

***Revised Generation Interconnection
Feasibility Study Report***

For

***PJM Generation Interconnection Request
Queue Position AB2-082***

Metuchen 230kV

**September 2016
Revised November 2016**

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 Middlesex, New Jersey. The installed facilities will have a total capability of 675 MW with 671 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is June 1, 2019. **This study does not imply a PSE&G commitment to this in-service date.**

Point of Interconnection

AB2-082 will interconnect with the PSE&G transmission system via a new circuit breaker position at the Metuchen 230kV substation.

Cost Summary

The AB2-082 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$ 0
Direct Connection Network Upgrades	\$ 21,400,000
Non Direct Connection Network Upgrades	\$ 0
Total Costs	\$ 21,400,000

In addition, the AB2-082 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	\$ 76,145,974
Previously Identified Upgrades	\$ 13,975,794
Total Costs	\$ 90,121,768

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

Attachment Facilities

No Attachment Facilities are required to support this interconnection request.

Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Expand the existing Metuchen 230kV substation to accommodate the AB2-082 interconnection	\$ 15,400,000
Total Direct Connection Facility Costs	\$ 15,400,000

Non-Direct Connection Cost Estimate

No Non-Direct Connection Facilities are required to support this interconnection request.

Schedule

Based on the extent of the Direct Connection and system upgrades required to support the AB2-082 generation project, it is expected to take a minimum of 60 months from the date of a fully executed Interconnection Construction Service Agreement to complete the installation.

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>

Network Impacts

The Queue Project AB2-082 was evaluated as a 675.0 MW (Capacity 671.0 MW) injection at the Metuchen 230kV substation in the PSEG area. Project AB2-082 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-082 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
BF_LIND2_3-10	CONTINGENCY 'BF_LIND2_3-10' DISCONNECT BUS 218353 /*REMOVE MINUE R CLOSE LINE FROM BUS 218396 TO BUS 218397 CKT 1 /*MINUE DISCONNECT BUS 218308 /* REMOVE LINDEN 5&6 DISCONNECT BUS 218418 /* LINDEN 5 DISCONNECT BUS 218419 /* LINDEN 6 END
BF_S8-7	CONTINGENCY 'BF_S8-7' /* SEWAREN 230KV BREAKER SECTION 7-8 DISCONNECT BUS 218353 /* DISCONNECT LINE R- 2218 MOVE 100 PERCENT LOAD FROM BUS 218397 TO BUS 218396 /* MINUE ST LOAD TRANSFER DISCONNECT BRANCH FROM BUS 218311 TO BUS 218400 CKT 1 END
G2207+R2218	CONTINGENCY 'G2207+R2218' /* LINDEN - DEAN & LINDEN - SEWARREN DISCONNECT BUS 218354 /* MINUE STREET G DISCONNECT BUS 218353 /* MINUE R DISCONNECT BUS 218396 /* MINUE STREET LOAD LOSS DISCONNECT BUS 218397 /* MINUE STREET LOAD LOSS END

