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Aug 31 2021

Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AD1-074/075/076

Trowbridge 230kV
320.7 MW Capacity / 484.0 MW Energy

December / 2019

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Introduction

This System Impact Study (SIS) has been prepared in accordance with the PJM Open Access Transmission Tariff, Section 205, as well as the System Impact Study Agreement between Macadamia Solar LLC, 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 System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the IC. As a requirement for interconnection, the IC may be responsible for the cost of constructing Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an IC may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, 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 System Impact Study is performed.

The System Impact 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 Transmission Owners, the costs may be included in the study.

General

The IC has proposed a solar generating facility located in Washington County, North Carolina. The installed AD1-074/075/076 facilities will have a total capability of 484 MW with 320.7 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is June 1, 2020. This study does not imply an ITO commitment to this in-service date.

Point of Interconnection

AD1-074/075/076 will interconnect with the ITO transmission system via a direct connection into the Trowbridge 230kV substation.

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Cost Summary

The AD1-074/075/076 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 1,800,000
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades	$ 4,000,000
Allocation for New System Upgrades	$ 39,646,725
Contribution for Previously Identified Upgrades	$ 87,020,707
Total Costs	**$ 132,467,432**

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Attachment Facilities

Generation Substation: Install metering and associated protection equipment. The estimated cost is $600,000.

Transmission: Construct approximately one span of 230kV Attachment line between the generation substation and the Trowbridge 230kV Substation. 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 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

None.

Non-Direct Network Upgrades:

Substation: Add two breakers in the Trowbridge 230 kV Substation and rearrange the 230 kV bus. See Attachment 1 for One-Line Diagram. The estimated cost of this work scope is $4,000,000. It is estimated to take 24-36 months to complete this work upon execution of an Interconnection Construction Service Agreement.

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.

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Violation #	Ruling Violation #	Loading	Upgrade Description	Upgrade Cost	Allocated Cost
Stability P4.08, P4.09	NA	NA	Reconfigure the Trowbridge substation to move the Mackeys – Trowbridge 230kV line	$500,000	**$500,000**
# 3	3	From 99.7% To 101.68%	Replace wave trap at both Ladysmith and Possum Point Substations for the Ladysmith – Possum Pt 500kV line #552	$500,000	**$0**
			Rebuild 26.2 miles of the Ladysmith - Elmont 500kV line #574	$65,500,000	**$0**
# 4	4	From 96.81% To 101.77%	Rebuild the Danville – East Danville 138kV line	$9,000,000	**$9,000,000**
# 6	6	From 52.78% To 114.45%	Rebuild 5.88 miles of the Five Points – Wharton 115 kV line # 189	$7,644,000	**$7,644,000**
# 7	7	From 96.92% To 109.48%	Rebuild Clubhouse-Lakeview 230 kV Line #254	$27,000,000	**$0**
# 8, 9	8	From 58.16% To 105.71%	Replace relays at Everetts substation on the Poplar Chapel – Everetts 115 kV line # 25	$500,000	**$400,725**
# 10	10	From 93.38% To 120.96%	Rebuild 10.28 miles of the Shawboro – Elizabeth City 230 kV line #2021	$15,420,000	**$15,420,000**
# 15	15	From 63.99% To 125.66%	Rebuild 5.14 miles of the AB2-169 Tap – Five Points D.P 115kV line # 189	$6,682,000	**$6,682,000**
# 1, 16	16	From 132.81% To 142.5%	Rebuild the 4.3 miles of Dominion 230 kV Line #2058 Rocky Mt. – Hathaway	$13,000,000	**$0**
# 17, 21, 22	17	From 124.84% To 128.39%	Rebuild 6.1 miles of Waller-Skiffes Creek 230 kV Line (#2154) between Waller and Kings Mill.	$10,000,000	**$0**
# 18	18	From 106.14% To 107.31%	Replace the Elmont 500/230 kV transformer #1	$22,000,000	**$6,653,682**
# 19, 20	19	From 109% To 113.56%	Reconductor 0.14 miles of the Chesterfield to Basin 230kV line	$250,000	**$0**
# 23	23	From 100.2% To 103.75%	Rebuild a portion of the Waller to Lightfoot 230 kV Line # 2113	$4,000,000	**$0**

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Violation #	Ruling Violation #	Loading	Upgrade Description	Upgrade Cost	Allocated Cost
# 5, 24	24	From 107.56% To 124.08%	Rebuild the 20.5 miles of Dominion 230 kV Line #218 Everetts - Greenville	$30,750,000	**$20,916,179**
# 11, 12, 13, 25, 26, 27	25	From 102.41% To 106.3%	Replace wave trap at Chickahominy substation on the Chickahominy – Elmont 500 kV line # 557	$500,000	**$0**
# 28, 29	28	From 108.58% To 110.54%	Replace a wave trap on the Chancellor – Bristers 500 kV line # 552	$250,000	**$0**
# 30, 31, 32, 33	30	From 134.85% To 138.08%	Replace wave traps at both Ladysmith and Elmont substations for the Ladysmith – Elmont 500kV line #574	$700,000	**$0**
			Rebuild 26.2 miles of the Ladysmith to Elmont 500kV line #574	$65,500,000	**$0**
# 2, 34	34	From 100.2% To 101.8%	Rebuild 15.2 miles of the Ladysmith to Chancellor 500kV Line #581	$44,380,000	**$0**
# 14, 35	35	From 100.49% To 103.48%	Replace wave trap at North Anna Substation for Midlothian – North Anna 500 kV line #576.	$250,000	**$0**
			Wreck and rebuild 41 miles of the Midlothian – North Anna 500 kV Line #576	123,390,000	**$66,104,528**
			Total Estimate Allocated Cost of Network Upgrades		**$ 126,667,432**

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Interconnection Customer Requirements

ITO's Facility Interconnection 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.

Meteorological Data Reporting Requirement - The solar generation facility shall, at a minimum, be required to provide the Transmission Provider with site-specific meteorological data including:

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

Revenue Metering and SCADA Requirements

PJM Requirements

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

Interconnected Transmission Owner Requirements

Metering and SCADA/Communication equipment must meet the requirements outlined in section 3.1.6 Metering and Telecommunications of ITO's Facility Connection Requirement NERC Standard FAC-001 which is publically available at www.dom.com.

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Network Impacts

The Queue Project AD1-074/075/076 was evaluated as a 484.0 MW (Capacity 320.7 MW) injection into Trowbridge 230kV substation in the VAP area. Project AD1-074/075/076 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-074/075/076 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
AEP_P4_#11112_05J.FERR 765_A1	CONTINGENCY 'AEP_P4_#11112_05J.FERR 765_A1' OPEN BRANCH FROM BUS 242511 TO BUS 242514 CKT 1 / 242511 05BROADF 765 242514 05J.FERR 765 1 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 OPEN BRANCH FROM BUS 242566 TO BUS 242567 CKT ZB / 242566 05BROADF 138 242567 05BROADX 138 ZB END
DVP_P1-2: LN 2020	CONTINGENCY 'DVP_P1-2: LN 2020' OPEN BRANCH FROM BUS 313851 TO BUS 314638 CKT 1 /* 6ECITYDP2 230.00 - 6ELIZ CT 230.00 OPEN BRANCH FROM BUS 313851 TO BUS 314639 CKT 1 /* 6ECITYDP2 230.00 - 6TANGLEW 230.00 OPEN BRANCH FROM BUS 314639 TO BUS 314651 CKT 1 /* 6TANGLEW 230.00 - 6WINFALL 230.00 OPEN BUS 313851 /* ISLAND OPEN BUS 314639 /* ISLAND OPEN BUS 913391 /* ISLAND OPEN BUS 913392 /* ISLAND END
DVP_P1-2: LN 2034-A	CONTINGENCY 'DVP_P1-2: LN 2034-A' OPEN BRANCH FROM BUS 314614 TO BUS 314616 CKT 1 /* 3TROWBR2 115.00 - 6TRWBRDG 230.00 OPEN BRANCH FROM BUS 314616 TO BUS 933990 CKT 1 /* 6TRWBRDG 230.00 - AD1-023 TAP 230.00 END

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DVP_P1-2: LN 2034-B	CONTINGENCY 'DVP_P1-2: LN 2034-B' OPEN BRANCH FROM BUS 314569 TO BUS 314620 CKT 1 /* 6EARLEYS 230.00 - 6CASHIE 230.00 OPEN BRANCH FROM BUS 933990 TO BUS 314620 CKT 1 /* AD1-023 TAP 230.00 - 6CASHIE 230.00 OPEN BUS 314620 /* ISLAND END
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 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 OPEN BUS 314591 /* ISLAND: 6NASH 230.00 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

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DVP_P1-2: LN 247	CONTINGENCY 'DVP_P1-2: LN 247' OPEN BRANCH FROM BUS 314537 TO BUS 314648 CKT 1 /* 6SUFFOLK 230.00 - 6SUNBURY 230.00 OPEN BRANCH FROM BUS 314648 TO BUS 901080 CKT 1 /* 6SUNBURY 230.00 - W1-029 230.00 OPEN BUS 314648 /* ISLAND END
DVP_P1-2: LN 552	CONTINGENCY 'DVP_P1-2: LN 552' OPEN BRANCH FROM BUS 314135 TO BUS 314905 CKT 1 /* 3CHANCE 115.00 - 8CHANCE 500.00 OPEN BRANCH FROM BUS 314900 TO BUS 314905 CKT 1 /* 8BRISTER 500.00 - 8CHANCE 500.00 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_P1-2: LN 573	CONTINGENCY 'DVP_P1-2: LN 573' OPEN BRANCH FROM BUS 314918 TO BUS 314934 CKT 1 /* 8NO ANNA 500.00 - 8SPOTSYL 500.00 END
DVP_P1-2: LN 574	CONTINGENCY 'DVP_P1-2: LN 574' OPEN BRANCH FROM BUS 314908 TO BUS 314911 CKT 1 /* 8ELMONT 500.00 - 8LDYSMTH 500.00 END
DVP_P1-2: LN 576	CONTINGENCY 'DVP_P1-2: LN 576' OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 END
DVP_P1-2: LN 581	CONTINGENCY 'DVP_P1-2: LN 581' OPEN BRANCH FROM BUS 314135 TO BUS 314905 CKT 2 /* 3CHANCE 115.00 - 8CHANCE 500.00 OPEN BRANCH FROM BUS 314905 TO BUS 314911 CKT 1 /* 8CHANCE 500.00 - 8LDYSMTH 500.00 END

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DVP_P1-2: LN 594	CONTINGENCY 'DVP_P1-2: LN 594' OPEN BRANCH FROM BUS 314916 TO BUS 314934 CKT 1 /* 8MORRSVL 500.00 - 8SPOTSYL 500.00 END
DVP_P4-2: 2014T2034	CONTINGENCY 'DVP_P4-2: 2014T2034' /* EARLEYS OPEN BRANCH FROM BUS 314569 TO BUS 314620 CKT 1 /* 2034 OPEN BRANCH FROM BUS 314620 TO BUS 933990 CKT 1 /* 2034 OPEN BRANCH FROM BUS 314569 TO BUS 314574 CKT 1 /* 2014 END
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 314620 CKT 1 /* 2034 OPEN BRANCH FROM BUS 314620 TO BUS 933990 CKT 1 /* 2034 END
DVP_P4-2: 246T247	CONTINGENCY 'DVP_P4-2: 246T247' /* SUFFOLK 230 KV 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: 6NUCO TP 230.00 OPEN BUS 314590 /* ISLAND: 6NUCOR 230.00 OPEN BRANCH FROM BUS 314537 TO BUS 314648 CKT 1 /* 6SUFFOLK 230.00 - 6SUNBURY 230.00 OPEN BRANCH FROM BUS 314648 TO BUS 901080 CKT 1 /* 6SUNBURY 230.00 - W1-029 230.00 OPEN BUS 314648 /* ISLAND: 6SUNBURY 230.00 END
DVP_P4-2: 557T574	CONTINGENCY 'DVP_P4-2: 557T574' /* 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 314911 TO BUS 314908 CKT 1 /*ELMONT

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	TO LADYSMITH (LINE 574) 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: 56372	CONTINGENCY 'DVP_P4-2: 56372' /*CARSON OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MIDLOTHIAN 500.00 OPEN BRANCH FROM BUS 314902 TO BUS 314282 CKT 1 /*CARSON 500-230 (TX#1) END
DVP_P4-2: 563T576	CONTINGENCY 'DVP_P4-2: 563T576' /* MIDLOTHIAN 500 500 KV OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 END
DVP_P4-2: 57602	CONTINGENCY 'DVP_P4-2: 57602' /* NORTH ANNA 500 KV OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 OPEN BRANCH FROM BUS 314232 TO BUS 314918 CKT 1 /* 6NO ANNA 230.00 - 8NO ANNA 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_P4-2: WT576	CONTINGENCY 'DVP_P4-2: WT576' /* NORTH ANNA 500 KV OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00

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	OPEN BRANCH FROM BUS 314232 TO BUS 314918 CKT 2 /* 6NO ANNA 230.00 - 8NO ANNA 500.00 END
DVP_P7-1: LN 2058-2181	CONTINGENCY 'DVP_P7-1: LN 2058-2181' OPEN BRANCH FROM BUS 304222 TO BUS 313845 CKT 1 /* 6ROCKYMT230T230.00 - 6HATHAWAY 230.00 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 OPEN BUS 314591 /* ISLAND: 6NASH 230.00 END
DVP_P7-1: LN 25-2034_A	CONTINGENCY 'DVP_P7-1: LN 25-2034_A' /*REPLACED ON 4/19/2016 OPEN BRANCH FROM BUS 314573 TO BUS 314596 CKT 1 /* 3EVERETS 115.00 - 3POPLR C 115.00 OPEN BRANCH FROM BUS 314596 TO BUS 314614 CKT 1 /* 3POPLR C 115.00 - 3TROWBR2 115.00 OPEN BUS 314596 /* ISLAND OPEN BRANCH FROM BUS 314569 TO BUS 314620 CKT 1 /* 6EARLEYS 230.00 - 6CASHIE 230.00 OPEN BRANCH FROM BUS 314614 TO BUS 314616 CKT 1 /* 3TROWBR2 115.00 - 6TRWBRDG 230.00 OPEN BRANCH FROM BUS 314616 TO BUS 933990 CKT 1 /* 6TRWBRDG 230.00 - AD1-023 TAP 230.00 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 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

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Summer Peak Analysis – 2021

Generator Deliverability

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

	Contingency				Bus				Loading %		Rating		MW	Flowgate
#	Type	Name	Affected Area	Facility Description	From	To	Ckt	Power Flow	Initial	Final	Type	MVA	Contribution	Appendix
1	N-1	DVP_P1-2: LN 2181	DVP - CPLE	6MORNSTR-6ROCKYMT230T 230 kV line	313845	304222	1	AC	97.64	105.05	ER	374	28.42	
2	N-1	DVP_P1-2: LN 594	DVP - DVP	8LADYSMITH-8CHANCE 500 kV line	314911	314905	1	AC	98.66	100.38	ER	2738	53.49	
3	N-1	DVP_P1-2: LN 573	DVP - DVP	8LADYSMITH-8POSSUM 500 kV line	314911	314922	1	AC	99.97	101.68	ER	2442	47.74	1

Multiple Facility Contingency

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

	Contingency				Bus				Loading %		Rating		MW	Flowgate
#	Type	Name	Affected Area	Facility Description	From	To	Ckt	Power Flow	Initial	Final	Type	MVA	Contribution	Appendix
4	LFFB	AEP_P4_#11112_05J.FERR 765_A1	AEP - AEP	05EDAN 1-05DANVL2 138 kV line	242631	242620	1	AC	96.81	101.77	ER	415	24.23	2
5	LFFB	DVP_P4-2: 246T247	DVP - CPLE	6EVERETS-6GREENVILE T 230 kV line	314574	304451	1	AC	90.85	109.85	ER	478	93.8	
6	DCTL	DVP_P7-1: LN 25-2034_A	DVP - DVP	3FIVE PT-3WHARTON 115 kV line	314576	314622	1	DC	52.78	114.45		91	56.12	3
7	LFFB	DVP_P4-2: 246T247	DVP - DVP	6LAKEVEW-AB2-100 TAP 230 kV line	314583	924510	1	AC	96.92	109.48		459	68.21	4
8	LFFB	DVP_P4-2: 2014T2034	DVP - DVP	3POPLR C-3EVERETS 115 kV line	314596	314573	1	AC	58.16	105.71		239	118.14	5
9	LFFB	DVP_P4-2: 246T2034	DVP - DVP	3POPLR C-3EVERETS 115 kV line	314596	314573	1	AC	51.88	101.98		239	123.51	
10	LFFB	DVP_P4-2: 246T247	DVP - DVP	6ELIZ CT-6SHAWBRO 230 kV line	314638	314647	1	AC	93.38	120.96		699	189.33	6
11	LFFB	DVP_P4-2: 56372	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	99.82	103.52		3144	126.14	
12	LFFB	DVP_P4-2: 57602	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	98.31	101.99		3144	125.64	
13	LFFB	DVP_P4-2: WT576	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	98.31	101.99		3144	125.64	
14	LFFB	DVP_P4-2: 557T574	DVP - DVP	8MDLTHAN-8NO ANNA 500 kV line	314914	314918	1	AC	99.21	102.52		3637	138	
15	DCTL	DVP_P7-1: LN 25-2034_A	DVP - DVP	AB2-169 TAP-3FIVE PT 115 kV line	925120	314576	1	DC	63.99	125.66		91	56.12	7

