Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AD1-034

Sapony 115kV
44.9 MW Capacity / 74.9 MW Energy

February 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 Sussex County, Virginia. The installed facilities will have a total capability of 74.9 MW with 44.9 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is December 31, 2020. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AD1-034 will interconnect with the ITO transmission system via one of the following Points of Interconnection:

Option 1: AD1-034 will interconnect into the existing Sapony 115kV Substation

Option 2: AD1-034 will interconnect via a new three breaker ring bus switching station that connects the Sapony – Clubhouse 230kV line.

Cost Summary

The AD1-034 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 1,550,000
Direct Connection Network Upgrades	$ 5,500,000
Non Direct Connection Network Upgrades	$ 800,000
Total Costs	**$ 7,850,000**

In addition, the AD1-034 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	$ 0
Previously Identified Upgrades	$ 17,500,000
Total Costs	**$ 17,750,000**

PJM Open Access Transmission Tariff (OATT) section 217.3A outlines 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.

System Reinforcements

Violation #	Upgrade Description	Upgrade Cost
	***NEW SYSTEM REINFORCEMENTS**	
NONE		
	CONTRIBUTIONS TO PREVIOUS SYSTEM REINFORCEMENTS	
3	Replace the 500-230 kV transformer #1 increase its line rating to 1134 MVA (normal), 1203 MVA (emergency), and 1365 MVA (load dump). It is estimated to cost $17,500,000 and 24-30 months to engineer and construct.	$17,500,000
4,5	Line #259 Chesterfield – Basin 230 kV: reconductor 0.14 miles of 1109 ACAR with a conductor which will increase the line rating to approximately 706 MVA (normal), 706 MVA (emergency), and 812 MVA (load dump). It is estimated to cost $250,000 and 15-18 months to engineer, permit and construct.	$250,000
	Total Network Upgrades	**$17,750,000**

*Note:
For New System Reinforcements, only violations in which the AD1-034 overloads the facility are included in the table above. Costs for New System Reinforcement for which AD1-034 is not the first project to overload the facility are included for reference in the later part of this report. Cost allocation will be provided in the Impact Study.

Attachment Facilities

Generation Substation: Install metering and associated protection equipment. Estimated Cost is $550,000.

Transmission: Construct approximately one span of 115 kV Attachment line between the generation substation and the existing Sapony Substation. The estimated cost for this work is $1,000,000.

The estimated total cost of the Attachment Facilities is $1,550,000. It is estimated to take 18-24 months to complete this work upon execution of an Interconnection Construction Service Agreement (ICSA). 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.

Direct Connection Cost Estimate

Substation: Add a three-breaker ring bus in the Sapony 115 kV Substation (interconnection substation). The estimated cost of this work scope is $5,500,000. It is estimated to take 24-36 months to complete this work upon execution of an Interconnection Construction Service Agreement.

Non-Direct Network Upgrades:

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 $800,000 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.

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 1:

Network Impacts

PJM assessed the impact of the proposed Queue Project as an injection into the ITO's transmission system, 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.

The Queue Project AD1-034 was evaluated as a 74.0 MW (Capacity 44.9 MW) injection tapping Reams to Purdy 115kV line in the ITO area. Project AD1-034 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-034 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
DVP_P1-2: LN 217	CONTINGENCY 'DVP_P1-2: LN 217' OPEN BRANCH FROM BUS 314225 TO BUS 314227 CKT 1 /* 6CHARCTY 230.00 - 6LAKESD 230.00 OPEN BRANCH FROM BUS 314225 TO BUS 314228 CKT 1 /* 6CHARCTY 230.00 - 6MESSER 230.00 OPEN BRANCH FROM BUS 314228 TO BUS 314287 CKT 1 /* 6MESSER 230.00 - 6CHSTF B 230.00 OPEN BUS 314225 /* ISLAND

Contingency Name	Description
	OPEN BUS 314228 /* ISLAND END
DVP_P1-2: LN 557	CONTINGENCY 'DVP_P1-2: LN 557' OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM 230.00 - 8CHCKAHM 500.00 OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM 500.00 - 8ELMONT 500.00 END
DVP_P1-2: LN 563	CONTINGENCY 'DVP_P1-2: LN 563' OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 END
DVP_P4-2: H2T557	CONTINGENCY 'DVP_P4-2: H2T557' /* ELMONT OPEN BRANCH FROM BUS 314908 TO BUS 314903 CKT 1 /*ELMONT TO CHICKAHOMINY (LINE 557) OPEN BRANCH FROM BUS 314903 TO BUS 314214 CKT 1 /*CHICKAHOMINY 500-230 (TX#1) OPEN BRANCH FROM BUS 314908 TO BUS 314218 CKT 2 /*ELMONT 500-230 (TX#2) END
DVP_P7-1: LN 212-240_D	CONTINGENCY 'DVP_P7-1: LN 212-240_D' OPEN BRANCH FROM BUS 925330 TO BUS 314538 CKT 2 /* AB2-190 TAP 230.00 - 6SURRY 230.00 OPEN BRANCH FROM BUS 924810 TO BUS 314538 CKT 1 /* AB2-134 TAP 230.00 - 6SURRY 230.00 END

Summer Peak Analysis – 2021

Generator Deliverability

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

None.

Multiple Facility Contingency

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

#	Contingency		Affected		Bus			Power	Loading %		Rating		MW	
	Type	Name	Area	Facility Description	From	To	Ckt	Flow	Initial	Final	Type	MVA	Contribution	Ref
1	DCTL	DVP_P7-1: LN 212-240_D	DVP - DVP	6BERMUDA-6CHESTF A 230 kV line	314278	314286	1	DC	91.02	91.59	LD	549	6.89	1
2	DCTL	DVP_P7-1: LN 212-240_D	DVP - DVP	6HOPEWLL-6BERMUDA 230 kV line	314303	314278	1	DC	91.02	91.59	LD	549	6.89	2

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 Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Ckt	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
3	LFFB	DVP_P4-2: H2T557	DVP - DVP	8ELMONT 500/230 kV transformer	314218	314908	1	DC	121.83	122.49	LD	1051	17.47	3
4	N-1	DVP_P1-2: LN 563	DVP - DVP	6CHESTF B-6BASIN 230 kV line	314287	314276	1	DC	124.66	125.76	ER	449	4.93	4
5	N-1	DVP_P1-2: LN 217	DVP - DVP	6CHESTF B-6BASIN 230 kV line	314287	314276	1	DC	118.43	119.73	ER	449	6.8	

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

New System Reinforcements

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

#	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
1,2	6BERMUDA-6CHESTF A 230 kV line; 6HOPEWLL-6BERMUDA 230 kV line	Line #228 Hopewell – Bermuda – Chesterfield 230 kV: wreck and rebuild the line of 11 miles increase its line rating to 722 MVA (normal), 722 MVA (emergency), and 830 MVA (load dump). It is estimated to cost $27,425,000 and 44-48 months to engineer, permit, and construct. A Va CPCN is required.	Pending	$27,425,000
			Total New Network Upgrades	$27,425,000

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 %

#	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
3	8ELMONT 500/230 kV transformer	Elmont 500 – 230 kV Tx#1: replace the 500-230 kV transformer #1 increase its line rating to 1134 MVA (normal), 1203 MVA (emergency), and 1365 MVA (load dump). It is estimated to cost $17,500,000 and 24-30 months to engineer and construct	Pending	$17,500,000
4,5	6CHESTF B-6BASIN 230 kV line	Line #259 Chesterfield – Basin 230 kV: reconductor 0.14 miles of 1109 ACAR with a conductor which will increase the line rating to approximately 706 MVA (normal), 706 MVA (emergency), and 812 MVA (load dump). It is estimated to cost $250,000 and 15-18 months to engineer, permit and construct.	Pending	$250,000
			Total New Network Upgrades	$17,750,000

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 Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Cir.	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution
6	N-1	DVP_P1-2: LN 557	DVP - DVP	6CHARCTY-6LAKESIDE 230 kV line	314225	314227	1	DC	98.58	99.51	ER	984	11.01
7	N-1	DVP_P1-2: LN 217	DVP - DVP	6BERMUDA-6CHESTF A 230 kV line	314278	314286	1	DC	105.8	106.41	ER	449	6.5

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Cir.	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution
8	N-1	DVP_P1-2: LN 563	DVP - DVP	6CHESTF B-6BASIN 230 kV line	314287	314276	1	DC	148.68	150.51	ER	449	8.12
9	N-1	DVP_P1-2: LN 217	DVP - DVP	6HOPEWLL-6BERMUDA 230 kV line	314303	314278	1	DC	105.8	106.41	ER	449	6.5

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 2

Network Impacts

PJM assessed the impact of the proposed Queue Project as an injection into the ITO's transmission system, 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.

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The Queue Project AD1-034 was evaluated as a 74.0 MW (Capacity 44.9 MW) injection tapping Sapony to Clubhouse 230kV line in the ITO area. Project AD1-034 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-034 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
DVP_P1-2: LN 2056	CONTINGENCY 'DVP_P1-2: LN 2056' OPEN BRANCH FROM BUS 313845 TO BUS 314579 CKT 1 /* 6HATHAWAY 230.00 - 6HORNRTN 230.00 END

Contingency Name	Description
DVP_P1-2: LN 2058	CONTINGENCY 'DVP_P1-2: LN 2058' OPEN BRANCH FROM BUS 304222 TO BUS 313845 CKT 1 /* 6ROCKYMT230T230.00 - 6MORNSTR 230.00 END
DVP_P1-2: LN 2131A	CONTINGENCY 'DVP_P1-2: LN 2131A' OPEN BRANCH FROM BUS 314662 TO BUS 916040 CKT 1 /* 6S HERTFORD 230.00 - Z1-036 TAP 230.00 OPEN BRANCH FROM BUS 314651 TO BUS 314662 CKT 1 /* 6WINFALL 230.00 - 6S HERTFORD 230.00 OPEN BUS 314662 /* ISLAND END
DVP_P1-2: LN 2141	CONTINGENCY 'DVP_P1-2: LN 2141' OPEN BRANCH FROM BUS 314561 TO BUS 314583 CKT 1 /* 6CAROLNA 230.00 - 6LAKEVEW 230.00 END
DVP_P1-2: LN 217	CONTINGENCY 'DVP_P1-2: LN 217' OPEN BRANCH FROM BUS 314225 TO BUS 314227 CKT 1 /* 6CHARCTY 230.00 - 6LAKESD 230.00 OPEN BRANCH FROM BUS 314225 TO BUS 314228 CKT 1 /* 6CHARCTY 230.00 - 6MESSER 230.00 OPEN BRANCH FROM BUS 314228 TO BUS 314287 CKT 1 /* 6MESSER 230.00 - 6CHSTF B 230.00 OPEN BUS 314225 /* ISLAND OPEN BUS 314228 /* ISLAND END
DVP_P1-2: LN 2181	CONTINGENCY 'DVP_P1-2: LN 2181' OPEN BUS 304226 /* ISLAND: 6PA-RMOUNT#4115.00 OPEN BRANCH FROM BUS 304226 TO BUS 314591 CKT 1 /* 6PA-RMOUNT#4230.00 - 6NASH 230.00 OPEN BRANCH FROM BUS 313845 TO BUS 314591 CKT 1 /* 6HATHAWAY 230.00 - 6NASH 230.00

Contingency Name	Description
	OPEN BUS 314591 /* ISLAND: 6NASH 230.00 END
DVP_P1-2: LN 238-A	CONTINGENCY 'DVP_P1-2: LN 238-A' OPEN BRANCH FROM BUS 314282 TO BUS 314435 CKT 1 /* 6CARSON 230.00 - 6SAPONY 230.00 OPEN BRANCH FROM BUS 314435 TO BUS 934070 CKT 1 /* 6SAPONY 230.00 - AD1-034 TAP 230.00 OPEN BUS 314435 /* ISLAND END
DVP_P1-2: LN 246	CONTINGENCY 'DVP_P1-2: LN 246' OPEN BRANCH FROM BUS 314537 TO BUS 314575 CKT 1 /* 6SUFFOLK 230.00 - 6NUCO TP 230.00 OPEN BRANCH FROM BUS 314569 TO BUS 314575 CKT 1 /* 6EARLEYS 230.00 - 6NUCO TP 230.00 OPEN BRANCH FROM BUS 314575 TO BUS 314590 CKT 1 /* 6NUCO TP 230.00 - 6NUCOR 230.00 OPEN BUS 314575 /* ISLAND OPEN BUS 314590 /* ISLAND END
DVP_P1-2: LN 563	CONTINGENCY 'DVP_P1-2: LN 563' OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 END
DVP_P4-2: 239T2141	CONTINGENCY 'DVP_P4-2: 239T2141' /* LAKEVIEW OPEN BRANCH FROM BUS 314583 TO BUS 314579 CKT 1 /* 239 OPEN BRANCH FROM BUS 314579 TO BUS 314605 CKT 1 /* 2057 OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141 END

