 TO BUS 218524 CKT 2
  DISCONNECT BRANCH FROM BUS 218354 TO BUS 218306 CKT 2          /* PRSN AVG
DEANS 230 230
  DISCONNECT BRANCH FROM BUS 218354 TO BUS 218300 CKT 1          /*
MINUESTG LINDEN 230 230
  MOVE 52 PERCENT LOAD FROM BUS 218396 TO BUS 218397           /* MINUESTR
T2 T1
  MOVE 24 PERCENT LOAD FROM BUS 218396 TO BUS 218410           /* MINUESTR
T2 WARINAN T1
  MOVE 24 PERCENT LOAD FROM BUS 218396 TO BUS 218414           /* MINUESTR
T2 WDBRDG T1
  END
```

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218326 | EDISON 1 | 32.63 |
| 218327 | EDISON 2 | 32.62 |
| 218328 | EDISON 3 | 32.63 |
| 218423 | LINDNCT1 | 3.14 |
| 218424 | LINDNCT2 | 3.14 |
| 218425 | LINDNCT3 | 3.14 |
| 218426 | LINDNST1 | 6.15 |
| 206679 | M&M S721 | -0.55 |
| 94130 | O66_NONFIRM | 32.22 |
| 206638 | PEAPACK | -0.21 |
| 290745 | S-061 | 0.44 |
| 218360 | SEWAREN1 | 39.35 |
| 218361 | SEWAREN2 | 44.65 |
| 218362 | SEWAREN3 | 40.49 |
| 218363 | SEWAREN4 | 46.92 |
| 218364 | SEWAREN6 | 41.96 |
| 218344 | TOSCONUG | 2.59 |
| 293093 | U2-077 | 382.44 |
| 292094 | V1-030 C1 | 0.02 |
| 292095 | V1-030 E1 | 0.81 |

| | | |
|---|---|---|
| 292185 | V1-030 E2 | 0.75 |
| 292101 | V1-030 E4 | 0.05 |
| 292107 | V1-030 E7 | 0.1 |
| 292111 | V1-030 E9 | -0.08 |
| 292189 | V1-030 EA | 0.31 |
| 292191 | V1-030 EC | -0.42 |
| 292092 | V1-030 ED | -0.24 |
| 292078 | V1-034 | 0.27 |
| 297021 | V2-009 E1 | 0.2 |
| 297023 | V2-009 E2 | 0.4 |
| 297025 | V2-009 E3 | 0.23 |
| 297069 | V2-025 E | -0.22 |
| 293378 | V3-024 E | 0.82 |
| 292666 | V3-058 E | 0.12 |
| 292668 | V3-059 E | 0.12 |
| 293444 | V3-065 E | -0.03 |
| 293440 | V3-066 E | -0.02 |
| 293434 | V3-067 E | -0.04 |
| 293429 | V3-068 E | -0.02 |
| 292681 | V3-069 E | 0.43 |
| 900801 | W1-001 | 9.11 |
| 901802 | W1-101 E | -0.08 |
| 901512 | W1-122 E | -0.19 |
| 902251 | W2-023 | 236.48 |
| 902652 | W2-052 E | 0.15 |
| 903672 | W3-106 E | -0.37 |
| 903682 | W3-110 E | -0.28 |
| 904452 | W3-126 E | -0.62 |
| 904592 | W3-140 E | -0.3 |
| 904642 | W3-145 E | -0.62 |
| 904652 | W3-146 E | -0.32 |
| 905492 | W4-059 E | -0.05 |
| 905542 | W4-064 E | -0.11 |
| 905552 | W4-065 E | -0.23 |
| 905642 | W4-080 E | 4.03 |
| 907012 | X1-012 E | -0.37 |
| 907132 | X1-046 E | -0.29 |
| 907402 | X1-072 E | -0.06 |
| 907302 | X1-094 E | -0.6 |
| 907522 | X1-114 E | -0.07 |
| 907412 | X1-116 E | -0.25 |
| 909442 | X2-087 E | -0.06 |
| 909452 | X2-088 E | 0.19 |
| 910712 | X3-052 E | -0.27 |
| 910722 | X3-054 E | -0.18 |

| | | |
|---|---|---|
| 910852 | X3-083 E | -0.32 |
| 913101 | Y1-026 | 95.44 |
| 915271 | Y3-051 C | 3.4 |
| 915272 | Y3-051 E1 | 43.04 |
| 916251 | Z1-033 | 37.42 |
| 916191 | Z1-059 C | 10.19 |
| 916192 | Z1-059 E | 2.83 |
| 916471 | Z1-096 C | 0.16 |
| 916472 | Z1-096 E | 0.26 |
| 916601 | Z1-109 | 125.17 |

# Appendix 17

(PSEG - PSEG) The G22_MTX5-WARINANC 230 kV line (from bus 218441 to bus 218316 ckt 1) loads from 170.16% to 185.33% (**DC power flow**) of its emergency rating (821 MVA) for the tower line contingency outage of 'H-2286 + G-2207'. This project contributes approximately 125.17 MW to the thermal violation.