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

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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				Bus				Loading %		Rating		MW	Flowgate
#	Type	Name	Affected Area	Facility Description	From	To	Ckt	Power Flow	Initial	Final	Type	MVA	Contribution	Appendix
16	DCTL	DVP_P7-1: LN 81-2056	DVP - CPLE	6MORNSTR-6ROCKYMT230T 230 kV line	313845	304222	1	AC	132.81	142.5	ER	374	43.03	8
17	N-1	DVP_P1-2: LN 557	DVP - DVP	6SKIFF CREEK-6KINGS M 230 kV line	314209	314386	1	AC	124.84	128.39	ER	442	18.19	9
18	LFFB	DVP_P4-2: H2T557	DVP - DVP	8ELMONT 500/230 kV transformer	314218	314908	1	AC	106.14	107.31		1051	70.14	10
19	LFFB	DVP_P4-2: 562T563	DVP - DVP	6CHESTF B-6BASIN 230 kV line	314287	314276	1	AC	109	113.56		549	29.24	11
20	N-1	DVP_P1-2: LN 563	DVP - DVP	6CHESTF B-6BASIN 230 kV line	314287	314276	1	AC	103.51	107.3	ER	449	19.72	
21	N-1	DVP_P1-2: LN 557	DVP - DVP	6PENNIMAN-6WALR209 230 kV line	314296	314415	1	AC	113.94	117.49	ER	442	18.19	12
22	N-1	DVP_P1-2: LN 557	DVP - DVP	6KINGS M-6PENNIMAN 230 kV line	314386	314296	1	AC	117.39	120.94	ER	442	18.19	13
23	N-1	DVP_P1-2: LN 557	DVP - DVP	6WALR209-6LIGH209 230 kV line	314415	314391	1	AC	100.2	103.75	ER	442	18.19	14
24	DCTL	DVP_P7-1: LN 2058-2181	DVP - CPLE	6EVERETS-6GREENVILE T 230 kV line	314574	304451	1	AC	107.56	124.08	ER	478	82.63	15
25	LFFB	DVP_P4-2: 563T576	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	102.41	106.3		3144	132.2	16
26	N-1	DVP_P1-2: LN 563	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	103.71	106.65	ER	2442	83.12	
27	N-1	DVP_P1-2: LN 576	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	103.08	106.02	ER	2442	83.25	
28	N-1	DVP_P1-2: LN 594	DVP - DVP	8CHANCE-8BRISTER 500 kV line	314905	314900	1	AC	108.58	110.54	ER	2442	54.75	17
29	N-1	DVP_P1-2: LN 573	DVP - DVP	8CHANCE-8BRISTER 500 kV line	314905	314900	1	AC	104.56	106.48	ER	2442	53.72	
30	N-1	DVP_P1-2: LN 576	DVP - DVP	8ELMONT-8LADYSMITH 500 kV line	314908	314911	1	AC	134.85	138.08	ER	2442	91.11	18
31	N-1	DVP_P1-2: LN 563	DVP - DVP	8ELMONT-8LADYSMITH 500 kV line	314908	314911	1	AC	120.34	123.06	ER	2442	77.43	
32	LFFB	DVP_P4-2: 57602	DVP - DVP	8ELMONT-8LADYSMITH 500 kV line	314908	314911	1	AC	115.63	119.16		3351	137.48	
33	LFFB	DVP_P4-2: WT576	DVP - DVP	8ELMONT-8LADYSMITH 500 kV line	314908	314911	1	AC	115.63	119.16		3351	137.48	
34	N-1	DVP_P1-2: LN 573	DVP - DVP	8LADYSMITH-8CHANCE 500 kV line	314911	314905	1	AC	100.02	101.8	ER	2738	55.53	19
35	N-1	DVP_P1-2: LN 574	DVP - DVP	8MDLTHAN-8NO ANNA 500 kV line	314914	314918	1	AC	100.49	103.48	ER	2442	83.83	20

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Steady-State Voltage Requirements

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

The AD1-074, AD1-075, and AD1-076 projects did not meet the 0.95 lagging power factor requirement. An additional 58.87 Mvar would be required for the plant to meet the 0.95 lagging power factor requirement. The plant did meet the 0.95 leading power factor requirement.

Generator	MFO (MW)	Required Power Factor Range		Maximum Lagging (Mvar)	Minimum Leading (Mvar)
		Lagging	Leading		
AD1-074, AD1-075, and AD1-076	484.00	0.95	0.95		
Total Reactive Power Required				159.08	-159.08
Reactive Power from Generator				**Qmax**	**Qmin**
				178.75	-178.75
Customer Planned Compensation				0	0
Reactive Power Losses				-78.54	-78.54
Total Available Reactive Power at High Side of Main Transformer				100.21	-257.29
Deficiency in Reactive Power				-58.87	Meet

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

The AD1-074, AD1-075, and AD1-076 generators were observed to be unstable for the contingencies listed in the table below. These P4 contingencies were caused by breaker 2034T2126 failing to open resulting in both 230 kV lines connected to Trowbridge 230 kV tripping. The AD1-074, AD1-075, and AD1-076 queue projects lost sychronism once the two 230 kV line tripped and the generators were connected to the system through the two Trowbridge 230/115 kV transformers.

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Fault ID	Fault Description	Clearing Time Normal/Delayed (Cycles)	AD1-074, AD1-075, and AD1-076
P4.08	Fault at Trowbridge 230 kV on AD1-022 TAP circuit 2034. Breaker 2034T2126 is stuck. Fault is cleared with loss of Trowbridge 230/115 kV Transformer 1 and Trowbridge to Mackeys 230 kV circuit 2126.	5.5/26	Unstable
P4.09	Fault at Trowbridge 230 kV on Mackeys circuit 2126. Breaker 2034T2126 is stuck. Fault is cleared with loss of Trowbridge 230/115 kV Transformer 1 and Trowbridge to AD1-022 Tap 230 kV circuit 2034.	5.5/26	Unstable

The instability issue is mitigated by reconfiguring the Trowbridge 230 kV substation. If the AD1-074, AD1-075, and AD1-076 generator tie line connection is moved between circuit breakers 2034T2126 and H1T2126 and the Trowbridge to Mackeys 230 kV transmission line is moved between circuit breakers A and B the AD1-074, AD1-075, and AD1-076 queue projects can remain connected to a 230 kV line at Trowbridge for all P4 contingencies at Trowbridge 230 kV. The single line in Attachment 1 has been updated to reflect this reconfiguration. The table below lists the updated P4 contingencies with the Trowbridge 230 kV substation reconfigured. AD1-074, AD1-075, and AD1-076 remained stable for all P4 contingencies with the Trowbridge 230 kV substation reconfigured.

Fault ID	Fault Description	Clearing Time Normal/Delayed (Cycles)	AD1-074, AD1-075, and AD1-076 with Mitigation
P4.05.MIT	Fault at Trowbridge 230 kV on AD1-074 MAIN circuit. Breaker 2034T2126 is stuck. Fault is cleared with loss of Trowbridge to AD1-022/023 Tap 230 kV circuit 2034. (Trips AD1-074, AD1-075, AD1-076).	5.5/26	Stable
P4.06.MIT	Fault at Trowbridge 230 kV on AD1-074 MAIN circuit. Breaker H1T2126 is stuck. Fault is cleared with loss of Trowbridge 230/115 kV transformer 1. (Trips AD1-074, AD1-075, AD1-076).	5.5/26	Stable

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P4.07_MIT	Fault at Trowbridge 230 kV on AD1-022 TAP circuit 2034. Breaker H2T2034 is stuck. Fault is cleared with loss of Trowbridge 230/115 kV Transformer 2.	5.5/26	Stable
P4.08.MIT	Fault at Trowbridge 230 kV on AD1-022 TAP circuit 2034. Breaker 2034T2126 is stuck. Fault is cleared with loss of AD1-074, AD1-075, and AD1-075 generation. (Trips AD1-074, AD1-075, AD1-076)	5.5/26	Stable

The reconfiguration moving the Mackeys – Trowbridge 230kV line is captured under Network Upgrade n6287 with an estimated cost of $500,000.

New System Reinforcements

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

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AD1-074/075/076 Allocation
Stability P4.08, P4.09	NA	Description: Reconfigure the Trowbridge substation to move the Mackeys – Trowbridge 230kV line	n6287	$500,000	**$500,000**

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Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AD1-074/075/076 Allocation
# 3	8LADYSMITH-8POSSUM 500 kV line	Description: Replace wave trap at both Ladysmith and Possum Point Substations for the Ladysmith – Possum Pt 500kV line #552 Rating: 2598/2857/3637 Schedule: 12 – 16 months Note 1: As changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AD1-074/075/076 could become the driver and could be responsible for the upgrade Note 2: Although Queue Project AD1-074/075/076 may not have cost responsibility for this upgrade, Queue Project AD1-074/075/076 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the upgrade, Queue Project AD1-074/075/076 will need an interim study.	n6063	$500,000	**$0**
		Description: Rebuild 26.2 miles of the Ladysmith - Elmont 500kV line #574 Schedule: 12/31/25 in-service date Note: Although Queue Project AD1-074/075/076 may not have cost responsibility for this upgrade, Queue Project AD1-074/075/076 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the upgrade, Queue Project AD1-074/075/076 will need an interim study.	b3020	$65,500,000	**$0**

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<table>
<tr><th>Violation #</th><th>Overloaded Facility</th><th>Upgrade Description</th><th>Network Upgrade Number</th><th>Upgrade Cost</th><th>AD1-074/075/076 Allocation</th></tr>
<tr><td># 4</td><td>05EDAN 1-05DANVL2 138 kV line</td><td>American Electric Power (AEP) Work Scope:
Description: Rebuild the Danville – East Danville 138kV line
Rating: 572 / 572 / 572
Schedule: 24 - 30 months

<table><tr><th>Queue</th><th>MW contribution</th><th>Cost $9,000,000</th></tr><tr><td>AD1-074/075/076</td><td>2.36</td><td>$9,000,000</td></tr></table></td><td>n6124</td><td>$9,000,000</td><td>$9,000,000</td></tr>
<tr><td># 6</td><td>3FIVE PT-3WHARTON 115 kV line</td><td>Description: Rebuild 5.88 miles of the Five Points – Wharton 115 kV line # 189
Rating: 199/199/229
Schedule: 30 – 36 months

<table><tr><th>Queue</th><th>MW contribution</th><th>Cost $7,644,000</th></tr><tr><td>AD1-074/075/076</td><td>13.14</td><td>$7,644,000</td></tr></table></td><td>n6143</td><td>$7,644,000</td><td>$7,644,000</td></tr>
<tr><td># 7</td><td>6LAKEVEW-AB2-100 TAP 230 kV line</td><td>Description: Rebuild Clubhouse-Lakeview 230 kV line #254
Schedule: 12/31/2024 in-service date</td><td>b3121</td><td>$27,000,000</td><td>$0</td></tr>
</table>

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<table>
<tr><th>Violation #</th><th>Overloaded Facility</th><th>Upgrade Description</th><th>Network Upgrade Number</th><th>Upgrade Cost</th><th>AD1-074/075/076 Allocation</th></tr>
<tr><td># 8, 9</td><td>3POPLR C-3EVERETS 115 kV line</td><td>Description: Replace relays at Everetts substation on the Poplar Chapel – Everetts 115 kV line # 25
Rating: 300/300/345
Schedule: 14 – 16 months

<table><tr><th>Queue</th><th>MW contribution</th><th>Cost $500,000</th></tr><tr><td>AD1-023</td><td>29.29</td><td>$99,275</td></tr><tr><td>AD1-074/075/076</td><td>118.23</td><td>$400,725</td></tr></table></td><td>n6141</td><td>$500,000</td><td>$400,725</td></tr>
<tr><td># 10</td><td>6ELIZ CT-6SHAWBRO 230 kV line</td><td>Description: Rebuild 10.28 miles of the Shawboro – Elizabeth City 230 kV line #2021
Ratings: 1047/1047/1204
Schedule: 30 – 36 months

<table><tr><th>Queue</th><th>MW contribution</th><th>Cost $15,420,000</th></tr><tr><td>AD1-074/075/076</td><td>143.87</td><td>$15,420,000</td></tr></table></td><td>TBD</td><td>$15,420,000</td><td>$15,420,000</td></tr>
</table>

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<table>
<tr><th>Violation #</th><th>Overloaded Facility</th><th>Upgrade Description</th><th>Network Upgrade Number</th><th>Upgrade Cost</th><th>AD1-074/075/076 Allocation</th></tr>
<tr><td># 15</td><td>AB2-169 TAP-3FIVE PT 115 kV line</td><td>Description: Rebuild 5.14 miles of the AB2-169 Tap – Five Points D.P 115kV line # 189
Ratings: 261/261/301
Schedule: 30 – 36 months
<table><tr><th>Queue</th><th>MW contribution</th><th>Cost $6,682,000</th></tr><tr><td>AD1-074/075/076</td><td>56.12</td><td>$6,682,000</td></tr></table></td><td>n6142</td><td>$6,682,000</td><td>$6,682,000</td></tr>
<tr><td colspan="5">Total New Network Upgrades</td><td>$ 39,646,725</td></tr>
</table>

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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 is calculated and reported for in the Impact Study)

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AD1-074/075/076 Allocation
# 1, 16	6MORNSTR-6ROCKYMT230T 230 kV line	Description: Rebuild the 4.3 miles of Dominion 230 kV Line #2058 Rocky Mt. – Hathaway Rating: 1047/1047/1204 Schedule: 12/31/2024 in-service date Note: Although Queue Project AD1-074/075/076 may not have cost responsibility for this upgrade, Queue Project AD1-074/075/076 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the upgrade, Queue Project AD1-074/075/076 will need an interim study.	b3122	$13,000,000	**$0**

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Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AD1-074/075/076 Allocation
# 17, 21, 22	6SKIFF CREEK-6KINGS M 230 kV line 6PENNIMAN-6WALR209 230 kV line 6KINGS M-6PENNIMAN 230 kV line	Description: Rebuild 6.1 miles of Waller-Skiffes Creek 230 kV Line (#2154) between Waller and Kings Mill. Rating: 1047/1047/1204 Schedule: 12/30/2024 in-service date Note: Although Queue Project AD1-074/075/076 may not have cost responsibility for this upgrade, Queue Project AD1-074/075/076 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the upgrade, Queue Project AD1-074/075/076 will need an interim study.	b3057	$10,000,000	**$0**

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<table>
<tr><th>Violation #</th><th>Overloaded Facility</th><th>Upgrade Description</th><th>Network Upgrade Number</th><th>Upgrade Cost</th><th>AD1-074/075/076 Allocation</th></tr>
<tr><td># 18</td><td>8ELMONT 500/230 kV transformer</td><td>Description: Replace the Elmont 500/230 kV transformer #1
Rating: 1134 MVA (normal), 1203 MVA (emergency), and 1365 MVA (load dump).
Schedule: 24 - 30 months

<table><tr><th>Queue</th><th>MW contribution</th><th>Cost $22,000,000</th></tr><tr><td>AC2-012</td><td>24.79</td><td>$2,330,057</td></tr><tr><td>AC2-078</td><td>12.13</td><td>$1,140,121</td></tr><tr><td>AC2-079</td><td>14.89</td><td>$1,399,538</td></tr><tr><td>AC2-141</td><td>38.06</td><td>$3,577,329</td></tr><tr><td>AD1-023</td><td>17.4</td><td>$1,635,458</td></tr><tr><td>AD1-025</td><td>33.16</td><td>$3,116,769</td></tr><tr><td>AD1-033</td><td>11.6074</td><td>$1,091,001</td></tr><tr><td>AD1-041</td><td>11.2355</td><td>$1,056,045</td></tr><tr><td>AD1-076</td><td>70.79</td><td>$6,653,682</td></tr></table></td><td>n6127</td><td>$22,000,000</td><td>$6,653,682</td></tr>
<tr><td># 19, 20</td><td>6CHSTF B-6BASIN 230 kV line</td><td>Description: Reconductor 0.14 miles of the Chesterfield to Basin 230kV line

This project is in-service.</td><td>b2990</td><td>$250,000</td><td>$0</td></tr>
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Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AD1-074/075/076 Allocation
# 23	6WALR209-6LIGH209 230 kV line	Description: Rebuild a portion of the Waller to Lightfoot 230 kV Line # 2113 Rating: 1047/1047/1204 Schedule: 12/30/2024 in-service date Note: Although Queue Project AD1-074/075/076 may not have cost responsibility for this upgrade, Queue Project AD1-074/075/076 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the upgrade, Queue Project AD1-074/075/076 will need an interim study.	b3056	$4,000,000	**$0**

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<table>
<tr><th>Violation #</th><th>Overloaded Facility</th><th>Upgrade Description</th><th>Network Upgrade Number</th><th>Upgrade Cost</th><th>AD1-074/075/076 Allocation</th></tr>
<tr><td># 5, 24</td><td>6EVERETS-6GREENVILE T 230 kV line</td><td>Dominion Portion:
Description: Rebuild the 20.5 miles of Dominion 230 kV Line #218 Everetts - Greenville
Rating: 1047/1047/1204
Schedule: 30-36 months

