Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AD2-165

“South River II 230 kV”

40 MW Capacity / 110 MW Energy Uprate

July 2018

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 users, 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 an increase in output to their future South River (R11/AC1-029) natural gas facility to be located in Sayreville, New Jersey. The IC also has a future Z2-109 battery storage facility behind the same Point of Interconnection (POI) as the natural gas facility. The uprate will increase the output of the natural gas generating facility by **110 MW** with **40 MW** being recognized by PJM as Capacity. (See the summary tables below.) The proposed facilities will have a total capability of **590 MW** with **500 MW** of this output being recognized by PJM as Capacity. The proposed in-service date for this project is **May 1, 2021**. **This study does not imply a Jersey Central Power & Light (JCP&L) commitment to this in-service date.**

MFO and Capacity:

Queue Project	MFO (MW)	Capacity (MW)
R11	440	440
Z2-109	+ 20	+ 0
AC1-029 (uprate)	+ 20	+ 20
AD2-165 (uprate)	+ 110	+ 40
Total Facility	**590**	**500**

Summer and Winter Energy:

Generating Facility Capability (Energy)	Summer Energy	Winter Energy
Net Energy Existing	480	480
Net Energy Proposed Increase with AD2-165	+40	+110
Total Net Energy	**520**	**590**

Point of Interconnection

AD2-165 "South River II 230 kV" will interconnect with the Jersey Central Power & Light Company transmission system at the same POI as the future R11/Z2-109/AC1-029 generation plant, also owned by the IC. The future AD2-165, AC1-029, Z2-109 and R11 interconnect will be to a common 230 kV breaker position of a future three-breaker ring bus identified as R11 Ring Bus and located on the 230 kV line between the South River Generating Plant and the future 230 kV 6-breaker ring bus identified as South River Junction.

Attachment 1 shows a one-line diagram of the connection facilities for the AD2-165 project. As indicated, the combined AD2-165, AC1-029, Z2-109 and R11 generation project was studied as a 590 MW injection to the JCP&L 230 kV system at the R11 Ring Bus Substation three breaker 230 kV ring bus. See Attachments 1 and 2.

Cost Summary

The **AD2-165 "South River II 230 kV"** project does not require any additional attachment facilities or direct/non-direct connection costs[1] to interconnect to the system from the original R11/Z2-109/AC1-029 project.

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades (APS)	$ 0
Total Costs	**$ 0**

[1] No additional work is required if R11/Z2-109/AC1-029 and AD2-165 go into service at the same time. There may be additional relay upgrade work required at remote stations if AD2-165 comes into service at a later date than the original request.

In addition, the AD2-165 project may be responsible for a contribution to the following costs. These costs do not include CIAC Tax Gross-up:

Description	Total Cost
New System Upgrades	$ 20,574,200
Previously Identified Upgrades	$ 5,583,000
Total Costs	**$ 26,157,200**

The transmission and substation costs given above exclude any applicable state or federal taxes. If at a future date Federal CIAC (contribution in aid of construction) taxes are deemed necessary by the IRS for this project, JCP&L shall be reimbursed by the Interconnection Customer for such taxes. JCPL estimates the tax, if applicable, would be approximately **$4,112,300** ($3,234,500 for New System Upgrades + $877,800 for Previously Identified Upgrades).

The required Attachment Facilities, Direct Connection, and Non-Direct Connection work for the interconnection of the AD2-165 generation project to the JCPL Transmission System is detailed in the following sections. The associated one-line with the generation project is shown in Attachment 1.

Note that all cost estimates contained in this document were produced without a detailed engineering review and are therefore subject to change. IC will be responsible for the actual cost of the work that is implemented. JCP&L herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any reinforcements to the transmission or subtransmission systems.

Attachment Facilities

No additional Attachment facilities are required to support this AD2-165 uprate interconnection.

Direct Connection Cost Estimate

No additional Direct Connection facilities are required to support this AD2-165 uprate interconnection.

Non-Direct Connection Cost Estimate[1]

No additional Non-Direct Connection facilities are required to support this AD2-165 uprate interconnection.

