

***Generation Interconnection
Feasibility Study Report***

For

***PJM Generation Interconnection Request
Queue Position AD1-087***

***Clover – Sedge Hill 230kV
51.8 MW Capacity / 76 MW Energy***

Revised March / 2018

Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company (VEPCO).

Preface

The intent of the Feasibility Study is to determine a plan, with high level estimated cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the IC. The IC may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the IC 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 IC is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by ITO, the costs may be included in the study.

General

The IC has proposed a solar generating facility located in Halifax County, VA. The installed facilities will have a total capability of 76 MW with 51.8 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is 9/02/2019. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AD1-087 will interconnect with the ITO transmission system at one of the following points of interconnection:

Option 1 will connect via a new three breaker ring bus switching station that connects on the Clover – Sedge Hill 230kV line #2068.

Option 2 will connect via a new three breaker ring bus switching station that connects at the Barnes Junction – Mt Laurel 115kV line #33.

Cost Summary

The AD1-087 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$1,800,000
Direct Connection Network Upgrades	\$6,300,000
Non Direct Connection Network Upgrades	\$1,000,000
Total Costs	\$9,100,000

In addition, the AD1-087 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	\$8,890,000
Previously Identified Upgrades	\$0
Total Costs	\$8,890,000

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

Note: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. For New System Upgrades, the cost allocation rule differ depending on whether the minimum amount of upgrades to resolve a single reliability criteria violation will cost less than \$5,000,000. For upgrades estimated to cost less than \$5,000,000 the allocation of costs will not occur outside of the Queue in which the need for the Network Upgrade was identified. Cost allocation within the Queue will be contingent each Queue projects Distribution Factor on the overloaded facility. For upgrades estimated to cost \$5,000,000 or greater the allocation of costs will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.

The Feasibility Study is used to make a preliminary determination of the type and scope of Attachment Facilities, Local Upgrades, and Network Upgrades that will be necessary to accommodate the Interconnection Request and to provide the Interconnection Customer a preliminary estimate of the time that will be required to construct any necessary facilities and upgrades and the Interconnection Customer's cost responsibility. The System Impact Study provides refined and comprehensive estimates of cost responsibility and construction lead times for new facilities and system upgrades. Facilities Studies will include, commensurate with the degree of engineering specificity as provided in the Facilities Study Agreement, good faith estimates of the cost, determined in accordance with Section 217 of the Tariff,

- (a) to be charged to each affected New Service Customer for the Facilities and System Upgrades that are necessary to accommodate this queue project;
- (b) the time required to complete detailed design and construction of the facilities and upgrades;
- and

- (c) a description of any site-specific environmental issues or requirements that could reasonably be anticipated to affect the cost or time required to complete construction of such facilities and upgrades.

Attachment Facilities

Generation Substation: Install metering and associated protection equipment. Estimated Cost \$600,000.

Transmission: Construct approximately one span of 230 kV Attachment line between the generation substation and a new AD1-087 Switching Station. The estimated cost for this work is \$1,200,000.

The estimated total cost of the Attachment Facilities is \$1,800,000. It is estimated to take 18-24 months to complete this work. These preliminary cost estimates are based on typical engineering costs. A more detailed engineering cost estimates are normally done when the IC provides an exact site plan location for the generation substation during the Facility Study phase. These costs do not include CIAC Tax Gross-up. The single line is shown below in Attachment 1.

Direct Connection Cost Estimate

Substation: Establish the new 230 kV AD1-087 Switching Substation (interconnection substation). The estimated cost of this work scope is \$6,300,000. It is estimated to take 24-36 months to complete this work

Non-Direct Connection Cost Estimate

Transmission: Install transmission structure in-line with transmission line to allow the proposed interconnection switching station to be interconnected with the transmission system. Estimated cost is \$1,000,000 and is estimated to take 24-30 months to complete.

Remote Terminal Work: During the Facilities Study, ITO's System Protection Engineering Department will review transmission line protection as well as anti-islanding required to accommodate the new generation and interconnection substation. System Protection Engineering will determine the minimal acceptable protection requirements to reliably interconnect the proposed generating facility with the transmission system. The review is based on maintaining system reliability by reviewing ITO's protection requirements with the known transmission system configuration which includes generating facilities in the area. This review may determine that transmission line protection and communication upgrades are required at remote substations.

System Reinforcement

AEP: Increase East Danville – Danville 138 kV line ratings S/N: 439 MVA S/E :510 MVA

- 1) Danville Sw. CB M - Danville CB M needs to be replaced, Estimated cost: \$1 million.
- 2) Danville Risers - Replace Danville risers, Estimated cost: \$100,000.
- 3) 2.81 miles of conductor will need to reconductor / rebuild, expected cost of \$4.2 million.
- 4) E Danville 1 - An Engineering study need to be conducted to determine if the relay thermal limit settings can be adjusted to mitigate the overload, Estimated cost: \$25,000.
New relay packages will be required if the settings cannot be adjusted, Estimated cost: \$600,000.

- 5) Danville 2 - An Engineering study need to be conducted to determine if the relay thermal limit settings can be adjusted to mitigate the overload, Estimated Cost: \$25,000. New relay packages will be required if the settings cannot be adjusted, Estimated cost: \$600,000.
- 6) E Danville (RCTL) - An Engineering study need to be conducted to determine if the relay compliance trip limits settings can be adjusted to mitigate the overload, Estimated Cost: \$25,000. New relay packages will be required if the settings cannot be adjusted, Estimated cost: \$600,000.
- 7) Danville 2 (RCTL) - An Engineering study need to be conducted to determine if the relay compliance trip limits settings can be adjusted to mitigate the overload, Estimated Cost: \$25,000. New relay packages will be required if the settings cannot be adjusted, Estimated cost: \$600,000.
- 8) Conductor Section 3 - 0.03 miles of conductor will need to recounductor / rebuild, Estimated cost: \$0.045 million.
- 9) Conductor Section 1 - 0.03 miles of conductor will need to recounductor / rebuild, Estimated cost: \$0.045 million.
- 10) E. Danville CB L - East Danville Circuit Breaker L needs to be replaced, estimated cost: \$1 million.

An Approximate construction time would be 24 to 36 months and the estimated cost is \$8,890,000.

Interconnection Customer Requirements

ITO's Facility Connection Requirements as posted on PJM's website

<http://www.pjm.com/~media/planning/plan-standards/private-dominion/facility-connection-requirements1.ashx>

Voltage Ride Through Requirements - The Customer Facility shall be designed to remain in service (not trip) for voltages and times as specified for the Eastern Interconnection in Attachment 1 of NERC Reliability Standard PRC-024-1, and successor Reliability Standards, for both high and low voltage conditions, irrespective of generator size, subject to the permissive trip exceptions established in PRC-024-1 (and successor Reliability Standards).

Frequency Ride Through Requirements - The Customer Facility shall be designed to remain in service (not trip) for frequencies and times as specified in Attachment 2 of NERC Reliability Standard PRC-024-1, and successor Reliability Standards, for both high and low frequency condition, irrespective of generator size, subject to the permissive trip exceptions established in PRC-024-1 (and successor Reliability Standards).

Reactive Power - The Generation Interconnection Customer shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading to 0.95 lagging measured at the generator's terminals.

Revenue Metering and SCADA Requirements

PJM Requirements

The IC 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.

Meteorological Data Reporting Requirement

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Temperature (degrees Fahrenheit)
- Atmospheric pressure (hectopascals)
- Irradiance
- Forced outage data

Option One

Network Impacts

The Queue Project AD1-087 was evaluated as a 76.0 MW (Capacity 51.8 MW) injection tapping the Clover to Halifax 230kV line in the ITO area. Project AD1-087 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-087 was studied with a commercial probability of 53%. Potential network impacts were as follows:

PJM assessed the impact of the proposed Queue Project as an injection into the ITO, for compliance with NERC Reliability Criteria. The system was assessed using the summer 2021 RTEP case. When performing analysis, ITO Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under single contingency (normal and stressed system conditions). A full listing of the ITO's Planning Criteria and interconnection requirements can be found in the ITO's Facility Connection Requirements which are publicly available at: <http://www.dom.com>.

The results of these studies evaluate the system under a limited set of operating conditions and do not guarantee the full delivery of the capacity and associated energy of this proposed generation facility under all operating conditions. NERC Planning and Operating Reliability Criteria allow for the re-dispatch of generating units to resolve projected and actual deficiencies in real time and planning studies. Specifically NERC Category C Contingency Conditions (Bus Fault, Tower Line, N-1-1, and Stuck Breaker scenarios) allow for re-dispatch of generating units to resolve potential reliability deficiencies. For ITO Planning Criteria the re-dispatch of generating units for these contingency conditions is allowed as long as the projected loading does not exceed 100% of a facility Load Dump Rating. The results of these studies are discussed in more detail below.