<table><tr><th>Queue</th><th>MW contribution</th><th>Cost $30,750,000</th></tr><tr><td>AD1-023</td><td>18.24</td><td>$4,619,338</td></tr><tr><td>AD1-047</td><td>7.1</td><td>$1,798,098</td></tr><tr><td>AD1-057</td><td>13.49</td><td>$3,416,385</td></tr><tr><td>AD1-076</td><td>82.59</td><td>$20,916,179</td></tr></table>
Duke Energy/Progress Portion:
A potential constraint was identified by PJM on the Duke Energy/Progress (DEP) portion of the Everetts - Greenville 230 kV line. There are no mitigations currently planned for the DEP portion of this overload. The Queue Project AD1-074/075/076 may be subject to operational restriction if real-time system reliability issues occur. Additionally, if a baseline Network Upgrade project is identified on the Everetts - Greenville 230 kV line prior to the execution of the Queue Project’s final agreements, the Queue Project may require this upgrade to be in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the baseline Network Upgrade, Queue Project AD1-074/075/076 will need an interim deliverability study.</td><td>n6144</td><td>$30,750,000</td><td>$20,916,179</td></tr>
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Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AD1-074/075/076 Allocation
# 11, 12, 13, 25, 26, 27	8CHCKAHM-8ELMONT 500 kV line	Description: Replace wave trap at Chickahominy substation on the Chickahominy – Elmont 500 kV line # 557 Rating: 3424/3424/3937 Schedule: 12- 16 months Note 1: As changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AD1-074/075/076 could become the driver and could be responsible for the upgrade Note 2: Although Queue Project AD1-074/075/076 may not have cost responsibility for this upgrade, Queue Project AD1-074/075/076 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the upgrade, Queue Project AD1-074/075/076 will need an interim study.	n5464	$500,000	**$0**

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Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AD1-074/075/076 Allocation
# 28, 29	8CHANCE-8BRISTER 500 kV line	Description: Replace a wave trap on the Chancellor – Bristers 500 kV line # 552 Rating: 2914/2914/3351 Schedule: 12 – 16 months Note 1: As changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AD1-074/075/076 could become the driver and could be responsible for the upgrade Note 2: Although Queue Project AD1-074/075/076 may not have cost responsibility for this upgrade, Queue Project AD1-074/075/076 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the upgrade, Queue Project AD1-074/075/076 will need an interim study.	n6217	$250,000	**$0**

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Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AD1-074/075/076 Allocation
# 30, 31, 32, 33	8ELMONT-8LADYSMITH 500 kV line	Description: Replace wave traps at both Ladysmith and Elmont substations for the Ladysmith – Elmont 500kV line #574 Schedule: 12 – 16 months Note 1: As changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AD1-074/075/076 could become the driver and could be responsible for the upgrade Note 2: Although Queue Project AD1-074/075/076 may not have cost responsibility for this upgrade, Queue Project AD1-074/075/076 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the upgrade, Queue Project AD1-074/075/076 will need an interim study.	n5483	$700,000	**$0**
		Description: Rebuild 26.2 miles of the Ladysmith to Elmont 500kV line #574 Schedule:12/31/2025 Note: Although Queue Project AD1-074/075/076 may not have cost responsibility for this upgrade, Queue Project AD1-074/075/076 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the upgrade, Queue Project AD1-074/075/076 will need an interim study.	b3020	$65,500,000	**$0**

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Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AD1-074/075/076 Allocation
# 2, 34	8LADYSMITH-8CHANCE 500 kV line	Description: Rebuild 15.2 miles of the Ladysmith to Chancellor 500kV Line #581 Schedule:12/31/2023 in-service date Note: Although Queue Project AD1-074/075/076 may not have cost responsibility for this upgrade, Queue Project AD1-074/075/076 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the upgrade, Queue Project AD1-074/075/076 will need an interim study.	b3021	$44,380,000	**$0**
# 14, 35	8MDLTHAN-8NO ANNA 500 kV line	Description: Replace wave trap at North Anna Substation for Midlothian – North Anna 500 kV line #576. Schedule: 12 - 16 months Note 1: As changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AD1-074/075/076 could become the driver and could be responsible for the upgrade Note 2: Although Queue Project AD1-074/075/076 may not have cost responsibility for this upgrade, Queue Project AD1-074/075/076 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-074/075/076 comes into service prior to completion of the upgrade, Queue Project AD1-074/075/076 will need an interim study.	n6055	$250,000	**$0**

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Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AD1-074/075/076 Allocation
		Description: Wreck and rebuild 41 miles of the Midlothian – North Anna 500 kV Line #576 Ratings: 4816 / 4816/ 5539 Schedule: 44 - 60 months (VA CPCN required) Queue / MW contribution / Cost $123,390,000 AC2-141 / 77.46 / $37,166,703 AD1-025 / 41.93 / $20,118,769 AD1-076 / 137.77 / $66,104,528	n5609	123,390,000	**$66,104,528**
				Total Previously Identified Upgrades	**$ 87,020,707**

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 interconnection request by addressing 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					Bus				Loading %		Rating		MW
#	Type	Name	Affected Area	Facility Description	From	To	Ckt	Power Flow	Initial	Final	Type	MVA	Contribution
36	N-1	DVP_P1-2: LN 2181	DVP - CPLE	6MORNSTR-6ROCKYMT230T 230 kV line	313845	304222	1	AC	132.17	141.83	ER	374	42.9
37	N-1	DVP_P1-2: LN 2058	DVP - DVP	6MORNSTR-6NASH 230 kV line	313845	314591	1	AC	117.09	125.3	ER	449	43.75
38	N-1	DVP_P1-2: LN 557	DVP - DVP	6SKIFF CREEK-6KINGS M 230 kV line	314209	314386	1	AC	125.26	131.34	ER	442	27.45
39	N-1	DVP_P1-2: LN 563	DVP - DVP	6CHESTF B-6BASIN 230 kV line	314287	314276	1	AC	127.53	133.18	ER	449	29.76

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40	N-1	DVP_P1-2: LN 557	DVP - DVP	6PENNIMAN-6WALR209 230 kV line	314296	314415	1	AC	114.45	120.52	ER	442	27.45
41	N-1	DVP_P1-2: LN 557	DVP - DVP	6KINGS M-6PENNIMAN 230 kV line	314386	314296	1	AC	117.86	123.93	ER	442	27.45
42	N-1	DVP_P1-2: LN 557	DVP - DVP	6WALR209-6LIGH209 230 kV line	314415	314391	1	AC	100.71	106.78	ER	442	27.45
43	N-1	DVP_P1-2: LN 2131A	DVP - DVP	6SAPONY-6CARSON 230 kV line	314435	314282	1	AC	94.51	105.63	ER	679	75.09
44	N-1	DVP_P1-2: LN 2131A	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	AC	108.68	121.31	ER	599	75.12
45	N-1	DVP_P1-2: LN 2131A	DVP - DVP	6EARLEYS-6NUCO TP 230 kV line	314569	314575	1	AC	110.37	139.61	ER	572	170.33
46	N-1	DVP_P1-2: LN 2131A	DVP - CPLE	6EVERETS-6GREENVILE T 230 kV line	314574	304451	1	AC	87.38	108.28	ER	478	105.27
47	N-1	DVP_P1-2: LN 2131A	DVP - DVP	6NUCO TP-6SUFFOLK 230 kV line	314575	314537	1	AC	104.15	133.37	ER	572	170.33
48	N-1	DVP_P1-2: LN 2131A	DVP - DVP	6LAKEVEW-AB2-100 TAP 230 kV line	314583	924510	1	AC	114.94	133.76	ER	375	71.8
49	Non	Non	DVP - DVP	6LAKEVEW-AB2-100 TAP 230 kV line	314583	924510	1	AC	92.09	101.93	NR	375	43.24
50	N-1	DVP_P1-2: LN 2058	DVP - CPLE	6NASH-6PA-RMOUNT#4 230 kV line	314591	304226	1	AC	107	114.84	ER	470	43.75
51	N-1	DVP_P1-2: LN 2034-B	DVP - DVP	3POPLR C-3EVERETS 115 kV line	314596	314573	1	AC	54.24	108.04	ER	225	124.46
52	N-1	DVP_P1-2: LN 2034-A	DVP - DVP	6TRWBRDG 230/115 kV transformer	314616	314613	1	AC	58.31	116.95	ER	195	131.02
53	N-1	DVP_P1-2: LN 2131A	DVP - DVP	6TRWBRDG-AD1-023 TAP 230 kV line	314616	933990	1	AC	54.37	112.82	ER	572	362.54
54	N-1	DVP_P1-2: LN 2131A	DVP - DVP	6CASHIE-6EARLEYS 230 kV line	314620	314569	1	AC	67.96	127.35	ER	572	362.54
55	N-1	DVP_P1-2: LN 247	DVP - DVP	6ELIZ CT-6SHAWBRO 230 kV line	314638	314647	1	AC	87.51	116.4	ER	572	163.93
56	N-1	DVP_P1-2: LN 2020	DVP - DVP	6SUNBURY-6SUFFOLK 230 kV line	314648	314537	1	AC	104.82	138.81	ER	449	153.06
57	N-1	DVP_P1-2: LN 2020	DVP - DVP	6WINFALL-W1-029 230 kV line	314651	901080	1	AC	67.21	101.25	ER	449	153.16
58	N-1	DVP_P1-2: LN 246	DVP - DVP	6S HERTFORD-6WINFALL 230 kV line	314662	314651	1	AC	84.26	114.46	ER	733	219.76
59	N-1	DVP_P1-2: LN 557	DVP - DVP	8CARSON-8MDLTHAN 500 kV line	314902	314914	1	AC	95.04	98.47	ER	3219	125.82
60	N-1	DVP_P1-2: LN 576	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	126.46	131.25	ER	2442	125.64
61	Non	Non	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	102.23	105.97	NR	2442	97.51
62	N-1	DVP_P1-2: LN 594	DVP - DVP	8CHANCE-8BRISTER 500 kV line	314905	314900	1	AC	124.74	127.68	ER	2442	82.63
63	N-1	DVP_P1-2: LN 576	DVP - DVP	8ELMONT-8LADYSMITH 500 kV line	314908	314911	1	AC	158.56	163.4	ER	2442	137.5
64	Non	Non	DVP - DVP	8ELMONT-8LADYSMITH 500 kV line	314908	314911	1	AC	111.89	114.94	NR	2442	86.54
65	N-1	DVP_P1-2: LN 573	DVP - DVP	8LADYSMITH-8CHANCE 500 kV line	314911	314905	1	AC	112.62	115.28	ER	2738	83.8
66	N-1	DVP_P1-2: LN 573	DVP - DVP	8LADYSMITH-8POSSUM 500 kV line	314911	314922	1	AC	109.25	111.8	ER	2442	72.05
67	N-1	DVP_P1-2: LN 574	DVP - DVP	8MDLTHAN-8NO ANNA 500 kV line	314914	314918	1	AC	127.97	132.5	ER	2442	126.52
68	N-1	DVP_P1-2: LN 581	DVP - DVP	8NO ANNA-8SPOTSYL 500 kV line	314918	314934	1	AC	103.16	105.65	ER	3219	91.77
69	N-1	DVP_P1-2: LN 552	DVP - DVP	8SPOTSYL-8MORRSVL 500 kV line	314934	314916	1	AC	105.52	108.48	ER	3219	90.79
70	N-1	DVP_P1-2: LN 2020	DVP - DVP	W1-029-6SUNBURY 230 kV line	901080	314648	1	AC	106.21	140.21	ER	449	153.06
71	N-1	DVP_P1-2: LN 246	DVP - DVP	Z1-036 TAP-6S HERTFORD 230 kV line	916040	314662	1	AC	86.43	116.64	ER	733	219.76
72	N-1	DVP_P1-2: LN 2131A	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	129.22	147.75	ER	375	71.8
73	Non	Non	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	107.05	116.84	NR	375	43.24
74	N-1	DVP_P1-2: LN 2131A	DVP - DVP	AD1-023 TAP-6CASHIE 230 kV line	933990	314620	1	AC	69.7	129.04	ER	572	362.54

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Light Load Analysis in 2021

Not required

Affected System Analysis & Mitigation

Duke Energy/Progress:

Potential constraints were identified by PJM on the following Dominion – Duke Energy/Progress (DEP) tie lines. There are no mitigations currently planned for the DEP portions of these overloads. The Queue Project AD1-074/AD1-075/AD1-076 may be subject to operational restriction if real-time system reliability issues occur. The following facilities were identified in this report:

- Everetts - Greenville 230 kV line
- Rocky Mt. – Hathaway 230 kV line

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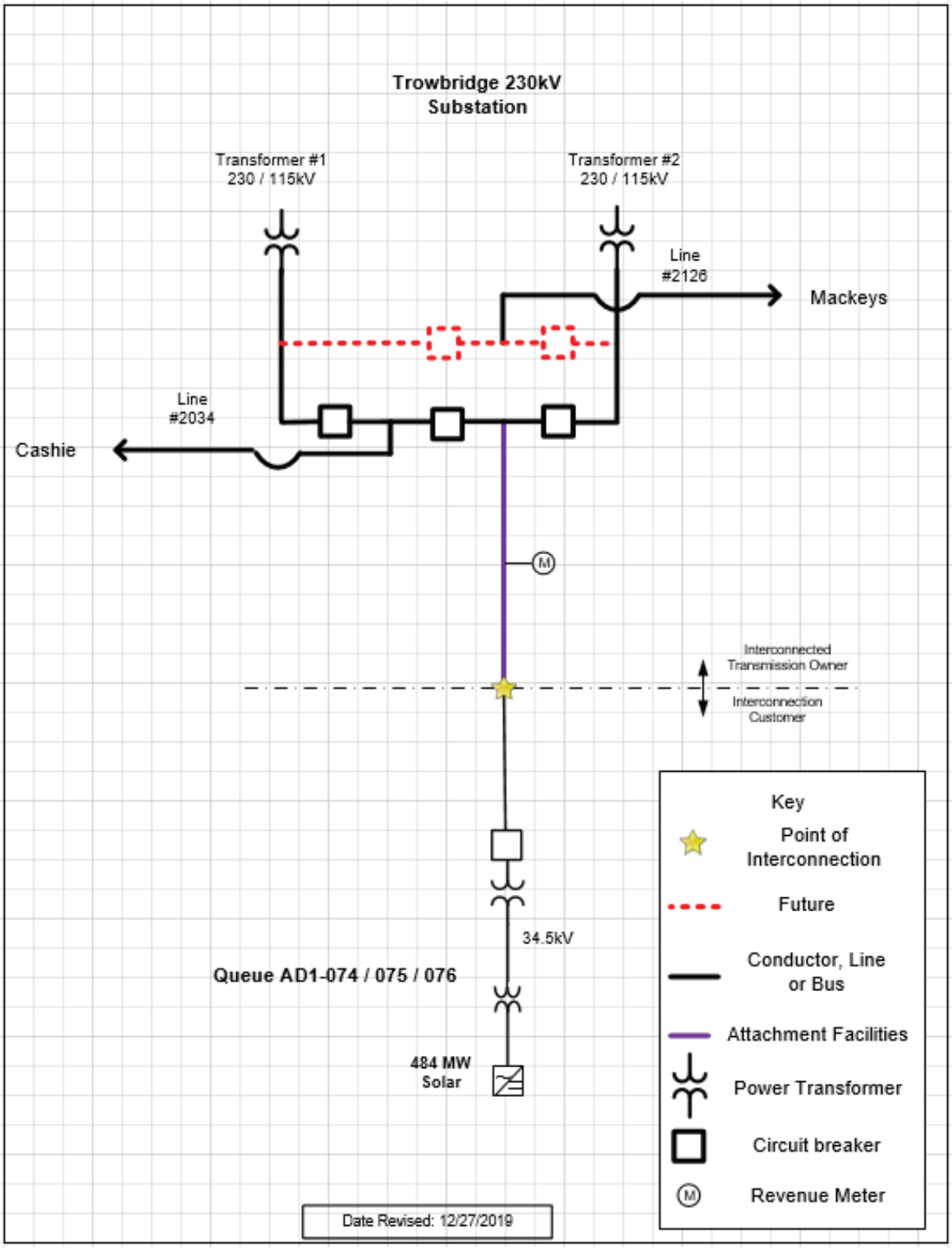
Attachment 1.