Contingency Name	Description
H2286+W2249_LT	CONTINGENCY 'H2286+W2249_LT' /* DEANS - WESTFIELD & METUCHEN - FANWOOD DISCONNECT BUS 218355 /* NEW DOVER REMOVE H DISCONNECT BUS 218320 /* REMOVE FANWOOD SECTION 1 DISCONNECT BUS 218305 /* REMOVE WESTFIELD BUS 1 DISCONNECT BUS 218356 /* RMEOVE NEW DOVER BUS W SIDE DISCONNECT BUS 218398 /* NEW DOVER LOAD LOSS DISCONNECT BUS 218399 /* NEW DOVER LOAD LOSS CLOSE LINE FROM BUS 218415 TO BUS 218416 CKT 1 /* WESTFIELD CLOSE LINE FROM BUS 218380 TO BUS 218381 CKT 1 /* FANWOOD MOVE 8 MW LOAD FROM BUS 218380 TO BUS 218374 /* INTERSTATION TIE TRANSFER LOAD FROM FANWOOD TO ALDENE T10 MOVE 8 MW LOAD FROM BUS 218381 TO BUS 216926 /* INTERSTATION TIE TRANSFER LOAD FROM FANWOOD TO SPRINGRD T1 MOVE 8 MW LOAD FROM BUS 218380 TO BUS 216927 /* INTERSTATION TIE TRANSFER LOAD FROM FANWOOD TO SPRINGRD T2 END
L_H-2286	CONTINGENCY 'L_H-2286' /* FANWOOD TO METUCHEN DISCONNECT BUS 218355 /* NEW DOVER REMOVE H DISCONNECT BUS 218320 /* REMOVE FANWOOD SECTION 1 END
L_I-2287_LT	CONTINGENCY 'L_I-2287_LT' /* ROSELAND TO FANWOOD DISCONNECT BUS 219052 /* FANWOOD SECTION 2 CLOSE LINE FROM BUS 218380 TO BUS 218381 CKT 1 /* FANWOOD MOVE 8 MW LOAD FROM BUS 218381 TO BUS 218415 /* INTERSTATION TIE TRANSFER LOAD FROM FANWOOD TO WESTFIELD T1 MOVE 8 MW LOAD FROM BUS 218380 TO BUS 218374 /* INTERSTATION TIE TRANSFER LOAD FROM FANWOOD TO ALDENE T10 MOVE 8 MW LOAD FROM BUS 218381 TO BUS 216926 /* INTERSTATION TIE TRANSFER LOAD FROM FANWOOD TO SPRINGRD T1 MOVE 8 MW LOAD FROM BUS 218380 TO BUS 216927 /* INTERSTATION TIE TRANSFER LOAD FROM FANWOOD TO SPRINGRD T2 END

Contingency Name	Description
L_R-2218	CONTINGENCY 'L_R-2218' /* LINDEN TO SEWARREN DISCONNECT BUS 218353 /* MINUE R END
L_R-2218_LT	CONTINGENCY 'L_R-2218_LT' /* LINDEN TO SEWARREN DISCONNECT BUS 218353 /* MINUE R CLOSE LINE FROM BUS 218396 TO BUS 218397 CKT 1 /* MINUE STREET MOVE 8 MW LOAD FROM BUS 218397 TO BUS 218413 /* INTERSTATION TIE TRANSFER LOAD FROM MINUEST TO WDBRDG T3 MOVE 8 MW LOAD FROM BUS 218396 TO BUS 218414 /* INTERSTATION TIE TRANSFER LOAD FROM MINUEST TO WDBRDG T1 MOVE 8 MW LOAD FROM BUS 218397 TO BUS 218410 /* INTERSTATION TIE TRANSFER LOAD FROM MINUEST TO WARINICO T1 MOVE 8 MW LOAD FROM BUS 218396 TO BUS 218414 /* INTERSTATION TIE TRANSFER LOAD FROM MINUEST TO WDBRDG T1 END
T_BRG3_230-1	CONTINGENCY 'T_BRG3_230-1' /*BERGEN 230/345 TX DISCONNECT BRANCH FROM BUS 217100 TO BUS 217960 CKT 1 /*REMOVE BERGEN 230/345 TX END

Generator Deliverability

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

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To	Circuit		Initial	Final	Type	MVA		
1	N-1	L_H-2286	PSEG	LINDEN-TOSCO_3 230 kV line	218300	219046	1	DC	89.61	103.17	ER	1081	152.3	1
2	N-1	L_I-2287_LT	PSEG	SEWAREN-MINUEST_R 230 kV line	218311	218353	1	DC	97.3	128.92	ER	887	282.75	
3	Non	Non	PSEG	SEWAREN-MINUEST_R 230 kV line	218311	218353	1	DC	89.25	114.97	NR	732	189.81	
4	N-1	T_BRG3_23 0-1	PSEG	TOSCO_2-VFT 2 230 kV line	218343	218441	1	DC	94.62	98.47	ER	1081	97.15	2
5	N-1	L_I-2287_LT	PSEG	MINUEST_R-LINDEN 230 kV line	218353	218300	1	DC	94.07	125.7	ER	887	282.75	
6	Non	Non	PSEG	MINUEST_R-LINDEN 230 kV line	218353	218300	1	DC	85.33	111.05	NR	732	189.81	
7	N-1	L_R-2218	PSEG	NEWDOVR_H-FANWOOD_1 230 kV line	218355	218320	1	DC	94.6	127.25	ER	885	291.35	
8	N-1	L_R-2218_LT	PSEG	NEWDOVR_H-FANWOOD_1 230 kV line	218355	218320	1	DC	93.41	126.07	ER	885	291.35	
9	N-1	L_R-2218	PSEG	METUCHEN-NEWDOVR_H 230 kV line	218469	218355	1	DC	97.97	130.62	ER	885	291.35	
10	N-1	L_R-2218_LT	PSEG	METUCHEN-NEWDOVR_H 230 kV line	218469	218355	1	DC	96.78	129.43	ER	885	291.35	
11	Non	Non	PSEG	METUCHEN-NEWDOVR_H 230 kV line	218469	218355	1	DC	75.35	102.32	NR	731	198.79	
12	N-1	L_R-2218	PSEG	FANWOOD_2-ROSELAND 230 kV line	219052	216950	1	DC	77.57	108.2	ER	885	273.28	