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
AEP_P1-2_#1377	CONTINGENCY 'AEP_P1-2_#1377' OPEN BRANCH FROM BUS 242514 TO BUS 242520 CKT 1 / 242514 05J.FERR 765 242520 05J.FERR 500 1 OPEN BRANCH FROM BUS 242520 TO BUS 306719 CKT 1 / 242520 05J.FERR 500 306719 8ANTIOCH 500 1 END
AEP_P4_#7589_05J.FERR 765	CONTINGENCY 'AEP_P4_#7589_05J.FERR 765' OPEN BRANCH FROM BUS 242514 TO BUS 242520 CKT 1 / 242514 05J.FERR 765 242520 05J.FERR 500 1 OPEN BRANCH FROM BUS 242514 TO BUS 242684 CKT 2 / 242514 05J.FERR 765 242684 05J.FERR 138 2 OPEN BRANCH FROM BUS 242520 TO BUS 306719 CKT 1 / 242520 05J.FERR 500 306719 8ANTIOCH 500 1 END

Contingency Name	Description
DVP_P1-2: LN 2027-A	CONTINGENCY 'DVP_P1-2: LN 2027-A' OPEN BRANCH FROM BUS 314310 TO BUS 314322 CKT 1 /* 6JUDES F 230.00 - 6MDLTHAN 230.00 OPEN BRANCH FROM BUS 314310 TO BUS 314333 CKT 1 /* 6JUDES F 230.00 - 6POWHATN 230.00 OPEN BRANCH FROM BUS 314333 TO BUS 933500 CKT 1 /* 6POWHATN 230.00 - AC2-165 TAP 230.00 OPEN BUS 314310 /* ISLAND OPEN BUS 314333 /* ISLAND END
DVP_P1-2: LN 550	CONTINGENCY 'DVP_P1-2: LN 550' OPEN BRANCH FROM BUS 314926 TO BUS 314917 CKT 1 /* 8VALLEY 500.00 - 8MT STM 500.00 END
DVP_P1-2: LN 556	CONTINGENCY 'DVP_P1-2: LN 556' OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 1 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 2 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 3 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314906 TO BUS 314936 CKT 1 /* 8CLOVER 500.00 - 8RAWLINGS 500.00 OPEN BUS 314906 /* ISLAND END
DVP_P4-2: 511T556	CONTINGENCY 'DVP_P4-2: 511T556' /*RAWLINGS OPEN BRANCH FROM BUS 314936 TO BUS 314906 CKT 1 /*RAWLINGS TO CLOVER (LINE 556) OPEN BRANCH FROM BUS 314906 TO BUS 314686 CKT 1 /*CLOVER 500-230 (TX#9) OPEN BRANCH FROM BUS 314906 TO BUS 314686 CKT 2 /*CLOVER 500-230 (TX#8) OPEN BRANCH FROM BUS 314906 TO BUS 314686 CKT 3 /*CLOVER 500-230 (TX#7) OPEN BRANCH FROM BUS 314936 TO BUS 314902 CKT 1 /*RAWLINGS TO CARSON (LINE 511) END
DVP_P4-2: 511T591	CONTINGENCY 'DVP_P4-2: 511T591' /*RAWLINGS OPEN BRANCH FROM BUS 314936 TO BUS 314902 CKT 1 /*RAWLINGS TO CARSON (LINE 511) OPEN BRANCH FROM BUS 314936 TO BUS 314935 CKT 1 /*RAWLINGS TO BRUNSWICK (LINE 591) END

Contingency Name	Description
DVP_P4-2: 556T591	CONTINGENCY 'DVP_P4-2: 556T591' /*RAWLINGS OPEN BRANCH FROM BUS 314936 TO BUS 314906 CKT 1 /*RAWLINGS TO CLOVER (LINE 556) OPEN BRANCH FROM BUS 314906 TO BUS 314686 CKT 1 /*CLOVER 500-230 (TX#9) OPEN BRANCH FROM BUS 314906 TO BUS 314686 CKT 2 /*CLOVER 500-230 (TX#8) OPEN BRANCH FROM BUS 314906 TO BUS 314686 CKT 3 /*CLOVER 500-230 (TX#7) OPEN BRANCH FROM BUS 314936 TO BUS 314935 CKT 1 /*RAWLINGS TO BRUNSWICK (LINE 591) END

Summer Peak Analysis - 2021

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	Cir.		Initial	Final	Type	MVA		
1	N-1	DVP_P1-2: LN 556	DVP - DVP	6PRINCE EDW-6FARMVIL 230 kV line	313802	314692	1	DC	94.16	96.48	ER	572	13.2	1
2	N-1	DVP_P1-2: LN 556	DVP - DVP	6BRIERY-6PRINCE EDW 230 kV line	314268	313802	1	DC	95.18	97.49	ER	572	13.2	2

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	
	Type	Name			From	To	Circuit		Initial	Final	Type	MVA		
3	LFFB	DVP_P4-2: 511T556	DVP - DVP	6PRINCE EDW-6FARMVIL 230 kV line	313802	314692	1	DC	86.77	89.55	LD	699	19.42	
4	LFFB	DVP_P4-2: 556T591	DVP - DVP	6PRINCE EDW-6FARMVIL 230 kV line	313802	314692	1	DC	86.77	89.55	LD	699	19.42	
5	LFFB	DVP_P4-2: 511T591	DVP - DVP	6PRINCE EDW-6FARMVIL 230 kV line	313802	314692	1	DC	86.59	89.38	LD	699	19.42	
6	LFFB	DVP_P4-2: 556T591	DVP - DVP	6BRIERY-6PRINCE EDW 230 kV line	314268	313802	1	DC	87.61	90.39	LD	699	19.42	
7	LFFB	DVP_P4-2: 511T556	DVP - DVP	6BRIERY-6PRINCE EDW 230 kV line	314268	313802	1	DC	87.6	90.38	LD	699	19.42	

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
8	LFFB	DVP_P4-2: 511T591	DVP - DVP	6BRIERY-6PRINCE EDW 230 kV line	314268	313802	1	DC	87.44	90.22	LD	699	19.42

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

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

None

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		Cir.	Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To			Initial	Final	Type	MVA		
9	LFFB	AEP_P4_#7 589_05J.FE RR 765	AEP - AEP	05EDAN 1-05DANVL2 138 kV line	242631	242620	1	DC	114.09	114.67	ER	415	5.32	3

Steady-State Voltage Requirements

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

To be determined during Impact Study

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 during Impact Study

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, 3 - 5	6PRINCE EDW-6FARMVIL 230 kV line	Wreck and rebuild the Farmville – Briery 230kV line of 13 miles to increase its line rating to 722 MVA (normal), 722 MVA (emergency), and 830 MVA (load dump). It is estimated to take 30-36 months to engineer, permit, and construct. A VA CPCN is required.	Pending	\$32,275,000
# 2, 6 - 8	6BRIERY-6PRINCE EDW 230 kV line			
Total New Network Upgrades				\$32,275,000

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
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Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
# 9	05EDAN 1-05DANVL2 138 kV line	<p>AEP: Current ratings S/N : 275 MVA S/E : 361 MVA, New rating: S/N : 439 MVA S/E :510 MVA</p> <p>(1) Danville Sw. CB M - Danville CB M needs to be replaced, Estimated cost: \$1 million.</p> <p>(2) Danville Risers - Replace Danville risers, Estimated cost: \$100,000.</p> <p>(3) 2.81 miles of conductor will need to reconductor / rebuild, expected cost of \$4.2 million.</p> <p>(4) E Danville 1 - An Engineering study need to be conducted to determine if the relay thermal limit settings can be adjusted to mitigate the overload, Estimated cost: \$25,000. New relay packages will be required if the settings cannot be adjusted, Estimated cost: \$600,000.</p> <p>(5) Danville2 - An Engineering study need to be conducted to determine if the relay thermal limit settings can be adjusted to mitigate the overload, Estimated Cost: \$25,000. New relay packages will be required if the settings cannot be adjusted, Estimated cost: \$600,000.</p> <p>(6) E Danville (RCTL) - An Engineering study need to be conducted to determine if the relay compliance trip limits settings can be adjusted to mitigate the overload, Estimated Cost: \$25,000. New relay packages will be required if the settings cannot be adjusted, Estimated cost: \$600,000.</p> <p>(7) Danville2 (RCTL) - An Engineering study need to be conducted to determine if the relay compliance trip limits settings can be adjusted to mitigate the overload, Estimated Cost: \$25,000. New relay packages will be required if the settings cannot be adjusted, Estimated cost: \$600,000.</p> <p>(8) Conductor Section 3 - 0.03 miles of conductor will need to reconductor / rebuild, Estimated cost: \$0.045 million.</p> <p>(9) Conductor Section 1 - 0.03 miles of conductor will need to reconductor / rebuild, Estimated cost: \$0.045 million.</p> <p>(10) E. Danville CB L - East Danville Circuit Breaker L needs to be replaced, estimated cost: \$1 million.</p> <p>An Approximate construction time would be 24 to 36months after signing an interconnection agreement.</p>		\$8,890,000
Total New Network Upgrades				\$8,890,000

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 IC 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
	Type	Name			From	To			Initial	Final	Type	MVA	
10	N-1	DVP_P1-2: LN 556	DVP - DVP	6PRINCE EDW-6FARMVIL 230 kV line	313802	314692	1	DC	103.9	107.3	ER	572	19.37
11	N-1	DVP_P1-2: LN 2027-A	DVP - DVP	6BREMIST-6MTEAGLE 230 kV line	313867	314765	1	DC	101.62	102.03	ER	662	6.66
12	N-1	DVP_P1-2: LN 556	DVP - DVP	6BRIERY-6PRINCE EDW 230 kV line	314268	313802	1	DC	104.91	108.31	ER	572	19.37
13	N-1	DVP_P1-2: LN 556	DVP - DVP	6HALIFAX-AC1-221 TAP 230 kV line	314697	927250	1	DC	92.54	98.81	ER	675	42.29
14	N-1	DVP_P1-2: LN 2027-A	DVP - DVP	6BREMO-6BREMIST 230 kV line	314747	313867	1	DC	103.73	104.14	ER	662	6.66
15	N-1	DVP_P1-2: LN 550	DVP - DVP	8NO ANNA-8SPOTSYL 500 kV line	314918	314934	1	DC	99.96	100.05	ER	3219	11.07
16	N-1	DVP_P1-2: LN 556	DVP - CPLE	AC1-221 TAP-6PERSON230 T 230 kV line	927250	304070	1	DC	100.44	105.89	ER	718	42.29
17	N-1	DVP_P1-2: LN 556	DVP - DVP	AD1-087 TAP-6HALIFAX 230 kV line	934610	314697	1	DC	91.46	98.93	ER	749	56.28
18	N-1	AEP_P1-2_#1377	AEP - AEP	05EDAN 1-05DANVL2 138 kV line	242631	242620	1	DC	114.07	114.65	ER	415	5.32

Light Load Analysis

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

Affected System Analysis & Mitigation

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

Option Two

Network Impacts

The Queue Project AD1-087 was evaluated as a 76.0 MW (Capacity 51.8 MW) injection tapping Barnes Junction to Mount Laurel 115kV line in the ITO area. Project AD1-087 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-087 was studied with a commercial probability of 53%. Potential network impacts were as follows:

PJM assessed the impact of the proposed Queue Project as an injection into the ITO, for compliance with NERC Reliability Criteria. The system was assessed using the summer 2021 RTEP case. When performing analysis, ITO Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under single contingency (normal and stressed system conditions). A full listing of the ITO's Planning Criteria and interconnection requirements can be found in the ITO's Facility Connection Requirements which are publicly available at: <http://www.dom.com>.