Schedule

Based on the extent of the JCPL network upgrade work required to support the AD2-165 generation project, it is expected to take a minimum of **9 months** from the date of a fully executed Interconnection Construction Service Agreement to complete the Parlin-Freneau 230 kV line reconductor network upgrade and **16 months** to complete the Red Oak Tap –Raritan River 230 kV line reconductor network upgrade subject to market conditions and vendor lead times. It will be determined in the Facilities Study phase whether or not these two network upgrades can be done concurrently. It assumes that there will be no environmental or permitting issues to implement the upgrades required for this uprate project and that all system outages will be allowed when requested.

JCPL Analysis and Requirements

Power Flow Analysis

PJM performed a power flow analysis of the transmission system using a 2021 summer peak load flow model and the results were verified by FE. Additionally, FE performed an analysis of its underlying transmission <100 kV system. At the Primary POI, the AD2-165 project contributes to overloads on the FE transmission system as shown in Attachment 2a. The estimated cost of system reinforcements necessary to mitigate these overloads are provided in Attachment 2b.

Short Circuit Analysis

In accordance with the RTEP process, a short circuit analysis will not be conducted by PJM since the AD2-165 generation project capacity increase request has no change to the electrical characteristics of the generating facility as indicated by the developer.

Stability Analysis

PJM will be responsible for completing a dynamic stability analysis, if necessary, as part of the System Impact Study. The results of this analysis will be reviewed by FE. Should stability concerns be identified in PJM's study, FE will develop appropriate system reinforcement(s) and included the estimated cost of any reinforcement(s) in FE's System Impact Study report.

System Protection

The IC must design it's Customer Facilities in accordance with all applicable standards, including the standards in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx. Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

Metering

The IC will be require to comply with all FE revenue metering requirements for generation interconnection customers which can be found in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx.

Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated 230 kV circuit breaker to protect the AD2-165 generator lead line. A single circuit breaker must be used to protect this line; if the project has several GSU transformers, the individual GSU transformer breakers cannot be used to protect this line.

2. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.

3. The purchase and installation of supervisory control and data acquisition ("SCADA") equipment to provide information in a compatible format to the FE Transmission System Control Center.

4. Compliance with the FE and PJM generator power factor and voltage control requirements.

5. The execution of a back-up service agreement to serve the customer load supplied from the AD2-165 generation project metering point when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

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

Power Factor Requirements

For the R11/AC1-029/AD2-165 Combined Cycle Generating Facility, the Interconnection Customer shall design its customer facility with the ability to maintain a power factor as described in the R11/Z2-109/AC1-029 Interconnection Service Agreement ("ISA") of at least 0.95 leading to 0.90 lagging measured at the generator's terminals.

For Z2-109 Battery Storage Facility, the results of the System Impact Study required that, for safety and reliability of the Transmission System, the Generation Interconnection Customer shall design its non-synchronous Customer Facility with the ability to maintain a power factor as described in the R11/Z2-109/AC1-029 Interconnection Service Agreement ("ISA") of at least 0.95 leading to 0.95 lagging measured at the generator's terminals.

If the R11, Z2-109, AC1-029 and AD2-165 generation projects cannot meet these requirements, a dynamic device such as a STATCOM or SVC must be installed at the R11 project substation at the IC's cost. Should the IC fail to provide dynamic reactive capability from this generation project for any reason once interconnected, the FE and/or PJM Dispatchers may need to take action to curtail its output to prevent non-compliance with voltage criteria.

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.

Network Impacts

The Queue Project AD2-165 was evaluated as a 40.0 MW (Capacity 40.0 MW) uprate to R11 / Z2-109 / AC1-029 which is an injection at the R11 230kV substation in the JCPL area. Project AD2-165 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-165 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2021