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To	Circuit		Initial	Final	Type	MVA		
13	N-1	L_R-2218_LT	PSEG	FANWOOD_2-ROSELAND 230 kV line	219052	216950	1	DC	76.46	107.08	ER	885	273.28	

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Multiple Facility Contingency

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

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To	Circuit		Initial	Final	Type	MVA		
14	DCTL	G2207+R22 18	PSEG	NEWDOVR_H- FANWOOD_1 230 kV line	218355	218320	1	DC	99.71	132.88	ER	885	293.54	3
15	LFFB	BF_LIND2_3 -10	PSEG	NEWDOVR_H- FANWOOD_1 230 kV line	218355	218320	1	DC	96.13	129.25	ER	885	293.06	
16	LFFB	BF_S8-7	PSEG	NEWDOVR_H- FANWOOD_1 230 kV line	218355	218320	1	DC	95.53	128.65	ER	885	293.09	
17	LFFB	BF_LIND2_3 -10	PSEG	METUCHEN-NEWDOVR_H 230 kV line	218469	218355	1	DC	99.49	132.6	ER	885	293.06	
18	LFFB	BF_S8-7	PSEG	METUCHEN-NEWDOVR_H 230 kV line	218469	218355	1	DC	98.89	132	ER	885	293.09	
19	DCTL	G2207+R22 18	PSEG	FANWOOD_2-ROSELAND 230 kV line	219052	216950	1	DC	82.58	113.7	ER	885	275.36	4
20	LFFB	BF_LIND2_3 -10	PSEG	FANWOOD_2-ROSELAND 230 kV line	219052	216950	1	DC	79.11	110.17	ER	885	274.88	
21	LFFB	BF_S8-7	PSEG	FANWOOD_2-ROSELAND 230 kV line	219052	216950	1	DC	78.43	109.5	ER	885	274.91	

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

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 Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To			Initial	Final	Type	MVA		
22	N-1	L_H-2286	PSEG	SEWAREN-MINUEST_R 230 kV line	218311	218353	1	DC	105.86	138.91	ER	887	295.48	5
23	DCTL	H2286+W22 49_LT	PSEG	SEWAREN-MINUEST_R 230 kV line	218311	218353	1	DC	106.69	121.76	ER	887	296.7	
24	N-1	L_H-2286	PSEG	MINUEST_R-LINDEN 230 kV line	218353	218300	1	DC	102.63	135.67	ER	887	295.48	6
25	DCTL	H2286+W22 49_LT	PSEG	MINUEST_R-LINDEN 230 kV line	218353	218300	1	DC	103.46	118.53	ER	887	296.7	
26	DCTL	G2207+R22 18	PSEG	METUCHEN-NEWDQVR_H 230 kV line	218469	218355	1	DC	103.06	136.23	ER	885	293.54	7