Contingency Name	Description
DVP_P4-2: 246T2034	CONTINGENCY 'DVP_P4-2: 246T2034' /* EARLEYS OPEN BRANCH FROM BUS 314569 TO BUS 314575 CKT 1 /* 246 OPEN BRANCH FROM BUS 314575 TO BUS 314537 CKT 1 /* 246 OPEN BRANCH FROM BUS 314575 TO BUS 314590 CKT 1 /* 246 - NUCOR OPEN BRANCH FROM BUS 314569 TO BUS 933450 CKT 1 /* 2034 END
DVP_P4-2: 562T563	CONTINGENCY 'DVP_P4-2: 562T563' /*CARSON OPEN BRANCH FROM BUS 314902 TO BUS 314923 CKT 1 /*CARSON TO MIDLOTHIAN OPEN BRANCH FROM BUS 314914 TO BUS 314902 CKT 1 /*CARSON 500.00 - 8SEPTA 500.00 END
DVP_P4-2: H2T557	CONTINGENCY 'DVP_P4-2: H2T557' /* ELMONT OPEN BRANCH FROM BUS 314908 TO BUS 314903 CKT 1 /*ELMONT TO CHICKAHOMINY (LINE 557) OPEN BRANCH FROM BUS 314903 TO BUS 314214 CKT 1 /*CHICKAHOMINY 500-230 (TX#1) OPEN BRANCH FROM BUS 314908 TO BUS 314218 CKT 2 /*ELMONT 500-230 (TX#2) END
DVP_P7-1: LN 81-2056	CONTINGENCY 'DVP_P7-1: LN 81-2056' OPEN BRANCH FROM BUS 314559 TO BUS 314578 CKT 1 /* 3CAROLNA 115.00 - 3HORNRTN 115.00 OPEN BRANCH FROM BUS 314578 TO BUS 314598 CKT 1 /* 3HORNRTN 115.00 - 3ROAN DP 115.00 OPEN BRANCH FROM BUS 314598 TO BUS 314628 CKT 1 /* 3ROAN DP 115.00 - 3DARLINGT DP115.00 OPEN BUS 314578 /* ISLAND: 3HORNRTN 115.00 OPEN BUS 314598 /* ISLAND: 3ROAN DP 115.00

Contingency Name	Description
	OPEN BRANCH FROM BUS 304226 TO BUS 314591 CKT 1 /* 6PA-RMOUNT#4230.00 - 6NASH 230.00 OPEN BRANCH FROM BUS 313845 TO BUS 314591 CKT 1 /* 6MORNSTR 230.00 - 6NASH 230.00 OPEN BRANCH FROM BUS 304226 TO BUS 304222 CKT 1 /* 6PA-RMOUNT#4230.00 - 6ROCKYMT230T OPEN BUS 304226 /* ISLAND OPEN BUS 314591 /* ISLAND: 6NASH 230.00 END

Summer Peak Analysis – 2021

Generator Deliverability

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

#	Contingency		Affected		Bus			Power	Loading %		Rating		MW	
	Type	Name	Area	Facility Description	From	To	Ckt	Flow	Initial	Final	Type	MVA	Contribution	Ref
1	N-1	DVP_P1-2: LN 563	DVP - DVP	6CARSON-6CHRL249 230 kV line	314282	314285	1	DC	95.52	96.99	ER	559	8.75	
2	N-1	DVP_P1-2: LN 2141	DVP - DVP	6HORNRTN-6MORNSTR 230 kV line	314579	313845	1	DC	98.37	99.89	ER	442	6.72	1

Multiple Facility Contingency

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

None.

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		Bus			Power	Loading %		Rating		MW	
	Type	Name	Area	Facility Description	From	To	Ckt	Flow	Initial	Final	Type	MVA	Contribution	Ref
3	DCTL	DVP_P7-1: LN 81-2056	DVP - CPLE	6MORNSTR-6ROCKYMT230T 230 kV line	313845	304222	1	DC	136.36	137.04	ER	374	5.65	2
4	LFFB	DVP_P4-2: H2T557	DVP - DVP	8ELMONT 500/230 kV transformer	314218	314908	1	DC	121.83	122.31	LD	1051	12.9	3
5	LFFB	DVP_P4-2: 562T563	DVP - DVP	6CARSON-6CHRL249 230 kV line	314282	314285	1	DC	107.6	109.72	LD	684	15.19	4
6	LFFB	DVP_P4-2: 562T563	DVP - DVP	6CHRL249-6LOCKS 230 kV line	314285	314316	1	DC	104.8	106.91	LD	684	15.19	5
7	N-1	DVP_P1-2: LN 563	DVP - DVP	6CHESTF B-6BASIN 230 kV line	314287	314276	1	DC	124.7	125.84	ER	449	5.06	6
8	N-1	DVP_P1-2: LN 217	DVP - DVP	6CHESTF B-6BASIN 230 kV line	314287	314276	1	DC	118.28	119.39	ER	449	6.09	
9	LFFB	DVP_P4-2: 239T2141	DVP - DVP	6CLUBHSE 230/115 kV transformer	314563	314562	1	DC	109.32	113.91	LD	209	9.59	7
10	N-1	DVP_P1-2: LN 2056	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	DC	126.89	128.96	ER	375	7.78	8
11	N-1	DVP_P1-2: LN 238-A	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	DC	116.77	121.9	ER	375	19.25	
12	LFFB	DVP_P4-2: 246T2034	DVP - DVP	AD1-034 TAP-6SAPONY 230 kV line	934070	314435	1	DC	122.32	130.38	LD	637	54.37	9

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		Bus			Power	Loading %		Rating		MW
#	Type	Name	Area	Facility Description	From	To	Cir.	Flow	Initial	Final	Type	MVA	Contribution
13	N-1	DVP_P1-2: LN 2181	DVP - CPLE	6MORNSTR-6ROCKYMT230T 230 kV line	313845	304222	1	DC	136.35	137.04	ER	374	5.71
14	N-1	DVP_P1-2: LN 2058	DVP - DVP	6MORNSTR-6NASH 230 kV line	313845	314591	1	DC	120.89	121.47	ER	449	5.83
15	N-1	DVP_P1-2: LN 217	DVP - DVP	6BERMUDA-6CHESTF A 230 kV line	314278	314286	1	DC	106.41	107.01	ER	449	5.98
16	N-1	DVP_P1-2: LN 563	DVP - DVP	6CARSON-6CHRL249 230 kV line	314282	314285	1	DC	97.48	99.63	ER	559	14.42
17	N-1	DVP_P1-2: LN 563	DVP - DVP	6CHRL249-6LOCKS 230 kV line	314285	314316	1	DC	94.07	96.21	ER	559	14.42
18	N-1	DVP_P1-2: LN 563	DVP - DVP	6CHESTF B-6BASIN 230 kV line	314287	314276	1	DC	148.71	150.59	ER	449	8.34

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Cir.	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution
19	N-1	DVP_P1-2: LN 217	DVP - DVP	6HOPEWLL-6BERMUDA 230 kV line	314303	314278	1	DC	106.41	107.01	ER	449	5.98
20	N-1	DVP_P1-2: LN 2131A	DVP - DVP	6SAPONY-6CARSON 230 kV line	314435	314282	1	DC	111.65	119.54	ER	679	53.45
21	Non	Non	DVP - DVP	6SAPONY-6CARSON 230 kV line	314435	314282	1	DC	87.78	95.59	NR	679	53.23
22	N-1	DVP_P1-2: LN 238-A	DVP - DVP	6CAROLNA-6ROA VAL 230 kV line	314561	314599	1	DC	93.88	98.1	ER	548	23.11
23	N-1	DVP_P1-2: LN 238-A	DVP - DVP	6HORNRTN-6MORNSTR 230 kV line	314579	313845	1	DC	113.22	118.67	ER	442	24.04
24	N-1	DVP_P1-2: LN 2056	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	DC	145.05	148.46	ER	375	12.82
25	Non	Non	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	DC	104.82	107.15	NR	352	8.22
26	N-1	DVP_P1-2: LN 2058	DVP - CPLE	6NASH-6PA-RMOUNT#4 230 kV line	314591	304226	1	DC	110.57	111.13	ER	470	5.83
27	N-1	DVP_P1-2: LN 238-A	DVP - DVP	6ROA VAL-6NORTHAMPTON 230 kV line	314599	314266	1	DC	93.83	98.05	ER	548	23.11
28	N-1	DVP_P1-2: LN 238-A	DVP - DVP	6S HERTFORD-6WINFALL 230 kV line	314662	314651	1	DC	91.36	92.44	ER	733	7.91
29	N-1	DVP_P1-2: LN 246	DVP - DVP	AD1-034 TAP-6SAPONY 230 kV line	934070	314435	1	DC	120.43	129.46	ER	599	53.86
30	Non	Non	DVP - DVP	AD1-034 TAP-6SAPONY 230 kV line	934070	314435	1	DC	102.5	110.38	NR	599	53.23

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).

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, those contributions take into consideration the commercial probability of each project as well as the ramping impact of "Adder" contributions.

OPTION 1

Appendix 1

(DVP - DVP) The 6BERMUDA-6CHESTF A 230 kV line (from bus 314278 to bus 314286 ckt 1) loads from 91.02% to 91.59% (**DC power flow**) of its load dump rating (549 MVA) for the tower line contingency outage of 'DVP_P7-1: LN 212-240_D'. This project contributes approximately 6.89 MW to the thermal violation.

CONTINGENCY 'DVP_P7-1: LN 212-240_D'
OPEN BRANCH FROM BUS 925330 TO BUS 314538 CKT 2 /* AB2-190 TAP 230.00 - 6SURRY 230.00
OPEN BRANCH FROM BUS 924810 TO BUS 314538 CKT 1 /* AB2-134 TAP 230.00 - 6SURRY 230.00
END

Bus Number	*Bus Name*	*Full Contribution*
315065	*1CHESTF6*	*20.42*
315074	*1HOPCGN1*	*20.52*
315075	*1HOPCGN2*	*20.26*
315077	*1HOPHCF1*	*6.49*
315078	*1HOPHCF2*	*6.49*
315079	*1HOPHCF3*	*6.49*
315080	*1HOPHCF4*	*9.85*
315076	*1HOPPOLC*	*4.62*
315073	*1STONECA*	*17.02*
314315	*3LOCKS E*	*0.65*
932581	*AC2-078 C*	*2.99*
932582	*AC2-078 E*	*4.88*
934011	*AD1-025 C O1*	*41.76*
934012	*AD1-025 E O1*	*24.74*
934071	*AD1-034 C O1*	*4.18*
934072	*AD1-034 E O1*	*2.71*

934571	*AD1-082 C O1*	*3.55*
934572	*AD1-082 E O1*	*2.02*
935161	*AD1-151 C O1*	*39.9*
935162	*AD1-151 E O1*	*26.6*
935211	*AD1-156 C*	*1.39*
935212	*AD1-156 E*	*0.93*
LTF	*CARR*	*0.06*
LTF	*CBM-S1*	*0.9*
LTF	*CBM-S2*	*2.08*
LTF	*CBM-W1*	*1.53*
LTF	*CBM-W2*	*4.7*
LTF	*CIN*	*0.35*
LTF	*CPLE*	*0.68*
LTF	*G-007*	*0.26*
LTF	*IPL*	*0.22*
LTF	*LGEE*	*0.08*
LTF	*MEC*	*0.88*
LTF	*MECS*	*0.25*
LTF	*O-066*	*0.88*
LTF	*RENSSELAER*	*0.05*
LTF	*ROSETON*	*0.35*
292791	*U1-032 E*	*8.87*
LTF	*WEC*	*0.1*
914231	*Y2-077*	*2.61*
924811	*AB2-134 C O1*	*31.83*
924812	*AB2-134 E O1*	*31.3*

925051	*AB2-160 C O1*	*2.83*
925052	*AB2-160 E O1*	*4.62*
925061	*AB2-161 C O1*	*1.56*
925062	*AB2-161 E O1*	*2.54*
925331	*AB2-190 C*	*49.65*
925332	*AB2-190 E*	*21.28*
927221	*AC1-216 C O1*	*24.29*
927222	*AC1-216 E O1*	*19.11*

Appendix 2

(DVP - DVP) The 6HOPEWLL-6BERMUDA 230 kV line (from bus 314303 to bus 314278 ckt 1) loads from 91.02% to 91.59% (**DC power flow**) of its load dump rating (549 MVA) for the tower line contingency outage of 'DVP_P7-1: LN 212-240_D'. This project contributes approximately 6.89 MW to the thermal violation.