Contingency Descriptions

Contingency Name	Description
JC-P7-1-JCC-230-17T	CONTINGENCY 'JC-P7-1-JCC-230-17T' /* RARITAN RIVER - KILMER - LAKE NELSON I1023 & W1037 DISCONNECT BUS 218331 /* KILMER_I 230 KV DISCONNECT BUS 218332 /* KILMER_W 230 KV END
JC-P7-1-JCC-230-4	CONTINGENCY 'JC-P7-1-JCC-230-4' /* R11B-ATLANTIC (P1030) & PARLIN-FRENEAU (K1025) DISCONNECT BRANCH FROM BUS 206411 TO BUS 206286 CKT 1 /* P1030 R11B-ATLANTIC DISCONNECT BRANCH FROM BUS 206286 TO BUS 206272 CKT 1 /* P1030 ATLANTIC BANK1 DISCONNECT BRANCH FROM BUS 206322 TO BUS 206298 CKT 1 /* K1025 PARLIN-WILLIAMS DISCONNECT BRANCH FROM BUS 206298 TO BUS 206292 CKT 1 /* K1025 WILLIAMS-FRENEAU DISCONNECT BUS 206298 /* K1025 WILLIAMS DISCONNECT BRANCH FROM BUS 206292 TO BUS 206267 CKT 1 /* K1025 FRENEAU 1 SET BUS 206292 LOAD TO 30 MW /* K1025 FRENEAU 3 DISCONNECT BRANCH FROM BUS 206292 TO BUS 206267 CKT 6 /* K1025 FRENEAU 6 END

PS_P7-1_1LINE+2LINE	CONTINGENCY 'PS_P7-1_1LINE+2LINE' /* LAKE NELSON - RARITIAN X2 DISCONNECT BUS 218331 /* REMOVE KILMER 1 DISCONNECT BUS 218332 /* REMOVE KILMER 2 MOVE 8 MW LOAD FROM BUS 218384 TO BUS 218383 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO GREENBK T1 MOVE 8 MW LOAD FROM BUS 218387 TO BUS 218399 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO NEWDOVR T2 MOVE 8 MW LOAD FROM BUS 218385 TO BUS 218393 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO MDWRD T2 MOVE 8 MW LOAD FROM BUS 218386 TO BUS 218347 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO BNNTLANE T2 END

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.)

Overload Number	Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
1	DCTL	PS_P7-1_1LINE+2LINE	JCPL - JCPL	28WILLIAMS-28FRENEAU 230 kV line	206298	206292	1	DC	98.8	100.52	ER	869	14.96	1
2	DCTL	JC-P7-1-JCC-230-17T	JCPL - JCPL	28WILLIAMS-28FRENEAU 230 kV line	206298	206292	1	DC	98.78	100.5	ER	869	14.96	
3	DCTL	PS_P7-1_1LINE+2LINE	JCPL - JCPL	28PARLIN-28WILLIAMS 230 kV line	206322	206298	1	DC	99.3	101.02	ER	869	14.96	2
4	DCTL	JC-P7-1-JCC-230-17T	JCPL - JCPL	28PARLIN-28WILLIAMS 230 kV line	206322	206298	1	DC	99.28	101.01	ER	869	14.96	

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

Overload Number	Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
5	DCTL	JC-P7-1-JCC-230-4	JCPL - JCPL	28RED OAKA-AA1-098 TAP 230 kV line	206314	918790	1	DC	100.18	102.74	ER	869	22.29	3
6	DCTL	JC-P7-1-JCC-230-4	JCPL - JCPL	AA1-098 TAP-28RAR RVR 230 kV line	918790	206305	1	DC	100.18	102.74	ER	869	22.29	4

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

Steady-State Voltage Requirements

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

To be determined in the Impact Study Phase.

Short Circuit

(Summary of impacted circuit breakers)

None

Affected System Analysis & Mitigation

(Summary of impacts on systems external to PJM)

NYISO Impacts:

NYISO Impacts to be determined during later study phases (as applicable).

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

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.

Light Load Analysis

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

To be determined in the Impact Study phase.

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 in the Impact Study phase.