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

#	Area	Bus No.	Bus	Breaker	Rating Type	Duty Percent Without AB2-155	Duty Percent With AB2-155	Duty Percent Difference
27	PSEG	4996	LINDEN 230.kV	11H	S	98.57%	100.39%	1.82%
28	PSEG	4996	LINDEN 230.kV	12H	S	98.57%	100.39%	1.82%
29	PSEG	4996	LINDEN 230.kV	21H	S	98.57%	100.39%	1.82%
30	PSEG	4996	LINDEN 230.kV	22H	S	98.57%	100.39%	1.82%
31	PSEG	4996	LINDEN 230.kV	31H	S	98.57%	100.39%	1.82%
32	PSEG	4996	LINDEN 230.kV	32H	S	98.57%	100.39%	1.82%
33	PSEG	4996	LINDEN 230.kV	41H	S	98.57%	100.39%	1.82%
34	PSEG	4996	LINDEN 230.kV	42H	S	98.57%	100.39%	1.82%

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.

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To			Initial	Final	Type	MVA		
35	N-1	L_H-2286	PSEG	SEWAREN-MINUEST_R 230 kV line	218311	218353	1	DC	100.65	115.74	ER	887	297.24	
36	N-1	L_H-2286	PSEG	MINUEST_R-LINDEN 230 kV line	218353	218300	1	DC	97.41	112.51	ER	887	297.24	

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To	Circuit		Initial	Final	Type	MVA		
37	N-1	L_R-2218	PSEG	NEWDOVR_H-FANWOOD_1 230 kV line	218355	218320	1	DC	95.46	128.58	ER	885	293.09	
38	N-1	L_R-2218	PSEG	METUCHEN-NEWDOVR_H 230 kV line	218469	218355	1	DC	98.83	131.95	ER	885	293.09	
39	Non	Non	PSEG	METUCHEN-NEWDOVR_H 230 kV line	218469	218355	1	DC	76.04	103.39	NR	731	199.98	
40	N-1	L_R-2218	PSEG	FANWOOD_2-ROSELAND 230 kV line	219052	216950	1	DC	78.35	109.42	ER	885	274.91	

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	LINDEN-TOSCO_3 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: <ul style="list-style-type: none"> Reconductor Linden-Tosco (B-2254) 230kV line The estimated schedule duration is 36 months.		\$ 2,921,885
#2, 3	SEWAREN-MINUEST_R 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: <ul style="list-style-type: none"> Reconductor Sewaren-Minue (R-2218-1) 230kV line The estimated schedule duration is 36 months.		\$ 6,585,062
#4	TOSCO_2-VFT 2 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: <ul style="list-style-type: none"> Reconductor Tosco-VFT (S-2271) 230kV line The estimated schedule duration is 36 months.		\$ 1,439,072

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
#5, 6	MINUEST_R-LINDEN 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: <ul style="list-style-type: none"> Reconductor Minue-Linden (R-2218-3) 230kV line The estimated schedule duration is 36 months.		\$ 7,390,732
#7, 8, 14, 15, 16	NEWDOVR_H-FANWOOD_1 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: <ul style="list-style-type: none"> Reconductor New Dover-Fanwood (H-2286-5) 230kV line The estimated schedule duration is 36 months.		\$ 10,953,854
#9, 10, 11, 17, 18	METUCHEN-NEWDOVR_H 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: <ul style="list-style-type: none"> Reconductor Metuchen-Pierson Ave (H-2286-1) 230kV line Reconductor Pierson Ave-New Dover (H-2286-3) 230kV line The estimated schedule duration is 36 months.		\$ 12,657,678
#12, 13, 19, 20, 21	FANWOOD_2-ROSELAND 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: <ul style="list-style-type: none"> Reconductor Fanwood-Roseland (R-2323 & I-2287) 230kV line The estimated schedule duration is 36 months.		\$ 2,709,834
27, 28, 29, 30, 31, 32, 33, 34	Eight (8) 230kV CB's at Linden Substation	In order to mitigate the overloads of facilities above, the following reinforcements are required: <ul style="list-style-type: none"> Upgrade A-2253 to 345 kV & connect at Linden 345 kV open position The estimated schedule duration is 36 months.		\$ 31,487,857
Total New Network Upgrades				\$ 76,145,974