CONTINGENCY 'DVP_P7-1: LN 212-240_D'
OPEN BRANCH FROM BUS 925330 TO BUS 314538 CKT 2 /* AB2-190 TAP 230.00 - 6SURRY 230.00
OPEN BRANCH FROM BUS 924810 TO BUS 314538 CKT 1 /* AB2-134 TAP 230.00 - 6SURRY 230.00
END

Bus Number	*Bus Name*	*Full Contribution*
315065	*1CHESTF6*	*20.42*
315074	*1HOPCGN1*	*20.52*
315075	*1HOPCGN2*	*20.26*
315077	*1HOPHCF1*	*6.49*
315078	*1HOPHCF2*	*6.49*
315079	*1HOPHCF3*	*6.49*
315080	*1HOPHCF4*	*9.85*
315076	*1HOPPOLC*	*4.62*
315073	*1STONECA*	*17.02*
314315	*3LOCKS E*	*0.65*
932581	*AC2-078 C*	*2.99*
932582	*AC2-078 E*	*4.88*
934011	*AD1-025 C O1*	*41.76*
934012	*AD1-025 E O1*	*24.74*
934071	*AD1-034 C O1*	*4.18*
934072	*AD1-034 E O1*	*2.71*
934571	*AD1-082 C O1*	*3.55*

934572	*AD1-082 E O1*	*2.02*
935161	*AD1-151 C O1*	*39.9*
935162	*AD1-151 E O1*	*26.6*
935211	*AD1-156 C*	*1.39*
935212	*AD1-156 E*	*0.93*
LTF	*CARR*	*0.06*
LTF	*CBM-S1*	*0.9*
LTF	*CBM-S2*	*2.08*
LTF	*CBM-W1*	*1.53*
LTF	*CBM-W2*	*4.7*
LTF	*CIN*	*0.35*
LTF	*CPLE*	*0.68*
LTF	*G-007*	*0.26*
LTF	*IPL*	*0.22*
LTF	*LGEE*	*0.08*
LTF	*MEC*	*0.88*
LTF	*MECS*	*0.25*
LTF	*O-066*	*0.88*
LTF	*RENSSELAER*	*0.05*
LTF	*ROSETON*	*0.35*
292791	*U1-032 E*	*8.87*
LTF	*WEC*	*0.1*
914231	*Y2-077*	*2.61*
924811	*AB2-134 C O1*	*31.83*
924812	*AB2-134 E O1*	*31.3*
925051	*AB2-160 C O1*	*2.83*

925052	*AB2-160 E O1*	*4.62*
925061	*AB2-161 C O1*	*1.56*
925062	*AB2-161 E O1*	*2.54*
925331	*AB2-190 C*	*49.65*
925332	*AB2-190 E*	*21.28*
927221	*AC1-216 C O1*	*24.29*
927222	*AC1-216 E O1*	*19.11*

Appendix 3

(DVP - DVP) The 8ELMONT 500/230 kV transformer (from bus 314218 to bus 314908 ckt 1) loads from 121.83% to 122.49% (**DC power flow**) of its load dump rating (1051 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: H2T557'. This project contributes approximately 17.47 MW to the thermal violation.

CONTINGENCY 'DVP_P4-2: H2T557' /* ELMONT
OPEN BRANCH FROM BUS 314908 TO BUS 314903 CKT 1 /*ELMONT TO CHICKAHOMINY (LINE 557)
OPEN BRANCH FROM BUS 314903 TO BUS 314214 CKT 1 /*CHICKAHOMINY 500-230 (TX#1)
OPEN BRANCH FROM BUS 314908 TO BUS 314218 CKT 2 /*ELMONT 500-230 (TX#2)
END

Bus Number	*Bus Name*	*Full Contribution*
315067	*1DARBY 1*	*4.99*
315068	*1DARBY 2*	*4.99*
315069	*1DARBY 3*	*5.01*
315070	*1DARBY 4*	*5.01*
315043	*1FOUR RIVERA*	*6.63*
315044	*1FOUR RIVERB*	*5.13*
315045	*1FOUR RIVERC*	*6.63*
315046	*1FOUR RIVERD*	*5.13*
315047	*1FOUR RIVERE*	*5.13*
315048	*1FOUR RIVERF*	*6.63*
315074	*1HOPCGN1*	*11.28*
315075	*1HOPCGN2*	*11.14*
315083	*1SPRUNCA*	*14.95*
315084	*1SPRUNCB*	*14.95*
315085	*1SPRUNCC*	*11.08*

315086	*1SPRUNCD*	*11.08*
315073	*1STONECA*	*9.36*
314566	*3CRESWEL*	*2.11*
314572	*3EMPORIA*	*0.36*
314315	*3LOCKS E*	*1.65*
314617	*3TUNIS*	*0.71*
314539	*3UNCAMP*	*2.19*
314541	*3WATKINS*	*0.61*
314620	*6CASHIE*	*0.72*
314229	*6MT RD221*	*1.41*
314236	*6NRTHEST*	*0.37*
314189	*6PAPERMILL*	*8.82*
314594	*6PLYMOTH*	*0.73*
314250	*6ROCKVILLE*	*0.4*
314256	*6ROCKVILLE E*	*1.15*
314648	*6SUNBURY*	*0.81*
314651	*6WINFALL*	*1.59*
932041	*AC2-012 C*	*9.62*
932042	*AC2-012 E*	*15.7*
932501	*AC2-070 C*	*2.9*
932502	*AC2-070 E*	*1.2*
932531	*AC2-073 C*	*3.1*
932532	*AC2-073 E*	*1.56*
932581	*AC2-078 C*	*4.75*
932582	*AC2-078 E*	*7.75*
932591	*AC2-079 C*	*6.82*

932592	*AC2-079 E*	*11.13*
932831	*AC2-110 C*	*1.74*
932832	*AC2-110 E*	*2.84*
933061	*AC2-130*	*3.48*
933071	*AC2-131 1*	*2.36*
933081	*AC2-131 2*	*1.07*
933111	*AC2-132 1*	*1.24*
933121	*AC2-132 2*	*0.63*
933261	*AC2-137 C*	*3.16*
933262	*AC2-137 E*	*2.05*
933271	*AC2-138 C*	*0.87*
933272	*AC2-138 E*	*1.09*
933291	*AC2-141 C*	*27.16*
933292	*AC2-141 E*	*11.59*
933451	*AC2-158 C*	*4.63*
933452	*AC2-158 E*	*4.63*
933471	*AC2-161 C*	*2.47*
933472	*AC2-161 E*	*1.27*
933481	*AC2-162 C*	*4.17*
933482	*AC2-162 E*	*2.15*
933711	*AC2-194 C*	*0.98*
933712	*AC2-194 E*	*1.59*
933731	*AC2-196 C*	*1.66*
933732	*AC2-196 E*	*1.1*
933991	*AD1-023 C*	*11.29*
933992	*AD1-023 E*	*6.14*

934011	*AD1-025 C O1*	*20.82*
934012	*AD1-025 E O1*	*12.33*
934061	*AD1-033 C O1*	*6.96*
934062	*AD1-033 E O1*	*4.64*
934071	*AD1-034 C O1*	*10.6*
934072	*AD1-034 E O1*	*6.87*
934141	*AD1-041 C O1*	*6.74*
934142	*AD1-041 E O1*	*4.49*
934191	*AD1-046 C*	*4.71*
934192	*AD1-046 E*	*3.14*
934201	*AD1-047 C*	*6.75*
934202	*AD1-047 E*	*4.5*
934211	*AD1-048 C*	*3.82*
934212	*AD1-048 E*	*1.93*
934391	*AD1-063 C*	*2.1*
934392	*AD1-063 E*	*1.4*
934521	*AD1-076 C O1*	*46.88*
934522	*AD1-076 E O1*	*23.87*
934571	*AD1-082 C O1*	*8.27*
934572	*AD1-082 E O1*	*4.72*
934781	*AD1-105 C*	*8.08*
934782	*AD1-105 E*	*5.62*
LTF	*AD1-120*	*5.93*
LTF	*AD1-121*	*5.89*
935111	*AD1-144 C*	*1.68*
935112	*AD1-144 E*	*0.92*

935161	*AD1-151 C O1*	*19.89*
935162	*AD1-151 E O1*	*13.26*
935211	*AD1-156 C*	*2.56*
935212	*AD1-156 E*	*1.71*
LTF	*CARR*	*0.67*
LTF	*CBM-S1*	*3.86*
LTF	*CBM-S2*	*13.84*
LTF	*CBM-W1*	*0.21*
LTF	*CBM-W2*	*17.91*
LTF	*CIN*	*0.13*
LTF	*CLIFTY*	*1.62*
LTF	*CPLE*	*4.75*
LTF	*DEARBORN*	*0.47*
LTF	*G-007*	*2.31*
LTF	*IPL*	*0.06*
LTF	*LGEE*	*0.05*
LTF	*MEC*	*1.99*
LTF	*O-066*	*7.73*
LTF	*RENSSELAER*	*0.53*
LTF	*ROSETON*	*3.84*
292791	*U1-032 E*	*4.87*
297087	*V2-040*	*0.28*
900672	*V4-068 E*	*0.26*
901082	*W1-029E*	*41.82*
LTF	*WEC*	*0.06*
907092	*X1-038 E*	*5.47*

913392	*Y1-086 E*	*1.99*
916042	*Z1-036 E*	*40.84*
916192	*Z1-068 E*	*1.76*
917122	*Z2-027 E*	*0.96*
917592	*Z2-099 E*	*0.38*
918492	*AA1-063AE OP*	*3.35*
918512	*AA1-065 E OP*	*3.74*
918691	*AA1-083*	*1.16*
919152	*AA1-139 E*	*5.92*
919211	*AA1-145*	*19.79*
919732	*AA2-059 E*	*0.5*
LTF	*AA2-074*	*3.23*
920022	*AA2-086 E*	*0.21*
920042	*AA2-088 E*	*9.15*
920691	*AA2-178 C*	*8.43*
920692	*AA2-178 E*	*3.61*
930051	*AB1-013 C*	*2.54*
930052	*AB1-013 E*	*17.02*
930121	*AB1-027 C*	*0.87*
930122	*AB1-027 E*	*1.89*
930861	*AB1-132 C*	*11.78*
930862	*AB1-132 E*	*5.05*
931231	*AB1-173 C*	*1.9*
931232	*AB1-173 E*	*0.89*
931241	*AB1-173AC*	*1.9*
931242	*AB1-173AE*	*0.89*

923801	*AB2-015 C O1*	*7.73*
923802	*AB2-015 E O1*	*6.34*
923831	*AB2-022 C*	*2.1*
923832	*AB2-022 E*	*1.13*
923842	*AB2-024 E*	*1.49*
923852	*AB2-025 E*	*1.09*
923862	*AB2-026 E*	*0.88*
923911	*AB2-031 C O1*	*1.88*
923912	*AB2-031 E O1*	*0.93*
923991	*AB2-040 C O1*	*6.19*
923992	*AB2-040 E O1*	*5.06*
924061	*AB2-050*	*1.16*
924071	*AB2-051*	*128.86*
924241	*AB2-068 O1*	*177.95*
924381	*AB2-087 C*	*0.48*
924382	*AB2-087 E*	*0.22*
924501	*AB2-099 C*	*0.49*
924502	*AB2-099 E*	*0.21*
924511	*AB2-100 C*	*10.48*
924512	*AB2-100 E*	*5.16*
924811	*AB2-134 C O1*	*15.87*
924812	*AB2-134 E O1*	*15.6*
925051	*AB2-160 C O1*	*7.18*
925052	*AB2-160 E O1*	*11.71*
925061	*AB2-161 C O1*	*3.63*
925062	*AB2-161 E O1*	*5.92*

925171	*AB2-174 C O1*	*5.96*
925172	*AB2-174 E O1*	*5.39*
925281	*AB2-186 C*	*0.55*
925282	*AB2-186 E*	*0.24*
925291	*AB2-188 C O1*	*2.08*
925292	*AB2-188 E O1*	*0.93*
925331	*AB2-190 C*	*24.76*
925332	*AB2-190 E*	*10.61*
925522	*AC1-027 E*	*1.07*
925692	*AC1-045 E*	*0.92*
925861	*AC1-065 C*	*4.36*
925862	*AC1-065 E*	*7.11*
926071	*AC1-086 C*	*17.34*
926072	*AC1-086 E*	*7.89*
926291	*AC1-107*	*268.61*
926411	*AC1-112 C*	*0.68*
926412	*AC1-112 E*	*1.93*
926441	*AC1-115 C*	*1.01*
926442	*AC1-115 E*	*1.64*
926472	*AC1-118 E*	*1.07*
926551	*AC1-134*	*14.83*
926662	*AC1-147 E*	*1.25*
926741	*AC1-159*	*62.13*
926751	*AC1-161 C*	*27.16*
926752	*AC1-161 E*	*11.59*
926771	*AC1-163 C*	*1.63*

926772	*AC1-163 E*	*0.76*
926781	*AC1-164 C*	*58.41*
926782	*AC1-164 E*	*26.24*
927041	*AC1-191 C*	*17.46*
927042	*AC1-191 E*	*8.7*
927111	*AC1-206 C*	*9.15*
927112	*AC1-206 E*	*4.32*
927221	*AC1-216 C O1*	*12.11*
927222	*AC1-216 E O1*	*9.53*