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, 2	28WILLIAMS-28FRENEAU 230 kV line	Reconductor the Freneau-Parlin 230kV line with 1590 ACSS, 10.6 miles. @ Freneau-Parlin 230kV Line for AD2-165 Replace (2) 230kV Disconnect Switches. @ Freneau SS Replace 230kV wave trap and limiting substation conductor. @ Parlin SS Total Time to Complete: 9 months	Pending	$20,276,200 $179,900 + $118,100 $20,574,200
3, 4	28PARLIN-28WILLIAMS 230 kV line	Same as above	Same as above	Same as above

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	28RED OAKA-AA1-098 TAP 230 kV line	Reconductor the Red Oak Tap-Raritan River (T1034) 230kV line with 1590 kcmil ACSS to mitigate overloading due to generation interconnection project AD2-165, 2.6 miles. @ Red Oak Tap-Raritan River (T1034) 230kV Line for AD2-165 Total Time to Complete: 16 months	Pending	$5,583,000
6	AA1-098 TAP-28RAR RVR 230 kV line	Same as above	Same as above	Same as above

Attachment 1. AD2-165 ‘South River II 230 kV’

One Line Diagram

Attachment 2. AD2-156 ‘South River II 230 kV’

Project Location

Attachment 3:
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. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the Appendices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the Appendices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators.

It should be noted the project/generator MW contributions presented in the body of the report and appendices sections are full contributions, whereas the loading percentages reported in the body of the report, take into consideration the commercial probability of each project as well as the ramping impact of "Adder" contributions.

Appendix 1

(JCPL - JCPL) The 28WILLIAMS-28FRENEAU 230 kV line (from bus 206298 to bus 206292 ckt 1) loads from 98.8% to 100.52% (**DC power flow**) of its emergency rating (869 MVA) for the tower line contingency outage of 'PS_P7-1_1LINE+2LINE'. This project contributes approximately 14.96 MW to the thermal violation.

CONTINGENCY 'PS_P7-1_1LINE+2LINE' /* LAKE NELSON - RARITIAN X2
DISCONNECT BUS 218331 /* REMOVE KILMER 1
DISCONNECT BUS 218332 /* REMOVE KILMER 2
MOVE 8 MW LOAD FROM BUS 218384 TO BUS 218383 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO GREENBK T1
MOVE 8 MW LOAD FROM BUS 218387 TO BUS 218399 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO NEWDOVR T2
MOVE 8 MW LOAD FROM BUS 218385 TO BUS 218393 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO MDWRD T2
MOVE 8 MW LOAD FROM BUS 218386 TO BUS 218347 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO BNNTLANE T2
END

Bus Number	*Bus Name*	*Full Contribution*
206358	*28PARLN1&2*	*4.56*
206359	*28PARLN3&4*	*4.56*
206412	*28R11*	*164.6*
206362	*28RDOAKCT1*	*12.66*
206363	*28RDOAKCT2*	*12.23*
206364	*28RDOAKCT3*	*12.23*
206365	*28RDOAKST1*	*17.74*
206327	*28S RIV G1*	*7.16*
206328	*28S RIV G2*	*7.16*
206329	*28S RIV G3*	*7.02*
206403	*28W4-009*	*49.76*
934841	*AD1-113*	*27.69*
937261	*AD2-165*	*14.96*
LTF	*AMIL*	*0.12*

LTF	*BAYOU*	*0.44*
LTF	*BIG_CAJUN1*	*0.68*
LTF	*BIG_CAJUN2*	*1.37*
LTF	*BLUEG*	*0.74*
LTF	*CALDERWOOD*	*0.23*
LTF	*CANNELTON*	*0.13*
LTF	*CARR*	*0.15*
LTF	*CATAWBA*	*0.15*
LTF	*CELEVELAND*	*0.43*
LTF	*CHEOAH*	*0.21*
LTF	*CHILHOWEE*	*0.08*
LTF	*CHOCTAW*	*0.45*
LTF	*CLIFTY*	*3.02*
LTF	*COTTONWOOD*	*1.75*
LTF	*DEARBORN*	*0.37*
LTF	*EDWARDS*	*0.22*
LTF	*ELMERSMITH*	*0.37*
LTF	*FARMERCITY*	*0.15*
LTF	*G-007A*	*88.52*
LTF	*GIBSON*	*0.25*
LTF	*HAMLET*	*0.49*
LTF	*MORGAN*	*0.74*
LTF	*NEWTON*	*0.56*
LTF	*O-066*	*2.5*
LTF	*PRAIRIE*	*1.08*
LTF	*RENSSELAER*	*0.12*