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
#22, 23	SEWAREN-MINUEST_R 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: <ul style="list-style-type: none"> Reconductor Sewaren-Minue (R-2218-1) 230kV line The estimated schedule duration is 36 months.		\$ 6,585,062
#24, 25	MINUEST_R-LINDEN 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: <ul style="list-style-type: none"> Reconductor Minue-Linden (R-2218-3) 230kV line The estimated schedule duration is 36 months.		\$ 7,390,732
#26	METUCHEN-NEWDVR_H 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: <ul style="list-style-type: none"> Reconductor Metuchen-Pierson Ave (H-2286-1) 230kV line Reconductor Pierson Ave-New Dover (H-2286-3) 230kV line The estimated schedule duration is 36 months. *** Cost for this upgrade is provided in the New System Reinforcements table under Violation #7, 8, 14, 15, 16.		\$ 0***
Total New Network Upgrades				\$ 13,975,794

Attachment 1. System Configuration

Attachment 2. Flowgate Details

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-TOSCO_3 230 kV line (from bus 218300 to bus 219046 ckt 1) loads from 89.61% to 103.17% (**DC power flow**) of its emergency rating (1081 MVA) for the single line contingency outage of 'L_H-2286'. This project contributes approximately 152.3 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
217136	BAYONNE_CTG1	6.32
217183	BAYONNE_CTG2	6.32
217184	BAYONNE_CTG3	6.32
217185	BAYONNE_STG4	9.58
219030	CIR_AB2-008A	8.36
219031	CIR_AB2-008B	8.36
219032	CIR_AB2-009A	9.23
219033	CIR_AB2-009B	9.23
218426	LINDEN_2ST	17.69
218318	LINDEN_AB	1.72
218436	LINDEN_G11	23.72
218425	LINDEN_G12	5.94
218423	LINDEN_G21	5.94
218424	LINDEN_G22	5.94
218418	LINDEN_G5	6.48
218419	LINDEN_G6	6.48
219036	LINDEN_G7	4.75
219035	LINDEN_G8	4.74

Bus Number	Bus Name	Full Contribution
219060	SEWAREN_1LD5	26.95
219064	SEWAREN_2LD2	30.58
219068	SEWAREN_3LD2	27.73
219071	SEWAREN_4LD1	33.17
218364	SEWAREN_G6	28.74
292094	V1-030 C1	0.06
292680	V3-069 C	0.04
902651	W2-052C	< 0.01
909461	X2-089 C	0.03
920612	Z1-116 C	164.56
920613	Z1-116 E	13.62
917521	Z2-089 C	131.9
918571	AA1-073 C	0.17
923302	AB1-139 C	0.57
924111	AB2-055 OP	176.95
924171	AB2-061 C	0.17
924341	AB2-082 C	152.3
924421	AB2-091 C OP	16.44

Appendix 2

(PSEG - PSEG) The TOSCO_2-VFT 2 230 kV line (from bus 218343 to bus 218441 ckt 1) loads from 94.62% to 98.47% (**DC power flow**) of its emergency rating (1081 MVA) for the single line contingency outage of 'T_BRG3_230-1'. This project contributes approximately 97.15 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
217136	BAYONNE_CTG1	8.29
217183	BAYONNE_CTG2	8.29
217184	BAYONNE_CTG3	8.29
217185	BAYONNE_STG4	12.57
219030	CIR_AB2-008A	5.34
219031	CIR_AB2-008B	5.34
219032	CIR_AB2-009A	5.9
219033	CIR_AB2-009B	5.9
217112	HUDSON_G2	27.33
218435	LINDEN_1GT	9.12
218426	LINDEN_2ST	17.27
218318	LINDEN_AB	1.94
218436	LINDEN_G11	24.96
218425	LINDEN_G12	5.8
218423	LINDEN_G21	5.8
218424	LINDEN_G22	5.8
218418	LINDEN_G5	6.33
218419	LINDEN_G6	6.33
219036	LINDEN_G7	4.99