The results of these studies evaluate the system under a limited set of operating conditions and do not guarantee the full delivery of the capacity and associated energy of this proposed generation facility under all operating conditions. NERC Planning and Operating Reliability Criteria allow for the re-dispatch of generating units to resolve projected and actual deficiencies in real time and planning studies. Specifically NERC Category C Contingency Conditions (Bus Fault, Tower Line, N-1-1, and Stuck Breaker scenarios) allow for re-dispatch of generating units to resolve potential reliability deficiencies. For ITO Planning Criteria the re-dispatch of generating units for these contingency conditions is allowed as long as the projected loading does not exceed 100% of a facility Load Dump Rating. The results of these studies are discussed in more detail below.

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
AEP_P1-2_#1377	CONTINGENCY 'AEP_P1-2_#1377' OPEN BRANCH FROM BUS 242514 TO BUS 242520 CKT 1 / 242514 05J.FERR 765 242520 05J.FERR 500 1 OPEN BRANCH FROM BUS 242520 TO BUS 306719 CKT 1 / 242520 05J.FERR 500 306719 8ANTIOCH 500 1 END
AEP_P4_#7589_05J.FERR 765	CONTINGENCY 'AEP_P4_#7589_05J.FERR 765' OPEN BRANCH FROM BUS 242514 TO BUS 242520 CKT 1 / 242514 05J.FERR 765 242520 05J.FERR 500 1 OPEN BRANCH FROM BUS 242514 TO BUS 242684 CKT 2 / 242514 05J.FERR 765 242684 05J.FERR 138 2 OPEN BRANCH FROM BUS 242520 TO BUS 306719 CKT 1 / 242520 05J.FERR 500 306719 8ANTIOCH 500 1 END

Contingency Name	Description
DVP_P1-2: LN 130-A	CONTINGENCY 'DVP_P1-2: LN 130-A' OPEN BRANCH FROM BUS 314562 TO BUS 314570 CKT 1 /* 3CLUBHSE 115.00 - 3METCATP 115.00 OPEN BRANCH FROM BUS 314570 TO BUS 314572 CKT 1 /* 3METCATP 115.00 - 3EMPORIA 115.00 OPEN BRANCH FROM BUS 314570 TO BUS 314588 CKT 1 /* 3METCATP 115.00 - 3METCALF 115.00 OPEN BRANCH FROM BUS 314572 TO BUS 925170 CKT 1 /* 3EMPORIA 115.00 - AB2-174 TAP 115.00 OPEN BRANCH FROM BUS 314572 TO BUS 314863 CKT 1 /* 3EMPORIA 115.00 - 3EMPOR_1 115.00 OPEN BUS 314570 /* ISLAND OPEN BUS 314572 /* ISLAND OPEN BUS 314588 /* ISLAND END
DVP_P1-2: LN 2027-A	CONTINGENCY 'DVP_P1-2: LN 2027-A' OPEN BRANCH FROM BUS 314310 TO BUS 314322 CKT 1 /* 6JUDES F 230.00 - 6MDLTHAN 230.00 OPEN BRANCH FROM BUS 314310 TO BUS 314333 CKT 1 /* 6JUDES F 230.00 - 6POWHATN 230.00 OPEN BRANCH FROM BUS 314333 TO BUS 933500 CKT 1 /* 6POWHATN 230.00 - AC2-165 TAP 230.00 OPEN BUS 314310 /* ISLAND OPEN BUS 314333 /* ISLAND END
DVP_P1-2: LN 33-C	CONTINGENCY 'DVP_P1-2: LN 33-C' OPEN BRANCH FROM BUS 926270 TO BUS 314696 CKT 1 /* AC1-105 TAP 115.00 - 3HALIFAX 115.00 END
DVP_P1-2: LN 556	CONTINGENCY 'DVP_P1-2: LN 556' OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 1 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 2 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 3 /* 6CLOVER 230.00 - 8CLOVER 500.00 OPEN BRANCH FROM BUS 314906 TO BUS 314936 CKT 1 /* 8CLOVER 500.00 - 8RAWLINGS 500.00 OPEN BUS 314906 /* ISLAND END
DVP_P1-3: 3ALTVSTA-4ALTVSTA	CONTINGENCY 'DVP_P1-3: 3ALTVSTA-4ALTVSTA' OPEN BRANCH FROM BUS 314666 TO BUS 314667 CKT 1 END
DVP_P1-3: 3ALTVSTA-4ALTVSTAA	CONTINGENCY 'DVP_P1-3: 3ALTVSTA-4ALTVSTAA' OPEN BRANCH FROM BUS 314666 TO BUS 314667 CKT 2 END
DVP_P1-3: 3CAROLNA-6CAROLNA	CONTINGENCY 'DVP_P1-3: 3CAROLNA-6CAROLNA' OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 END
DVP_P1-3: 3HALIFAX-6HALIFAXA	CONTINGENCY 'DVP_P1-3: 3HALIFAX-6HALIFAXA' OPEN BRANCH FROM BUS 314696 TO BUS 314697 CKT 2 END

Contingency Name	Description
DVP_P4-2: 101002	CONTINGENCY 'DVP_P4-2: 101002' /* CAROLINA 115 KV OPEN BRANCH FROM BUS 313723 TO BUS 314259 CKT 1 /* 3PECAN 115.00 - 3CAROL56_1 115.00 OPEN BRANCH FROM BUS 314259 TO BUS 314559 CKT Z1 /* 3CAROL56_1 115.00 - 3CAROLNA 115.00 OPEN BRANCH FROM BUS 314259 TO BUS 314835 CKT 1 /* 3CAROL56_1 115.00 - 3CAROL_1 115.00 OPEN BUS 314259 /* ISLAND: 3CAROL56_1 115.00 OPEN BUS 314835 /* ISLAND: 3CAROL_1 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314571 CKT 1 /* 3CAROLNA 115.00 - 3EATON F 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 919690 CKT 1 /* 3CAROLNA 115.00 - AA2-053 TAP 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314600 CKT 1 /* 3CAROLNA 115.00 - 3PLHITP 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 /* 3CAROLNA 115.00 - 6CAROLNA 230.00 END
DVP_P4-2: 2202	CONTINGENCY 'DVP_P4-2: 2202' /* CAROLINA OPEN BRANCH FROM BUS 314559 TO BUS 314571 CKT 1 /* LINE 22 OPEN BRANCH FROM BUS 314571 TO BUS 925780 CKT 1 /* LINE 22 OPEN BRANCH FROM BUS 314559 TO BUS 314259 CKT Z1 /* LINE 56 OPEN BRANCH FROM BUS 314559 TO BUS 919690 CKT 1 /* LINE 54 OPEN BRANCH FROM BUS 314559 TO BUS 314600 CKT 1 /* LINE 130 OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 /* TX. #4 DECREASE BUS 314559 LOAD BY 100 PERCENT /* REMOVE ALL LOAD AT CAROLINA END
DVP_P4-2: 5402	CONTINGENCY 'DVP_P4-2: 5402' /* CAROLINA OPEN BRANCH FROM BUS 314559 TO BUS 919690 CKT 1 /* LINE 54 OPEN BRANCH FROM BUS 314559 TO BUS 314571 CKT 1 /* LINE 22 OPEN BRANCH FROM BUS 314559 TO BUS 314259 CKT Z1 /* LINE 56 OPEN BRANCH FROM BUS 314559 TO BUS 314600 CKT 1 /* LINE 130 OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 /* TX. #4 DECREASE BUS 314559 LOAD BY 100 PERCENT /* REMOVE ALL LOAD AT CAROLINA END