LTF	*ROSETON*	*0.86*
LTF	*ROWAN*	*0.29*
LTF	*SANTEETLA*	*0.06*
LTF	*SMITHLAND*	*0.09*
LTF	*TATANKA*	*0.26*
LTF	*TILTON*	*0.26*
LTF	*TRIMBLE*	*0.14*
LTF	*TVA*	*0.33*
LTF	*UNIONPOWER*	*0.33*
905502	*W4-060 E OP1*	*0.46*
912042	*X4-005 E*	*22.15*
917682	*Z2-109 E*	*7.48*
925541	*AC1-029*	*7.48*

Appendix 2

(JCPL - JCPL) The 28PARLIN-28WILLIAMS 230 kV line (from bus 206322 to bus 206298 ckt 1) loads from 99.3% to 101.02% (**DC power flow**) of its emergency rating (869 MVA) for the tower line contingency outage of 'PS_P7-1_1LINE+2LINE'. This project contributes approximately 14.96 MW to the thermal violation.

CONTINGENCY 'PS_P7-1_1LINE+2LINE' /* LAKE NELSON - RARITIAN X2
DISCONNECT BUS 218331 /* REMOVE KILMER 1
DISCONNECT BUS 218332 /* REMOVE KILMER 2
MOVE 8 MW LOAD FROM BUS 218384 TO BUS 218383 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO GREENBK T1
MOVE 8 MW LOAD FROM BUS 218387 TO BUS 218399 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO NEWDOVR T2
MOVE 8 MW LOAD FROM BUS 218385 TO BUS 218393 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO MDWRD T2
MOVE 8 MW LOAD FROM BUS 218386 TO BUS 218347 /* INTERSTATION TIE TRANSFER LOAD FROM KILMER TO BNNTLANE T2
END

Bus Number	*Bus Name*	*Full Contribution*
206358	*28PARLN1&2*	*4.56*
206359	*28PARLN3&4*	*4.56*
206412	*28R11*	*164.6*
206362	*28RDOAKCT1*	*12.66*
206363	*28RDOAKCT2*	*12.23*
206364	*28RDOAKCT3*	*12.23*
206365	*28RDOAKST1*	*17.74*
206327	*28S RIV G1*	*7.16*
206328	*28S RIV G2*	*7.16*
206329	*28S RIV G3*	*7.02*
206403	*28W4-009*	*49.76*
934841	*AD1-113*	*27.69*
937261	*AD2-165*	*14.96*
LTF	*AMIL*	*0.12*

LTF	*BAYOU*	*0.44*
LTF	*BIG_CAJUN1*	*0.68*
LTF	*BIG_CAJUN2*	*1.37*
LTF	*BLUEG*	*0.74*
LTF	*CALDERWOOD*	*0.23*
LTF	*CANNELTON*	*0.13*
LTF	*CARR*	*0.15*
LTF	*CATAWBA*	*0.15*
LTF	*CELEVELAND*	*0.43*
LTF	*CHEOAH*	*0.21*
LTF	*CHILHOWEE*	*0.08*
LTF	*CHOCTAW*	*0.45*
LTF	*CLIFTY*	*3.02*
LTF	*COTTONWOOD*	*1.75*
LTF	*DEARBORN*	*0.37*
LTF	*EDWARDS*	*0.22*
LTF	*ELMERSMITH*	*0.37*
LTF	*FARMERCITY*	*0.15*
LTF	*G-007A*	*88.52*
LTF	*GIBSON*	*0.25*
LTF	*HAMLET*	*0.49*
LTF	*MORGAN*	*0.74*
LTF	*NEWTON*	*0.56*
LTF	*O-066*	*2.5*
LTF	*PRAIRIE*	*1.08*
LTF	*RENSSELAER*	*0.12*