Bus Number	Bus Name	Full Contribution
219035	LINDEN_G8	4.99
290745	S-061	1.63
219060	SEWAREN_1LD5	20.1
219064	SEWAREN_2LD2	22.8
219068	SEWAREN_3LD2	20.68
219071	SEWAREN_4LD1	24.74
218364	SEWAREN_G6	21.43
292094	V1-030 C1	0.06
901801	W1-101C	0.02
913101	Y1-026	13.07
920612	Z1-116 C	104.97
920613	Z1-116 E	8.69
917521	Z2-089 C	98.36
923302	AB1-139 C	0.36
924111	AB2-055 OP	232.12
924171	AB2-061 C	0.11
924341	AB2-082 C	97.15
924421	AB2-091 C OP	22.07

Appendix 3

(PSEG - PSEG) The NEWDOVR_H-FANWOOD_1 230 kV line (from bus 218355 to bus 218320 ckt 1) loads from 99.71% to 132.88% (**DC power flow**) of its emergency rating (885 MVA) for the tower line contingency outage of 'G2207+R2218'. This project contributes approximately 293.54 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
219030	CIR_AB2-008A	15.93
219031	CIR_AB2-008B	15.93
219032	CIR_AB2-009A	17.59
219033	CIR_AB2-009B	17.59

Bus Number	Bus Name	Full Contribution
902651	W2-052C	0.02
902652	W2-052E	0.21
909452	X2-088 E	0.29
909461	X2-089 C	0.06

Bus Number	Bus Name	Full Contribution
219060	SEWAREN_1LD5	45.15
219064	SEWAREN_2LD2	51.23
219068	SEWAREN_3LD2	46.45
219071	SEWAREN_4LD1	55.57
218364	SEWAREN_G6	48.14
292185	V1-030 E2	1.17
292107	V1-030 E7	0.15
292078	V1-034	0.36
297021	V2-009 E1	0.3
297023	V2-009 E2	0.61
297027	V2-009 E4	0.39
293378	V3-024 E	1.22
292680	V3-069 C	0.08
292681	V3-069 E	0.53

Bus Number	Bus Name	Full Contribution
909462	X2-089 E	0.75
910762	X3-052 E	-0.36
920612	Z1-116 C	315.28
920613	Z1-116 E	26.09
917521	Z2-089 C	220.96
917522	Z2-089 E	25.61
918571	AA1-073 C	0.33
918572	AA1-073 E	0.74
923302	AB1-139 C	1.09
923303	AB1-139 E	1.78
924171	AB2-061 C	0.32
924172	AB2-061 E	0.53
924341	AB2-082 C	291.8
924342	AB2-082 E	1.74

Appendix 4

(PSEG - PSEG) The FANWOOD_2-ROSELAND 230 kV line (from bus 219052 to bus 216950 ckt 1) loads from 82.58% to 113.7% (**DC power flow**) of its emergency rating (885 MVA) for the tower line contingency outage of 'G2207+R2218'. This project contributes approximately 275.36 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
219030	CIR_AB2-008A	15
219031	CIR_AB2-008B	15
219032	CIR_AB2-009A	16.58
219033	CIR_AB2-009B	16.58
219060	SEWAREN_1LD5	42.34
219064	SEWAREN_2LD2	48.04
219068	SEWAREN_3LD2	43.56
219071	SEWAREN_4LD1	52.11
218364	SEWAREN_G6	45.15
292185	V1-030 E2	1.1
292107	V1-030 E7	0.14
292078	V1-034	0.38
297021	V2-009 E1	0.29
297023	V2-009 E2	0.58
297027	V2-009 E4	0.38
293378	V3-024 E	1.16
292680	V3-069 C	0.07
292681	V3-069 E	0.5

Bus Number	Bus Name	Full Contribution
902651	W2-052C	0.02
902652	W2-052E	0.19
909452	X2-088 E	0.27
909461	X2-089 C	0.06
909462	X2-089 E	0.71
910762	X3-052 E	-0.38
920612	Z1-116 C	295.76
920613	Z1-116 E	24.48
917521	Z2-089 C	207.22
917522	Z2-089 E	24.02
918571	AA1-073 C	0.31
918572	AA1-073 E	0.69
923302	AB1-139 C	1.02
923303	AB1-139 E	1.67
924171	AB2-061 C	0.3
924172	AB2-061 E	0.5
924341	AB2-082 C	273.73
924342	AB2-082 E	1.63