Appendix 4

(DVP - DVP) The 6CHESTF B-6BASIN 230 kV line (from bus 314287 to bus 314276 ckt 1) loads from 124.66% to 125.76% (**DC power flow**) of its emergency rating (449 MVA) for the single line contingency outage of 'DVP_P1-2: LN 563'. This project contributes approximately 4.93 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 563'
OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315065	*1CHESTF6*	*33.33*
315131	*1EDGECMA*	*3.18*
315132	*1EDGECMB*	*3.18*
315139	*1GASTONA*	*1.58*
315141	*1GASTONB*	*1.58*
315119	*1GRAVEL3*	*1.24*
315120	*1GRAVEL4*	*1.26*
315121	*1GRAVEL5*	*1.24*
315122	*1GRAVEL6*	*1.26*
315117	*1GRAVELC*	*0.43*
315074	*1HOPCGN1*	*5.63*
315075	*1HOPCGN2*	*5.56*
315077	*1HOPHCF1*	*1.78*
315078	*1HOPHCF2*	*1.78*
315079	*1HOPHCF3*	*1.78*
315080	*1HOPHCF4*	*2.7*
315076	*1HOPPOLC*	*1.27*
315116	*1SURRY 1*	*12.47*

314314	*3LOCKS*	*0.06*
314315	*3LOCKS E*	*0.77*
932041	*AC2-012 C*	*3.21*
932581	*AC2-078 C*	*2.86*
932591	*AC2-079 C*	*3.07*
932631	*AC2-084 C*	*3.22*
932701	*AC2-093 C*	*23.37*
933451	*AC2-158 C*	*1.94*
933461	*AC2-159 C*	*2.55*
933471	*AC2-161 C*	*0.89*
933711	*AC2-194 C*	*0.35*
933731	*AC2-196 C*	*0.55*
933991	*AD1-023 C*	*4.54*
934011	*AD1-025 C O1*	*9.21*
934041	*AD1-029 C*	*3.98*
934061	*AD1-033 C O1*	*2.31*
934071	*AD1-034 C O1*	*4.93*
934201	*AD1-047 C*	*3.58*
934331	*AD1-057 C O1*	*3.86*
934521	*AD1-076 C O1*	*18.6*
934571	*AD1-082 C O1*	*4.27*
935111	*AD1-144 C*	*0.56*
935161	*AD1-151 C O1*	*8.8*
935211	*AD1-156 C*	*1.97*
LTF	*CARR*	*0.2*
LTF	*CBM-S1*	*3.34*

LTF	*CBM-S2*	*7.3*
LTF	*CBM-W1*	*6.1*
LTF	*CBM-W2*	*17.57*
LTF	*CIN*	*1.4*
LTF	*CPLE*	*2.35*
LTF	*IPL*	*0.89*
LTF	*LGEE*	*0.31*
LTF	*MEC*	*3.38*
LTF	*MECS*	*1.11*
LTF	*RENSSELAER*	*0.16*
LTF	*ROSETON*	*1.15*
LTF	*WEC*	*0.39*
914231	*Y2-077*	*0.72*
LTF	*AA2-074*	*1.6*
920631	*AA2-169 C*	*0.75*
920691	*AA2-178 C*	*3.22*
930051	*AB1-013 C*	*0.97*
930401	*AB1-081 C*	*3.05*
930861	*AB1-132 C*	*6.17*
931231	*AB1-173 C*	*1.01*
931241	*AB1-173AC*	*1.01*
923801	*AB2-015 C O1*	*3.22*
923831	*AB2-022 C*	*0.73*
923851	*AB2-025 C*	*0.31*
923911	*AB2-031 C O1*	*1.*
923941	*AB2-035 C*	*0.11*

923991	*AB2-040 C O1*	*3.28*
924071	*AB2-051*	*42.84*
924151	*AB2-059 C O1*	*3.6*
924381	*AB2-087 C*	*0.21*
924391	*AB2-088 C*	*0.15*
924491	*AB2-098 C*	*0.19*
924501	*AB2-099 C*	*0.22*
924511	*AB2-100 C*	*6.19*
924811	*AB2-134 C O1*	*7.02*
925051	*AB2-160 C O1*	*3.33*
925061	*AB2-161 C O1*	*1.87*
925121	*AB2-169 C*	*2.2*
925171	*AB2-174 C O1*	*3.2*
925281	*AB2-186 C*	*0.2*
925291	*AB2-188 C O1*	*0.79*
925331	*AB2-190 C*	*10.95*
925591	*AC1-034 C*	*2.34*
925821	*AC1-061*	*< 0.01*
926071	*AC1-086 C*	*9.08*
926201	*AC1-098 C*	*2.26*
926211	*AC1-099 C*	*0.76*
926741	*AC1-159*	*20.65*
926771	*AC1-163 C*	*0.71*
927021	*AC1-189 C*	*2.92*
927111	*AC1-206 C*	*5.47*
927141	*AC1-208 C*	*3.41*

927221	*AC1-216 C O1*	*5.36*

OPTION 2

Appendix 1

(DVP - DVP) The 6HORNRTN-6MORNSTR 230 kV line (from bus 314579 to bus 313845 ckt 1) loads from 98.37% to 99.89% (**DC power flow**) of its emergency rating (442 MVA) for the single line contingency outage of 'DVP_P1-2: LN 2141'. This project contributes approximately 6.72 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 2141'
OPEN BRANCH FROM BUS 314561 TO BUS 314583 CKT 1 /* 6CAROLNA 230.00 - 6LAKEVEW 230.00
END

Bus Number	*Bus Name*	*Full Contribution*
315139	*1GASTONA*	*9.67*
315141	*1GASTONB*	*9.67*
315136	*1ROSEMG1*	*7.63*
315138	*1ROSEMG2*	*3.58*
315137	*1ROSEMS1*	*4.73*
314704	*3LAWRENC*	*0.27*
934043	*AD1-029 BAT*	*8.06*
934071	*AD1-034 C O2*	*6.72*
934201	*AD1-047 C*	*4.21*
935211	*AD1-156 C*	*0.61*
LTF	*AMIL*	*0.32*
LTF	*BAYOU*	*1.71*
LTF	*BIG_CAJUN1*	*2.69*
LTF	*BIG_CAJUN2*	*5.42*
LTF	*BLUEG*	*1.68*
LTF	*CALDERWOOD*	*1.*
LTF	*CANNELTON*	*0.32*
LTF	*CATAWBA*	*0.98*
LTF	*CBM-N*	*< 0.01*
LTF	*CELEVELAND*	*2.79*
LTF	*CHEOAH*	*0.94*
LTF	*CHILHOWEE*	*0.33*
LTF	*CHOCTAW*	*1.83*
LTF	*CLIFTY*	*6.12*
LTF	*COTTONWOOD*	*6.68*
LTF	*DEARBORN*	*0.6*
LTF	*EDWARDS*	*0.52*
LTF	*ELMERSMITH*	*0.94*
LTF	*FARMERCITY*	*0.41*
LTF	*G-007A*	*0.68*

LTF	*GIBSON*	*0.59*
LTF	*HAMLET*	*4.01*
LTF	*MORGAN*	*2.96*
LTF	*NEWTON*	*1.43*
LTF	*NYISO*	*0.04*
LTF	*O-066A*	*0.31*
LTF	*PRAIRIE*	*3.08*
LTF	*ROWAN*	*2.02*
LTF	*SANTEETLA*	*0.28*
LTF	*SMITHLAND*	*0.27*
LTF	*TATANKA*	*0.69*
LTF	*TILTON*	*0.61*
LTF	*TRIMBLE*	*0.32*
LTF	*TVA*	*1.24*
LTF	*UNIONPOWER*	*1.79*
LTF	*VFT*	*1.81*
LTF	*X1-078*	*0.53*
930861	*AB1-132 C*	*37.6*
931231	*AB1-173 C*	*1.18*
931241	*AB1-173AC*	*1.18*
923851	*AB2-025 C*	*0.38*
923911	*AB2-031 C O1*	*1.17*
923991	*AB2-040 C O1*	*3.85*
924511	*AB2-100 C*	*17.83*
925171	*AB2-174 C O1*	*4.45*
926071	*AC1-086 C*	*55.37*
927111	*AC1-206 C*	*14.05*

Appendix 2

(DVP - CPLE) The 6MORNSTR-6ROCKYMT230T 230 kV line (from bus 313845 to bus 304222 ckt 1) loads from 136.36% to 137.04% (**DC power flow**) of its emergency rating (374 MVA) for the tower line contingency outage of 'DVP_P7-1: LN 81-2056'. This project contributes approximately 5.65 MW to the thermal violation.

CONTINGENCY 'DVP_P7-1: LN 81-2056'
OPEN BRANCH FROM BUS 314559 TO BUS 314578 CKT 1 /* 3CAROLNA 115.00 - 3HORNRTN 115.00
OPEN BRANCH FROM BUS 314578 TO BUS 314598 CKT 1 /* 3HORNRTN 115.00 - 3ROAN DP 115.00
OPEN BRANCH FROM BUS 314598 TO BUS 314628 CKT 1 /* 3ROAN DP 115.00 - 3DARLINGT DP115.00
OPEN BUS 314578 /* ISLAND: 3HORNRTN 115.00
OPEN BUS 314598 /* ISLAND: 3ROAN DP 115.00
OPEN BRANCH FROM BUS 304226 TO BUS 314591 CKT 1 /* 6PA-RMOUNT#4230.00 - 6NASH 230.00
OPEN BRANCH FROM BUS 313845 TO BUS 314591 CKT 1 /* 6MORNSTR 230.00 - 6NASH 230.00
OPEN BRANCH FROM BUS 304226 TO BUS 304222 CKT 1 /* 6PA-RMOUNT#4230.00 - 6ROCKYMT230T
OPEN BUS 304226 /* ISLAND
OPEN BUS 314591 /* ISLAND: 6NASH 230.00
END

Bus Number	*Bus Name*	*Full Contribution*
315131	*1EDGECMA*	*24.8*
315132	*1EDGECMB*	*24.8*
315139	*1GASTONA*	*4.01*
315141	*1GASTONB*	*4.01*
315126	*1ROARAP2*	*1.22*
315128	*1ROARAP4*	*1.18*
315136	*1ROSEMG1*	*3.36*
315138	*1ROSEMG2*	*1.57*
315137	*1ROSEMS1*	*2.09*
314557	*3BETHELC*	*1.61*
314554	*3BTLEBRO*	*1.08*
314566	*3CRESWEL*	*1.09*
314572	*3EMPORIA*	*0.27*
314582	*3KELFORD*	*0.7*
314603	*3SCOT NK*	*3.23*
314617	*3TUNIS*	*0.55*
314541	*3WATKINS*	*0.33*
314620	*6CASHIE*	*0.49*
314574	*6EVERETS*	*1.81*

314594	*6PLYMOTH*	*0.44*
932631	*AC2-084 C*	*9.38*
932632	*AC2-084 E*	*4.62*
933451	*AC2-158 C*	*3.44*
933452	*AC2-158 E*	*3.44*
933461	*AC2-159 C*	*4.87*
933462	*AC2-159 E*	*4.87*
933991	*AD1-023 C*	*7.25*
933992	*AD1-023 E*	*3.95*
934041	*AD1-029 C*	*11.6*
934042	*AD1-029 E*	*7.65*
934071	*AD1-034 C O2*	*3.43*
934072	*AD1-034 E O2*	*2.22*
934201	*AD1-047 C*	*5.53*
934202	*AD1-047 E*	*3.69*
934331	*AD1-057 C O2*	*11.83*
934332	*AD1-057 E O2*	*6.31*
934521	*AD1-076 C O2*	*31.66*
934522	*AD1-076 E O2*	*16.12*
LTF	*AMIL*	*0.38*
LTF	*BAYOU*	*1.98*
LTF	*BIG_CAJUN1*	*3.12*
LTF	*BIG_CAJUN2*	*6.28*
LTF	*BLUEG*	*1.99*
LTF	*CALDERWOOD*	*1.17*
LTF	*CANNELTON*	*0.38*
LTF	*CARR*	*< 0.01*
LTF	*CATAWBA*	*1.14*
LTF	*CELEVELAND*	*3.25*
LTF	*CHEOAH*	*1.09*
LTF	*CHILHOWEE*	*0.38*
LTF	*CHOCTAW*	*2.13*
LTF	*CLIFTY*	*7.32*
LTF	*COTTONWOOD*	*7.76*
LTF	*DEARBORN*	*0.72*
LTF	*EDWARDS*	*0.61*
LTF	*ELMERSMITH*	*1.11*
LTF	*FARMERCITY*	*0.48*
LTF	*G-007A*	*0.76*
LTF	*GIBSON*	*0.69*
LTF	*HAMLET*	*4.52*
LTF	*MORGAN*	*3.43*
LTF	*NEWTON*	*1.68*
LTF	*O-066A*	*0.35*
LTF	*PRAIRIE*	*3.62*