LTF	*ROSETON*	*0.86*
LTF	*ROWAN*	*0.29*
LTF	*SANTEETLA*	*0.06*
LTF	*SMITHLAND*	*0.09*
LTF	*TATANKA*	*0.26*
LTF	*TILTON*	*0.26*
LTF	*TRIMBLE*	*0.14*
LTF	*TVA*	*0.33*
LTF	*UNIONPOWER*	*0.33*
905502	*W4-060 E OP1*	*0.46*
912042	*X4-005 E*	*22.15*
917682	*Z2-109 E*	*7.48*
925541	*AC1-029*	*7.48*

Appendix 3

(JCPL - JCPL) The 28RED OAKA-AA1-098 TAP 230 kV line (from bus 206314 to bus 918790 ckt 1) loads from 100.18% to 102.74% (**DC power flow**) of its emergency rating (869 MVA) for the tower line contingency outage of 'JC-P7-1-JCC-230-4'. This project contributes approximately 22.29 MW to the thermal violation.

CONTINGENCY 'JC-P7-1-JCC-230-4' /* R11B-ATLANTIC (P1030) & PARLIN-FRENEAU (K1025)
DISCONNECT BRANCH FROM BUS 206411 TO BUS 206286 CKT 1 /* P1030 R11B-ATLANTIC
DISCONNECT BRANCH FROM BUS 206286 TO BUS 206272 CKT 1 /* P1030 ATLANTIC BANK1
DISCONNECT BRANCH FROM BUS 206322 TO BUS 206298 CKT 1 /* K1025 PARLIN-WILLIAMS
DISCONNECT BRANCH FROM BUS 206298 TO BUS 206292 CKT 1 /* K1025 WILLIAMS-FRENEAU
DISCONNECT BUS 206298 /* K1025 WILLIAMS
DISCONNECT BRANCH FROM BUS 206292 TO BUS 206267 CKT 1 /* K1025 FRENEAU 1
SET BUS 206292 LOAD TO 30 MW /* K1025 FRENEAU 3
DISCONNECT BRANCH FROM BUS 206292 TO BUS 206267 CKT 6 /* K1025 FRENEAU 6
END

Bus Number	*Bus Name*	*Full Contribution*
206358	*28PARLN1&2*	*4.82*
206359	*28PARLN3&4*	*4.82*
206412	*28R11*	*245.16*
206362	*28RDOAKCT1*	*11.83*
206363	*28RDOAKCT2*	*20.99*
206364	*28RDOAKCT3*	*20.99*
206365	*28RDOAKST1*	*16.58*
206327	*28S RIV G1*	*10.67*
206328	*28S RIV G2*	*10.67*
206329	*28S RIV G3*	*10.46*
937261	*AD2-165*	*22.29*

LTF	*AMIL*	*0.09*
LTF	*BAYOU*	*0.33*
LTF	*BIG_CAJUN1*	*0.51*
LTF	*BIG_CAJUN2*	*1.03*
LTF	*BLUEG*	*0.56*
LTF	*CALDERWOOD*	*0.17*
LTF	*CANNELTON*	*0.1*
LTF	*CARR*	*0.12*
LTF	*CATAWBA*	*0.11*
LTF	*CELEVELAND*	*0.32*
LTF	*CHEOAH*	*0.16*
LTF	*CHILHOWEE*	*0.06*
LTF	*CHOCTAW*	*0.34*
LTF	*CLIFTY*	*2.28*
LTF	*COTTONWOOD*	*1.32*
LTF	*DEARBORN*	*0.28*
LTF	*EDWARDS*	*0.17*
LTF	*ELMERSMITH*	*0.28*
LTF	*FARMERCITY*	*0.11*
LTF	*G-007*	*0.33*
LTF	*GIBSON*	*0.19*
LTF	*HAMLET*	*0.37*
LTF	*MORGAN*	*0.55*
LTF	*NEWTON*	*0.42*
LTF	*O-066*	*2.13*
LTF	*PRAIRIE*	*0.82*

LTF	*RENSSELAER*	*0.09*
LTF	*ROSETON*	*0.67*
LTF	*ROWAN*	*0.22*
LTF	*SANTEETLA*	*0.05*
LTF	*SMITHLAND*	*0.07*
LTF	*TATANKA*	*0.2*
LTF	*TILTON*	*0.2*
LTF	*TRIMBLE*	*0.11*
LTF	*TVA*	*0.25*
LTF	*UNIONPOWER*	*0.25*
917682	*Z2-109 E*	*11.14*
925541	*AC1-029*	*11.14*

Appendix 4

(JCPL - JCPL) The AA1-098 TAP-28RAR RVR 230 kV line (from bus 918790 to bus 206305 ckt 1) loads from 100.18% to 102.74% (**DC power flow**) of its emergency rating (869 MVA) for the tower line contingency outage of 'JC-P7-1-JCC-230-4'. This project contributes approximately 22.29 MW to the thermal violation.