Contingency Name	Description
DVP_P4-2: 5602	CONTINGENCY 'DVP_P4-2: 5602' /* CAROLINA 115 KV OPEN BRANCH FROM BUS 313723 TO BUS 314604 CKT 1 /* 3PECAN 115.00 - 3SEABORD 115.00 OPEN BRANCH FROM BUS 314558 TO BUS 314587 CKT 1 /* 3BOYKINS 115.00 - 3MARGTSV 115.00 OPEN BRANCH FROM BUS 314587 TO BUS 314604 CKT 1 /* 3MARGTSV 115.00 - 3SEABORD 115.00 OPEN BUS 314587 /* ISLAND: 3MARGTSV 115.00 OPEN BUS 314604 /* ISLAND: 3SEABORD 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314571 CKT 1 /* 3CAROLNA 115.00 - 3EATON F 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 919690 CKT 1 /* 3CAROLNA 115.00 - AA2-053 TAP 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314600 CKT 1 /* 3CAROLNA 115.00 - 3PLHITP 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 /* 3CAROLNA 115.00 - 6CAROLNA 230.00 END
DVP_P4-5: T122C	CONTINGENCY 'DVP_P4-5: T122C' /* CAROLINA OPEN BUS 314559 /* CAROLINA 115KV BUS OPEN BUS 315126 /* ROANOKE RAPIDS GEN 1 AND 2 OPEN BUS 315128 /* ROANOKE RAPIDS GEN 3 AND 4 OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 /* TX. #4 END
DVP_P7-1: LN 22-90_B	CONTINGENCY 'DVP_P7-1: LN 22-90_B' OPEN BRANCH FROM BUS 314559 TO BUS 314571 CKT 1 /* 3CAROLNA 115.00 - 3EATON F 115.00 OPEN BRANCH FROM BUS 314571 TO BUS 925780 CKT 1 /* 3EATON F 115.00 - AC1-054 TAP 115.00 OPEN BUS 314571 /* ISLAND OPEN BRANCH FROM BUS 314265 TO BUS 314584 CKT 1 /* 3FIVEFORKSDP115.00 - 3LITTLTN 115.00 OPEN BRANCH FROM BUS 314265 TO BUS 314673 CKT 1 /* 3FIVEFORKSDP115.00 - 3BCHWD90 115.00 OPEN BRANCH FROM BUS 314559 TO BUS 314585 CKT 1 /* 3CAROLNA 115.00 - 3L GASTN 115.00 OPEN BRANCH FROM BUS 314584 TO BUS 314585 CKT 1 /* 3LITTLTN 115.00 - 3L GASTN 115.00 OPEN BRANCH FROM BUS 314672 TO BUS 314673 CKT 1 /* 3BEECHWD 115.00 - 3BCHWD90 115.00 OPEN BRANCH FROM BUS 314673 TO BUS 314702 CKT 1 /* 3BCHWD90 115.00 - 3KERR 115.00 OPEN BUS 314265 /* ISLAND OPEN BUS 314584 /* ISLAND OPEN BUS 314585 /* ISLAND OPEN BUS 314672 /* ISLAND OPEN BUS 314673 /* ISLAND END

Summer Peak Analysis - 2021

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	Cir.		Initial	Final	Type	MVA		
1	N-1	DVP_P1-2: LN 130-A	DVP - DVP	6CAROLNA 230/115 kV transformer	314559	314561	1	DC	99.53	100.7	ER	240	2.81	4
2	N-1	DVP_P1-3: 3ALTVSTA - 4ALTVSTA	DVP - DVP	4ALTVSTA 138/115 kV transformer	314666	314667	2	DC	91.04	94.23	ER	130	4.17	5

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
	Type	Name			From	To	Circuit		Initial	Final	Type	MVA	
3	DCTL	DVP_P7-1: LN 22-90_B	DVP - CPLE	3KERR-3GW KING TAP 115 kV line	314702	304102	1	DC	97.99	100.29	ER	199	10.14
4	LFFB	DVP_P4-2: 2202	DVP - CPLE	3KERR-3GW KING TAP 115 kV line	314702	304102	1	DC	98.34	100.37	ER	199	8.95

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

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

None

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			Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To	Cir.		Initial	Final	Type	MVA		
5	LFFB	DVP_P4-5: T122C	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	131.93	133.81	LD	209	8.69	6
6	LFFB	DVP_P4-2: 2202	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	126.23	129.91	LD	209	8.19	
7	LFFB	DVP_P4-2: 5602	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	125.68	129.36	LD	209	8.19	
8	LFFB	DVP_P4-2: 5402	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	125.42	129.1	LD	209	8.19	
9	LFFB	DVP_P4-2: 101002	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	124.65	128.33	LD	209	8.19	
10	LFFB	DVP_P4-5: T122C	DVP - CPLE	3KERR-3GW KING TAP 115 kV line	314702	304102	1	DC	105.96	108.29	ER	199	10.26	7
11	LFFB	AEP_P4_#7 589_05J.FE RR 765	AEP - AEP	05EDAN 1-05DANVL2 138 kV line	242631	242620	1	DC	114.33	114.89	ER	415	5.13	8

Steady-State Voltage Requirements

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

To be determined during Impact Study

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 during Impact Study

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 IC 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			Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To	Circuit		Initial	Final	Type	MVA	
12	N-1	DVP_P1-2: LN 33-C	DVP - DVP	3PLYWOOD-3HALIFAX 115 kV line	313825	314696	1	DC	67.39	76.35	ER	141	12.63
13	N-1	DVP_P1-2: LN 2027-A	DVP - DVP	6BREMIST-6MTEAGLE 230 kV line	313867	314765	1	DC	101.64	102.15	ER	662	8.37
14	N-1	DVP_P1-3: 3CAROLN A-6CAROLN A	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	128.82	130.54	ER	183	8
15	Non	Non	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	97.05	98.78	NR	177	6.77

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
16	N-1	DVP_P1-3: 3ALTVSTA - 4ALTVSTA A	DVP - DVP	4ALTVSTA 138/115 kV transformer	314666	314667	1	DC	100.73	102.79	ER	127	5.76
17	N-1	DVP_P1-3: 3ALTVSTA - 4ALTVSTA	DVP - DVP	4ALTVSTA 138/115 kV transformer	314666	314667	2	DC	105.01	107.12	ER	130	6.11
18	N-1	DVP_P1-3: 3HALIFAX - 6HALIFAX A	DVP - DVP	6HALIFAX 230/115 kV transformer	314696	314697	1	DC	56.24	69.24	ER	219	28.44
19	N-1	DVP_P1-2: LN 556	DVP - DVP	6HALIFAX-AC1-221 TAP 230 kV line	314697	927250	1	DC	92.53	96.33	ER	675	25.56
20	N-1	DVP_P1-2: LN 2027-A	DVP - DVP	6BREMO-6BREMOTIST 230 kV line	314747	313867	1	DC	103.74	104.25	ER	662	8.37
21	N-1	DVP_P1-2: LN 2027-A	DVP - DVP	6MTEAGLE-6CHARLVL 230 kV line	314765	314749	1	DC	98.73	99.31	ER	662	8.37
22	N-1	DVP_P1-2: LN 556	DVP - CPLE	AC1-221 TAP-6PERSON230 T 230 kV line	927250	304070	1	DC	100.23	103.41	ER	718	25.56
23	N-1	AEP_P1- 2_#1377	AEP - AEP	05EDAN 1-05DANVL2 138 kV line	242631	242620	1	DC	114.3	114.86	ER	415	5.13
24	Non	Non	AEP - AEP	05EDAN 1-05DANVL2 138 kV line	242631	242620	1	DC	94.07	94.78	NR	275	4.31

Light Load Analysis

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

Affected System Analysis & Mitigation

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

Attachment 1.

Flowgate Appendices

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 gauge other generators impact. When a flowgate is identified in multiple analysis the appendix is presented for only the analysis with the greatest overload.

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

(DVP - DVP) The 6PRINCE EDW-6FARMVIL 230 kV line (from bus 313802 to bus 314692 ckt 1) loads from 94.16% to 96.48% (**DC power flow**) of its emergency rating (572 MVA) for the single line contingency outage of 'DVP_P1-2: LN 556'. This project contributes approximately 13.2 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 556'

OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 1 /* 6CLOVER
230.00 - 8CLOVER 500.00
OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 2 /* 6CLOVER
230.00 - 8CLOVER 500.00
OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 3 /* 6CLOVER
230.00 - 8CLOVER 500.00
OPEN BRANCH FROM BUS 314906 TO BUS 314936 CKT 1 /* 8CLOVER
500.00 - 8RAWLINGS 500.00
OPEN BUS 314906 /* ISLAND
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315153	1CLOVER1	27.5
315154	1CLOVER2	27.14
315266	1PLYWOOD A	1.11
932761	AC2-100 C	3.38
932821	AC2-107 C	6.66
934311	AD1-055 C	2.12
934341	AD1-058 C	3.68
934611	AD1-087 C O1	13.2
934621	AD1-088 C O1	41.81
LTF	AD1-120	3.52
LTF	AD1-121	3.56
934911	AD1-123 C	0.95
934991	AD1-131 C	1.21
935171	AD1-152 C O1	12.24
LTF	CARR	0.12
LTF	CBM-S1	3.96
LTF	CBM-S2	8.23
LTF	CBM-W1	8.21
LTF	CBM-W2	21.12
LTF	CIN	1.86

<i>LTF</i>	<i>CPLE</i>	<i>2.63</i>
<i>LTF</i>	<i>IPL</i>	<i>1.19</i>
<i>LTF</i>	<i>LGEE</i>	<i>0.4</i>
<i>LTF</i>	<i>MEC</i>	<i>4.27</i>
<i>LTF</i>	<i>MECS</i>	<i>1.75</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>0.09</i>
<i>LTF</i>	<i>ROSETON</i>	<i>0.67</i>
<i>LTF</i>	<i>WEC</i>	<i>0.51</i>
<i>LTF</i>	<i>AA2-074</i>	<i>1.79</i>
<i>925991</i>	<i>ACI-075 C</i>	<i>3.75</i>
<i>926021</i>	<i>ACI-080 C</i>	<i>1.25</i>
<i>926271</i>	<i>ACI-105 C</i>	<i>3.89</i>
<i>926761</i>	<i>ACI-162 C</i>	<i>106.14</i>
<i>927251</i>	<i>ACI-221 C</i>	<i>1.47</i>
<i>927261</i>	<i>ACI-222 C</i>	<i>3.05</i>

Appendix 2

(DVP - DVP) The 6BRIERY-6PRINCE EDW 230 kV line (from bus 314268 to bus 313802 ckt 1) loads from 95.18% to 97.49% (**DC power flow**) of its emergency rating (572 MVA) for the single line contingency outage of 'DVP_P1-2: LN 556'. This project contributes approximately 13.2 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 556'

OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 1 /* 6CLOVER
230.00 - 8CLOVER 500.00
OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 2 /* 6CLOVER
230.00 - 8CLOVER 500.00
OPEN BRANCH FROM BUS 314686 TO BUS 314906 CKT 3 /* 6CLOVER
230.00 - 8CLOVER 500.00
OPEN BRANCH FROM BUS 314906 TO BUS 314936 CKT 1 /* 8CLOVER
500.00 - 8RAWLINGS 500.00
OPEN BUS 314906 /* ISLAND
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315153	1CLOVER1	27.5
315154	1CLOVER2	27.14
315266	1PLYWOOD A	1.11
932761	AC2-100 C	3.38
932821	AC2-107 C	6.66
934311	AD1-055 C	2.12
934341	AD1-058 C	3.68
934611	AD1-087 C O1	13.2
934621	AD1-088 C O1	41.81
LTF	AD1-120	3.52
LTF	AD1-121	3.56
934911	AD1-123 C	0.95
934991	AD1-131 C	1.21
935171	AD1-152 C O1	12.24
LTF	CARR	0.12
LTF	CBM-S1	3.96
LTF	CBM-S2	8.23
LTF	CBM-W1	8.21
LTF	CBM-W2	21.12
LTF	CIN	1.86

<i>LTF</i>	<i>CPLE</i>	<i>2.63</i>
<i>LTF</i>	<i>IPL</i>	<i>1.19</i>
<i>LTF</i>	<i>LGEE</i>	<i>0.4</i>
<i>LTF</i>	<i>MEC</i>	<i>4.27</i>
<i>LTF</i>	<i>MECS</i>	<i>1.75</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>0.09</i>
<i>LTF</i>	<i>ROSETON</i>	<i>0.67</i>
<i>LTF</i>	<i>WEC</i>	<i>0.51</i>
<i>LTF</i>	<i>AA2-074</i>	<i>1.79</i>
<i>925991</i>	<i>ACI-075 C</i>	<i>3.75</i>
<i>926021</i>	<i>ACI-080 C</i>	<i>1.25</i>
<i>926271</i>	<i>ACI-105 C</i>	<i>3.89</i>
<i>926761</i>	<i>ACI-162 C</i>	<i>106.14</i>
<i>927251</i>	<i>ACI-221 C</i>	<i>1.47</i>
<i>927261</i>	<i>ACI-222 C</i>	<i>3.05</i>

Appendix 3

(AEP - AEP) The 05EDAN 1-05DANVL2 138 kV line (from bus 242631 to bus 242620 ckt 1) loads from 114.09% to 114.67% (**DC power flow**) of its emergency rating (415 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#7589_05J.FERR 765'. This project contributes approximately 5.32 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#7589_05J.FERR 765'

OPEN BRANCH FROM BUS 242514 TO BUS 242520 CKT 1 / 242514 05J.FERR
765 242520 05J.FERR 500 1

OPEN BRANCH FROM BUS 242514 TO BUS 242684 CKT 2 / 242514 05J.FERR
765 242684 05J.FERR 138 2

OPEN BRANCH FROM BUS 242520 TO BUS 306719 CKT 1 / 242520 05J.FERR
500 306719 8ANTIOCH 500 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
244012	05PINNACLE	-2.08
315131	1EDGECEMA	4.25
315132	1EDGECEMB	4.25
314557	3BETHEL C	0.35
314554	3BTLEBRO	0.37
314572	3EMPORIA	0.14
314578	3HORNRTN	1.21
314582	3KELFORD	0.3
314603	3SCOT NK	1.24
314617	3TUNIS	0.28
314620	6CASHIE	0.27
314574	6EVERETS	0.98
314594	6PLYMOTH	0.26
932631	AC2-084 C	3.42
932632	AC2-084 E	1.68
932701	AC2-093 C	24.4
932702	AC2-093 E	13.96
932761	AC2-100 C	3.66
932762	AC2-100 E	1.79
932821	AC2-107 C	3.48
932822	AC2-107 E	1.63
933451	AC2-158 C	1.78
933452	AC2-158 E	1.78

933461	AC2-159 C	2.33
933462	AC2-159 E	2.33
933941	AD1-017 C	0.84
933942	AD1-017 E	1.36
933991	AD1-023 C	4.1
933992	AD1-023 E	2.23
934041	AD1-029 C	4.23
934042	AD1-029 E	2.79
934201	AD1-047 C	2.75
934202	AD1-047 E	1.83
934231	AD1-050 C	2.01
934232	AD1-050 E	1.1
934311	AD1-055 C	1.07
934312	AD1-055 E	0.28
934331	AD1-057 C OI	4.1
934332	AD1-057 E OI	2.19
934341	AD1-058 C	3.99
934342	AD1-058 E	1.01
934521	AD1-076 C OI	16.71
934522	AD1-076 E OI	8.51
934611	AD1-087 C OI	3.62
934612	AD1-087 E OI	1.69
934621	AD1-088 C OI	4.63
934622	AD1-088 E OI	2.17
LTF	AD1-120	7.55
LTF	AD1-121	7.6
934911	AD1-123 C	0.47
934912	AD1-123 E	0.24
934991	AD1-131 C	1.31
934992	AD1-131 E	0.87
935171	AD1-152 C OI	3.36
935172	AD1-152 E OI	2.24
935221	AD1-157 C	0.46
935222	AD1-157 E	0.31
935231	AD1-160 C	0.34
935232	AD1-160 E	0.47
LTF	AMIL	0.17
LTF	BLUEG	2.07
LTF	CANNELTON	0.27

<i>LTF</i>	<i>CARR</i>	<i>0.06</i>
<i>LTF</i>	<i>CBM-S1</i>	<i>1.13</i>
<i>LTF</i>	<i>CBM-S2</i>	<i>16.92</i>
<i>LTF</i>	<i>CBM-W2</i>	<i>2.91</i>
<i>LTF</i>	<i>CLIFTY</i>	<i>10.78</i>
<i>LTF</i>	<i>CPLE</i>	<i>5.57</i>
<i>LTF</i>	<i>DEARBORN</i>	<i>0.98</i>
<i>LTF</i>	<i>EDWARDS</i>	<i>0.45</i>
<i>LTF</i>	<i>ELMERSMITH</i>	<i>0.71</i>
<i>LTF</i>	<i>FARMERCITY</i>	<i>0.12</i>
<i>LTF</i>	<i>G-007A</i>	<i>0.79</i>
<i>LTF</i>	<i>GIBSON</i>	<i>0.59</i>
<i>LTF</i>	<i>NEWTON</i>	<i>0.97</i>
<i>LTF</i>	<i>O-066A</i>	<i>0.36</i>
<i>LTF</i>	<i>PRAIRIE</i>	<i>0.86</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>0.05</i>
<i>LTF</i>	<i>ROSETON</i>	<i>0.35</i>
<i>LTF</i>	<i>SMITHLAND</i>	<i>< 0.01</i>
<i>LTF</i>	<i>TATANKA</i>	<i>0.34</i>
<i>LTF</i>	<i>TILTON</i>	<i>0.61</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>0.41</i>
<i>900672</i>	<i>V4-068 E</i>	<i>0.1</i>
<i>LTF</i>	<i>VFT</i>	<i>2.09</i>
<i>LTF</i>	<i>X1-078</i>	<i>0.61</i>
<i>917332</i>	<i>Z2-043 E</i>	<i>0.36</i>
<i>917342</i>	<i>Z2-044 E</i>	<i>0.25</i>
<i>917512</i>	<i>Z2-088 E OP1</i>	<i>1.66</i>
<i>917592</i>	<i>Z2-099 E</i>	<i>0.14</i>
<i>918492</i>	<i>AA1-063AE OP</i>	<i>1.37</i>
<i>918512</i>	<i>AA1-065 E OP</i>	<i>1.46</i>
<i>918532</i>	<i>AA1-067 E</i>	<i>0.29</i>
<i>918562</i>	<i>AA1-072 E</i>	<i>0.06</i>
<i>919692</i>	<i>AA2-053 E</i>	<i>1.33</i>
<i>919702</i>	<i>AA2-057 E</i>	<i>1.51</i>
<i>919822</i>	<i>AA2-068 E</i>	<i>0.41</i>
<i>LTF</i>	<i>AA2-074</i>	<i>3.79</i>
<i>920022</i>	<i>AA2-086 E</i>	<i>0.07</i>
<i>920042</i>	<i>AA2-088 E</i>	<i>3.27</i>
<i>920592</i>	<i>AA2-165 E</i>	<i>0.2</i>

920631	AA2-169 C	0.91
920632	AA2-169 E	0.42
920672	AA2-174 E	0.15
930401	AB1-081 C	4.09
930402	AB1-081 E	1.75
930861	AB1-132 C	4.93
930862	AB1-132 E	2.11
931231	AB1-173 C	0.77
931232	AB1-173 E	0.36
931241	AB1-173AC	0.77
931242	AB1-173AE	0.36
923911	AB2-031 C O1	0.77
923912	AB2-031 E O1	0.38
923941	AB2-035 C	0.15
923942	AB2-035 E	0.06
923991	AB2-040 C O1	2.52
923992	AB2-040 E O1	2.06
924021	AB2-043 C O1	1.21
924022	AB2-043 E O1	1.99
924151	AB2-059 C O1	4.82
924152	AB2-059 E O1	2.48
924161	AB2-060 C O1	3.48
924162	AB2-060 E O1	1.64
924301	AB2-077 C O1	0.78
924302	AB2-077 E O1	0.52
924311	AB2-078 C O1	0.78
924312	AB2-078 E O1	0.52
924321	AB2-079 C O1	0.78
924322	AB2-079 E O1	0.52
924381	AB2-087 C	0.19
924382	AB2-087 E	0.09
924391	AB2-088 C	0.19
924392	AB2-088 E	0.09
924401	AB2-089 C	0.91
924402	AB2-089 E	0.47
924411	AB2-090 C	1.53
924412	AB2-090 E	0.78
924491	AB2-098 C	0.23
924492	AB2-098 E	0.1