LTF	*ROWAN*	*2.4*
LTF	*SANTEETLA*	*0.32*
LTF	*SMITHLAND*	*0.32*
LTF	*TATANKA*	*0.82*
LTF	*TILTON*	*0.73*
LTF	*TRIMBLE*	*0.38*
LTF	*TVA*	*1.45*
LTF	*UNIONPOWER*	*2.08*
900671	*V4-068 C*	*0.07*
900672	*V4-068 E*	*0.18*
LTF	*VFT*	*2.03*
LTF	*X1-078*	*0.59*
917331	*Z2-043 C*	*0.38*
917332	*Z2-043 E*	*0.84*
917341	*Z2-044 C*	*0.34*
917342	*Z2-044 E*	*0.75*
917511	*Z2-088 C OP1*	*1.68*
917512	*Z2-088 E OP1*	*6.74*
917592	*Z2-099 E*	*0.25*
918411	*AA1-050*	*1.41*
918491	*AA1-063AC OP*	*1.14*
918492	*AA1-063AE OP*	*2.74*
918511	*AA1-065 C OP*	*1.16*
918512	*AA1-065 E OP*	*2.92*
918531	*AA1-067 C*	*0.25*
918532	*AA1-067 E*	*0.54*
918561	*AA1-072 C*	*0.06*
918562	*AA1-072 E*	*0.14*
919691	*AA2-053 C*	*1.27*
919692	*AA2-053 E*	*2.78*
919701	*AA2-057 C*	*1.72*
919702	*AA2-057 E*	*4.39*
919821	*AA2-068 C*	*0.51*
919822	*AA2-068 E*	*1.19*
920022	*AA2-086 E*	*0.14*
920042	*AA2-088 E*	*5.93*
920591	*AA2-165 C*	*0.23*
920592	*AA2-165 E*	*0.58*
920671	*AA2-174 C*	*0.06*
920672	*AA2-174 E*	*0.32*
920691	*AA2-178 C*	*4.34*
920692	*AA2-178 E*	*1.86*
930051	*AB1-013 C*	*1.31*
930052	*AB1-013 E*	*8.77*
930401	*AB1-081 C*	*14.55*

930402	*AB1-081 E*	*6.23*
930861	*AB1-132 C*	*15.61*
930862	*AB1-132 E*	*6.69*
931231	*AB1-173 C*	*1.56*
931232	*AB1-173 E*	*0.73*
931241	*AB1-173AC*	*1.56*
931242	*AB1-173AE*	*0.73*
923801	*AB2-015 C O1*	*3.93*
923802	*AB2-015 E O1*	*3.23*
923911	*AB2-031 C O1*	*1.54*
923912	*AB2-031 E O1*	*0.76*
923941	*AB2-035 C*	*0.68*
923942	*AB2-035 E*	*0.29*
923991	*AB2-040 C O1*	*5.07*
923992	*AB2-040 E O1*	*4.15*
924151	*AB2-059 C O1*	*17.14*
924152	*AB2-059 E O1*	*8.83*
924381	*AB2-087 C*	*0.4*
924382	*AB2-087 E*	*0.19*
924391	*AB2-088 C*	*0.87*
924392	*AB2-088 E*	*0.42*
924491	*AB2-098 C*	*0.42*
924492	*AB2-098 E*	*0.18*
924501	*AB2-099 C*	*0.4*
924502	*AB2-099 E*	*0.17*
924511	*AB2-100 C*	*8.29*
924512	*AB2-100 E*	*4.08*
925121	*AB2-169 C*	*4.03*
925122	*AB2-169 E*	*3.62*
925171	*AB2-174 C O1*	*4.74*
925172	*AB2-174 E O1*	*4.29*
925291	*AB2-188 C O1*	*1.07*
925292	*AB2-188 E O1*	*0.48*
925591	*AC1-034 C*	*13.75*
925592	*AC1-034 E*	*10.37*
926071	*AC1-086 C*	*22.99*
926072	*AC1-086 E*	*10.47*
926201	*AC1-098 C*	*6.58*
926202	*AC1-098 E*	*3.92*
926211	*AC1-099 C*	*2.2*
926212	*AC1-099 E*	*1.29*
926771	*AC1-163 C*	*1.32*
926772	*AC1-163 E*	*0.62*
927021	*AC1-189 C*	*12.21*
927022	*AC1-189 E*	*6.08*

927111	*AC1-206 C*	*6.69*
927112	*AC1-206 E*	*3.16*
927141	*AC1-208 C*	*10.44*
927142	*AC1-208 E*	*4.63*

Appendix 3

(DVP - DVP) The 8ELMONT 500/230 kV transformer (from bus 314218 to bus 314908 ckt 1) loads from 121.83% to 122.31% (**DC power flow**) of its load dump rating (1051 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: H2T557'. This project contributes approximately 12.9 MW to the thermal violation.

CONTINGENCY 'DVP_P4-2: H2T557' /* ELMONT
OPEN BRANCH FROM BUS 314908 TO BUS 314903 CKT 1 /*ELMONT TO CHICKAHOMINY (LINE 557)
OPEN BRANCH FROM BUS 314903 TO BUS 314214 CKT 1 /*CHICKAHOMINY 500-230 (TX#1)
OPEN BRANCH FROM BUS 314908 TO BUS 314218 CKT 2 /*ELMONT 500-230 (TX#2)
END

Bus Number	*Bus Name*	*Full Contribution*
315067	*1DARBY 1*	*4.99*
315068	*1DARBY 2*	*4.99*
315069	*1DARBY 3*	*5.01*
315070	*1DARBY 4*	*5.01*
315043	*1FOUR RIVERA*	*6.63*
315044	*1FOUR RIVERB*	*5.13*
315045	*1FOUR RIVERC*	*6.63*
315046	*1FOUR RIVERD*	*5.13*
315047	*1FOUR RIVERE*	*5.13*
315048	*1FOUR RIVERF*	*6.63*
315074	*1HOPCGN1*	*11.28*
315075	*1HOPCGN2*	*11.14*
315083	*1SPRUNCA*	*14.95*
315084	*1SPRUNCB*	*14.95*
315085	*1SPRUNCC*	*11.08*
315086	*1SPRUNCD*	*11.08*
315073	*1STONECA*	*9.36*
314566	*3CRESWEL*	*2.11*
314572	*3EMPORIA*	*0.36*
314315	*3LOCKS E*	*1.65*
314617	*3TUNIS*	*0.71*
314539	*3UNCAMP*	*2.19*
314541	*3WATKINS*	*0.61*
314620	*6CASHIE*	*0.72*
314229	*6MT RD221*	*1.41*
314236	*6NRTHEST*	*0.37*
314189	*6PAPERMILL*	*8.82*
314594	*6PLYMOTH*	*0.73*
314250	*6ROCKVILLE*	*0.4*

314256	*6ROCKVILLE E*	*1.15*
314648	*6SUNBURY*	*0.81*
314651	*6WINFALL*	*1.59*
932041	*AC2-012 C*	*9.62*
932042	*AC2-012 E*	*15.7*
932501	*AC2-070 C*	*2.9*
932502	*AC2-070 E*	*1.2*
932531	*AC2-073 C*	*3.1*
932532	*AC2-073 E*	*1.56*
932581	*AC2-078 C*	*4.75*
932582	*AC2-078 E*	*7.75*
932591	*AC2-079 C*	*6.82*
932592	*AC2-079 E*	*11.13*
932831	*AC2-110 C*	*1.74*
932832	*AC2-110 E*	*2.84*
933061	*AC2-130*	*3.48*
933071	*AC2-131 1*	*2.36*
933081	*AC2-131 2*	*1.07*
933111	*AC2-132 1*	*1.24*
933121	*AC2-132 2*	*0.63*
933261	*AC2-137 C*	*3.16*
933262	*AC2-137 E*	*2.05*
933271	*AC2-138 C*	*0.87*
933272	*AC2-138 E*	*1.09*
933291	*AC2-141 C*	*27.16*
933292	*AC2-141 E*	*11.59*
933451	*AC2-158 C*	*4.63*
933452	*AC2-158 E*	*4.63*
933471	*AC2-161 C*	*2.47*
933472	*AC2-161 E*	*1.27*
933481	*AC2-162 C*	*4.17*
933482	*AC2-162 E*	*2.15*
933711	*AC2-194 C*	*0.98*
933712	*AC2-194 E*	*1.59*
933731	*AC2-196 C*	*1.66*
933732	*AC2-196 E*	*1.1*
933991	*AD1-023 C*	*11.29*
933992	*AD1-023 E*	*6.14*
934011	*AD1-025 C O2*	*20.82*
934012	*AD1-025 E O2*	*12.33*
934061	*AD1-033 C O2*	*6.97*
934062	*AD1-033 E O2*	*4.65*
934071	*AD1-034 C O2*	*7.83*
934072	*AD1-034 E O2*	*5.07*
934141	*AD1-041 C O2*	*7.07*

934142	*AD1-041 E O2*	*4.71*
934191	*AD1-046 C*	*4.71*
934192	*AD1-046 E*	*3.14*
934201	*AD1-047 C*	*6.75*
934202	*AD1-047 E*	*4.5*
934211	*AD1-048 C*	*3.82*
934212	*AD1-048 E*	*1.93*
934391	*AD1-063 C*	*2.1*
934392	*AD1-063 E*	*1.4*
934521	*AD1-076 C O2*	*44.5*
934522	*AD1-076 E O2*	*22.66*
934571	*AD1-082 C O2*	*8.78*
934572	*AD1-082 E O2*	*5.01*
934781	*AD1-105 C*	*8.08*
934782	*AD1-105 E*	*5.62*
LTF	*AD1-120*	*5.93*
LTF	*AD1-121*	*5.89*
935111	*AD1-144 C*	*1.68*
935112	*AD1-144 E*	*0.92*
935161	*AD1-151 C O2*	*15.11*
935162	*AD1-151 E O2*	*10.07*
935211	*AD1-156 C*	*2.56*
935212	*AD1-156 E*	*1.71*
LTF	*CARR*	*0.67*
LTF	*CBM-S1*	*3.86*
LTF	*CBM-S2*	*13.84*
LTF	*CBM-W1*	*0.21*
LTF	*CBM-W2*	*17.92*
LTF	*CIN*	*0.13*
LTF	*CLIFTY*	*1.61*
LTF	*CPLE*	*4.75*
LTF	*DEARBORN*	*0.47*
LTF	*G-007*	*2.31*
LTF	*IPL*	*0.06*
LTF	*LGEE*	*0.05*
LTF	*MEC*	*1.99*
LTF	*O-066*	*7.73*
LTF	*RENSSELAER*	*0.53*
LTF	*ROSETON*	*3.84*
292791	*U1-032 E*	*4.87*
297087	*V2-040*	*0.28*
900672	*V4-068 E*	*0.26*
901082	*W1-029E*	*41.82*
LTF	*WEC*	*0.06*
907092	*X1-038 E*	*5.47*

913392	*Y1-086 E*	*1.99*
916042	*Z1-036 E*	*40.84*
916192	*Z1-068 E*	*1.76*
917122	*Z2-027 E*	*0.96*
917592	*Z2-099 E*	*0.38*
918492	*AA1-063AE OP*	*3.35*
918512	*AA1-065 E OP*	*3.74*
918691	*AA1-083*	*1.16*
919152	*AA1-139 E*	*5.92*
919211	*AA1-145*	*19.79*
919732	*AA2-059 E*	*0.5*
LTF	*AA2-074*	*3.23*
920022	*AA2-086 E*	*0.21*
920042	*AA2-088 E*	*9.15*
920691	*AA2-178 C*	*8.43*
920692	*AA2-178 E*	*3.61*
930051	*AB1-013 C*	*2.54*
930052	*AB1-013 E*	*17.02*
930121	*AB1-027 C*	*0.87*
930122	*AB1-027 E*	*1.89*
930861	*AB1-132 C*	*11.78*
930862	*AB1-132 E*	*5.05*
931231	*AB1-173 C*	*1.9*
931232	*AB1-173 E*	*0.89*
931241	*AB1-173AC*	*1.9*
931242	*AB1-173AE*	*0.89*
923801	*AB2-015 C O1*	*7.73*
923802	*AB2-015 E O1*	*6.34*
923831	*AB2-022 C*	*2.1*
923832	*AB2-022 E*	*1.13*
923842	*AB2-024 E*	*1.49*
923852	*AB2-025 E*	*1.09*
923862	*AB2-026 E*	*0.88*
923911	*AB2-031 C O1*	*1.88*
923912	*AB2-031 E O1*	*0.93*
923991	*AB2-040 C O1*	*6.19*
923992	*AB2-040 E O1*	*5.06*
924061	*AB2-050*	*1.16*
924071	*AB2-051*	*128.86*
924241	*AB2-068 O1*	*177.95*
924381	*AB2-087 C*	*0.48*
924382	*AB2-087 E*	*0.22*
924501	*AB2-099 C*	*0.49*
924502	*AB2-099 E*	*0.21*
924511	*AB2-100 C*	*10.48*