CONTINGENCY 'JC-P7-1-JCC-230-4' /* R11B-ATLANTIC (P1030) & PARLIN-FRENEAU (K1025)
DISCONNECT BRANCH FROM BUS 206411 TO BUS 206286 CKT 1 /* P1030 R11B-ATLANTIC
DISCONNECT BRANCH FROM BUS 206286 TO BUS 206272 CKT 1 /* P1030 ATLANTIC BANK1
DISCONNECT BRANCH FROM BUS 206322 TO BUS 206298 CKT 1 /* K1025 PARLIN-WILLIAMS
DISCONNECT BRANCH FROM BUS 206298 TO BUS 206292 CKT 1 /* K1025 WILLIAMS-FRENEAU
DISCONNECT BUS 206298 /* K1025 WILLIAMS
DISCONNECT BRANCH FROM BUS 206292 TO BUS 206267 CKT 1 /* K1025 FRENEAU 1
SET BUS 206292 LOAD TO 30 MW /* K1025 FRENEAU 3
DISCONNECT BRANCH FROM BUS 206292 TO BUS 206267 CKT 6 /* K1025 FRENEAU 6
END

Bus Number	*Bus Name*	*Full Contribution*
206358	*28PARLN1&2*	*4.82*
206359	*28PARLN3&4*	*4.82*
206412	*28R11*	*245.16*
206362	*28RDOAKCT1*	*11.83*
206363	*28RDOAKCT2*	*20.99*
206364	*28RDOAKCT3*	*20.99*
206365	*28RDOAKST1*	*16.58*
206327	*28S RIV G1*	*10.67*
206328	*28S RIV G2*	*10.67*
206329	*28S RIV G3*	*10.46*
937261	*AD2-165*	*22.29*

LTF	*AMIL*	*0.09*
LTF	*BAYOU*	*0.33*
LTF	*BIG_CAJUN1*	*0.51*
LTF	*BIG_CAJUN2*	*1.03*
LTF	*BLUEG*	*0.56*
LTF	*CALDERWOOD*	*0.17*
LTF	*CANNELTON*	*0.1*
LTF	*CARR*	*0.12*
LTF	*CATAWBA*	*0.11*
LTF	*CELEVELAND*	*0.32*
LTF	*CHEOAH*	*0.16*
LTF	*CHILHOWEE*	*0.06*
LTF	*CHOCTAW*	*0.34*
LTF	*CLIFTY*	*2.28*
LTF	*COTTONWOOD*	*1.32*
LTF	*DEARBORN*	*0.28*
LTF	*EDWARDS*	*0.17*
LTF	*ELMERSMITH*	*0.28*
LTF	*FARMERCITY*	*0.11*
LTF	*G-007*	*0.33*
LTF	*GIBSON*	*0.19*
LTF	*HAMLET*	*0.37*
LTF	*MORGAN*	*0.55*
LTF	*NEWTON*	*0.42*
LTF	*O-066*	*2.13*
LTF	*PRAIRIE*	*0.82*

LTF	*RENSSELAER*	*0.09*
LTF	*ROSETON*	*0.67*
LTF	*ROWAN*	*0.22*
LTF	*SANTEETLA*	*0.05*
LTF	*SMITHLAND*	*0.07*
LTF	*TATANKA*	*0.2*
LTF	*TILTON*	*0.2*
LTF	*TRIMBLE*	*0.11*
LTF	*TVA*	*0.25*
LTF	*UNIONPOWER*	*0.25*
917682	*Z2-109 E*	*11.14*
925541	*AC1-029*	*11.14*