System Configuration



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Appendices

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

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

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Appendix 1

(DVP - DVP) The 8LADYSMITH-8POSSUM 500 kV line (from bus 314911 to bus 314922 ckt 1) loads from 99.97% to 101.68% (AC power flow) of its emergency rating (2442 MVA) for the single line contingency outage of 'DVP_P1-2: LN 573'. This project contributes approximately 47.74 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 573'
OPEN BRANCH FROM BUS 314918 TO BUS 314934 CKT 1 /* 8NO ANNA 500.00 - 8SPOTSYL 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315053	*1BELMED1*	*3.*
315054	*1BELMED2*	*3.*
315055	*1BELMED3*	*2.49*
315060	*1CHESTF5*	*10.63*
315061	*1CHESTG7*	*4.17*
315063	*1CHESTG8*	*4.12*
315062	*1CHESTS7*	*1.89*
315064	*1CHESTS8*	*2.11*
315067	*1DARBY 1*	*2.72*
315068	*1DARBY 2*	*2.73*
315069	*1DARBY 3*	*2.74*
315070	*1DARBY 4*	*2.74*
315043	*1FOUR RIVERA*	*3.58*
315044	*1FOUR RIVERB*	*2.77*
315045	*1FOUR RIVERC*	*3.58*
315046	*1FOUR RIVERD*	*2.77*
315047	*1FOUR RIVERE*	*2.77*
315048	*1FOUR RIVERF*	*3.58*
315074	*1HOPCGN1*	*7.7*

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315075	1HOPCGN2	7.6
315225	1N ANNA1	39.1
315226	1N ANNA2	39.08
315083	1SPRUNCA	9.81
315084	1SPRUNCB	9.81
315085	1SPRUNCC	7.27
315086	1SPRUNCD	7.27
315090	1YORKTN1	26.2
315091	1YORKTN2	27.19
314315	3LOCKS E	1.16
314309	6IRON208	0.48
314236	6NRTHEST	0.2
314250	6ROCKVILLE	0.23
932041	AC2-012 C	9.3
932501	AC2-070 C	1.57
932531	AC2-073 C	2.13
932581	AC2-078 C	3.72
932591	AC2-079 C	5.2
932831	AC2-110 C	1.21
933011	AC2-125	2.27
933021	AC2-126	2.28
933061	AC2-130	2.22
933261	AC2-137 C	0.36
933291	AC2-141 C	27.75
933991	AD1-023 C	11.51
934011	AD1-025 C O1	15.57

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934061	AD1-033 C O1	6.83
934141	AD1-041 C O1	4.74
934211	AD1-048 C	2.25
934391	AD1-063 C	1.44
934521	AD1-076 C O1	47.74
934571	AD1-082 C O1	7.01
934781	AD1-105 C	7.23
935111	AD1-144 C	1.57
935161	AD1-151 C O1	14.88
935211	AD1-156 C	1.94
LTF	CARR	1.1
LTF	CBM-S1	14.42
LTF	CBM-S2	23.19
LTF	CBM-W1	34.26
LTF	CBM-W2	77.81
LTF	CIN	7.95
LTF	CPLE	6.86
LTF	IPL	5.08
LTF	LGEE	1.73
LTF	MEC	16.86
LTF	MECS	7.82
LTF	RENSSELAER	0.88
297087	V2-040	0.13
LTF	WEC	2.13
LTF	Z1-043	8.38
918691	AA1-083	0.63

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919211	AA1-145	10.7
LTF	AA2-074	4.67
930121	AB1-027 C	0.45
923801	AB2-015 C O1	7.61
923831	AB2-022 C	2.07
924061	AB2-050	0.63
924241	AB2-068 O1	186.17
924511	AB2-100 C	9.97
924811	AB2-134 C O1	11.87
925051	AB2-160 C O1	5.02
925061	AB2-161 C O1	3.08
925331	AB2-190 C	18.52
925861	AC1-065 C	3.02
926291	AC1-107	281.01
926411	AC1-112 C	0.35
926551	AC1-134	8.37
926751	AC1-161 C	27.75
926781	AC1-164 C	37.16
927041	AC1-191 C	8.61
927221	AC1-216 C O1	9.06

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Appendix 2

(AEP - AEP) The 05EDAN 1-05DANVL2 138 kV line (from bus 242631 to bus 242620 ckt 1) loads from 96.81% to 101.77% (AC power flow) of its emergency rating (415 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#11112_05J.FERR 765_A1'. This project contributes approximately 24.23 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#11112_05J.FERR 765_A1'
OPEN BRANCH FROM BUS 242511 TO BUS 242514 CKT 1 / 242511 05BROADF 765 242514 05J.FERR 765 1
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
OPEN BRANCH FROM BUS 242566 TO BUS 242567 CKT ZB / 242566 05BROADF 138 242567 05BROADX 138 ZB
END

Bus Number	*Bus Name*	*Full Contribution*
244012	*05PINNACLE*	*-2.13*
315131	*1EDGECMA*	*4.15*
315132	*1EDGECMB*	*4.15*
314557	*3BETHELC*	*0.34*
314554	*3BTLEBRO*	*0.36*
314572	*3EMPORIA*	*0.13*
314578	*3HORNRTN*	*1.17*
314582	*3KELFORD*	*0.29*
314603	*3SCOT NK*	*1.2*
314617	*3TUNIS*	*0.27*
314620	*6CASHIE*	*0.26*
314574	*6EVERETS*	*0.95*
932631	*AC2-084 C*	*3.32*
932632	*AC2-084 E*	*1.63*

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932761	*AC2-100 C*	*3.59*
932762	*AC2-100 E*	*1.75*
933941	*AD1-017 C*	*0.79*
933942	*AD1-017 E*	*1.28*
933991	*AD1-023 C*	*3.94*
933992	*AD1-023 E*	*2.15*
934201	*AD1-047 C*	*2.64*
934202	*AD1-047 E*	*1.76*
934231	*AD1-050 C*	*1.94*
934232	*AD1-050 E*	*1.06*
934311	*AD1-055 C*	*1.01*
934312	*AD1-055 E*	*0.26*
934331	*AD1-057 C O1*	*3.99*
934332	*AD1-057 E O1*	*2.13*
934341	*AD1-058 C*	*3.91*
934342	*AD1-058 E*	*0.99*
934521	*AD1-076 C O1*	*16.05*
934522	*AD1-076 E O1*	*8.17*
934611	*AD1-087 C O1*	*3.26*
934612	*AD1-087 E O1*	*1.53*
934621	*AD1-088 C*	*3.6*
934622	*AD1-088 E*	*1.69*
934991	*AD1-131 C*	*1.28*
934992	*AD1-131 E*	*0.85*
935171	*AD1-152 C O1*	*3.24*
935172	*AD1-152 E O1*	*2.16*

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LTF	*AMIL*	*0.07*
LTF	*BLUEG*	*1.48*
LTF	*CANNELTON*	*0.16*
LTF	*CARR*	*0.08*
LTF	*CBM-S1*	*2.66*
LTF	*CBM-S2*	*17.19*
LTF	*CBM-W2*	*9.72*
LTF	*CLIFTY*	*8.91*
LTF	*CPLE*	*5.54*
LTF	*EDWARDS*	*0.29*
LTF	*ELMERSMITH*	*0.38*
LTF	*G-007A*	*0.49*
LTF	*GIBSON*	*0.39*
LTF	*NEWTON*	*0.51*
LTF	*O-066A*	*0.22*
LTF	*RENSSELAER*	*0.07*
LTF	*TATANKA*	*0.13*
LTF	*TILTON*	*0.41*
LTF	*TRIMBLE*	*0.29*
900672	*V4-068 E*	*0.09*
LTF	*VFT*	*1.3*
917332	*Z2-043 E*	*0.34*
917342	*Z2-044 E*	*0.25*
917512	*Z2-088 E OP1*	*1.62*
918492	*AA1-063AE OP*	*1.32*
918512	*AA1-065 E OP*	*1.41*

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918532	*AA1-067 E*	*0.29*
918562	*AA1-072 E*	*0.06*
919692	*AA2-053 E*	*1.28*
919701	*AA2-057 C*	*2.94*
919702	*AA2-057 E*	*1.47*
LTF	*AA2-074*	*3.77*
920042	*AA2-088 E*	*3.14*
920592	*AA2-165 E*	*0.19*
920672	*AA2-174 E*	*0.15*
930402	*AB1-081 E*	*1.71*
930861	*AB1-132 C*	*4.76*
930862	*AB1-132 E*	*2.04*
931231	*AB1-173 C*	*0.74*
931232	*AB1-173 E*	*0.35*
931241	*AB1-173AC*	*0.74*
931242	*AB1-173AE*	*0.35*
923911	*AB2-031 C O1*	*0.74*
923912	*AB2-031 E O1*	*0.36*
923991	*AB2-040 C O1*	*2.42*
923992	*AB2-040 E O1*	*1.98*
924021	*AB2-043 C O1*	*1.16*
924022	*AB2-043 E O1*	*1.91*
924151	*AB2-059 C O1*	*4.71*
924152	*AB2-059 E O1*	*2.43*
924161	*AB2-060 C O1*	*3.33*
924162	*AB2-060 E O1*	*1.57*

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924301	*AB2-077 C O1*	*0.75*
924302	*AB2-077 E O1*	*0.5*
924311	*AB2-078 C O1*	*0.75*
924312	*AB2-078 E O1*	*0.5*
924321	*AB2-079 C O1*	*0.75*
924322	*AB2-079 E O1*	*0.5*
924401	*AB2-089 C*	*0.88*
924402	*AB2-089 E*	*0.45*
924491	*AB2-098 C*	*0.22*
924492	*AB2-098 E*	*0.1*
924501	*AB2-099 C*	*0.19*
924502	*AB2-099 E*	*0.08*
924511	*AB2-100 C*	*3.36*
924512	*AB2-100 E*	*1.65*
925121	*AB2-169 C*	*2.19*
925122	*AB2-169 E*	*1.96*
925171	*AB2-174 C O1*	*2.29*
925172	*AB2-174 E O1*	*2.07*
925591	*AC1-034 C*	*3.05*
925592	*AC1-034 E*	*2.3*
925612	*AC1-036 E*	*0.52*
925781	*AC1-054 C*	*2.93*
925782	*AC1-054 E*	*1.35*
926051	*AC1-083 C*	*3.93*
926052	*AC1-083 E*	*6.41*
926071	*AC1-086 C*	*7.02*

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926072	*AC1-086 E*	*3.19*
926201	*AC1-098 C*	*2.33*
926202	*AC1-098 E*	*1.39*
926211	*AC1-099 C*	*0.78*
926212	*AC1-099 E*	*0.46*
926271	*AC1-105 C*	*2.29*
926272	*AC1-105 E*	*1.14*
927021	*AC1-189 C*	*3.54*
927022	*AC1-189 E*	*1.76*
927141	*AC1-208 C*	*3.44*
927142	*AC1-208 E*	*1.53*
927251	*AC1-221 C*	*1.56*
927252	*AC1-221 E*	*1.56*
927261	*AC1-222 C*	*1.46*
927262	*AC1-222 E*	*1.39*

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Appendix 3

(DVP - DVP) The 3FIVE PT-3WHARTON 115 kV line (from bus 314576 to bus 314622 ckt 1) loads from 52.78% to 114.45% (**DC power flow**) of its load dump rating (91 MVA) for the tower line contingency outage of 'DVP_P7-1: LN 25-2034_A'. This project contributes approximately 56.12 MW to the thermal violation.

```
CONTINGENCY 'DVP_P7-1: LN 25-2034_A'                    /*REPLACED ON
4/19/2016
  OPEN BRANCH FROM BUS 314573 TO BUS 314596 CKT 1        /* 3EVERETS
115.00 - 3POPLR C 115.00
  OPEN BRANCH FROM BUS 314596 TO BUS 314614 CKT 1        /* 3POPLR C
115.00 - 3TROWBR2 115.00
  OPEN BUS 314596                                        /* ISLAND
  OPEN BRANCH FROM BUS 314569 TO BUS 314620 CKT 1        /* 6EARLEYS
230.00 - 6CASHIE 230.00
  OPEN BRANCH FROM BUS 314614 TO BUS 314616 CKT 1        /* 3TROWBR2
115.00 - 6TRWBRDG 230.00
  OPEN BRANCH FROM BUS 314616 TO BUS 933990 CKT 1        /* 6TRWBRDG
230.00 - AD1-023 TAP 230.00
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315294	*1DOMTR10*	*3.04*
315292	*1DOMTR78*	*2.06*
315293	*1DOMTR9*	*1.68*
314566	*3CRESWEL*	*1.3*
314594	*6PLYMOTH*	*0.56*
934521	*AD1-076 C O1*	*37.19*
934522	*AD1-076 E O1*	*18.94*
LTF	*AMIL*	*0.06*
LTF	*BLUEG*	*0.31*
LTF	*CALDERWOOD*	*0.18*
LTF	*CANNELTON*	*0.06*
LTF	*CARR*	*< 0.01*

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LTF	*CATAWBA*	*0.17*
LTF	*CHEOAH*	*0.17*
LTF	*CHILHOWEE*	*0.06*
LTF	*CLIFTY*	*1.12*
LTF	*COTTONWOOD*	*0.61*
LTF	*EDWARDS*	*0.1*
LTF	*ELMERSMITH*	*0.17*
LTF	*FARMERCITY*	*0.07*
LTF	*G-007A*	*0.11*
LTF	*GIBSON*	*0.11*
LTF	*HAMLET*	*0.36*
LTF	*MORGAN*	*0.54*
LTF	*NEWTON*	*0.26*
LTF	*O-066A*	*0.05*
LTF	*PRAIRIE*	*0.56*
LTF	*RENSSELAER*	*< 0.01*
LTF	*SANTEETLA*	*0.05*
LTF	*SMITHLAND*	*0.05*
LTF	*TATANKA*	*0.13*
LTF	*TILTON*	*0.11*
LTF	*TRIMBLE*	*0.06*
LTF	*TVA*	*0.23*
LTF	*UNIONPOWER*	*0.3*
LTF	*VFT*	*0.28*
916042	*Z1-036 E*	*16.14*
920692	*AA2-178 E*	*2.23*

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925121	*AB2-169 C*	*19.*
925122	*AB2-169 E*	*17.05*

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Appendix 4

(DVP - DVP) The 6LAKEVEW-AB2-100 TAP 230 kV line (from bus 314583 to bus 924510 ckt 1) loads from 96.92% to 109.48% (AC power flow) of its load dump rating (459 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 246T247'. This project contributes approximately 68.21 MW to the thermal violation.

```
CONTINGENCY 'DVP_P4-2: 246T247'                          /* SUFFOLK 230 KV
  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: 6NUCO TP 230.00
  OPEN BUS 314590                                  /* ISLAND: 6NUCOR 230.00
  OPEN BRANCH FROM BUS 314537 TO BUS 314648 CKT 1        /* 6SUFFOLK
230.00 - 6SUNBURY 230.00
  OPEN BRANCH FROM BUS 314648 TO BUS 901080 CKT 1        /* 6SUNBURY
230.00 - W1-029 230.00
  OPEN BUS 314648                                  /* ISLAND: 6SUNBURY 230.00
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315294	*1DOMTR10*	*2.03*
315131	*1EDGECMA*	*10.46*
315132	*1EDGECMB*	*10.46*
315139	*1GASTONA*	*7.6*
315141	*1GASTONB*	*7.6*
315126	*1ROARAP2*	*1.56*
315128	*1ROARAP4*	*1.5*
315136	*1ROSEMG1*	*5.1*
315138	*1ROSEMG2*	*2.39*
315137	*1ROSEMS1*	*3.16*
314557	*3BETHELC*	*0.87*

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314554	3BTLEBRO	0.84
314566	3CRESWEL	1.63
314578	3HORNRTN	3.35
314582	3KELFORD	0.91
314603	3SCOT NK	3.54
314617	3TUNIS	0.81
314541	3WATKINS	0.32
314620	6CASHIE	0.83
314574	6EVERETS	2.42
314594	6PLYMOTH	0.69
932631	AC2-084 C	9.32
932632	AC2-084 E	4.59
933991	AD1-023 C	11.93
933992	AD1-023 E	6.49
934231	AD1-050 C	2.12
934232	AD1-050 E	1.16
934331	AD1-057 C O1	16.06
934332	AD1-057 E O1	8.57
934521	AD1-076 C O1	45.2
934522	AD1-076 E O1	23.02
LTF	CARR	0.09
LTF	CBM-S1	4.49
LTF	CBM-S2	9.25
LTF	CBM-W1	9.78
LTF	CBM-W2	24.05
LTF	CIN	2.19

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LTF	*CPLE*	*3.18*
LTF	*G-007*	*0.61*
LTF	*IPL*	*1.39*
LTF	*LGEE*	*0.47*
LTF	*MEC*	*4.96*
LTF	*MECS*	*2.18*
LTF	*O-066*	*2.03*
LTF	*RENSSELAER*	*0.08*
900672	*V4-068 E*	*0.24*
LTF	*WEC*	*0.6*
916042	*Z1-036 E*	*21.74*
917331	*Z2-043 C*	*0.48*
917332	*Z2-043 E*	*1.09*
917341	*Z2-044 C*	*0.27*
917342	*Z2-044 E*	*0.61*
917511	*Z2-088 C OP1*	*0.98*
917512	*Z2-088 E OP1*	*4.11*
918411	*AA1-050*	*0.82*
918491	*AA1-063AC OP*	*1.4*
918492	*AA1-063AE OP*	*3.51*
918511	*AA1-065 C OP*	*2.04*
918512	*AA1-065 E OP*	*5.33*
918531	*AA1-067 C*	*0.32*
918532	*AA1-067 E*	*0.73*
918561	*AA1-072 C*	*0.07*
918562	*AA1-072 E*	*0.18*

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919691	*AA2-053 C*	*1.69*
919692	*AA2-053 E*	*3.85*
919701	*AA2-057 C*	*7.44*
919702	*AA2-057 E*	*3.72*
LTF	*AA2-074*	*2.16*
920042	*AA2-088 E*	*6.93*
920591	*AA2-165 C*	*0.19*
920592	*AA2-165 E*	*0.49*
920671	*AA2-174 C*	*0.08*
920672	*AA2-174 E*	*0.45*
920692	*AA2-178 E*	*2.8*
930401	*AB1-081 C*	*1.79*
930402	*AB1-081 E*	*4.08*
930861	*AB1-132 C*	*30.87*
930862	*AB1-132 E*	*13.23*
923801	*AB2-015 C O1*	*3.67*
923802	*AB2-015 E O1*	*3.01*
924151	*AB2-059 C O1*	*11.21*
924152	*AB2-059 E O1*	*5.78*
924401	*AB2-089 C*	*0.96*
924402	*AB2-089 E*	*0.49*
924491	*AB2-098 C*	*0.57*
924492	*AB2-098 E*	*0.24*
924501	*AB2-099 C*	*0.61*
924502	*AB2-099 E*	*0.26*
925121	*AB2-169 C*	*5.86*

