Generation Interconnection
System Impact Study Report

For

PJM Generation Interconnection Request
Queue Position AC1-216

Hopewell – Surry 230kV
54.8 MW Capacity / 97.9 MW Energy

Revised January / 2020

Revised January / 2017

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 Spring Grove Solar I, 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 Surry County, VA. The installed facilities will have a total capability of 97.9 MW with 54.8 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is 9/30/2019. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AC1-216 will interconnect with the ITO transmission system will connect via a new ringbus bay in switching station to be built for the AB2-134 queue project that connects on the Hopewell - Surry 230kV line # 212.

Cost Summary

The AC1-216 interconnection request 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	$2,500,000
Allocation for New System Upgrades	$0
Contribution for Previously Identified Upgrades	$0
Total Costs	**$4,300,000**

Attachment Facilities

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

Transmission: Build approximately 0.5 miles of 230 kV Line. Estimated Cost $1,200,000

The estimated total cost of the Attachment Facilities is $1,800,000. It is estimated to take 30-36 months to complete this work. These preliminary cost estimates are based on typical engineering costs. A more detailed engineering cost estimates are normally done when the IC provides an exact site plan location for the generation substation during the Facility Study phase. These costs do not include CIAC Tax Gross-up. The single line is shown below in Attachment 1.

Direct Connection Cost Estimate

None

Non-Direct Connection Cost Estimate

AB2-134 Substation:

- Substation: Add one 230 kV breaker at AB2-134 Substation to interconnect the proposed AC1-216 Project and associated equipment. Estimated Cost $1,500,000.
- Transmission: Re-arrange existing lines to accommodate new 230 kV Line. Estimated Cost $1,000,000.

The estimated total cost of these Facilities is $2,500,000. It is estimated to take 36-48 months to complete this work. These preliminary cost estimates are based on typical engineering costs. More detailed engineering cost estimates are completed during the Facility Study phase.

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.

New System Reinforcements

PJM OATT 217.3 outlines cost responsibility for Network Upgrades and as the minimum amount of Network Upgrades required to resolve a single reliability criteria violation will not meet or exceed $5,000,000 such costs shall be allocated to those Interconnection Requests in the New Services Queue that contribute to the need for such upgrades. Such allocations shall be made in proportion to each Interconnection Request's megawatt contribution to the need for these upgrades subject to the rules for minimum cost allocation thresholds in the PJM Manuals. For the purpose of applying the $5,000,000 threshold, each reliability criteria violation shall be considered separately.

Violation #	Ruling Violation #	Loading	Upgrade Description	Upgrade Cost	Allocated Cost
# 2	2	From 106.89% to 108.46%	Rebuild 500kV Line #581 Ladysmith to Chancellor - 15.2 miles long.	$44,380,000	**$0**
# 1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20	14	From 116.9% to 118.97%	Rebuild 21.32 miles of existing line between Chesterfield - Lakeside 230 kV	$41,500.000	**$0**
# 3	3	From 99.84% to 100.17%	Replace wave trap at both Ladysmith and Possum Point substations for the Ladysmith – Possum Pt 500kV line #568.	$500,000	**$0**
# 13	13	From 104.66% to 133.36%	Replace the existing Prince George 230/115 kV transformer.	$3,441,235	**$0**
# 21	21	From 105.01% to 106.64%	Reconductor 0.14 miles of the Chesterfield to Basin 230kV line.	$250,000	**$0**
			Total Estimate Allocated Cost of Network Upgrades		**$0**

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.

Network Impacts

The Queue Project AC1-216 was evaluated as a 97.9 MW (Capacity 54.8 MW) injection tapping the Hopewell-Surry 230kV line (AB2-134 Tap) in the ITO area. Project AC1-216 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-216 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
562T563	CONTINGENCY '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
BASIN 230 B#2	CONTINGENCY 'BASIN 230 B#2' /* OPEN BRANCH FROM BUS 314276 TO BUS 314339 CKT 1 OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 OPEN BRANCH FROM BUS 314276 TO BUS 314274 CKT 2 END
LN 208-259	CONTINGENCY 'LN 208-259' OPEN BRANCH FROM BUS 314286 TO BUS 314309 CKT 1 /* 6CHSTF A 230.00 - 6IRON208 230.00 OPEN BRANCH FROM BUS 314309 TO BUS 314338 CKT 1 /* 6IRON208 230.00 - 6SOUWEST 230.00 OPEN BUS 314309 /* ISLAND OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHSTF B 230.00 END
LN 211-228	CONTINGENCY 'LN 211-228' OPEN BRANCH FROM BUS 314287 TO BUS 314303 CKT 1 /* 6CHSTF B 230.00 - 6HOPEWLL 230.00 OPEN BRANCH FROM BUS 314278 TO BUS 314286 CKT 1 /* 6BERMUDA 230.00 - 6CHSTF A 230.00