924501	AB2-099 C	0.2
924502	AB2-099 E	0.08
924511	AB2-100 C	3.5
924512	AB2-100 E	1.72
925121	AB2-169 C	2.26
925122	AB2-169 E	2.03
925171	AB2-174 C O1	2.38
925172	AB2-174 E O1	2.15
925221	AB2-176 C	0.63
925222	AB2-176 E	0.27
925591	AC1-034 C	3.01
925592	AC1-034 E	2.27
925611	AC1-036 C	0.33
925612	AC1-036 E	0.54
925781	AC1-054 C	3.03
925782	AC1-054 E	1.4
925991	AC1-075 C	1.96
925992	AC1-075 E	1.11
926021	AC1-080 C	0.65
926022	AC1-080 E	0.37
926051	AC1-083 C	4.18
926052	AC1-083 E	6.82
926071	AC1-086 C	7.26
926072	AC1-086 E	3.31
926201	AC1-098 C	2.4
926202	AC1-098 E	1.43
926211	AC1-099 C	0.8
926212	AC1-099 E	0.47
926271	AC1-105 C	2.39
926272	AC1-105 E	1.19
926771	AC1-163 C	0.65
926772	AC1-163 E	0.3
927021	AC1-189 C	3.63
927022	AC1-189 E	1.81
927111	AC1-206 C	2.97
927112	AC1-206 E	1.4
927141	AC1-208 C	3.54
927142	AC1-208 E	1.57
927251	AC1-221 C	1.59

<i>927252</i>	<i>ACI-221 E</i>	<i>1.59</i>
<i>927261</i>	<i>ACI-222 C</i>	<i>1.54</i>
<i>927262</i>	<i>ACI-222 E</i>	<i>1.46</i>

Appendix 4

(DVP - DVP) The 6CAROLNA 230/115 kV transformer (from bus 314559 to bus 314561 ckt 1) loads from 99.53% to 100.7% (**DC power flow**) of its emergency rating (240 MVA) for the single line contingency outage of 'DVP_P1-2: LN 130-A'. This project contributes approximately 2.81 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 130-A'

```

OPEN BRANCH FROM BUS 314562 TO BUS 314570 CKT 1          /* 3CLUBHSE
115.00 - 3METCATP 115.00
OPEN BRANCH FROM BUS 314570 TO BUS 314572 CKT 1          /* 3METCATP
115.00 - 3EMPORIA 115.00
OPEN BRANCH FROM BUS 314570 TO BUS 314588 CKT 1          /* 3METCATP
115.00 - 3METCALF 115.00
OPEN BRANCH FROM BUS 314572 TO BUS 925170 CKT 1          /* 3EMPORIA
115.00 - AB2-174 TAP 115.00
OPEN BRANCH FROM BUS 314572 TO BUS 314863 CKT 1          /* 3EMPORIA
115.00 - 3EMPOR_1 115.00
OPEN BUS 314570                                           /* ISLAND
OPEN BUS 314572                                           /* ISLAND
OPEN BUS 314588                                           /* ISLAND
END

```

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315150	1BUGGS 1	1.26
315151	1BUGGS 2	1.26
315158	1KERR 1	0.38
315159	1KERR 2	1.56
315160	1KERR 3	1.54
315161	1KERR 4	1.54
315162	1KERR 5	1.54
315163	1KERR 6	1.54
315164	1KERR 7	1.54
315126	1ROARAP2	4.37
315128	1ROARAP4	4.21
315115	1S HAMPT1	1.75
932631	AC2-084 C	8.3
933461	AC2-159 C	10.52
934041	AD1-029 C	10.26
934201	AD1-047 C	21.53
934231	AD1-050 C	5.76

934331	AD1-057 C O2	8.97
934611	AD1-087 C O2	2.81
934621	AD1-088 C O2	6.58
LTF	CARR	0.03
LTF	CBM-S1	0.22
LTF	CBM-S2	0.36
LTF	CBM-W1	0.44
LTF	CBM-W2	1.14
LTF	CIN	0.11
LTF	CPL	0.08
LTF	IPL	0.07
LTF	LGEE	0.02
LTF	MEC	0.24
LTF	MECS	0.08
LTF	RENSSELAER	0.02
LTF	ROSETON	0.16
900671	V4-068 C	0.11
LTF	WEC	0.03
917331	Z2-043 C	0.29
917341	Z2-044 C	0.1
917591	Z2-099 C	0.26
918491	AA1-063AC OP	3.58
918561	AA1-072 C	0.04
919691	AA2-053 C	3.76
919701	AA2-057 C	0.94
919821	AA2-068 C	0.47
920021	AA2-086 C	0.13
920041	AA2-088 C	1.61
920591	AA2-165 C	0.13
920631	AA2-169 C	3.7
920671	AA2-174 C	0.17
931231	AB1-173 C	6.05
931241	AB1-173AC	6.05
923801	AB2-015 C O1	7.56
923911	AB2-031 C O1	6.01
923991	AB2-040 C O1	19.73
924021	AB2-043 C O1	1.42
924161	AB2-060 C O1	4.05
924301	AB2-077 C O1	0.93

<i>924311</i>	<i>AB2-078 C OI</i>	<i>0.93</i>
<i>924321</i>	<i>AB2-079 C OI</i>	<i>0.93</i>
<i>924381</i>	<i>AB2-087 C</i>	<i>0.25</i>
<i>924401</i>	<i>AB2-089 C</i>	<i>2.61</i>
<i>924411</i>	<i>AB2-090 C</i>	<i>1.79</i>
<i>924501</i>	<i>AB2-099 C</i>	<i>0.34</i>
<i>925171</i>	<i>AB2-174 C OI</i>	<i>18.83</i>
<i>925221</i>	<i>AB2-176 C</i>	<i>0.74</i>
<i>925611</i>	<i>AC1-036 C</i>	<i>0.34</i>
<i>925781</i>	<i>AC1-054 C</i>	<i>10.03</i>
<i>926201</i>	<i>AC1-098 C</i>	<i>5.82</i>
<i>926211</i>	<i>AC1-099 C</i>	<i>1.95</i>
<i>926771</i>	<i>AC1-163 C</i>	<i>1.14</i>
<i>927141</i>	<i>AC1-208 C</i>	<i>13.74</i>

Appendix 5

(DVP - DVP) The 4ALTVSTA 138/115 kV transformer (from bus 314666 to bus 314667 ckt 2) loads from 91.04% to 94.23% (**DC power flow**) of its emergency rating (130 MVA) for the single line contingency outage of 'DVP_P1-3: 3ALTVSTA-4ALTVSTA'. This project contributes approximately 4.17 MW to the thermal violation.

CONTINGENCY 'DVP_P1-3: 3ALTVSTA-4ALTVSTA'

OPEN BRANCH FROM BUS 314666 TO BUS 314667 CKT 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315150	1BUGGS 1	0.88
315151	1BUGGS 2	0.88
315156	1HALLBRI	7.38
315165	1HURT 1	5.1
315166	1HURT 2	5.1
315266	1PLYWOOD A	0.95
932821	AC2-107 C	24.25
934311	AD1-055 C	2.67
934611	AD1-087 C O2	4.17
934621	AD1-088 C O2	4.79
934911	AD1-123 C	0.75
935171	AD1-152 C O2	4.87
LTF	AMIL	0.1
LTF	BAYOU	0.19
LTF	BIG_CAJUN1	0.27
LTF	BIG_CAJUN2	0.55
LTF	BLUEG	0.76
LTF	CALDERWOOD	0.08
LTF	CANNELTON	0.12
LTF	CARR	0.02
LTF	CBM-S2	1.39
LTF	CHEOAH	0.06
LTF	CHILHOWEE	0.03
LTF	CHOCTAW	0.17
LTF	CLIFTY	3.41
LTF	COTTONWOOD	0.8
LTF	CPL	0.67
LTF	DEARBORN	0.33

<i>LTF</i>	<i>EDWARDS</i>	<i>0.2</i>
<i>LTF</i>	<i>ELMERSMITH</i>	<i>0.34</i>
<i>LTF</i>	<i>FARMERCITY</i>	<i>0.12</i>
<i>LTF</i>	<i>G-007A</i>	<i>0.22</i>
<i>LTF</i>	<i>GIBSON</i>	<i>0.24</i>
<i>LTF</i>	<i>MORGAN</i>	<i>0.31</i>
<i>LTF</i>	<i>NEWTON</i>	<i>0.5</i>
<i>LTF</i>	<i>O-066A</i>	<i>0.1</i>
<i>LTF</i>	<i>PRAIRIE</i>	<i>0.86</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>0.02</i>
<i>LTF</i>	<i>ROSETON</i>	<i>0.13</i>
<i>LTF</i>	<i>SANTEETLA</i>	<i>0.02</i>
<i>LTF</i>	<i>SMITHLAND</i>	<i>0.06</i>
<i>LTF</i>	<i>TATANKA</i>	<i>0.22</i>
<i>LTF</i>	<i>TILTON</i>	<i>0.25</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>0.15</i>
<i>LTF</i>	<i>TVA</i>	<i>0.17</i>
<i>LTF</i>	<i>VFT</i>	<i>0.57</i>
<i>LTF</i>	<i>X1-078</i>	<i>0.17</i>
<i>924021</i>	<i>AB2-043 C O1</i>	<i>1.03</i>
<i>924161</i>	<i>AB2-060 C O1</i>	<i>2.95</i>
<i>924301</i>	<i>AB2-077 C O1</i>	<i>0.67</i>
<i>924311</i>	<i>AB2-078 C O1</i>	<i>0.67</i>
<i>924321</i>	<i>AB2-079 C O1</i>	<i>0.67</i>
<i>924411</i>	<i>AB2-090 C</i>	<i>1.3</i>
<i>925221</i>	<i>AB2-176 C</i>	<i>0.54</i>
<i>925991</i>	<i>AC1-075 C</i>	<i>13.64</i>
<i>926021</i>	<i>AC1-080 C</i>	<i>4.56</i>
<i>926271</i>	<i>AC1-105 C</i>	<i>3.45</i>
<i>927261</i>	<i>AC1-222 C</i>	<i>3.84</i>

Appendix 6

(DVP - DVP) The 6CLUBHSE 230/115 kV transformer (from bus 314562 to bus 314563 ckt 1) loads from 131.93% to 133.81% (**DC power flow**) of its load dump rating (209 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-5: T122C'. This project contributes approximately 8.69 MW to the thermal violation.