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925122	*AB2-169 E*	*5.26*
925591	*AC1-034 C*	*7.26*
925592	*AC1-034 E*	*5.48*
925781	*AC1-054 C*	*3.7*
925782	*AC1-054 E*	*1.7*
926071	*AC1-086 C*	*45.45*
926072	*AC1-086 E*	*20.69*
926201	*AC1-098 C*	*6.54*
926202	*AC1-098 E*	*3.89*
926211	*AC1-099 C*	*2.19*
926212	*AC1-099 E*	*1.29*
927021	*AC1-189 C*	*8.98*
927022	*AC1-189 E*	*4.48*
927141	*AC1-208 C*	*9.39*
927142	*AC1-208 E*	*4.17*

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Appendix 5

(DVP - DVP) The 3POPLR C-3EVERETS 115 kV line (from bus 314596 to bus 314573 ckt 1) loads from 58.16% to 105.71% (AC power flow) of its load dump rating (239 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 2014T2034'. This project contributes approximately 118.14 MW to the thermal violation.

```
CONTINGENCY 'DVP_P4-2: 2014T2034'                    /* EARLEYS
  OPEN BRANCH FROM BUS 314569 TO BUS 314620 CKT 1    /* 2034
  OPEN BRANCH FROM BUS 314620 TO BUS 933990 CKT 1    /* 2034
  OPEN BRANCH FROM BUS 314569 TO BUS 314574 CKT 1    /* 2014
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315294	*1DOMTR10*	*4.8*
315292	*1DOMTR78*	*3.24*
315293	*1DOMTR9*	*2.65*
314566	*3CRESWEL*	*2.76*
314594	*6PLYMOTH*	*1.18*
314648	*6SUNBURY*	*0.34*
314651	*6WINFALL*	*1.05*
933991	*AD1-023 C*	*18.97*
933992	*AD1-023 E*	*10.33*
934521	*AD1-076 C O1*	*78.28*
934522	*AD1-076 E O1*	*39.86*
LTF	*AMIL*	*0.17*
LTF	*BLUEG*	*0.89*
LTF	*CALDERWOOD*	*0.54*
LTF	*CANNELTON*	*0.17*
LTF	*CATAWBA*	*0.52*
LTF	*CBM-N*	*< 0.01*

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LTF	*CHEOAH*	*0.5*
LTF	*CHILHOWEE*	*0.17*
LTF	*CLIFTY*	*3.23*
LTF	*COTTONWOOD*	*1.81*
LTF	*EDWARDS*	*0.28*
LTF	*ELMERSMITH*	*0.5*
LTF	*FARMERCITY*	*0.22*
LTF	*G-007A*	*0.37*
LTF	*GIBSON*	*0.31*
LTF	*HAMLET*	*1.09*
LTF	*MORGAN*	*1.58*
LTF	*NEWTON*	*0.76*
LTF	*NYISO*	*0.03*
LTF	*O-066A*	*0.17*
LTF	*PRAIRIE*	*1.64*
LTF	*SANTEETLA*	*0.15*
LTF	*SMITHLAND*	*0.15*
LTF	*TATANKA*	*0.37*
LTF	*TILTON*	*0.32*
LTF	*TRIMBLE*	*0.17*
LTF	*TVA*	*0.67*
LTF	*UNIONPOWER*	*0.89*
LTF	*VFT*	*0.99*
901082	*W1-029E*	*23.46*
913392	*Y1-086 E*	*1.07*
916041	*Z1-036 C*	*0.98*

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916042	*Z1-036 E*	*34.82*
917122	*Z2-027 E*	*0.52*
920691	*AA2-178 C*	*2.08*
920692	*AA2-178 E*	*4.73*
923831	*AB2-022 C*	*0.99*
923832	*AB2-022 E*	*0.53*
925121	*AB2-169 C*	*4.79*
925122	*AB2-169 E*	*4.3*

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Appendix 6

(DVP - DVP) The 6ELIZ CT-6SHAWBRO 230 kV line (from bus 314638 to bus 314647 ckt 1) loads from 93.38% to 120.96% (AC power flow) of its load dump rating (699 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 246T247'. This project contributes approximately 189.33 MW to the thermal violation.

```
CONTINGENCY 'DVP_P4-2: 246T247'                          /* SUFFOLK 230 KV
  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: 6NUCO TP 230.00
  OPEN BUS 314590                                  /* ISLAND: 6NUCOR 230.00
  OPEN BRANCH FROM BUS 314537 TO BUS 314648 CKT 1        /* 6SUFFOLK
230.00 - 6SUNBURY 230.00
  OPEN BRANCH FROM BUS 314648 TO BUS 901080 CKT 1        /* 6SUNBURY
230.00 - W1-029 230.00
  OPEN BUS 314648                                  /* ISLAND: 6SUNBURY 230.00
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315294	*1DOMTR10*	*4.7*
315292	*1DOMTR78*	*3.18*
315293	*1DOMTR9*	*2.59*
315139	*1GASTONA*	*2.14*
315141	*1GASTONB*	*2.14*
315136	*1ROSEMG1*	*1.52*
315138	*1ROSEMG2*	*0.71*
315137	*1ROSEMS1*	*0.94*
314557	*3BETHELC*	*0.6*
314566	*3CRESWEL*	*6.73*
314582	*3KELFORD*	*0.78*

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314603	3SCOT NK	2.69
314617	3TUNIS	0.7
314620	6CASHIE	1.59
314574	6EVERETS	2.48
314594	6PLYMOTH	2.03
314651	6WINFALL	6.57
932631	AC2-084 C	6.52
932632	AC2-084 E	3.21
933991	AD1-023 C	27.51
933992	AD1-023 E	14.98
934331	AD1-057 C O1	6.06
934332	AD1-057 E O1	3.23
934521	AD1-076 C O1	125.45
934522	AD1-076 E O1	63.88
LTF	CARR	0.07
LTF	CBM-S1	3.19
LTF	CBM-S2	6.62
LTF	CBM-W1	6.93
LTF	CBM-W2	17.1
LTF	CIN	1.55
LTF	CPLE	2.3
LTF	G-007	0.44
LTF	IPL	0.99
LTF	LGEE	0.33
LTF	MEC	3.53
LTF	MECS	1.54

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LTF	*O-066*	*1.47*
LTF	*RENSSELAER*	*0.06*
900671	*V4-068 C*	*0.06*
900672	*V4-068 E*	*0.18*
901081	*W1-029C*	*4.81*
901082	*W1-029E*	*171.39*
LTF	*WEC*	*0.43*
913391	*Y1-086 C*	*1.04*
913392	*Y1-086 E*	*8.99*
916041	*Z1-036 C*	*4.42*
916042	*Z1-036 E*	*157.67*
917121	*Z2-027 C*	*1.91*
917122	*Z2-027 E*	*4.35*
917331	*Z2-043 C*	*0.41*
917332	*Z2-043 E*	*0.94*
917342	*Z2-044 E*	*0.35*
917511	*Z2-088 C OP1*	*0.74*
917512	*Z2-088 E OP1*	*3.1*
918411	*AA1-050*	*0.62*
918511	*AA1-065 C OP*	*2.13*
918512	*AA1-065 E OP*	*5.58*
918531	*AA1-067 C*	*0.33*
918532	*AA1-067 E*	*0.75*
918561	*AA1-072 C*	*0.06*
918562	*AA1-072 E*	*0.16*
919691	*AA2-053 C*	*1.1*

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919692	*AA2-053 E*	*2.52*
919701	*AA2-057 C*	*4.51*
919702	*AA2-057 E*	*2.26*
LTF	*AA2-074*	*1.57*
920591	*AA2-165 C*	*0.12*
920592	*AA2-165 E*	*0.3*
920671	*AA2-174 C*	*0.05*
920672	*AA2-174 E*	*0.29*
920691	*AA2-178 C*	*5.06*
920692	*AA2-178 E*	*11.54*
930861	*AB1-132 C*	*8.68*
930862	*AB1-132 E*	*3.72*
923831	*AB2-022 C*	*9.91*
923832	*AB2-022 E*	*5.34*
924491	*AB2-098 C*	*0.58*
924492	*AB2-098 E*	*0.25*
924501	*AB2-099 C*	*0.56*
924502	*AB2-099 E*	*0.24*
925121	*AB2-169 C*	*11.25*
925122	*AB2-169 E*	*10.09*
926071	*AC1-086 C*	*12.78*
926072	*AC1-086 E*	*5.81*
926201	*AC1-098 C*	*4.58*
926202	*AC1-098 E*	*2.73*
926211	*AC1-099 C*	*1.53*
926212	*AC1-099 E*	*0.9*

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927021	*AC1-189 C*	*7.53*
927022	*AC1-189 E*	*3.75*
927141	*AC1-208 C*	*5.8*
927142	*AC1-208 E*	*2.57*