924512	*AB2-100 E*	*5.16*
924811	*AB2-134 C O1*	*15.87*
924812	*AB2-134 E O1*	*15.6*
925051	*AB2-160 C O1*	*7.18*
925052	*AB2-160 E O1*	*11.71*
925061	*AB2-161 C O1*	*3.63*
925062	*AB2-161 E O1*	*5.92*
925171	*AB2-174 C O1*	*5.96*
925172	*AB2-174 E O1*	*5.39*
925281	*AB2-186 C*	*0.55*
925282	*AB2-186 E*	*0.24*
925291	*AB2-188 C O1*	*2.08*
925292	*AB2-188 E O1*	*0.93*
925331	*AB2-190 C*	*24.76*
925332	*AB2-190 E*	*10.61*
925522	*AC1-027 E*	*1.07*
925692	*AC1-045 E*	*0.92*
925861	*AC1-065 C*	*4.36*
925862	*AC1-065 E*	*7.11*
926071	*AC1-086 C*	*17.34*
926072	*AC1-086 E*	*7.89*
926291	*AC1-107*	*268.61*
926411	*AC1-112 C*	*0.68*
926412	*AC1-112 E*	*1.93*
926441	*AC1-115 C*	*1.01*
926442	*AC1-115 E*	*1.64*
926472	*AC1-118 E*	*1.07*
926551	*AC1-134*	*14.83*
926662	*AC1-147 E*	*1.25*
926741	*AC1-159*	*62.13*
926751	*AC1-161 C*	*27.16*
926752	*AC1-161 E*	*11.59*
926771	*AC1-163 C*	*1.63*
926772	*AC1-163 E*	*0.76*
926781	*AC1-164 C*	*58.41*
926782	*AC1-164 E*	*26.24*
927041	*AC1-191 C*	*17.46*
927042	*AC1-191 E*	*8.7*
927111	*AC1-206 C*	*9.15*
927112	*AC1-206 E*	*4.32*
927221	*AC1-216 C O1*	*12.11*
927222	*AC1-216 E O1*	*9.53*

Appendix 4

(DVP - DVP) The 6CARSON-6CHRL249 230 kV line (from bus 314282 to bus 314285 ckt 1) loads from 107.6% to 109.72% (**DC power flow**) of its load dump rating (684 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 562T563'. This project contributes approximately 15.19 MW to the thermal violation.

CONTINGENCY 'DVP_P4-2: 562T563' /*CARSON
OPEN BRANCH FROM BUS 314902 TO BUS 314923 CKT 1 /*CARSON TO MIDLOTHIAN
OPEN BRANCH FROM BUS 314914 TO BUS 314902 CKT 1 /*CARSON 500.00 - 8SEPTA 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315105	*1BRUNSWICKS1*	*11.25*
315131	*1EDGECMA*	*4.76*
315132	*1EDGECMB*	*4.76*
315139	*1GASTONA*	*2.46*
315141	*1GASTONB*	*2.46*
315136	*1ROSEMG1*	*1.7*
315138	*1ROSEMG2*	*0.8*
315137	*1ROSEMS1*	*1.06*
315073	*1STONECA*	*-2.58*
314557	*3BETHELC*	*0.39*
314554	*3BTLEBRO*	*0.41*
314572	*3EMPORIA*	*0.33*
314578	*3HORNRTN*	*1.92*
314582	*3KELFORD*	*0.39*
314704	*3LAWRENC*	*0.28*
314603	*3SCOT NK*	*1.62*
314617	*3TUNIS*	*0.36*
314541	*3WATKINS*	*0.24*
314620	*6CASHIE*	*0.31*
314574	*6EVERETS*	*1.06*
932631	*AC2-084 C*	*4.46*
932632	*AC2-084 E*	*2.2*
932701	*AC2-093 C*	*40.58*
932702	*AC2-093 E*	*23.21*
932761	*AC2-100 C*	*2.16*
932762	*AC2-100 E*	*1.05*
933451	*AC2-158 C*	*2.15*
933452	*AC2-158 E*	*2.15*
933461	*AC2-159 C*	*3.44*
933462	*AC2-159 E*	*3.44*
933991	*AD1-023 C*	*4.58*

933992	*AD1-023 E*	*2.49*
934041	*AD1-029 C*	*5.52*
934042	*AD1-029 E*	*3.64*
934071	*AD1-034 C O2*	*9.22*
934072	*AD1-034 E O2*	*5.97*
934201	*AD1-047 C*	*5.74*
934202	*AD1-047 E*	*3.83*
934231	*AD1-050 C*	*2.37*
934232	*AD1-050 E*	*1.3*
934311	*AD1-055 C*	*1.03*
934312	*AD1-055 E*	*0.27*
934331	*AD1-057 C O2*	*5.2*
934332	*AD1-057 E O2*	*2.77*
934341	*AD1-058 C*	*2.35*
934342	*AD1-058 E*	*0.6*
934521	*AD1-076 C O2*	*19.48*
934522	*AD1-076 E O2*	*9.92*
934611	*AD1-087 C O2*	*3.75*
934612	*AD1-087 E O2*	*1.75*
934621	*AD1-088 C O2*	*6.62*
934622	*AD1-088 E O2*	*3.11*
LTF	*AD1-120*	*5.26*
LTF	*AD1-121*	*5.24*
934911	*AD1-123 C*	*0.45*
934912	*AD1-123 E*	*0.23*
934991	*AD1-131 C*	*0.77*
934992	*AD1-131 E*	*0.51*
935171	*AD1-152 C O2*	*3.36*
935172	*AD1-152 E O2*	*2.24*
935211	*AD1-156 C*	*1.*
935212	*AD1-156 E*	*0.67*
LTF	*CARR*	*0.18*
LTF	*CBM-S1*	*6.32*
LTF	*CBM-S2*	*12.36*
LTF	*CBM-W1*	*13.64*
LTF	*CBM-W2*	*33.99*
LTF	*CIN*	*3.08*
LTF	*CPLE*	*3.87*
LTF	*G-007*	*1.04*
LTF	*IPL*	*1.96*
LTF	*LGEE*	*0.67*
LTF	*MEC*	*6.97*
LTF	*MECS*	*3.01*
LTF	*O-066*	*3.47*
LTF	*RENSSELAER*	*0.14*

LTF	*ROSETON*	*1.04*
292791	*U1-032 E*	*-1.34*
900672	*V4-068 E*	*0.13*
LTF	*WEC*	*0.84*
916301	*Z1-086 C*	*33.*
916302	*Z1-086 E*	*5.26*
917332	*Z2-043 E*	*0.46*
917342	*Z2-044 E*	*0.3*
917512	*Z2-088 E OP1*	*1.84*
917592	*Z2-099 E*	*0.18*
918492	*AA1-063AE OP*	*2.09*
918512	*AA1-065 E OP*	*1.82*
918532	*AA1-067 E*	*0.32*
918562	*AA1-072 E*	*0.08*
919692	*AA2-053 E*	*2.08*
919702	*AA2-057 E*	*1.84*
919822	*AA2-068 E*	*0.54*
LTF	*AA2-074*	*2.63*
920022	*AA2-086 E*	*0.1*
920042	*AA2-088 E*	*4.33*
920592	*AA2-165 E*	*0.24*
920631	*AA2-169 C*	*1.18*
920632	*AA2-169 E*	*0.54*
920672	*AA2-174 E*	*0.24*
930401	*AB1-081 C*	*4.55*
930402	*AB1-081 E*	*1.95*
930861	*AB1-132 C*	*9.57*
930862	*AB1-132 E*	*4.1*
931231	*AB1-173 C*	*1.61*
931232	*AB1-173 E*	*0.75*
931241	*AB1-173AC*	*1.61*
931242	*AB1-173AE*	*0.75*
923851	*AB2-025 C*	*0.57*
923852	*AB2-025 E*	*1.3*
923911	*AB2-031 C O1*	*1.6*
923912	*AB2-031 E O1*	*0.79*
923941	*AB2-035 C*	*0.16*
923942	*AB2-035 E*	*0.07*
923991	*AB2-040 C O1*	*5.26*
923992	*AB2-040 E O1*	*4.3*
924021	*AB2-043 C O1*	*1.43*
924022	*AB2-043 E O1*	*2.34*
924151	*AB2-059 C O1*	*5.37*
924152	*AB2-059 E O1*	*2.76*
924161	*AB2-060 C O1*	*4.07*

924162	*AB2-060 E O1*	*1.92*
924301	*AB2-077 C O1*	*0.91*
924302	*AB2-077 E O1*	*0.6*
924311	*AB2-078 C O1*	*0.91*
924312	*AB2-078 E O1*	*0.6*
924321	*AB2-079 C O1*	*0.91*
924322	*AB2-079 E O1*	*0.6*
924381	*AB2-087 C*	*0.25*
924382	*AB2-087 E*	*0.12*
924391	*AB2-088 C*	*0.21*
924392	*AB2-088 E*	*0.1*
924401	*AB2-089 C*	*1.08*
924402	*AB2-089 E*	*0.55*
924411	*AB2-090 C*	*1.8*
924412	*AB2-090 E*	*0.92*
924491	*AB2-098 C*	*0.25*
924492	*AB2-098 E*	*0.11*
924501	*AB2-099 C*	*0.26*
924502	*AB2-099 E*	*0.11*
924511	*AB2-100 C*	*10.65*
924512	*AB2-100 E*	*5.25*
925121	*AB2-169 C*	*2.45*
925122	*AB2-169 E*	*2.2*
925171	*AB2-174 C O1*	*5.22*
925172	*AB2-174 E O1*	*4.72*
925221	*AB2-176 C*	*0.74*
925222	*AB2-176 E*	*0.32*
925591	*AC1-034 C*	*3.33*
925592	*AC1-034 E*	*2.52*
925611	*AC1-036 C*	*0.37*
925612	*AC1-036 E*	*0.61*
925781	*AC1-054 C*	*3.71*
925782	*AC1-054 E*	*1.71*
926071	*AC1-086 C*	*14.1*
926072	*AC1-086 E*	*6.42*
926201	*AC1-098 C*	*3.13*
926202	*AC1-098 E*	*1.86*
926211	*AC1-099 C*	*1.05*
926212	*AC1-099 E*	*0.62*
926271	*AC1-105 C*	*2.38*
926272	*AC1-105 E*	*1.19*
926771	*AC1-163 C*	*0.84*
926772	*AC1-163 E*	*0.39*
927021	*AC1-189 C*	*3.98*
927022	*AC1-189 E*	*1.98*

927111	*AC1-206 C*	*9.5*
927112	*AC1-206 E*	*4.49*
927141	*AC1-208 C*	*4.92*
927142	*AC1-208 E*	*2.19*
927251	*AC1-221 C*	*0.94*
927252	*AC1-221 E*	*0.94*
927261	*AC1-222 C*	*1.48*
927262	*AC1-222 E*	*1.41*

Appendix 5

(DVP - DVP) The 6CHRL249-6LOCKS 230 kV line (from bus 314285 to bus 314316 ckt 1) loads from 104.8% to 106.91% (**DC power flow**) of its load dump rating (684 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 562T563'. This project contributes approximately 15.19 MW to the thermal violation.