CONTINGENCY 'H-2286 + G-2207'
  DISCONNECT BUS 218357
  DISCONNECT BUS 218355
  MOVE 100 PERCENT LOAD FROM BUS 218381 TO BUS 218380
  MOVE 100 PERCENT LOAD FROM BUS 218398 TO BUS 218399
  DISCONNECT BRANCH FROM BUS 218320 TO BUS 218524 CKT 2
  DISCONNECT BRANCH FROM BUS 218354 TO BUS 218306 CKT 2 /* PRSN AVG DEANS 230 230
  DISCONNECT BRANCH FROM BUS 218354 TO BUS 218300 CKT 1 /* MINUESTG LINDEN 230 230
  MOVE 52 PERCENT LOAD FROM BUS 218396 TO BUS 218397 /* MINUESTR T2 T1
  MOVE 24 PERCENT LOAD FROM BUS 218396 TO BUS 218410 /* MINUESTR T2 WARINAN T1
  MOVE 24 PERCENT LOAD FROM BUS 218396 TO BUS 218414 /* MINUESTR T2 WDBRDG T1
  END

| Bus Number | Bus Name | Full Contribution |
|---|---|---|
| 218326 | EDISON 1 | 32.63 |
| 218327 | EDISON 2 | 32.62 |
| 218328 | EDISON 3 | 32.63 |
| 218423 | LINDNCT1 | 3.14 |
| 218424 | LINDNCT2 | 3.14 |
| 218425 | LINDNCT3 | 3.14 |
| 218426 | LINDNST1 | 6.15 |
| 206679 | M&M S721 | -0.55 |
| 94130 | O66_NONFIRM | 32.22 |
| 206638 | PEAPACK | -0.21 |
| 290745 | S-061 | 0.44 |
| 218360 | SEWAREN1 | 39.35 |
| 218361 | SEWAREN2 | 44.65 |
| 218362 | SEWAREN3 | 40.49 |
| 218363 | SEWAREN4 | 46.92 |
| 218364 | SEWAREN6 | 41.96 |
| 218344 | TOSCONUG | 2.59 |
| 293093 | U2-077 | 382.44 |
| 292094 | V1-030 C1 | 0.02 |
| 292095 | V1-030 E1 | 0.81 |

| | | |
|---|---|---|
| 292185 | V1-030 E2 | 0.75 |
| 292101 | V1-030 E4 | 0.05 |
| 292107 | V1-030 E7 | 0.1 |
| 292111 | V1-030 E9 | -0.08 |
| 292189 | V1-030 EA | 0.31 |
| 292191 | V1-030 EC | -0.42 |
| 292092 | V1-030 ED | -0.24 |
| 292078 | V1-034 | 0.27 |
| 297021 | V2-009 E1 | 0.2 |
| 297023 | V2-009 E2 | 0.4 |
| 297025 | V2-009 E3 | 0.23 |
| 297069 | V2-025 E | -0.22 |
| 293378 | V3-024 E | 0.82 |
| 292666 | V3-058 E | 0.12 |
| 292668 | V3-059 E | 0.12 |
| 293444 | V3-065 E | -0.03 |
| 293440 | V3-066 E | -0.02 |
| 293434 | V3-067 E | -0.04 |
| 293429 | V3-068 E | -0.02 |
| 292681 | V3-069 E | 0.43 |
| 900801 | W1-001 | 9.11 |
| 901802 | W1-101 E | -0.08 |
| 901512 | W1-122 E | -0.19 |
| 902251 | W2-023 | 236.48 |
| 902652 | W2-052 E | 0.15 |
| 903672 | W3-106 E | -0.37 |
| 903682 | W3-110 E | -0.28 |
| 904452 | W3-126 E | -0.62 |
| 904592 | W3-140 E | -0.3 |
| 904642 | W3-145 E | -0.62 |
| 904652 | W3-146 E | -0.32 |
| 905492 | W4-059 E | -0.05 |
| 905542 | W4-064 E | -0.11 |
| 905552 | W4-065 E | -0.23 |
| 905642 | W4-080 E | 4.03 |
| 907012 | X1-012 E | -0.37 |
| 907132 | X1-046 E | -0.29 |
| 907402 | X1-072 E | -0.06 |
| 907302 | X1-094 E | -0.6 |
| 907522 | X1-114 E | -0.07 |
| 907412 | X1-116 E | -0.25 |
| 909442 | X2-087 E | -0.06 |
| 909452 | X2-088 E | 0.19 |
| 910712 | X3-052 E | -0.27 |
| 910722 | X3-054 E | -0.18 |

| | | |
|---|---|---|
| 910852 | X3-083 E | -0.32 |
| 913101 | Y1-026 | 95.44 |
| 915271 | Y3-051 C | 3.4 |
| 915272 | Y3-051 E1 | 43.04 |
| 916251 | Z1-033 | 37.42 |
| 916191 | Z1-059 C | 10.19 |
| 916192 | Z1-059 E | 2.83 |
| 916471 | Z1-096 C | 0.16 |
| 916472 | Z1-096 E | 0.26 |
| 916601 | Z1-109 | 125.17 |