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Appendix 7

(DVP - DVP) The AB2-169 TAP-3FIVE PT 115 kV line (from bus 925120 to bus 314576 ckt 1) loads from 63.99% to 125.66% (**DC power flow**) of its load dump rating (91 MVA) for the tower line contingency outage of 'DVP_P7-1: LN 25-2034_A'. This project contributes approximately 56.12 MW to the thermal violation.

```
CONTINGENCY 'DVP_P7-1: LN 25-2034_A'                    /*REPLACED ON
4/19/2016
  OPEN BRANCH FROM BUS 314573 TO BUS 314596 CKT 1        /* 3EVERETS
115.00 - 3POPLR C 115.00
  OPEN BRANCH FROM BUS 314596 TO BUS 314614 CKT 1        /* 3POPLR C
115.00 - 3TROWBR2 115.00
  OPEN BUS 314596                                        /* ISLAND
  OPEN BRANCH FROM BUS 314569 TO BUS 314620 CKT 1        /* 6EARLEYS
230.00 - 6CASHIE 230.00
  OPEN BRANCH FROM BUS 314614 TO BUS 314616 CKT 1        /* 3TROWBR2
115.00 - 6TRWBRDG 230.00
  OPEN BRANCH FROM BUS 314616 TO BUS 933990 CKT 1        /* 6TRWBRDG
230.00 - AD1-023 TAP 230.00
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315294	*1DOMTR10*	*3.04*
315292	*1DOMTR78*	*2.06*
315293	*1DOMTR9*	*1.68*
314566	*3CRESWEL*	*1.3*
314594	*6PLYMOTH*	*0.56*
934521	*AD1-076 C O1*	*37.19*
934522	*AD1-076 E O1*	*18.94*
LTF	*AMIL*	*0.06*
LTF	*BLUEG*	*0.31*
LTF	*CALDERWOOD*	*0.18*
LTF	*CANNELTON*	*0.06*
LTF	*CARR*	*< 0.01*

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LTF	*CATAWBA*	*0.17*
LTF	*CHEOAH*	*0.17*
LTF	*CHILHOWEE*	*0.06*
LTF	*CLIFTY*	*1.12*
LTF	*COTTONWOOD*	*0.61*
LTF	*EDWARDS*	*0.1*
LTF	*ELMERSMITH*	*0.17*
LTF	*FARMERCITY*	*0.07*
LTF	*G-007A*	*0.11*
LTF	*GIBSON*	*0.11*
LTF	*HAMLET*	*0.36*
LTF	*MORGAN*	*0.54*
LTF	*NEWTON*	*0.26*
LTF	*O-066A*	*0.05*
LTF	*PRAIRIE*	*0.56*
LTF	*RENSSELAER*	*< 0.01*
LTF	*SANTEETLA*	*0.05*
LTF	*SMITHLAND*	*0.05*
LTF	*TATANKA*	*0.13*
LTF	*TILTON*	*0.11*
LTF	*TRIMBLE*	*0.06*
LTF	*TVA*	*0.23*
LTF	*UNIONPOWER*	*0.3*
LTF	*VFT*	*0.28*
916042	*Z1-036 E*	*16.14*
920692	*AA2-178 E*	*2.23*

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925121	*AB2-169 C*	*19.*
925122	*AB2-169 E*	*17.05*

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Appendix 8

(DVP - CPLE) The 6MORNSTR-6ROCKYMT230T 230 kV line (from bus 313845 to bus 304222 ckt 1) loads from 132.81% to 142.5% (AC 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 43.03 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*	*3.84*
315141	*1GASTONB*	*3.84*
315126	*1ROARAP2*	*1.17*
315128	*1ROARAP4*	*1.13*
315136	*1ROSEMG1*	*3.22*
315138	*1ROSEMG2*	*1.51*
315137	*1ROSEMS1*	*2.*

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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
314539	3UNCAMP	1.04
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
933991	AD1-023 C	7.25
933992	AD1-023 E	3.95
934201	AD1-047 C	5.53
934202	AD1-047 E	3.69
934331	AD1-057 C O1	19.79
934332	AD1-057 E O1	10.55
934521	AD1-076 C O1	28.51
934522	AD1-076 E O1	14.52
LTF	AMIL	0.38
LTF	BLUEG	1.99
LTF	CALDERWOOD	1.17
LTF	CANNELTON	0.38

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LTF	CARR	< 0.01
LTF	CATAWBA	1.14
LTF	CELEVELAND /* 35% REVERSE 4479079 4642907	< 0.01
LTF	CHEOAH	1.09
LTF	CHILHOWEE	0.38
LTF	CLIFTY	7.33
LTF	COTTONWOOD	3.91
LTF	EDWARDS	0.61
LTF	ELMERSMITH	1.11
LTF	FARMERCITY	0.48
LTF	G-007A	0.76
LTF	GIBSON	0.7
LTF	HAMLET	2.25
LTF	MORGAN	3.43
LTF	NEWTON	1.68
LTF	O-066A	0.35
LTF	PRAIRIE	3.62
LTF	RENSSELAER	< 0.01
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	1.94
900671	V4-068 C	0.06

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900672	*V4-068 E*	*0.18*
LTF	*VFT*	*2.01*
907092	*X1-038 E*	*2.6*
LTF	*Y3-032*	*< 0.01*
917331	*Z2-043 C*	*0.37*
917332	*Z2-043 E*	*0.84*
917341	*Z2-044 C*	*0.33*
917342	*Z2-044 E*	*0.75*
917511	*Z2-088 C OP1*	*1.6*
917512	*Z2-088 E OP1*	*6.74*
918411	*AA1-050*	*1.35*
918491	*AA1-063AC OP*	*1.09*
918492	*AA1-063AE OP*	*2.74*
918511	*AA1-065 C OP*	*1.11*
918512	*AA1-065 E OP*	*2.92*
918531	*AA1-067 C*	*0.24*
918532	*AA1-067 E*	*0.54*
918561	*AA1-072 C*	*0.06*
918562	*AA1-072 E*	*0.14*
919691	*AA2-053 C*	*1.22*
919692	*AA2-053 E*	*2.79*
919701	*AA2-057 C*	*8.78*
919702	*AA2-057 E*	*4.39*
920042	*AA2-088 E*	*5.93*
920591	*AA2-165 C*	*0.23*
920592	*AA2-165 E*	*0.58*

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920671	*AA2-174 C*	*0.06*
920672	*AA2-174 E*	*0.32*
920692	*AA2-178 E*	*1.86*
930401	*AB1-081 C*	*2.74*
930402	*AB1-081 E*	*6.24*
930861	*AB1-132 C*	*15.62*
930862	*AB1-132 E*	*6.7*
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*	*3.94*
923802	*AB2-015 E O1*	*3.23*
923852	*AB2-025 E*	*0.45*
923911	*AB2-031 C O1*	*1.55*
923912	*AB2-031 E O1*	*0.76*
923991	*AB2-040 C O1*	*5.07*
923992	*AB2-040 E O1*	*4.15*
924151	*AB2-059 C O1*	*17.15*
924152	*AB2-059 E O1*	*8.83*
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*	*8.3*
924512	*AB2-100 E*	*4.09*

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925121	*AB2-169 C*	*4.03*
925122	*AB2-169 E*	*3.62*
925171	*AB2-174 C O1*	*4.75*
925172	*AB2-174 E O1*	*4.3*
925591	*AC1-034 C*	*11.11*
925592	*AC1-034 E*	*8.38*
926071	*AC1-086 C*	*23.01*
926072	*AC1-086 E*	*10.47*
926201	*AC1-098 C*	*6.58*
926202	*AC1-098 E*	*3.92*
926211	*AC1-099 C*	*2.21*
926212	*AC1-099 E*	*1.3*
927021	*AC1-189 C*	*12.21*
927022	*AC1-189 E*	*6.08*
927141	*AC1-208 C*	*10.44*
927142	*AC1-208 E*	*4.64*

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Appendix 9

(DVP - DVP) The 6SKIFF CREEK-6KINGS M 230 kV line (from bus 314209 to bus 314386 ckt 1) loads from 124.84% to 128.39% (AC power flow) of its emergency rating (442 MVA) for the single line contingency outage of 'DVP_P1-2: LN 557'. This project contributes approximately 18.19 MW to the thermal violation.

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

Bus Number	*Bus Name*	*Full Contribution*
315108	*1ELIZAR1*	*1.52*
315109	*1ELIZAR2*	*1.49*
315110	*1ELIZAR3*	*1.54*
315233	*1SURRY 2*	*15.45*
315090	*1YORKTN1*	*23.06*
315091	*1YORKTN2*	*23.93*
315092	*1YORKTN3*	*21.66*
314421	*6WINCHST*	*0.13*
932041	*AC2-012 C*	*4.2*
932591	*AC2-079 C*	*1.72*
933291	*AC2-141 C*	*14.07*
933731	*AC2-196 C*	*0.14*
933991	*AD1-023 C*	*4.31*
934061	*AD1-033 C O1*	*3.11*
934521	*AD1-076 C O1*	*18.19*
935111	*AD1-144 C*	*0.75*
LTF	*CARR*	*0.13*

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LTF	*CBM-S1*	*2.35*
LTF	*CBM-S2*	*5.13*
LTF	*CBM-W1*	*4.34*
LTF	*CBM-W2*	*12.28*
LTF	*CIN*	*0.99*
LTF	*CPLE*	*1.65*
LTF	*IPL*	*0.63*
LTF	*LGEE*	*0.22*
LTF	*MEC*	*2.38*
LTF	*MECS*	*0.8*
LTF	*RENSSELAER*	*0.11*
LTF	*WEC*	*0.27*
916191	*Z1-068 C*	*0.02*
923801	*AB2-015 C O1*	*2.76*
923831	*AB2-022 C*	*0.91*
924241	*AB2-068 O1*	*103.29*
925121	*AB2-169 C*	*1.96*
925521	*AC1-027 C*	*0.16*
926291	*AC1-107*	*155.9*
926751	*AC1-161 C*	*14.07*

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Appendix 10

(DVP - DVP) The 8ELMONT 500/230 kV transformer (from bus 314218 to bus 314908 ckt 1) loads from 106.14% to 107.31% (AC 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 70.14 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*	*4.77*
315068	*1DARBY 2*	*4.78*
315069	*1DARBY 3*	*4.8*
315070	*1DARBY 4*	*4.8*
315043	*1FOUR RIVERA*	*6.38*
315044	*1FOUR RIVERB*	*4.93*
315045	*1FOUR RIVERC*	*6.38*
315046	*1FOUR RIVERD*	*4.93*
315047	*1FOUR RIVERE*	*4.93*
315048	*1FOUR RIVERF*	*6.38*
315074	*1HOPCGN1*	*11.17*
315075	*1HOPCGN2*	*11.02*
315083	*1SPRUNCA*	*14.88*
315084	*1SPRUNCB*	*14.88*
315085	*1SPRUNCC*	*11.03*

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315086	1SPRUNCD	11.03
315073	1STONECA	9.26
315090	1YORKTN1	30.76
315091	1YORKTN2	31.92
314566	3CRESWEL	2.09
314315	3LOCKS E	1.63
314539	3UNCAMP	2.17
314541	3WATKINS	0.61
314229	6MT RD221	1.41
314236	6NRTHEST	0.35
314189	6PAPERMILL	8.8
314594	6PLYMOTH	0.73
314250	6ROCKVILLE	0.38
314256	6ROCKVILLE E	1.16
314648	6SUNBURY	0.8
314651	6WINFALL	1.58
932041	AC2-012 C	9.55
932042	AC2-012 E	15.57
932501	AC2-070 C	2.91
932502	AC2-070 E	1.2
932531	AC2-073 C	3.09
932532	AC2-073 E	1.56
932581	AC2-078 C	4.69
932582	AC2-078 E	7.66
932591	AC2-079 C	5.74
932592	AC2-079 E	9.36

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932831	*AC2-110 C*	*1.74*
932832	*AC2-110 E*	*2.84*
933061	*AC2-130*	*3.47*
933261	*AC2-137 C*	*0.59*
933262	*AC2-137 E*	*2.05*
933272	*AC2-138 E*	*1.08*
933291	*AC2-141 C*	*26.96*
933292	*AC2-141 E*	*11.51*
933732	*AC2-196 E*	*1.1*
933991	*AD1-023 C*	*11.18*
933992	*AD1-023 E*	*6.09*
934011	*AD1-025 C O1*	*20.62*
934012	*AD1-025 E O1*	*12.22*
934061	*AD1-033 C O1*	*6.91*
934062	*AD1-033 E O1*	*4.6*
934141	*AD1-041 C O1*	*6.72*
934142	*AD1-041 E O1*	*4.48*
934211	*AD1-048 C*	*3.82*
934212	*AD1-048 E*	*1.93*
934391	*AD1-063 C*	*2.09*
934392	*AD1-063 E*	*1.4*
934521	*AD1-076 C O1*	*46.47*
934522	*AD1-076 E O1*	*23.66*
934571	*AD1-082 C O1*	*8.18*
934572	*AD1-082 E O1*	*4.67*
934781	*AD1-105 C*	*8.13*

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934782	*AD1-105 E*	*5.65*
935111	*AD1-144 C*	*1.67*
935112	*AD1-144 E*	*0.91*
935161	*AD1-151 C O1*	*19.7*
935162	*AD1-151 E O1*	*13.14*
935211	*AD1-156 C*	*2.52*
935212	*AD1-156 E*	*1.68*
LTF	*CARR*	*0.67*
LTF	*CBM-S1*	*3.79*
LTF	*CBM-S2*	*13.69*
LTF	*CBM-W1*	*0.11*
LTF	*CBM-W2*	*17.24*
LTF	*CIN*	*0.09*
LTF	*CLIFTY*	*1.71*
LTF	*CPLE*	*4.71*
LTF	*G-007*	*2.3*
LTF	*IPL*	*0.04*
LTF	*LGEE*	*0.04*
LTF	*MEC*	*1.91*
LTF	*O-066*	*7.7*
LTF	*RENSSELAER*	*0.53*
LTF	*TRIMBLE*	*< 0.01*
292791	*U1-032 E*	*4.82*
297087	*V2-040*	*0.27*
901082	*W1-029E*	*41.48*
LTF	*WEC*	*0.05*

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907092	*X1-038 E*	*5.43*
913392	*Y1-086 E*	*1.98*
916042	*Z1-036 E*	*40.5*
916192	*Z1-068 E*	*1.74*
917122	*Z2-027 E*	*0.96*
918691	*AA1-083*	*1.12*
919152	*AA1-139 E*	*5.87*
919211	*AA1-145*	*19.04*
LTF	*AA2-074*	*3.21*
920042	*AA2-088 E*	*9.07*
920692	*AA2-178 E*	*3.58*
930121	*AB1-027 C*	*0.83*
930122	*AB1-027 E*	*1.9*
923801	*AB2-015 C O1*	*7.66*
923802	*AB2-015 E O1*	*6.28*
923831	*AB2-022 C*	*2.08*
923832	*AB2-022 E*	*1.12*
923842	*AB2-024 E*	*1.48*
923852	*AB2-025 E*	*1.08*
924061	*AB2-050*	*1.12*
924241	*AB2-068 O1*	*176.73*
924511	*AB2-100 C*	*10.36*
924512	*AB2-100 E*	*5.1*
924811	*AB2-134 C O1*	*15.72*
924812	*AB2-134 E O1*	*15.46*
925051	*AB2-160 C O1*	*7.1*

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925052	*AB2-160 E O1*	*11.58*
925061	*AB2-161 C O1*	*3.59*
925062	*AB2-161 E O1*	*5.85*
925331	*AB2-190 C*	*24.52*
925332	*AB2-190 E*	*10.51*
925522	*AC1-027 E*	*1.06*
925861	*AC1-065 C*	*4.35*
925862	*AC1-065 E*	*7.1*
926291	*AC1-107*	*266.77*
926411	*AC1-112 C*	*0.65*
926412	*AC1-112 E*	*1.93*
926472	*AC1-118 E*	*1.07*
926551	*AC1-134*	*14.9*
926662	*AC1-147 E*	*1.24*
926751	*AC1-161 C*	*26.96*
926752	*AC1-161 E*	*11.51*
926781	*AC1-164 C*	*58.34*
926782	*AC1-164 E*	*26.21*
927041	*AC1-191 C*	*17.54*
927042	*AC1-191 E*	*8.74*
927221	*AC1-216 C O1*	*12.*
927222	*AC1-216 E O1*	*9.44*

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Appendix 11

(DVP - DVP) The 6CHESTF B-6BASIN 230 kV line (from bus 314287 to bus 314276 ckt 1) loads from 109.0% to 113.56% (AC power flow) of its load dump rating (549 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 562T563'. This project contributes approximately 29.24 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*
315065	*1CHESTF6*	*33.69*
315131	*1EDGECMA*	*3.54*
315132	*1EDGECMB*	*3.54*
315074	*1HOPCGN1*	*5.88*
315075	*1HOPCGN2*	*5.81*
315077	*1HOPHCF1*	*1.78*
315078	*1HOPHCF2*	*1.78*
315079	*1HOPHCF3*	*1.78*
315080	*1HOPHCF4*	*2.7*
315076	*1HOPPOLC*	*1.27*
315073	*1STONECA*	*4.88*
314557	*3BETHELC*	*0.3*
314554	*3BTLEBRO*	*0.3*
314572	*3EMPORIA*	*0.22*
314578	*3HORNRTN*	*1.43*
314582	*3KELFORD*	*0.33*
314314	*3LOCKS*	*0.06*

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314315	3LOCKS E	0.83
314603	3SCOT NK	1.31
314617	3TUNIS	0.33
314539	3UNCAMP	0.94
314541	3WATKINS	0.27
314620	6CASHIE	0.31
314594	6PLYMOTH	0.3
932581	AC2-078 C	3.04
932582	AC2-078 E	4.95
932591	AC2-079 C	2.7
932592	AC2-079 E	4.41
932631	AC2-084 C	3.51
932632	AC2-084 E	1.73
933991	AD1-023 C	4.75
933992	AD1-023 E	2.59
934011	AD1-025 C O1	9.49
934012	AD1-025 E O1	5.62
934201	AD1-047 C	3.93
934202	AD1-047 E	2.62
934331	AD1-057 C O1	4.26
934332	AD1-057 E O1	2.27
934521	AD1-076 C O1	19.37
934522	AD1-076 E O1	9.86
934571	AD1-082 C O1	4.47
934572	AD1-082 E O1	2.55
935161	AD1-151 C O1	9.07

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935162	AD1-151 E O1	6.04
935211	AD1-156 C	2.12
935212	AD1-156 E	1.41
LTF	CARR	0.23
LTF	CBM-S1	4.
LTF	CBM-S2	8.63
LTF	CBM-W1	7.44
LTF	CBM-W2	20.89
LTF	CIN	1.7
LTF	CPLE	2.76
LTF	G-007	1.04
LTF	IPL	1.08
LTF	LGEE	0.37
LTF	MEC	4.07
LTF	MECS	1.38
LTF	O-066	3.48
LTF	RENSSELAER	0.18
292791	U1-032 E	2.54
900672	V4-068 E	0.12
LTF	WEC	0.47
907092	X1-038 E	2.35
914231	Y2-077	0.72
916302	Z1-086 E	3.71
917332	Z2-043 E	0.39
917342	Z2-044 E	0.22
917512	Z2-088 E OP1	1.45

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918492	*AA1-063AE OP*	*1.7*
918512	*AA1-065 E OP*	*1.69*
918562	*AA1-072 E*	*0.07*
919692	*AA2-053 E*	*1.6*
919701	*AA2-057 C*	*2.8*
919702	*AA2-057 E*	*1.4*
LTF	*AA2-074*	*1.88*
920042	*AA2-088 E*	*4.24*
920592	*AA2-165 E*	*0.18*
920672	*AA2-174 E*	*0.18*
930402	*AB1-081 E*	*1.46*
930861	*AB1-132 C*	*6.74*
930862	*AB1-132 E*	*2.89*
931231	*AB1-173 C*	*1.1*
931232	*AB1-173 E*	*0.52*
931241	*AB1-173AC*	*1.1*
931242	*AB1-173AE*	*0.52*
923801	*AB2-015 C O1*	*3.37*
923802	*AB2-015 E O1*	*2.76*
923851	*AB2-025 C*	*0.33*
923852	*AB2-025 E*	*0.78*
923911	*AB2-031 C O1*	*1.1*
923912	*AB2-031 E O1*	*0.54*
923991	*AB2-040 C O1*	*3.6*
923992	*AB2-040 E O1*	*2.94*
924151	*AB2-059 C O1*	*4.01*

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924152	*AB2-059 E O1*	*2.06*
924501	*AB2-099 C*	*0.23*
924502	*AB2-099 E*	*0.1*
924511	*AB2-100 C*	*6.79*
924512	*AB2-100 E*	*3.35*
924811	*AB2-134 C O1*	*7.23*
924812	*AB2-134 E O1*	*7.11*
925051	*AB2-160 C O1*	*3.59*
925052	*AB2-160 E O1*	*5.86*
925061	*AB2-161 C O1*	*1.96*
925062	*AB2-161 E O1*	*3.2*
925171	*AB2-174 C O1*	*3.52*
925172	*AB2-174 E O1*	*3.18*
925331	*AB2-190 C*	*11.28*
925332	*AB2-190 E*	*4.84*
925591	*AC1-034 C*	*2.6*
925592	*AC1-034 E*	*1.96*
925821	*AC1-061*	*< 0.01*
926071	*AC1-086 C*	*9.93*
926072	*AC1-086 E*	*4.52*
926201	*AC1-098 C*	*2.47*
926202	*AC1-098 E*	*1.47*
926211	*AC1-099 C*	*0.83*
926212	*AC1-099 E*	*0.49*
927141	*AC1-208 C*	*3.74*
927142	*AC1-208 E*	*1.66*

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927221	*AC1-216 C O1*	*5.52*
927222	*AC1-216 E O1*	*4.34*

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Appendix 12

(DVP - DVP) The 6PENNIMAN-6WALR209 230 kV line (from bus 314296 to bus 314415 ckt 1) loads from 113.94% to 117.49% (AC power flow) of its emergency rating (442 MVA) for the single line contingency outage of 'DVP_P1-2: LN 557'. This project contributes approximately 18.19 MW to the thermal violation.

```
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
```

Bus Number	*Bus Name*	*Full Contribution*
315108	*1ELIZAR1*	*1.52*
315109	*1ELIZAR2*	*1.49*
315110	*1ELIZAR3*	*1.54*
315233	*1SURRY 2*	*15.45*
315090	*1YORKTN1*	*23.06*
315091	*1YORKTN2*	*23.93*
315092	*1YORKTN3*	*21.66*
314421	*6WINCHST*	*0.13*
932041	*AC2-012 C*	*4.2*
932591	*AC2-079 C*	*1.72*
933291	*AC2-141 C*	*14.07*
933731	*AC2-196 C*	*0.14*
933991	*AD1-023 C*	*4.31*
934061	*AD1-033 C O1*	*3.11*
934521	*AD1-076 C O1*	*18.19*
935111	*AD1-144 C*	*0.75*
LTF	*CARR*	*0.13*

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LTF	*CBM-S1*	*2.35*
LTF	*CBM-S2*	*5.13*
LTF	*CBM-W1*	*4.34*
LTF	*CBM-W2*	*12.28*
LTF	*CIN*	*0.99*
LTF	*CPLE*	*1.65*
LTF	*IPL*	*0.63*
LTF	*LGEE*	*0.22*
LTF	*MEC*	*2.38*
LTF	*MECS*	*0.8*
LTF	*RENSSELAER*	*0.11*
LTF	*WEC*	*0.27*
916191	*Z1-068 C*	*0.02*
923801	*AB2-015 C O1*	*2.76*
923831	*AB2-022 C*	*0.91*
924241	*AB2-068 O1*	*103.29*
925121	*AB2-169 C*	*1.96*
925521	*AC1-027 C*	*0.16*
926291	*AC1-107*	*155.9*
926751	*AC1-161 C*	*14.07*

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Appendix 13

(DVP - DVP) The 6KINGS M-6PENNIMAN 230 kV line (from bus 314386 to bus 314296 ckt 1) loads from 117.39% to 120.94% (AC power flow) of its emergency rating (442 MVA) for the single line contingency outage of 'DVP_P1-2: LN 557'. This project contributes approximately 18.19 MW to the thermal violation.