CONTINGENCY 'DVP_P4-2: 562T563' /*CARSON
OPEN BRANCH FROM BUS 314902 TO BUS 314923 CKT 1 /*CARSON TO MIDLOTHIAN
OPEN BRANCH FROM BUS 314914 TO BUS 314902 CKT 1 /*CARSON 500.00 - 8SEPTA 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315105	*1BRUNSWICKS1*	*11.25*
315131	*1EDGECMA*	*4.76*
315132	*1EDGECMB*	*4.76*
315139	*1GASTONA*	*2.46*
315141	*1GASTONB*	*2.46*
315136	*1ROSEMG1*	*1.7*
315138	*1ROSEMG2*	*0.8*
315137	*1ROSEMS1*	*1.06*
315073	*1STONECA*	*-2.58*
314557	*3BETHELC*	*0.39*
314554	*3BTLEBRO*	*0.41*
314572	*3EMPORIA*	*0.33*
314578	*3HORNRTN*	*1.92*
314582	*3KELFORD*	*0.39*
314704	*3LAWRENC*	*0.28*
314603	*3SCOT NK*	*1.62*
314617	*3TUNIS*	*0.36*
314541	*3WATKINS*	*0.24*
314620	*6CASHIE*	*0.31*
314574	*6EVERETS*	*1.06*
932631	*AC2-084 C*	*4.46*
932632	*AC2-084 E*	*2.2*
932701	*AC2-093 C*	*40.58*
932702	*AC2-093 E*	*23.21*
932761	*AC2-100 C*	*2.16*
932762	*AC2-100 E*	*1.05*
933451	*AC2-158 C*	*2.15*
933452	*AC2-158 E*	*2.15*
933461	*AC2-159 C*	*3.44*
933462	*AC2-159 E*	*3.44*
933991	*AD1-023 C*	*4.58*

933992	*AD1-023 E*	*2.49*
934041	*AD1-029 C*	*5.52*
934042	*AD1-029 E*	*3.64*
934071	*AD1-034 C O2*	*9.22*
934072	*AD1-034 E O2*	*5.97*
934201	*AD1-047 C*	*5.74*
934202	*AD1-047 E*	*3.83*
934231	*AD1-050 C*	*2.37*
934232	*AD1-050 E*	*1.3*
934311	*AD1-055 C*	*1.03*
934312	*AD1-055 E*	*0.27*
934331	*AD1-057 C O2*	*5.2*
934332	*AD1-057 E O2*	*2.77*
934341	*AD1-058 C*	*2.35*
934342	*AD1-058 E*	*0.6*
934521	*AD1-076 C O2*	*19.48*
934522	*AD1-076 E O2*	*9.92*
934611	*AD1-087 C O2*	*3.75*
934612	*AD1-087 E O2*	*1.75*
934621	*AD1-088 C O2*	*6.62*
934622	*AD1-088 E O2*	*3.11*
LTF	*AD1-120*	*5.26*
LTF	*AD1-121*	*5.24*
934911	*AD1-123 C*	*0.45*
934912	*AD1-123 E*	*0.23*
934991	*AD1-131 C*	*0.77*
934992	*AD1-131 E*	*0.51*
935171	*AD1-152 C O2*	*3.36*
935172	*AD1-152 E O2*	*2.24*
935211	*AD1-156 C*	*1.*
935212	*AD1-156 E*	*0.67*
LTF	*CARR*	*0.18*
LTF	*CBM-S1*	*6.32*
LTF	*CBM-S2*	*12.36*
LTF	*CBM-W1*	*13.64*
LTF	*CBM-W2*	*33.99*
LTF	*CIN*	*3.08*
LTF	*CPLE*	*3.87*
LTF	*G-007*	*1.04*
LTF	*IPL*	*1.96*
LTF	*LGEE*	*0.67*
LTF	*MEC*	*6.97*
LTF	*MECS*	*3.01*
LTF	*O-066*	*3.47*
LTF	*RENSSELAER*	*0.14*

LTF	*ROSETON*	*1.04*
292791	*U1-032 E*	*-1.34*
900672	*V4-068 E*	*0.13*
LTF	*WEC*	*0.84*
916301	*Z1-086 C*	*33.*
916302	*Z1-086 E*	*5.26*
917332	*Z2-043 E*	*0.46*
917342	*Z2-044 E*	*0.3*
917512	*Z2-088 E OP1*	*1.84*
917592	*Z2-099 E*	*0.18*
918492	*AA1-063AE OP*	*2.09*
918512	*AA1-065 E OP*	*1.82*
918532	*AA1-067 E*	*0.32*
918562	*AA1-072 E*	*0.08*
919692	*AA2-053 E*	*2.08*
919702	*AA2-057 E*	*1.84*
919822	*AA2-068 E*	*0.54*
LTF	*AA2-074*	*2.63*
920022	*AA2-086 E*	*0.1*
920042	*AA2-088 E*	*4.33*
920592	*AA2-165 E*	*0.24*
920631	*AA2-169 C*	*1.18*
920632	*AA2-169 E*	*0.54*
920672	*AA2-174 E*	*0.24*
930401	*AB1-081 C*	*4.55*
930402	*AB1-081 E*	*1.95*
930861	*AB1-132 C*	*9.57*
930862	*AB1-132 E*	*4.1*
931231	*AB1-173 C*	*1.61*
931232	*AB1-173 E*	*0.75*
931241	*AB1-173AC*	*1.61*
931242	*AB1-173AE*	*0.75*
923851	*AB2-025 C*	*0.57*
923852	*AB2-025 E*	*1.3*
923911	*AB2-031 C O1*	*1.6*
923912	*AB2-031 E O1*	*0.79*
923941	*AB2-035 C*	*0.16*
923942	*AB2-035 E*	*0.07*
923991	*AB2-040 C O1*	*5.26*
923992	*AB2-040 E O1*	*4.3*
924021	*AB2-043 C O1*	*1.43*
924022	*AB2-043 E O1*	*2.34*
924151	*AB2-059 C O1*	*5.37*
924152	*AB2-059 E O1*	*2.76*
924161	*AB2-060 C O1*	*4.07*

924162	*AB2-060 E O1*	*1.92*
924301	*AB2-077 C O1*	*0.91*
924302	*AB2-077 E O1*	*0.6*
924311	*AB2-078 C O1*	*0.91*
924312	*AB2-078 E O1*	*0.6*
924321	*AB2-079 C O1*	*0.91*
924322	*AB2-079 E O1*	*0.6*
924381	*AB2-087 C*	*0.25*
924382	*AB2-087 E*	*0.12*
924391	*AB2-088 C*	*0.21*
924392	*AB2-088 E*	*0.1*
924401	*AB2-089 C*	*1.08*
924402	*AB2-089 E*	*0.55*
924411	*AB2-090 C*	*1.8*
924412	*AB2-090 E*	*0.92*
924491	*AB2-098 C*	*0.25*
924492	*AB2-098 E*	*0.11*
924501	*AB2-099 C*	*0.26*
924502	*AB2-099 E*	*0.11*
924511	*AB2-100 C*	*10.65*
924512	*AB2-100 E*	*5.25*
925121	*AB2-169 C*	*2.45*
925122	*AB2-169 E*	*2.2*
925171	*AB2-174 C O1*	*5.22*
925172	*AB2-174 E O1*	*4.72*
925221	*AB2-176 C*	*0.74*
925222	*AB2-176 E*	*0.32*
925591	*AC1-034 C*	*3.33*
925592	*AC1-034 E*	*2.52*
925611	*AC1-036 C*	*0.37*
925612	*AC1-036 E*	*0.61*
925781	*AC1-054 C*	*3.71*
925782	*AC1-054 E*	*1.71*
926071	*AC1-086 C*	*14.1*
926072	*AC1-086 E*	*6.42*
926201	*AC1-098 C*	*3.13*
926202	*AC1-098 E*	*1.86*
926211	*AC1-099 C*	*1.05*
926212	*AC1-099 E*	*0.62*
926271	*AC1-105 C*	*2.38*
926272	*AC1-105 E*	*1.19*
926771	*AC1-163 C*	*0.84*
926772	*AC1-163 E*	*0.39*
927021	*AC1-189 C*	*3.98*
927022	*AC1-189 E*	*1.98*

927111	*AC1-206 C*	*9.5*
927112	*AC1-206 E*	*4.49*
927141	*AC1-208 C*	*4.92*
927142	*AC1-208 E*	*2.19*
927251	*AC1-221 C*	*0.94*
927252	*AC1-221 E*	*0.94*
927261	*AC1-222 C*	*1.48*
927262	*AC1-222 E*	*1.41*

Appendix 6

(DVP - DVP) The 6CHESTF B-6BASIN 230 kV line (from bus 314287 to bus 314276 ckt 1) loads from 124.7% to 125.84% (**DC power flow**) of its emergency rating (449 MVA) for the single line contingency outage of 'DVP_P1-2: LN 563'. This project contributes approximately 5.06 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 563'
OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315065	*1CHESTF6*	*33.34*
315131	*1EDGECMA*	*3.18*
315132	*1EDGECMB*	*3.18*
315139	*1GASTONA*	*1.58*
315141	*1GASTONB*	*1.58*
315119	*1GRAVEL3*	*1.24*
315120	*1GRAVEL4*	*1.26*
315121	*1GRAVEL5*	*1.24*
315122	*1GRAVEL6*	*1.26*
315117	*1GRAVELC*	*0.43*
315074	*1HOPCGN1*	*5.63*
315075	*1HOPCGN2*	*5.56*
315077	*1HOPHCF1*	*1.78*
315078	*1HOPHCF2*	*1.78*
315079	*1HOPHCF3*	*1.78*
315080	*1HOPHCF4*	*2.7*
315076	*1HOPPOLC*	*1.27*
315116	*1SURRY 1*	*12.47*
314314	*3LOCKS*	*0.06*
314315	*3LOCKS E*	*0.77*
932041	*AC2-012 C*	*3.21*
932581	*AC2-078 C*	*2.86*
932591	*AC2-079 C*	*3.07*
932631	*AC2-084 C*	*3.22*
932701	*AC2-093 C*	*23.37*
933451	*AC2-158 C*	*1.94*
933461	*AC2-159 C*	*2.55*
933471	*AC2-161 C*	*0.89*
933711	*AC2-194 C*	*0.35*
933731	*AC2-196 C*	*0.55*
933991	*AD1-023 C*	*4.54*
934011	*AD1-025 C O2*	*9.21*
934041	*AD1-029 C*	*3.98*

934061	*AD1-033 C O2*	*2.31*
934071	*AD1-034 C O2*	*5.06*
934201	*AD1-047 C*	*3.58*
934331	*AD1-057 C O2*	*3.61*
934521	*AD1-076 C O2*	*18.25*
934571	*AD1-082 C O2*	*5.05*
935111	*AD1-144 C*	*0.56*
935211	*AD1-156 C*	*1.97*
LTF	*CARR*	*0.2*
LTF	*CBM-S1*	*3.35*
LTF	*CBM-S2*	*7.31*
LTF	*CBM-W1*	*6.11*
LTF	*CBM-W2*	*17.58*
LTF	*CIN*	*1.4*
LTF	*CPLE*	*2.35*
LTF	*IPL*	*0.89*
LTF	*LGEE*	*0.31*
LTF	*MEC*	*3.38*
LTF	*MECS*	*1.12*
LTF	*RENSSELAER*	*0.16*
LTF	*ROSETON*	*1.14*
LTF	*WEC*	*0.39*
914231	*Y2-077*	*0.72*
LTF	*AA2-074*	*1.6*
920631	*AA2-169 C*	*0.75*
920691	*AA2-178 C*	*3.22*
930051	*AB1-013 C*	*0.97*
930401	*AB1-081 C*	*3.05*
930861	*AB1-132 C*	*6.17*
931231	*AB1-173 C*	*1.01*
931241	*AB1-173AC*	*1.01*
923801	*AB2-015 C O1*	*3.22*
923831	*AB2-022 C*	*0.73*
923851	*AB2-025 C*	*0.31*
923911	*AB2-031 C O1*	*1.*
923941	*AB2-035 C*	*0.11*
923991	*AB2-040 C O1*	*3.28*
924071	*AB2-051*	*42.84*
924151	*AB2-059 C O1*	*3.6*
924381	*AB2-087 C*	*0.21*
924391	*AB2-088 C*	*0.15*
924491	*AB2-098 C*	*0.19*
924501	*AB2-099 C*	*0.22*
924511	*AB2-100 C*	*6.19*
924811	*AB2-134 C O1*	*7.02*

925051	*AB2-160 C O1*	*3.33*
925061	*AB2-161 C O1*	*1.87*
925121	*AB2-169 C*	*2.2*
925171	*AB2-174 C O1*	*3.2*
925281	*AB2-186 C*	*0.2*
925291	*AB2-188 C O1*	*0.79*
925331	*AB2-190 C*	*10.95*
925591	*AC1-034 C*	*2.34*
925821	*AC1-061*	*< 0.01*
926071	*AC1-086 C*	*9.08*
926201	*AC1-098 C*	*2.26*
926211	*AC1-099 C*	*0.76*
926741	*AC1-159*	*20.65*
926771	*AC1-163 C*	*0.71*
927021	*AC1-189 C*	*2.92*
927111	*AC1-206 C*	*5.47*
927141	*AC1-208 C*	*3.41*
927221	*AC1-216 C O1*	*5.36*

Appendix 7

(DVP - DVP) The 6CLUBHSE 230/115 kV transformer (from bus 314563 to bus 314562 ckt 1) loads from 109.32% to 113.91% (**DC power flow**) of its load dump rating (209 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 239T2141'. This project contributes approximately 9.59 MW to the thermal violation.