Appendix 5

(PSEG - PSEG) The SEWAREN-MINUEST_R 230 kV line (from bus 218311 to bus 218353 ckt 1) loads from 105.86% to 138.91% (**DC power flow**) of its emergency rating (887 MVA) for the single line contingency outage of 'L_H-2286'. This project contributes approximately 295.48 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
219030	CIR_AB2-008A	15.75
219031	CIR_AB2-008B	15.75
219032	CIR_AB2-009A	17.4
219033	CIR_AB2-009B	17.4
219060	SEWAREN_1LD5	52.87
219064	SEWAREN_2LD2	59.99
219068	SEWAREN_3LD2	54.39
219071	SEWAREN_4LD1	65.07
218364	SEWAREN_G6	56.38
292096	V1-030 C2	0.14
292078	V1-034	0.39

Bus Number	Bus Name	Full Contribution
292680	V3-069 C	0.08
902651	W2-052C	0.02
909461	X2-089 C	0.07
920612	Z1-116 C	319.26
920613	Z1-116 E	26.42
917521	Z2-089 C	258.76
918571	AA1-073 C	0.34
923302	AB1-139 C	1.1
924171	AB2-061 C	0.32
924341	AB2-082 C	295.48

Appendix 6

(PSEG - PSEG) The MINUEST_R-LINDEN 230 kV line (from bus 218353 to bus 218300 ckt 1) loads from 102.63% to 135.67% (**DC power flow**) of its emergency rating (887 MVA) for the single line contingency outage of 'L_H-2286'. This project contributes approximately 295.48 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
219030	CIR_AB2-008A	15.75
219031	CIR_AB2-008B	15.75
219032	CIR_AB2-009A	17.4
219033	CIR_AB2-009B	17.4
219060	SEWAREN_1LD5	52.87
219064	SEWAREN_2LD2	59.99
219068	SEWAREN_3LD2	54.39
219071	SEWAREN_4LD1	65.07
218364	SEWAREN_G6	56.38
292096	V1-030 C2	0.14
292078	V1-034	0.39

Bus Number	Bus Name	Full Contribution
292680	V3-069 C	0.08
902651	W2-052C	0.02
909461	X2-089 C	0.07
920612	Z1-116 C	319.26
920613	Z1-116 E	26.42
917521	Z2-089 C	258.76
918571	AA1-073 C	0.34
923302	AB1-139 C	1.1
924171	AB2-061 C	0.32
924341	AB2-082 C	295.48

Appendix 7

(PSEG - PSEG) The METUCHEN-NEWDOVR_H 230 kV line (from bus 218469 to bus 218355 ckt 1) loads from 103.06% to 136.23% (**DC power flow**) of its emergency rating (885 MVA) for the tower line contingency outage of 'G2207+R2218'. This project contributes approximately 293.54 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
219030	CIR_AB2-008A	15.93
219031	CIR_AB2-008B	15.93
219032	CIR_AB2-009A	17.59
219033	CIR_AB2-009B	17.59
219060	SEWAREN_1LD5	45.15
219064	SEWAREN_2LD2	51.23
219068	SEWAREN_3LD2	46.45
219071	SEWAREN_4LD1	55.57
218364	SEWAREN_G6	48.14
292185	V1-030 E2	1.17
292107	V1-030 E7	0.15
292078	V1-034	0.36
297021	V2-009 E1	0.3
297023	V2-009 E2	0.61
297027	V2-009 E4	0.39
293378	V3-024 E	1.22
292680	V3-069 C	0.08
292681	V3-069 E	0.53

Bus Number	Bus Name	Full Contribution
902651	W2-052C	0.02
902652	W2-052E	0.21
909452	X2-088 E	0.29
909461	X2-089 C	0.06
909462	X2-089 E	0.75
910762	X3-052 E	-0.36
920612	Z1-116 C	315.28
920613	Z1-116 E	26.09
917521	Z2-089 C	220.96
917522	Z2-089 E	25.61
918571	AA1-073 C	0.33
918572	AA1-073 E	0.74
923302	AB1-139 C	1.09
923303	AB1-139 E	1.78
924171	AB2-061 C	0.32
924172	AB2-061 E	0.53
924341	AB2-082 C	291.8
924342	AB2-082 E	1.74