```
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
```

Bus Number	*Bus Name*	*Full Contribution*
315108	*1ELIZAR1*	*1.52*
315109	*1ELIZAR2*	*1.49*
315110	*1ELIZAR3*	*1.54*
315233	*1SURRY 2*	*15.45*
315090	*1YORKTN1*	*23.06*
315091	*1YORKTN2*	*23.93*
315092	*1YORKTN3*	*21.66*
314421	*6WINCHST*	*0.13*
932041	*AC2-012 C*	*4.2*
932591	*AC2-079 C*	*1.72*
933291	*AC2-141 C*	*14.07*
933731	*AC2-196 C*	*0.14*
933991	*AD1-023 C*	*4.31*
934061	*AD1-033 C O1*	*3.11*
934521	*AD1-076 C O1*	*18.19*
935111	*AD1-144 C*	*0.75*
LTF	*CARR*	*0.13*

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LTF	*CBM-S1*	*2.35*
LTF	*CBM-S2*	*5.13*
LTF	*CBM-W1*	*4.34*
LTF	*CBM-W2*	*12.28*
LTF	*CIN*	*0.99*
LTF	*CPLE*	*1.65*
LTF	*IPL*	*0.63*
LTF	*LGEE*	*0.22*
LTF	*MEC*	*2.38*
LTF	*MECS*	*0.8*
LTF	*RENSSELAER*	*0.11*
LTF	*WEC*	*0.27*
916191	*Z1-068 C*	*0.02*
923801	*AB2-015 C O1*	*2.76*
923831	*AB2-022 C*	*0.91*
924241	*AB2-068 O1*	*103.29*
925121	*AB2-169 C*	*1.96*
925521	*AC1-027 C*	*0.16*
926291	*AC1-107*	*155.9*
926751	*AC1-161 C*	*14.07*

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Appendix 14

(DVP - DVP) The 6WALR209-6LIGH209 230 kV line (from bus 314415 to bus 314391 ckt 1) loads from 100.2% to 103.75% (AC power flow) of its emergency rating (442 MVA) for the single line contingency outage of 'DVP_P1-2: LN 557'. This project contributes approximately 18.19 MW to the thermal violation.

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

Bus Number	*Bus Name*	*Full Contribution*
315108	*1ELIZAR1*	*1.52*
315109	*1ELIZAR2*	*1.49*
315110	*1ELIZAR3*	*1.54*
315233	*1SURRY 2*	*15.45*
315090	*1YORKTN1*	*23.06*
315091	*1YORKTN2*	*23.93*
315092	*1YORKTN3*	*21.66*
314421	*6WINCHST*	*0.13*
932041	*AC2-012 C*	*4.2*
932591	*AC2-079 C*	*1.72*
933291	*AC2-141 C*	*14.07*
933731	*AC2-196 C*	*0.14*
933991	*AD1-023 C*	*4.31*
934061	*AD1-033 C O1*	*3.11*
934521	*AD1-076 C O1*	*18.19*
935111	*AD1-144 C*	*0.75*
LTF	*CARR*	*0.13*

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LTF	*CBM-S1*	*2.35*
LTF	*CBM-S2*	*5.13*
LTF	*CBM-W1*	*4.34*
LTF	*CBM-W2*	*12.28*
LTF	*CIN*	*0.99*
LTF	*CPLE*	*1.65*
LTF	*IPL*	*0.63*
LTF	*LGEE*	*0.22*
LTF	*MEC*	*2.38*
LTF	*MECS*	*0.8*
LTF	*RENSSELAER*	*0.11*
LTF	*WEC*	*0.27*
916191	*Z1-068 C*	*0.02*
923801	*AB2-015 C O1*	*2.76*
923831	*AB2-022 C*	*0.91*
924241	*AB2-068 O1*	*103.29*
925121	*AB2-169 C*	*1.96*
925521	*AC1-027 C*	*0.16*
926291	*AC1-107*	*155.9*
926751	*AC1-161 C*	*14.07*

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Appendix 15

(DVP - CPLE) The 6EVERETS-6GREENVILE T 230 kV line (from bus 314574 to bus 304451 ckt 1) loads from 107.56% to 124.08% (AC power flow) of its emergency rating (478 MVA) for the tower line contingency outage of 'DVP_P7-1: LN 2058-2181'. This project contributes approximately 82.63 MW to the thermal violation.

```
CONTINGENCY 'DVP_P7-1: LN 2058-2181'
  OPEN BRANCH FROM BUS 304222 TO BUS 313845 CKT 1              /*
6ROCKYMT230T230.00 - 6HATHAWAY 230.00
  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
  OPEN BUS 314591                                  /* ISLAND: 6NASH 230.00
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315294	*1DOMTR10*	*2.99*
315292	*1DOMTR78*	*2.02*
315293	*1DOMTR9*	*1.65*
315131	*1EDGECMA*	*9.28*
315132	*1EDGECMB*	*9.28*
315136	*1ROSEMG1*	*1.9*
315138	*1ROSEMG2*	*0.89*
315137	*1ROSEMS1*	*1.18*
314557	*3BETHELC*	*1.14*
314554	*3BTLEBRO*	*0.43*
314566	*3CRESWEL*	*2.04*
314572	*3EMPORIA*	*0.21*
314578	*3HORNRTN*	*2.04*
314582	*3KELFORD*	*0.72*

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314603	3SCOT NK	2.51
314617	3TUNIS	0.7
314539	3UNCAMP	1.18
314541	3WATKINS	0.36
314620	6CASHIE	0.88
314574	6EVERETS	5.39
314594	6PLYMOTH	0.83
314648	6SUNBURY	0.4
314651	6WINFALL	0.97
932631	AC2-084 C	6.17
932632	AC2-084 E	3.04
933991	AD1-023 C	13.47
933992	AD1-023 E	7.33
934201	AD1-047 C	4.29
934202	AD1-047 E	2.86
934331	AD1-057 C O1	8.81
934332	AD1-057 E O1	4.7
934521	AD1-076 C O1	54.75
934522	AD1-076 E O1	27.88
LTF	AMIL	0.49
LTF	BLUEG	2.5
LTF	CALDERWOOD	1.54
LTF	CANNELTON	0.48
LTF	CATAWBA	1.51
LTF	CBM-N	< 0.01
LTF	CELEVELAND /* 35% REVERSE 4479079 4642907	< 0.01

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LTF	*CHEOAH*	*1.44*
LTF	*CHILHOWEE*	*0.5*
LTF	*CLIFTY*	*9.05*
LTF	*COTTONWOOD*	*5.21*
LTF	*EDWARDS*	*0.78*
LTF	*ELMERSMITH*	*1.42*
LTF	*FARMERCITY*	*0.62*
LTF	*G-007A*	*1.03*
LTF	*GIBSON*	*0.88*
LTF	*HAMLET*	*3.22*
LTF	*MORGAN*	*4.57*
LTF	*NEWTON*	*2.15*
LTF	*NYISO*	*0.08*
LTF	*O-066A*	*0.47*
LTF	*PRAIRIE*	*4.69*
LTF	*SANTEETLA*	*0.43*
LTF	*SMITHLAND*	*0.42*
LTF	*TATANKA*	*1.05*
LTF	*TILTON*	*0.92*
LTF	*TRIMBLE*	*0.47*
LTF	*TVA*	*1.92*
LTF	*UNIONPOWER*	*2.56*
900672	*V4-068 E*	*0.21*
LTF	*VFT*	*2.74*
901082	*W1-029E*	*23.38*
907092	*X1-038 E*	*2.96*

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913392	*Y1-086 E*	*1.05*
LTF	*Y3-032*	*< 0.01*
916042	*Z1-036 E*	*29.13*
917122	*Z2-027 E*	*0.51*
917331	*Z2-043 C*	*0.38*
917332	*Z2-043 E*	*0.86*
917342	*Z2-044 E*	*0.33*
917511	*Z2-088 C OP1*	*1.46*
917512	*Z2-088 E OP1*	*6.13*
918411	*AA1-050*	*1.23*
918492	*AA1-063AE OP*	*2.44*
918511	*AA1-065 C OP*	*1.85*
918512	*AA1-065 E OP*	*4.84*
918531	*AA1-067 C*	*0.71*
918532	*AA1-067 E*	*1.62*
918561	*AA1-072 C*	*0.06*
918562	*AA1-072 E*	*0.14*
919692	*AA2-053 E*	*2.58*
919701	*AA2-057 C*	*4.25*
919702	*AA2-057 E*	*2.12*
920042	*AA2-088 E*	*6.25*
920592	*AA2-165 E*	*0.28*
920672	*AA2-174 E*	*0.3*
920691	*AA2-178 C*	*1.53*
920692	*AA2-178 E*	*3.5*
930402	*AB1-081 E*	*2.42*

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930861	AB1-132 C	10.36
930862	AB1-132 E	4.44
931231	AB1-173 C	1.21
931232	AB1-173 E	0.56
931241	AB1-173AC	1.21
931242	AB1-173AE	0.56
923801	AB2-015 C O1	4.4
923802	AB2-015 E O1	3.61
923831	AB2-022 C	1.02
923832	AB2-022 E	0.55
923911	AB2-031 C O1	1.2
923912	AB2-031 E O1	0.59
923991	AB2-040 C O1	3.93
923992	AB2-040 E O1	3.22
924151	AB2-059 C O1	6.64
924152	AB2-059 E O1	3.42
924491	AB2-098 C	1.26
924492	AB2-098 E	0.54
924501	AB2-099 C	0.53
924502	AB2-099 E	0.23
924511	AB2-100 C	5.85
924512	AB2-100 E	2.88
925121	AB2-169 C	10.02
925122	AB2-169 E	8.99
925171	AB2-174 C O1	3.64
925172	AB2-174 E O1	3.29

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925591	*AC1-034 C*	*4.3*
925592	*AC1-034 E*	*3.25*
926071	*AC1-086 C*	*15.26*
926072	*AC1-086 E*	*6.94*
926201	*AC1-098 C*	*4.33*
926202	*AC1-098 E*	*2.58*
926211	*AC1-099 C*	*1.45*
926212	*AC1-099 E*	*0.85*
LTF	*AC1-131*	*5.64*
927021	*AC1-189 C*	*15.45*
927022	*AC1-189 E*	*7.7*
927141	*AC1-208 C*	*5.74*
927142	*AC1-208 E*	*2.55*