CONTINGENCY 'DVP_P4-5: T122C'

/* CAROLINA

OPEN BUS 314559

/* CAROLINA 115KV BUS

OPEN BUS 315126

/* ROANOKE RAPIDS GEN 1 AND 2

OPEN BUS 315128

/* ROANOKE RAPIDS GEN 3 AND 4

OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1

/* TX. #4

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315159	1KERR 2	1.27
315164	1KERR 7	1.25
314572	3EMPORIA	1.99
314704	3LAWRENC	1.44
934201	AD1-047 C	38.11
934202	AD1-047 E	25.41
934231	AD1-050 C	3.55
934232	AD1-050 E	1.94
934611	AD1-087 C O2	5.92
934612	AD1-087 E O2	2.77
934621	AD1-088 C O2	14.58
934622	AD1-088 E O2	6.84
LTF	CARR	0.01
LTF	CBM-S1	0.61
LTF	CBM-S2	0.82
LTF	CBM-W1	1.65
LTF	CBM-W2	3.36
LTF	CIN	0.38
LTF	CPL	0.21
LTF	G-007	0.11
LTF	IPL	0.24
LTF	LGEE	0.08
LTF	MEC	0.77
LTF	MECS	0.42
LTF	O-066	0.36

<i>LTF</i>	<i>RENSSELAER</i>	<i>0.01</i>
<i>LTF</i>	<i>ROSETON</i>	<i>0.08</i>
<i>LTF</i>	<i>WEC</i>	<i>0.1</i>
<i>920631</i>	<i>AA2-169 C</i>	<i>1.67</i>
<i>920632</i>	<i>AA2-169 E</i>	<i>0.77</i>
<i>931231</i>	<i>AB1-173 C</i>	<i>10.72</i>
<i>931232</i>	<i>AB1-173 E</i>	<i>5.</i>
<i>931241</i>	<i>AB1-173AC</i>	<i>10.72</i>
<i>931242</i>	<i>AB1-173AE</i>	<i>5.</i>
<i>923911</i>	<i>AB2-031 C O1</i>	<i>10.64</i>
<i>923912</i>	<i>AB2-031 E O1</i>	<i>5.24</i>
<i>923991</i>	<i>AB2-040 C O1</i>	<i>34.94</i>
<i>923992</i>	<i>AB2-040 E O1</i>	<i>28.59</i>
<i>924021</i>	<i>AB2-043 C O1</i>	<i>3.16</i>
<i>924022</i>	<i>AB2-043 E O1</i>	<i>5.18</i>
<i>924161</i>	<i>AB2-060 C O1</i>	<i>8.96</i>
<i>924162</i>	<i>AB2-060 E O1</i>	<i>4.22</i>
<i>924301</i>	<i>AB2-077 C O1</i>	<i>1.94</i>
<i>924302</i>	<i>AB2-077 E O1</i>	<i>1.29</i>
<i>924311</i>	<i>AB2-078 C O1</i>	<i>1.94</i>
<i>924312</i>	<i>AB2-078 E O1</i>	<i>1.29</i>
<i>924321</i>	<i>AB2-079 C O1</i>	<i>1.94</i>
<i>924322</i>	<i>AB2-079 E O1</i>	<i>1.29</i>
<i>924401</i>	<i>AB2-089 C</i>	<i>1.61</i>
<i>924402</i>	<i>AB2-089 E</i>	<i>0.83</i>
<i>924411</i>	<i>AB2-090 C</i>	<i>3.97</i>
<i>924412</i>	<i>AB2-090 E</i>	<i>2.04</i>
<i>925171</i>	<i>AB2-174 C O1</i>	<i>33.35</i>
<i>925172</i>	<i>AB2-174 E O1</i>	<i>30.17</i>
<i>925221</i>	<i>AB2-176 C</i>	<i>1.64</i>
<i>925222</i>	<i>AB2-176 E</i>	<i>0.7</i>
<i>925611</i>	<i>AC1-036 C</i>	<i>0.76</i>
<i>925612</i>	<i>AC1-036 E</i>	<i>1.25</i>
<i>925781</i>	<i>AC1-054 C</i>	<i>5.42</i>
<i>925782</i>	<i>AC1-054 E</i>	<i>2.5</i>

Appendix 7

(DVP - CPLE) The 3KERR-3GW KING TAP 115 kV line (from bus 314702 to bus 304102 ckt 1) loads from 105.96% to 108.29% (**DC power flow**) of its emergency rating (199 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-5: T122C'. This project contributes approximately 10.26 MW to the thermal violation.

CONTINGENCY 'DVP_P4-5: T122C'

/* CAROLINA

OPEN BUS 314559

/* CAROLINA 115KV BUS

OPEN BUS 315126

/* ROANOKE RAPIDS GEN 1 AND 2

OPEN BUS 315128

/* ROANOKE RAPIDS GEN 3 AND 4

OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1

/* TX. #4

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315159	1KERR 2	3.64
315163	1KERR 6	3.59
315164	1KERR 7	3.59
934231	AD1-050 C	10.19
934232	AD1-050 E	5.57
934611	AD1-087 C O2	6.99
934612	AD1-087 E O2	3.27
934621	AD1-088 C O2	17.09
934622	AD1-088 E O2	8.01
935171	AD1-152 C O2	4.12
935172	AD1-152 E O2	2.75
935221	AD1-157 C	1.02
935222	AD1-157 E	0.68
935231	AD1-160 C	0.75
935232	AD1-160 E	1.03
LTF	AMIL	0.13
LTF	BAYOU	0.72
LTF	BIG_CAJUN1	1.14
LTF	BIG_CAJUN2	2.28
LTF	BLUEG	0.7
LTF	CALDERWOOD	0.43
LTF	CANNELTON	0.13
LTF	CARR	0.02
LTF	CATAWBA	0.43
LTF	CELEVELAND	1.23

<i>LTF</i>	<i>CHEOAH</i>	<i>0.4</i>
<i>LTF</i>	<i>CHILHOWEE</i>	<i>0.14</i>
<i>LTF</i>	<i>CHOCTAW</i>	<i>0.77</i>
<i>LTF</i>	<i>CLIFTY</i>	<i>2.54</i>
<i>LTF</i>	<i>COTTONWOOD</i>	<i>2.82</i>
<i>LTF</i>	<i>DEARBORN</i>	<i>0.26</i>
<i>LTF</i>	<i>EDWARDS</i>	<i>0.22</i>
<i>LTF</i>	<i>ELMERSMITH</i>	<i>0.39</i>
<i>LTF</i>	<i>FARMERCITY</i>	<i>0.17</i>
<i>LTF</i>	<i>G-007A</i>	<i>0.1</i>
<i>LTF</i>	<i>GIBSON</i>	<i>0.25</i>
<i>LTF</i>	<i>HAMLET</i>	<i>1.67</i>
<i>LTF</i>	<i>MORGAN</i>	<i>1.25</i>
<i>LTF</i>	<i>NEWTON</i>	<i>0.6</i>
<i>LTF</i>	<i>O-066A</i>	<i>0.04</i>
<i>LTF</i>	<i>PRAIRIE</i>	<i>1.3</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>0.01</i>
<i>LTF</i>	<i>ROSETON</i>	<i>0.1</i>
<i>LTF</i>	<i>ROWAN</i>	<i>0.93</i>
<i>LTF</i>	<i>SANTEETLA</i>	<i>0.12</i>
<i>LTF</i>	<i>SMITHLAND</i>	<i>0.12</i>
<i>LTF</i>	<i>TATANKA</i>	<i>0.29</i>
<i>LTF</i>	<i>TILTON</i>	<i>0.26</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>0.13</i>
<i>LTF</i>	<i>TVA</i>	<i>0.52</i>
<i>LTF</i>	<i>UNIONPOWER</i>	<i>0.78</i>
<i>LTF</i>	<i>VFT</i>	<i>0.26</i>
<i>LTF</i>	<i>X1-078</i>	<i>0.08</i>
<i>920631</i>	<i>AA2-169 C</i>	<i>4.8</i>
<i>920632</i>	<i>AA2-169 E</i>	<i>2.21</i>
<i>924021</i>	<i>AB2-043 C O1</i>	<i>3.7</i>
<i>924022</i>	<i>AB2-043 E O1</i>	<i>6.06</i>
<i>924161</i>	<i>AB2-060 C O1</i>	<i>10.51</i>
<i>924162</i>	<i>AB2-060 E O1</i>	<i>4.94</i>
<i>924301</i>	<i>AB2-077 C O1</i>	<i>2.38</i>
<i>924302</i>	<i>AB2-077 E O1</i>	<i>1.59</i>
<i>924311</i>	<i>AB2-078 C O1</i>	<i>2.38</i>
<i>924312</i>	<i>AB2-078 E O1</i>	<i>1.59</i>
<i>924321</i>	<i>AB2-079 C O1</i>	<i>2.38</i>

924322	<i>AB2-079 E OI</i>	<i>1.59</i>
924401	<i>AB2-089 C</i>	<i>4.62</i>
924402	<i>AB2-089 E</i>	<i>2.38</i>
924411	<i>AB2-090 C</i>	<i>4.65</i>
924412	<i>AB2-090 E</i>	<i>2.39</i>
925221	<i>AB2-176 C</i>	<i>1.92</i>
925222	<i>AB2-176 E</i>	<i>0.82</i>
925611	<i>AC1-036 C</i>	<i>0.9</i>
925612	<i>AC1-036 E</i>	<i>1.47</i>
925781	<i>AC1-054 C</i>	<i>15.59</i>
925782	<i>AC1-054 E</i>	<i>7.18</i>
926271	<i>AC1-105 C</i>	<i>2.92</i>
926272	<i>AC1-105 E</i>	<i>1.46</i>