CONTINGENCY 'DVP_P4-2: 239T2141' /* LAKEVIEW
OPEN BRANCH FROM BUS 314583 TO BUS 314579 CKT 1 /* 239
OPEN BRANCH FROM BUS 314579 TO BUS 314605 CKT 1 /* 2057
OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141
END

Bus Number	*Bus Name*	*Full Contribution*
315139	*1GASTONA*	*4.6*
315141	*1GASTONB*	*4.6*
314541	*3WATKINS*	*-0.27*
934043	*AD1-029 BAT*	*9.45*
934071	*AD1-034 C O2*	*5.82*
934072	*AD1-034 E O2*	*3.77*
934233	*AD1-050 BAT*	*5.52*
LTF	*AMIL*	*0.13*
LTF	*BAYOU*	*0.69*
LTF	*BIG_CAJUN1*	*1.09*
LTF	*BIG_CAJUN2*	*2.18*
LTF	*BLUEG*	*0.69*
LTF	*CALDERWOOD*	*0.41*
LTF	*CANNELTON*	*0.13*
LTF	*CATAWBA*	*0.39*
LTF	*CBM-N*	*0.02*
LTF	*CELEVELAND*	*1.12*
LTF	*CHEOAH*	*0.38*
LTF	*CHILHOWEE*	*0.13*
LTF	*CHOCTAW*	*0.74*
LTF	*CLIFTY*	*2.53*
LTF	*COTTONWOOD*	*2.7*
LTF	*DEARBORN*	*0.23*
LTF	*EDWARDS*	*0.21*
LTF	*ELMERSMITH*	*0.39*
LTF	*FARMERCITY*	*0.17*
LTF	*G-007A*	*0.55*
LTF	*GIBSON*	*0.24*
LTF	*HAMLET*	*1.52*
LTF	*MORGAN*	*1.2*
LTF	*NEWTON*	*0.58*
LTF	*NYISO*	*0.28*

LTF	*O-066A*	*0.26*
LTF	*PRAIRIE*	*1.25*
LTF	*ROWAN*	*0.83*
LTF	*SANTEETLA*	*0.11*
LTF	*SMITHLAND*	*0.11*
LTF	*TATANKA*	*0.28*
LTF	*TILTON*	*0.25*
LTF	*TRIMBLE*	*0.13*
LTF	*TVA*	*0.51*
LTF	*UNIONPOWER*	*0.72*
LTF	*VFT*	*1.48*
LTF	*X1-078*	*0.42*
930861	*AB1-132 C*	*17.9*
930862	*AB1-132 E*	*7.67*
923851	*AB2-025 C*	*0.33*
923852	*AB2-025 E*	*0.75*
924511	*AB2-100 C*	*14.28*
924512	*AB2-100 E*	*7.03*
926071	*AC1-086 C*	*26.37*
926072	*AC1-086 E*	*12.*
927111	*AC1-206 C*	*12.3*
927112	*AC1-206 E*	*5.82*

Appendix 8

(DVP - DVP) The 6LAKEVEW-6CAROLNA 230 kV line (from bus 314583 to bus 314561 ckt 1) loads from 126.89% to 128.96% (**DC power flow**) of its emergency rating (375 MVA) for the single line contingency outage of 'DVP_P1-2: LN 2056'. This project contributes approximately 7.78 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 2056'
 OPEN BRANCH FROM BUS 313845 TO BUS 314579 CKT 1 /* 6HATHAWAY 230.00 - 6HORNRTN 230.00
 END

Bus Number	*Bus Name*	*Full Contribution*
315139	*1GASTONA*	*12.26*
315141	*1GASTONB*	*12.26*
315136	*1ROSEMG1*	*8.8*
315138	*1ROSEMG2*	*4.12*
315137	*1ROSEMS1*	*5.46*
314704	*3LAWRENC*	*0.21*
934043	*AD1-029 BAT*	*14.31*
934071	*AD1-034 C O2*	*7.78*
934233	*AD1-050 BAT*	*3.5*
935211	*AD1-156 C*	*0.6*
LTF	*AMIL*	*0.18*
LTF	*BAYOU*	*0.93*
LTF	*BIG_CAJUN1*	*1.47*
LTF	*BIG_CAJUN2*	*2.95*
LTF	*BLUEG*	*0.92*
LTF	*CALDERWOOD*	*0.55*
LTF	*CANNELTON*	*0.18*
LTF	*CATAWBA*	*0.53*
LTF	*CBM-N*	*< 0.01*
LTF	*CELEVELAND*	*1.5*
LTF	*CHEOAH*	*0.51*
LTF	*CHILHOWEE*	*0.18*
LTF	*CHOCTAW*	*1.*
LTF	*CLIFTY*	*3.38*
LTF	*COTTONWOOD*	*3.64*
LTF	*DEARBORN*	*0.33*
LTF	*EDWARDS*	*0.28*
LTF	*ELMERSMITH*	*0.52*
LTF	*FARMERCITY*	*0.22*
LTF	*G-007A*	*0.39*
LTF	*GIBSON*	*0.32*
LTF	*HAMLET*	*2.16*
LTF	*MORGAN*	*1.61*

LTF	*NEWTON*	*0.78*
LTF	*NYISO*	*0.03*
LTF	*O-066A*	*0.18*
LTF	*PRAIRIE*	*1.69*
LTF	*ROWAN*	*1.08*
LTF	*SANTEETLA*	*0.15*
LTF	*SMITHLAND*	*0.15*
LTF	*TATANKA*	*0.38*
LTF	*TILTON*	*0.34*
LTF	*TRIMBLE*	*0.18*
LTF	*TVA*	*0.68*
LTF	*UNIONPOWER*	*0.97*
LTF	*VFT*	*1.03*
LTF	*X1-078*	*0.3*
930861	*AB1-132 C*	*47.69*
923851	*AB2-025 C*	*0.44*
924511	*AB2-100 C*	*21.43*
926071	*AC1-086 C*	*70.23*
927111	*AC1-206 C*	*16.67*

Appendix 9

(DVP - DVP) The AD1-034 TAP-6SAPONY 230 kV line (from bus 934070 to bus 314435 ckt 1) loads from 122.32% to 130.38% (**DC power flow**) of its load dump rating (637 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 246T2034'. This project contributes approximately 54.37 MW to the thermal violation.

```
CONTINGENCY 'DVP_P4-2: 246T2034'                    /* EARLEYS
  OPEN BRANCH FROM BUS 314569 TO BUS 314575 CKT 1   /* 246
  OPEN BRANCH FROM BUS 314575 TO BUS 314537 CKT 1   /* 246
  OPEN BRANCH FROM BUS 314575 TO BUS 314590 CKT 1   /* 246 - NUCOR
  OPEN BRANCH FROM BUS 314569 TO BUS 933450 CKT 1   /* 2034
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315131	*1EDGECMA*	*11.46*
315132	*1EDGECMB*	*11.46*
315139	*1GASTONA*	*7.99*
315141	*1GASTONB*	*7.99*
315126	*1ROARAP2*	*2.89*
315128	*1ROARAP4*	*2.78*
315136	*1ROSEMG1*	*5.4*
315138	*1ROSEMG2*	*2.53*
315137	*1ROSEMS1*	*3.35*
314557	*3BETHELC*	*0.96*
314554	*3BTLEBRO*	*0.97*
314572	*3EMPORIA*	*1.07*
314578	*3HORNRTN*	*5.76*
314582	*3KELFORD*	*1.24*
314704	*3LAWRENC*	*0.85*
314603	*3SCOT NK*	*4.89*
314617	*3TUNIS*	*1.14*
314541	*3WATKINS*	*0.52*
314574	*6EVERETS*	*2.71*
932631	*AC2-084 C*	*12.97*
932632	*AC2-084 E*	*6.39*
933461	*AC2-159 C*	*10.98*
933462	*AC2-159 E*	*10.98*
934041	*AD1-029 C*	*16.05*
934042	*AD1-029 E*	*10.58*
934071	*AD1-034 C O2*	*32.99*
934072	*AD1-034 E O2*	*21.38*
934201	*AD1-047 C*	*18.26*
934202	*AD1-047 E*	*12.17*
934231	*AD1-050 C*	*5.37*
934232	*AD1-050 E*	*2.93*

934331	*AD1-057 C O2*	*14.21*
934332	*AD1-057 E O2*	*7.58*
934621	*AD1-088 C O2*	*12.9*
934622	*AD1-088 E O2*	*6.05*
LTF	*AD1-120*	*4.72*
LTF	*AD1-121*	*4.7*
LTF	*CARR*	*0.12*
LTF	*CBM-S1*	*5.81*
LTF	*CBM-S2*	*11.59*
LTF	*CBM-W1*	*12.9*
LTF	*CBM-W2*	*31.36*
LTF	*CIN*	*2.91*
LTF	*CPLE*	*3.91*
LTF	*G-007*	*0.8*
LTF	*IPL*	*1.85*
LTF	*LGEE*	*0.63*
LTF	*MEC*	*6.5*
LTF	*MECS*	*2.94*
LTF	*O-066*	*2.67*
LTF	*RENSSELAER*	*0.1*
LTF	*ROSETON*	*0.7*
900671	*V4-068 C*	*0.13*
900672	*V4-068 E*	*0.37*
LTF	*WEC*	*0.8*
917331	*Z2-043 C*	*0.68*
917332	*Z2-043 E*	*1.49*
917341	*Z2-044 C*	*0.34*
917342	*Z2-044 E*	*0.75*
917511	*Z2-088 C OP1*	*1.13*
917512	*Z2-088 E OP1*	*4.55*
917591	*Z2-099 C*	*0.22*
917592	*Z2-099 E*	*0.48*
918411	*AA1-050*	*0.95*
918491	*AA1-063AC OP*	*2.52*
918492	*AA1-063AE OP*	*6.06*
918511	*AA1-065 C OP*	*2.7*
918512	*AA1-065 E OP*	*6.77*
918531	*AA1-067 C*	*0.37*
918532	*AA1-067 E*	*0.81*
918561	*AA1-072 C*	*0.1*
918562	*AA1-072 E*	*0.25*
919691	*AA2-053 C*	*2.94*
919692	*AA2-053 E*	*6.44*
919701	*AA2-057 C*	*1.91*
919702	*AA2-057 E*	*4.86*

919821	*AA2-068 C*	*0.64*
919822	*AA2-068 E*	*1.51*
LTF	*AA2-074*	*2.66*
920021	*AA2-086 C*	*0.11*
920022	*AA2-086 E*	*0.26*
920041	*AA2-088 C*	*1.35*
920042	*AA2-088 E*	*11.25*
920591	*AA2-165 C*	*0.26*
920592	*AA2-165 E*	*0.64*
920631	*AA2-169 C*	*2.97*
920632	*AA2-169 E*	*1.36*
920671	*AA2-174 C*	*0.13*
920672	*AA2-174 E*	*0.74*
930401	*AB1-081 C*	*10.91*
930402	*AB1-081 E*	*4.68*
930861	*AB1-132 C*	*31.1*
930862	*AB1-132 E*	*13.33*
931231	*AB1-173 C*	*5.14*
931232	*AB1-173 E*	*2.4*
931241	*AB1-173AC*	*5.14*
931242	*AB1-173AE*	*2.4*
923911	*AB2-031 C O1*	*5.1*
923912	*AB2-031 E O1*	*2.51*
923941	*AB2-035 C*	*0.4*
923942	*AB2-035 E*	*0.17*
923991	*AB2-040 C O1*	*16.74*
923992	*AB2-040 E O1*	*13.69*
924021	*AB2-043 C O1*	*2.79*
924022	*AB2-043 E O1*	*4.58*
924151	*AB2-059 C O1*	*12.86*
924152	*AB2-059 E O1*	*6.63*
924161	*AB2-060 C O1*	*7.93*
924162	*AB2-060 E O1*	*3.73*
924301	*AB2-077 C O1*	*1.75*
924302	*AB2-077 E O1*	*1.17*
924311	*AB2-078 C O1*	*1.75*
924312	*AB2-078 E O1*	*1.17*
924321	*AB2-079 C O1*	*1.75*
924322	*AB2-079 E O1*	*1.17*
924381	*AB2-087 C*	*0.86*
924382	*AB2-087 E*	*0.4*
924391	*AB2-088 C*	*0.52*
924392	*AB2-088 E*	*0.25*
924401	*AB2-089 C*	*2.43*
924402	*AB2-089 E*	*1.25*

924411	*AB2-090 C*	*3.52*
924412	*AB2-090 E*	*1.8*
924491	*AB2-098 C*	*0.63*
924492	*AB2-098 E*	*0.27*
924501	*AB2-099 C*	*0.85*
924502	*AB2-099 E*	*0.36*
924511	*AB2-100 C*	*36.7*
924512	*AB2-100 E*	*18.08*
925171	*AB2-174 C O1*	*16.74*
925172	*AB2-174 E O1*	*15.15*
925221	*AB2-176 C*	*1.45*
925222	*AB2-176 E*	*0.62*
925591	*AC1-034 C*	*8.2*
925592	*AC1-034 E*	*6.18*
925781	*AC1-054 C*	*8.75*
925782	*AC1-054 E*	*4.03*
926071	*AC1-086 C*	*45.8*
926072	*AC1-086 E*	*20.85*
926201	*AC1-098 C*	*9.1*
926202	*AC1-098 E*	*5.42*
926211	*AC1-099 C*	*3.05*
926212	*AC1-099 E*	*1.79*
926771	*AC1-163 C*	*2.79*
926772	*AC1-163 E*	*1.3*
927021	*AC1-189 C*	*9.96*
927022	*AC1-189 E*	*4.96*
927111	*AC1-206 C*	*32.89*
927112	*AC1-206 E*	*15.55*
927141	*AC1-208 C*	*14.12*
927142	*AC1-208 E*	*6.27*