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Appendix 16

(DVP - DVP) The 8CHCKAHM-8ELMONT 500 kV line (from bus 314903 to bus 314908 ckt 1) loads from 102.41% to 106.3% (AC power flow) of its load dump rating (3144 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 563T576'. This project contributes approximately 132.2 MW to the thermal violation.

```
CONTINGENCY 'DVP_P4-2: 563T576'                    /* MIDLOTHIAN 500 500 KV
  OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1          /* 8CARSON
500.00 - 8MDLTHAN 500.00
  OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1          /* 8MDLTHAN
500.00 - 8NO ANNA 500.00
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315131	*1EDGECMA*	*11.85*
315132	*1EDGECMB*	*11.85*
315074	*1HOPCGN1*	*10.64*
315075	*1HOPCGN2*	*10.5*
315073	*1STONECA*	*8.82*
315233	*1SURRY 2*	*60.39*
315090	*1YORKTN1*	*53.6*
315091	*1YORKTN2*	*55.63*
315092	*1YORKTN3*	*50.12*
314557	*3BETHELC*	*1.06*
314554	*3BTLEBRO*	*1.02*
314566	*3CRESWEL*	*3.98*
314572	*3EMPORIA*	*0.56*
314578	*3HORNRTN*	*4.52*
314582	*3KELFORD*	*1.21*
314315	*3LOCKS E*	*1.44*
314603	*3SCOT NK*	*4.64*

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314617	*3TUNIS*	*1.27*
314539	*3UNCAMP*	*3.91*
314541	*3WATKINS*	*1.09*
314620	*6CASHIE*	*1.33*
314574	*6EVERETS*	*3.39*
314189	*6PAPERMILL*	*10.97*
314594	*6PLYMOTH*	*1.37*
314648	*6SUNBURY*	*1.56*
314651	*6WINFALL*	*3.05*
932041	*AC2-012 C*	*18.6*
932042	*AC2-012 E*	*30.35*
932531	*AC2-073 C*	*3.89*
932532	*AC2-073 E*	*1.96*
932581	*AC2-078 C*	*5.53*
932582	*AC2-078 E*	*9.03*
932591	*AC2-079 C*	*9.32*
932592	*AC2-079 E*	*15.21*
932631	*AC2-084 C*	*12.14*
932632	*AC2-084 E*	*5.98*
932831	*AC2-110 C*	*2.15*
932832	*AC2-110 E*	*3.5*
933061	*AC2-130*	*3.12*
933262	*AC2-137 E*	*1.87*
933272	*AC2-138 E*	*1.18*
933291	*AC2-141 C*	*59.6*
933292	*AC2-141 E*	*25.44*

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933732	AC2-196 E	2.18
933991	AD1-023 C	20.97
933992	AD1-023 E	11.42
934011	AD1-025 C O1	24.76
934012	AD1-025 E O1	14.66
934061	AD1-033 C O1	13.73
934062	AD1-033 E O1	9.15
934141	AD1-041 C O1	8.49
934142	AD1-041 E O1	5.66
934201	AD1-047 C	10.77
934202	AD1-047 E	7.18
934211	AD1-048 C	2.73
934212	AD1-048 E	1.37
934231	AD1-050 C	5.58
934232	AD1-050 E	3.05
934331	AD1-057 C O1	13.19
934332	AD1-057 E O1	7.04
934391	AD1-063 C	2.63
934392	AD1-063 E	1.76
934521	AD1-076 C O1	87.6
934522	AD1-076 E O1	44.6
934571	AD1-082 C O1	11.71
934572	AD1-082 E O1	6.68
934611	AD1-087 C O1	9.65
934612	AD1-087 E O1	4.53
935111	AD1-144 C	3.07

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935112	AD1-144 E	1.68
935161	AD1-151 C O1	23.65
935162	AD1-151 E O1	15.77
935171	AD1-152 C O1	9.59
935172	AD1-152 E O1	6.39
935211	AD1-156 C	2.59
935212	AD1-156 E	1.73
LTF	CARR	1.01
LTF	CBM-S1	12.87
LTF	CBM-S2	30.4
LTF	CBM-W1	20.39
LTF	CBM-W2	65.9
LTF	CIN	4.7
LTF	CPLE	9.86
LTF	G-007	4.23
LTF	IPL	2.98
LTF	LGEE	1.04
LTF	MEC	12.11
LTF	MECS	2.92
LTF	O-066	14.15
LTF	RENSSELAER	0.8
292791	U1-032 E	4.6
900672	V4-068 E	0.45
901082	W1-029E	80.28
LTF	WEC	1.3
907092	X1-038 E	9.77

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913392	Y1-086 E	3.85
916042	Z1-036 E	78.06
916192	Z1-068 E	3.43
916302	Z1-086 E	13.66
917122	Z2-027 E	1.86
917332	Z2-043 E	1.45
917342	Z2-044 E	0.75
917512	Z2-088 E OP1	5.15
918492	AA1-063AE OP	5.75
918512	AA1-065 E OP	6.8
918532	AA1-067 E	1.02
918562	AA1-072 E	0.24
919152	AA1-139 E	11.61
919692	AA2-053 E	5.23
919701	AA2-057 C	9.41
919702	AA2-057 E	4.71
LTF	AA2-074	6.71
920042	AA2-088 E	16.1
920592	AA2-165 E	0.62
920672	AA2-174 E	0.6
920692	AA2-178 E	6.81
930402	AB1-081 E	4.91
930861	AB1-132 C	19.25
930862	AB1-132 E	8.25
931231	AB1-173 C	3.03
931232	AB1-173 E	1.41

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931241	AB1-173AC	3.03
931242	AB1-173AE	1.41
923801	AB2-015 C O1	13.75
923802	AB2-015 E O1	11.27
923831	AB2-022 C	4.08
923832	AB2-022 E	2.2
923842	AB2-024 E	1.84
923852	AB2-025 E	1.45
923911	AB2-031 C O1	3.01
923912	AB2-031 E O1	1.48
923991	AB2-040 C O1	9.87
923992	AB2-040 E O1	8.08
924151	AB2-059 C O1	13.49
924152	AB2-059 E O1	6.95
924241	AB2-068 O1	619.7
924401	AB2-089 C	2.53
924402	AB2-089 E	1.3
924491	AB2-098 C	0.79
924492	AB2-098 E	0.34
924501	AB2-099 C	0.88
924502	AB2-099 E	0.38
924511	AB2-100 C	15.41
924512	AB2-100 E	7.59
924811	AB2-134 C O1	18.87
924812	AB2-134 E O1	18.55
925051	AB2-160 C O1	6.26

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925052	*AB2-160 E O1*	*10.22*
925061	*AB2-161 C O1*	*5.14*
925062	*AB2-161 E O1*	*8.38*
925121	*AB2-169 C*	*9.82*
925122	*AB2-169 E*	*8.81*
925171	*AB2-174 C O1*	*9.4*
925172	*AB2-174 E O1*	*8.5*
925331	*AB2-190 C*	*29.43*
925332	*AB2-190 E*	*12.61*
925522	*AC1-027 E*	*2.09*
925591	*AC1-034 C*	*8.74*
925592	*AC1-034 E*	*6.59*
925781	*AC1-054 C*	*8.7*
925782	*AC1-054 E*	*4.01*
925861	*AC1-065 C*	*5.37*
925862	*AC1-065 E*	*8.76*
926071	*AC1-086 C*	*28.35*
926072	*AC1-086 E*	*12.9*
926201	*AC1-098 C*	*8.51*
926202	*AC1-098 E*	*5.07*
926211	*AC1-099 C*	*2.85*
926212	*AC1-099 E*	*1.68*
926291	*AC1-107*	*935.39*
926662	*AC1-147 E*	*2.42*
926751	*AC1-161 C*	*59.6*
926752	*AC1-161 E*	*25.44*

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926781	*AC1-164 C*	*68.11*
926782	*AC1-164 E*	*30.6*
927021	*AC1-189 C*	*11.67*
927022	*AC1-189 E*	*5.81*
927141	*AC1-208 C*	*12.32*
927142	*AC1-208 E*	*5.47*
927221	*AC1-216 C O1*	*14.4*
927222	*AC1-216 E O1*	*11.33*

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Appendix 17

(DVP - DVP) The 8CHANCE-8BRISTER 500 kV line (from bus 314905 to bus 314900 ckt 1) loads from 108.58% to 110.54% (AC power flow) of its emergency rating (2442 MVA) for the single line contingency outage of 'DVP_P1-2: LN 594'. This project contributes approximately 54.75 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 594'
OPEN BRANCH FROM BUS 314916 TO BUS 314934 CKT 1 /* 8MORRSVL 500.00 - 8SPOTSYL 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315053	*1BELMED1*	*3.52*
315054	*1BELMED2*	*3.52*
315055	*1BELMED3*	*2.92*
315060	*1CHESTF5*	*12.48*
315061	*1CHESTG7*	*4.89*
315063	*1CHESTG8*	*4.83*
315062	*1CHESTS7*	*2.22*
315064	*1CHESTS8*	*2.48*
315067	*1DARBY 1*	*3.2*
315068	*1DARBY 2*	*3.21*
315069	*1DARBY 3*	*3.22*
315070	*1DARBY 4*	*3.22*
315043	*1FOUR RIVERA*	*4.32*
315044	*1FOUR RIVERB*	*3.34*
315045	*1FOUR RIVERC*	*4.32*
315046	*1FOUR RIVERD*	*3.34*
315047	*1FOUR RIVERE*	*3.34*
315048	*1FOUR RIVERF*	*4.32*

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315074	1HOPCGN1	9.01
315075	1HOPCGN2	8.89
315225	1N ANNA1	45.84
315226	1N ANNA2	45.81
315083	1SPRUNCA	11.47
315084	1SPRUNCB	11.47
315085	1SPRUNCC	8.5
315086	1SPRUNCD	8.5
315090	1YORKTN1	30.61
315091	1YORKTN2	31.77
314315	3LOCKS E	1.35
314309	6IRON208	0.56
314236	6NRTHEST	0.23
314250	6ROCKVILLE	0.26
932041	AC2-012 C	10.79
932501	AC2-070 C	1.85
932531	AC2-073 C	2.54
932581	AC2-078 C	4.33
932591	AC2-079 C	6.03
932831	AC2-110 C	1.44
933011	AC2-125	2.93
933021	AC2-126	2.95
933061	AC2-130	2.6
933261	AC2-137 C	0.43
933291	AC2-141 C	32.22
933501	AC2-165 C	10.5

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933991	AD1-023 C	13.19
934011	AD1-025 C O1	18.18
934061	AD1-033 C O1	7.92
934141	AD1-041 C O1	5.66
934201	AD1-047 C	7.81
934211	AD1-048 C	2.65
934391	AD1-063 C	1.72
934521	AD1-076 C O1	54.75
934571	AD1-082 C O1	8.14
934781	AD1-105 C	9.04
935111	AD1-144 C	1.82
935161	AD1-151 C O1	17.37
935211	AD1-156 C	2.26
LTF	CARR	1.28
LTF	CBM-S1	12.59
LTF	CBM-S2	24.23
LTF	CBM-W1	23.18
LTF	CBM-W2	65.17
LTF	CIN	5.57
LTF	CPLE	7.42
LTF	IPL	3.54
LTF	LGEE	1.24
LTF	MEC	12.85
LTF	MECS	3.91
LTF	RENSSELAER	1.02
LTF	ROWAN /* 35% REVERSE 4479078	< 0.01

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297087	V2-040	0.15
LTF	WEC	1.49
918691	AA1-083	0.76
919211	AA1-145	12.89
LTF	AA2-074	5.05
930121	AB1-027 C	0.53
930861	AB1-132 C	13.61
931231	AB1-173 C	2.2
931241	AB1-173AC	2.2
923801	AB2-015 C O1	8.75
923831	AB2-022 C	2.4
923911	AB2-031 C O1	2.18
923991	AB2-040 C O1	7.16
924061	AB2-050	0.76
924241	AB2-068 O1	217.41
924501	AB2-099 C	0.58
924511	AB2-100 C	11.43
924811	AB2-134 C O1	13.86
925051	AB2-160 C O1	5.86
925061	AB2-161 C O1	3.57
925121	AB2-169 C	6.32
925171	AB2-174 C O1	6.86
925331	AB2-190 C	21.62
925861	AC1-065 C	3.6
926001	AC1-076 C	4.68
926071	AC1-086 C	20.05

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926291	*AC1-107*	*328.16*
926411	*AC1-112 C*	*0.41*
926551	*AC1-134*	*10.09*
926731	*AC1-158 C*	*89.12*
926751	*AC1-161 C*	*32.22*
926781	*AC1-164 C*	*43.71*
927041	*AC1-191 C*	*10.33*
927221	*AC1-216 C O1*	*10.58*

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Appendix 18

(DVP - DVP) The 8ELMONT-8LADYSMITH 500 kV line (from bus 314908 to bus 314911 ckt 1) loads from 134.85% to 138.08% (AC power flow) of its emergency rating (2442 MVA) for the single line contingency outage of 'DVP_P1-2: LN 576'. This project contributes approximately 91.11 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 576'
OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315059	*1CHESTF4*	*9.93*
315060	*1CHESTF5*	*21.07*
315061	*1CHESTG7*	*8.26*
315063	*1CHESTG8*	*8.16*
315062	*1CHESTS7*	*3.75*
315064	*1CHESTS8*	*4.19*
315067	*1DARBY 1*	*5.38*
315068	*1DARBY 2*	*5.38*
315069	*1DARBY 3*	*5.4*
315070	*1DARBY 4*	*5.41*
315074	*1HOPCGN1*	*15.04*
315075	*1HOPCGN2*	*14.85*
315083	*1SPRUNCA*	*18.59*
315084	*1SPRUNCB*	*18.59*
315085	*1SPRUNCC*	*13.78*
315086	*1SPRUNCD*	*13.78*
315233	*1SURRY 2*	*52.67*
315090	*1YORKTN1*	*51.93*

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315091	1YORKTN2	53.89
315092	1YORKTN3	48.45
314315	3LOCKS E	2.22
314309	6IRON208	0.93
314236	6NRTHEST	0.39
314421	6WINCHST	0.31
932041	AC2-012 C	18.05
932501	AC2-070 C	3.15
932531	AC2-073 C	4.16
932581	AC2-078 C	7.14
932591	AC2-079 C	10.03
932631	AC2-084 C	13.76
932831	AC2-110 C	2.34
933061	AC2-130	4.39
933261	AC2-137 C	0.73
933291	AC2-141 C	54.24
933991	AD1-023 C	21.94
934011	AD1-025 C O1	30.41
934061	AD1-033 C O1	13.24
934141	AD1-041 C O1	9.09
934201	AD1-047 C	12.78
934211	AD1-048 C	4.48
934391	AD1-063 C	2.82
934521	AD1-076 C O1	91.11
934571	AD1-082 C O1	13.49
935111	AD1-144 C	3.05

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935161	AD1-151 C O1	29.06
935211	AD1-156 C	3.69
LTF	CARR	1.66
LTF	CBM-S1	25.65
LTF	CBM-S2	42.07
LTF	CBM-W1	59.5
LTF	CBM-W2	137.74
LTF	CIN	13.83
LTF	CPLE	12.5
LTF	IPL	8.83
LTF	LGEE	3.02
LTF	MEC	29.57
LTF	MECS	13.35
LTF	RENSSELAER	1.33
LTF	ROWAN /* 35% REVERSE 4479078	< 0.01
297087	V2-040	0.26
LTF	WEC	3.71
LTF	Z1-043	14.59
LTF	AA2-074	8.5
930121	AB1-027 C	0.9
930861	AB1-132 C	22.39
931231	AB1-173 C	3.59
931241	AB1-173AC	3.59
LTF	AB2-013	< 0.01
923801	AB2-015 C O1	14.53
923831	AB2-022 C	4.

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923911	AB2-031 C O1	3.57
923991	AB2-040 C O1	11.72
924241	AB2-068 O1	417.29
924501	AB2-099 C	0.96
924511	AB2-100 C	18.66
924811	AB2-134 C O1	23.18
925051	AB2-160 C O1	9.63
925061	AB2-161 C O1	5.92
925121	AB2-169 C	10.51
925171	AB2-174 C O1	11.22
925331	AB2-190 C	36.16
925861	AC1-065 C	5.84
926071	AC1-086 C	32.97
926201	AC1-098 C	9.65
926211	AC1-099 C	3.24
926291	AC1-107	629.87
926411	AC1-112 C	0.7
926751	AC1-161 C	54.24
926781	AC1-164 C	75.62
927041	AC1-191 C	16.51
927141	AC1-208 C	14.16
927221	AC1-216 C O1	17.69

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Appendix 19

(DVP - DVP) The 8LADYSMITH-8CHANCE 500 kV line (from bus 314911 to bus 314905 ckt 1) loads from 100.02% to 101.8% (AC power flow) of its emergency rating (2738 MVA) for the single line contingency outage of 'DVP_P1-2: LN 573'. This project contributes approximately 55.53 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 573'
OPEN BRANCH FROM BUS 314918 TO BUS 314934 CKT 1 /* 8NO ANNA 500.00 - 8SPOTSYL 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315053	*1BELMED1*	*3.58*
315054	*1BELMED2*	*3.58*
315055	*1BELMED3*	*2.97*
315060	*1CHESTF5*	*12.69*
315061	*1CHESTG7*	*4.97*
315063	*1CHESTG8*	*4.92*
315067	*1DARBY 1*	*3.26*
315068	*1DARBY 2*	*3.26*
315069	*1DARBY 3*	*3.27*
315070	*1DARBY 4*	*3.28*
315043	*1FOUR RIVERA*	*4.41*
315044	*1FOUR RIVERB*	*3.41*
315045	*1FOUR RIVERC*	*4.41*
315046	*1FOUR RIVERD*	*3.41*
315047	*1FOUR RIVERE*	*3.41*
315048	*1FOUR RIVERF*	*4.41*
315074	*1HOPCGN1*	*9.16*
315075	*1HOPCGN2*	*9.04*

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315037	1LDYSMT1	5.72
315038	1LDYSMT2	5.72
315039	1LDYSMT3	6.05
315040	1LDYSMT4	6.06
315041	1LDYSMT5	6.08
315225	1N ANNA1	46.5
315226	1N ANNA2	46.47
315083	1SPRUNCA	11.65
315084	1SPRUNCB	11.65
315085	1SPRUNCC	8.64
315086	1SPRUNCD	8.64
315090	1YORKTN1	31.11
315091	1YORKTN2	32.29
314315	3LOCKS E	1.37
314309	6IRON208	0.57
314236	6NRTHEST	0.24
314250	6ROCKVILLE	0.27
932041	AC2-012 C	10.96
932501	AC2-070 C	1.88
932531	AC2-073 C	2.58
932581	AC2-078 C	4.4
932591	AC2-079 C	6.13
932831	AC2-110 C	1.47
933011	AC2-125	3.
933021	AC2-126	3.02
933061	AC2-130	2.65

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933261	AC2-137 C	0.43
933291	AC2-141 C	32.72
933501	AC2-165 C	10.44
933991	AD1-023 C	13.38
934011	AD1-025 C O1	18.47
934061	AD1-033 C O1	8.04
934141	AD1-041 C O1	5.76
934201	AD1-047 C	7.9
934211	AD1-048 C	2.69
934391	AD1-063 C	1.75
934521	AD1-076 C O1	55.53
934571	AD1-082 C O1	8.27
934781	AD1-105 C	9.24
935111	AD1-144 C	1.85
935161	AD1-151 C O1	17.65
935211	AD1-156 C	2.3
LTF	CARR	1.28
LTF	CBM-S1	12.61
LTF	CBM-S2	24.42
LTF	CBM-W1	23.04
LTF	CBM-W2	65.21
LTF	CIN	5.53
LTF	CPLE	7.49
LTF	IPL	3.52
LTF	LGEE	1.24
LTF	MEC	12.82

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LTF	MECS	3.84
LTF	RENSSELAER	1.02
LTF	ROWAN /* 35% REVERSE 4479078	< 0.01
297087	V2-040	0.15
LTF	WEC	1.48
918691	AA1-083	0.77
919211	AA1-145	13.15
LTF	AA2-074	5.09
930121	AB1-027 C	0.54
930861	AB1-132 C	13.79
931231	AB1-173 C	2.22
931241	AB1-173AC	2.22
923801	AB2-015 C O1	8.88
923831	AB2-022 C	2.43
923911	AB2-031 C O1	2.21
923991	AB2-040 C O1	7.24
924061	AB2-050	0.77
924241	AB2-068 O1	221.37
924501	AB2-099 C	0.59
924511	AB2-100 C	11.59
924811	AB2-134 C O1	14.08
925051	AB2-160 C O1	5.95
925061	AB2-161 C O1	3.63
925121	AB2-169 C	6.41
925171	AB2-174 C O1	6.94
925331	AB2-190 C	21.97

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925861	*AC1-065 C*	*3.67*
926071	*AC1-086 C*	*20.31*
926291	*AC1-107*	*334.14*
926411	*AC1-112 C*	*0.42*
926551	*AC1-134*	*10.29*
926751	*AC1-161 C*	*32.72*
926781	*AC1-164 C*	*44.48*
927041	*AC1-191 C*	*10.53*
927221	*AC1-216 C O1*	*10.75*

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Appendix 20

(DVP - DVP) The 8MDLTHAN-8NO ANNA 500 kV line (from bus 314914 to bus 314918 ckt 1) loads from 100.49% to 103.48% (AC power flow) of its emergency rating (2442 MVA) for the single line contingency outage of 'DVP_P1-2: LN 574'. This project contributes approximately 83.83 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 574'
OPEN BRANCH FROM BUS 314908 TO BUS 314911 CKT 1 /* 8ELMONT 500.00 - 8LDYSMTH 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315102	*1BRUNSWICKG1*	*15.66*
315103	*1BRUNSWICKG2*	*15.66*
315104	*1BRUNSWICKG3*	*15.66*
315105	*1BRUNSWICKS1*	*32.54*
315099	*1CHESPKB*	*1.97*
315131	*1EDGECMA*	*13.32*
315132	*1EDGECMB*	*13.32*
315108	*1ELIZAR1*	*5.81*
315109	*1ELIZAR2*	*5.71*
315110	*1ELIZAR3*	*5.89*
315074	*1HOPCGN1*	*11.9*
315075	*1HOPCGN2*	*11.75*
315083	*1SPRUNCA*	*15.72*
315084	*1SPRUNCB*	*15.72*
315085	*1SPRUNCC*	*11.65*
315086	*1SPRUNCD*	*11.65*
315090	*1YORKTN1*	*41.69*
315091	*1YORKTN2*	*43.26*

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314315	3LOCKS E	1.85
932041	AC2-012 C	16.1
932501	AC2-070 C	2.04
932531	AC2-073 C	2.99
932581	AC2-078 C	6.22
932591	AC2-079 C	8.92
932631	AC2-084 C	13.05
932831	AC2-110 C	1.7
933061	AC2-130	3.23
933291	AC2-141 C	48.3
933501	AC2-165 C	16.06
933731	AC2-196 C	0.53
933991	AD1-023 C	20.23
934011	AD1-025 C O1	24.81
934061	AD1-033 C O1	11.87
934141	AD1-041 C O1	6.63
934201	AD1-047 C	12.17
934211	AD1-048 C	3.13
934231	AD1-050 C	6.68
934331	AD1-057 C O1	14.7
934391	AD1-063 C	2.02
934521	AD1-076 C O1	83.83
934571	AD1-082 C O1	11.9
934611	AD1-087 C O1	12.01
934621	AD1-088 C	17.52
935111	AD1-144 C	2.69

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935161	AD1-151 C O1	23.7
935171	AD1-152 C O1	11.94
935211	AD1-156 C	3.28
935221	AD1-157 C	1.94
935231	AD1-160 C	1.42
LTF	CARR	1.38
LTF	CBM-S1	22.19
LTF	CBM-S2	40.31
LTF	CBM-W1	47.84
LTF	CBM-W2	118.
LTF	CIN	11.06
LTF	CPLE	12.3
LTF	IPL	7.06
LTF	LGEE	2.42
LTF	MEC	24.52
LTF	MECS	10.15
LTF	RENSSELAER	1.1
LTF	ROWAN /* 35% REVERSE 4479078	< 0.01
LTF	WEC	2.99
LTF	Z1-043	11.77
916191	Z1-068 C	0.08
916301	Z1-086 C	95.29
919701	AA2-057 C	10.39
LTF	AA2-074	8.37
930861	AB1-132 C	21.24
931231	AB1-173 C	3.42

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931241	*AB1-173AC*	*3.42*
923801	*AB2-015 C O1*	*13.3*
923831	*AB2-022 C*	*3.61*
923911	*AB2-031 C O1*	*3.4*
923991	*AB2-040 C O1*	*11.15*
924021	*AB2-043 C O1*	*4.25*
924151	*AB2-059 C O1*	*15.16*
924161	*AB2-060 C O1*	*12.23*
924241	*AB2-068 O1*	*240.65*
924301	*AB2-077 C O1*	*2.7*
924311	*AB2-078 C O1*	*2.7*
924321	*AB2-079 C O1*	*2.7*
924401	*AB2-089 C*	*3.03*
924491	*AB2-098 C*	*0.83*
924501	*AB2-099 C*	*0.89*
924511	*AB2-100 C*	*17.76*
924811	*AB2-134 C O1*	*18.91*
925051	*AB2-160 C O1*	*8.05*
925061	*AB2-161 C O1*	*5.22*
925121	*AB2-169 C*	*9.79*
925171	*AB2-174 C O1*	*10.68*
925331	*AB2-190 C*	*29.49*
925521	*AC1-027 C*	*0.59*
925591	*AC1-034 C*	*9.82*
925781	*AC1-054 C*	*10.32*
925861	*AC1-065 C*	*4.24*

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926071	*AC1-086 C*	*31.28*
926201	*AC1-098 C*	*9.15*
926211	*AC1-099 C*	*3.07*
926271	*AC1-105 C*	*7.53*
926291	*AC1-107*	*363.25*
926751	*AC1-161 C*	*48.3*
926781	*AC1-164 C*	*51.52*
927021	*AC1-189 C*	*12.57*
927141	*AC1-208 C*	*13.46*
927221	*AC1-216 C O1*	*14.43*

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