Appendix 8

(AEP - AEP) The 05EDAN 1-05DANVL2 138 kV line (from bus 242631 to bus 242620 ckt 1) loads from 114.33% to 114.89% (**DC power flow**) of its emergency rating (415 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#7589_05J.FERR 765'. This project contributes approximately 5.13 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#7589_05J.FERR 765'

OPEN BRANCH FROM BUS 242514 TO BUS 242520 CKT 1 / 242514 05J.FERR
765 242520 05J.FERR 500 1

OPEN BRANCH FROM BUS 242514 TO BUS 242684 CKT 2 / 242514 05J.FERR
765 242684 05J.FERR 138 2

OPEN BRANCH FROM BUS 242520 TO BUS 306719 CKT 1 / 242520 05J.FERR
500 306719 8ANTIOCH 500 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
244012	05PINNACLE	-2.08
315131	1EDGECEMA	4.25
315132	1EDGECEMB	4.25
314557	3BETHEL C	0.35
314554	3BTLEBRO	0.37
314572	3EMPORIA	0.14
314578	3HORNRTN	1.21
314582	3KELFORD	0.3
314603	3SCOT NK	1.24
314617	3TUNIS	0.28
314620	6CASHIE	0.27
314574	6EVERETS	0.98
314594	6PLYMOTH	0.26
932631	AC2-084 C	3.42
932632	AC2-084 E	1.68
932701	AC2-093 C	24.4
932702	AC2-093 E	13.96
932761	AC2-100 C	3.66
932762	AC2-100 E	1.79
932821	AC2-107 C	3.48
932822	AC2-107 E	1.63
933451	AC2-158 C	1.78
933452	AC2-158 E	1.78

933461	AC2-159 C	2.33
933462	AC2-159 E	2.33
933941	AD1-017 C	0.84
933942	AD1-017 E	1.36
933991	AD1-023 C	4.1
933992	AD1-023 E	2.23
934041	AD1-029 C	4.23
934042	AD1-029 E	2.79
934201	AD1-047 C	2.75
934202	AD1-047 E	1.83
934231	AD1-050 C	2.01
934232	AD1-050 E	1.1
934311	AD1-055 C	1.07
934312	AD1-055 E	0.28
934331	AD1-057 C O2	4.1
934332	AD1-057 E O2	2.18
934341	AD1-058 C	3.99
934342	AD1-058 E	1.01
934521	AD1-076 C O2	18.
934522	AD1-076 E O2	9.16
934611	AD1-087 C O2	3.5
934612	AD1-087 E O2	1.63
934621	AD1-088 C O2	5.65
934622	AD1-088 E O2	2.65
LTF	AD1-120	7.55
LTF	AD1-121	7.6
934911	AD1-123 C	0.47
934912	AD1-123 E	0.24
934991	AD1-131 C	1.31
934992	AD1-131 E	0.87
935171	AD1-152 C O2	3.37
935172	AD1-152 E O2	2.25
935221	AD1-157 C	0.46
935222	AD1-157 E	0.31
935231	AD1-160 C	0.34
935232	AD1-160 E	0.47
LTF	AMIL	0.17
LTF	BLUEG	2.07
LTF	CANNELTON	0.27

<i>LTF</i>	<i>CARR</i>	<i>0.06</i>
<i>LTF</i>	<i>CBM-S1</i>	<i>1.13</i>
<i>LTF</i>	<i>CBM-S2</i>	<i>16.92</i>
<i>LTF</i>	<i>CBM-W2</i>	<i>2.91</i>
<i>LTF</i>	<i>CLIFTY</i>	<i>10.78</i>
<i>LTF</i>	<i>CPLE</i>	<i>5.57</i>
<i>LTF</i>	<i>DEARBORN</i>	<i>0.99</i>
<i>LTF</i>	<i>EDWARDS</i>	<i>0.45</i>
<i>LTF</i>	<i>ELMERSMITH</i>	<i>0.71</i>
<i>LTF</i>	<i>FARMERCITY</i>	<i>0.12</i>
<i>LTF</i>	<i>G-007A</i>	<i>0.79</i>
<i>LTF</i>	<i>GIBSON</i>	<i>0.59</i>
<i>LTF</i>	<i>NEWTON</i>	<i>0.97</i>
<i>LTF</i>	<i>O-066A</i>	<i>0.36</i>
<i>LTF</i>	<i>PRAIRIE</i>	<i>0.86</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>0.05</i>
<i>LTF</i>	<i>ROSETON</i>	<i>0.35</i>
<i>LTF</i>	<i>SMITHLAND</i>	<i>< 0.01</i>
<i>LTF</i>	<i>TATANKA</i>	<i>0.34</i>
<i>LTF</i>	<i>TILTON</i>	<i>0.61</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>0.41</i>
<i>900672</i>	<i>V4-068 E</i>	<i>0.1</i>
<i>LTF</i>	<i>VFT</i>	<i>2.09</i>
<i>LTF</i>	<i>X1-078</i>	<i>0.61</i>
<i>917332</i>	<i>Z2-043 E</i>	<i>0.36</i>
<i>917342</i>	<i>Z2-044 E</i>	<i>0.25</i>
<i>917512</i>	<i>Z2-088 E OP1</i>	<i>1.66</i>
<i>917592</i>	<i>Z2-099 E</i>	<i>0.14</i>
<i>918492</i>	<i>AA1-063AE OP</i>	<i>1.37</i>
<i>918512</i>	<i>AA1-065 E OP</i>	<i>1.46</i>
<i>918532</i>	<i>AA1-067 E</i>	<i>0.29</i>
<i>918562</i>	<i>AA1-072 E</i>	<i>0.06</i>
<i>919692</i>	<i>AA2-053 E</i>	<i>1.33</i>
<i>919702</i>	<i>AA2-057 E</i>	<i>1.51</i>
<i>919822</i>	<i>AA2-068 E</i>	<i>0.41</i>
<i>LTF</i>	<i>AA2-074</i>	<i>3.79</i>
<i>920022</i>	<i>AA2-086 E</i>	<i>0.07</i>
<i>920042</i>	<i>AA2-088 E</i>	<i>3.27</i>
<i>920592</i>	<i>AA2-165 E</i>	<i>0.2</i>

920631	AA2-169 C	0.91
920632	AA2-169 E	0.42
920672	AA2-174 E	0.15
930401	AB1-081 C	4.09
930402	AB1-081 E	1.75
930861	AB1-132 C	4.93
930862	AB1-132 E	2.11
931231	AB1-173 C	0.77
931232	AB1-173 E	0.36
931241	AB1-173AC	0.77
931242	AB1-173AE	0.36
923911	AB2-031 C O1	0.77
923912	AB2-031 E O1	0.38
923941	AB2-035 C	0.15
923942	AB2-035 E	0.06
923991	AB2-040 C O1	2.52
923992	AB2-040 E O1	2.06
924021	AB2-043 C O1	1.21
924022	AB2-043 E O1	1.99
924151	AB2-059 C O1	4.82
924152	AB2-059 E O1	2.48
924161	AB2-060 C O1	3.48
924162	AB2-060 E O1	1.64
924301	AB2-077 C O1	0.78
924302	AB2-077 E O1	0.52
924311	AB2-078 C O1	0.78
924312	AB2-078 E O1	0.52
924321	AB2-079 C O1	0.78
924322	AB2-079 E O1	0.52
924381	AB2-087 C	0.19
924382	AB2-087 E	0.09
924391	AB2-088 C	0.19
924392	AB2-088 E	0.09
924401	AB2-089 C	0.91
924402	AB2-089 E	0.47
924411	AB2-090 C	1.53
924412	AB2-090 E	0.78
924491	AB2-098 C	0.23
924492	AB2-098 E	0.1

924501	AB2-099 C	0.2
924502	AB2-099 E	0.08
924511	AB2-100 C	3.5
924512	AB2-100 E	1.72
925121	AB2-169 C	2.26
925122	AB2-169 E	2.03
925171	AB2-174 C O1	2.38
925172	AB2-174 E O1	2.15
925221	AB2-176 C	0.63
925222	AB2-176 E	0.27
925591	AC1-034 C	3.01
925592	AC1-034 E	2.27
925611	AC1-036 C	0.33
925612	AC1-036 E	0.54
925781	AC1-054 C	3.03
925782	AC1-054 E	1.4
925991	AC1-075 C	1.96
925992	AC1-075 E	1.11
926021	AC1-080 C	0.65
926022	AC1-080 E	0.37
926051	AC1-083 C	4.18
926052	AC1-083 E	6.82
926071	AC1-086 C	7.26
926072	AC1-086 E	3.31
926201	AC1-098 C	2.4
926202	AC1-098 E	1.43
926211	AC1-099 C	0.8
926212	AC1-099 E	0.47
926271	AC1-105 C	2.39
926272	AC1-105 E	1.19
926771	AC1-163 C	0.65
926772	AC1-163 E	0.3
927021	AC1-189 C	3.63
927022	AC1-189 E	1.81
927111	AC1-206 C	2.97
927112	AC1-206 E	1.4
927141	AC1-208 C	3.54
927142	AC1-208 E	1.57
927251	AC1-221 C	1.59

<i>927252</i>	<i>ACI-221 E</i>	<i>1.59</i>
<i>927261</i>	<i>ACI-222 C</i>	<i>1.54</i>
<i>927262</i>	<i>ACI-222 E</i>	<i>1.46</i>