	OPEN BRANCH FROM BUS 314278 TO BUS 314303 CKT 1 /* 6BERMUDA 230.00 - 6HOPEWLL 230.00 OPEN BUS 314278 /* ISLAND END
LN 259	CONTINGENCY 'LN 259' OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHSTF B 230.00 END
LN 259-2065	CONTINGENCY 'LN 259-2065' OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHSTF B 230.00 OPEN BRANCH FROM BUS 314276 TO BUS 314339 CKT 1 /* 6BASIN 230.00 - 6SPRUNCE 230.00 END
LN 552	CONTINGENCY '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
LN 563	CONTINGENCY 'LN 563' OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 END
LN 573	CONTINGENCY 'LN 573' OPEN BRANCH FROM BUS 314918 TO BUS 314934 CKT 1 /* 8NO ANNA 500.00 - 8SPOTSYL 500.00 END
LN 574	CONTINGENCY 'LN 574' OPEN BRANCH FROM BUS 314908 TO BUS 314911 CKT 1 /* 8ELMONT 500.00 - 8LDYSMTH 500.00 END
LN 576	CONTINGENCY 'LN 576' OPEN BRANCH FROM BUS 314322 TO BUS 314914 CKT 1 /* 6MDLTHAN 230.00 - 8MDLTHAN 500.00 OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00

	END
T672B	CONTINGENCY 'T672B' /*_ BASIN OPEN BRANCH FROM BUS 314276 TO BUS 314260 CKT 1 /*L284 BASIN VARINA OPEN BRANCH FROM BUS 314275 TO BUS 314276 CKT 1 /*L2055 BASIN BELLMEADE REMOVE MACHINE 1 FROM BUS 315053 /*BELMEADE GEN CT-1 REMOVE MACHINE 2 FROM BUS 315054 /*BELMEADE GEN CT-2 REMOVE MACHINE 3 FROM BUS 315055 /*BELMEADE GEN ST OPEN BRANCH FROM BUS 314274 TO BUS 314276 CKT 1 /*BASIN TX5 OPEN BRANCH FROM BUS 314274 TO BUS 314276 CKT 2 /*BASIN TX6 OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /*L259 BASIN CHESTERFIELD OPEN BRANCH FROM BUS 314276 TO BUS 314339 CKT 1 /*L2065 BASIN SPRUANCE NUG END

Summer Peak Analysis – 2020

Generator Deliverability

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

#	Contingency				Bus			Power	Loading %		Rating		MW	Flowgate
	Type	Name	Affected Area	Facility Description	From	To	Ckt	Flow	Initial	Final	Type	MVA	Contribution	Appendix
1	N-1	LN 576	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	AC	99.15	100.37	ER	375	4.6	
2	N-1	LN 573	DVP - DVP	8LDYSMTH-8CHANCE 500 kV line	314911	314905	1	AC	99.99	100.33	ER	2738	10.63	1
3	N-1	LN 552	DVP - DVP	8LDYSMTH-8POSSUM 500 kV line	314911	314922	1	AC	99.84	100.17	ER	2442	9.29	2

Multiple Facility Contingency

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

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

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

None

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

#	Contingency		Affected Area	Facility Description	Bus		Ckt	Power Flow	Loading %		Rating		MW Contribution	Flowgate Appendix
	Type	Name			From	To			Initial	Final	Type	MVA		
4	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	AC	105.75	107.82		459	11.16	3
5	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	AC	101.66	103.15	ER	375	5.62	
6	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	116.87	118.94		459	11.16	4
7	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	115.68	117.18	ER	375	5.62	
8	N-1	LN 576	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	112.89	114.12	ER	375	4.6	
9	LFFB	562T563	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	102.49	103.93		459	7.79	
10	LFFB	T672B	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	101.35	103.21		459	10.06	
11	DCTL	LN 259-2065	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	100.36	102.2		459	9.98	
12	BUS	BASIN 230 B#2	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	100.11	101.96		459	9.99	
13	DCTL	LN 211-228	DVP - DVP	6PRGEORG 230/115 kV transformer	314269	314291	1	AC	104.66	113.36		220	19.42	5
14	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	116.9	118.97		459	11.16	6
15	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	115.35	116.85	ER	375	5.62	
16	N-1	LN 576	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	112.91	114.14	ER	375	4.6	
17	LFFB	562T563	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	102.51	103.96		459	7.79	
18	LFFB	T672B	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	101.38	103.24		459	10.06	
19	DCTL	LN 259-2065	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	100.39	102.23		459	9.98	
20	BUS	BASIN 230 B#2	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	100.14	101.99		459	9.99	
21	LFFB	562T563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	AC	105.01	106.64		549	10.57	7

Steady-State Voltage Requirements

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

None

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

No mitigations were found to be required.

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	AC1-216 Allocation
#2	8LDYSMTH-8CHANCE 500 kV line	Description: Rebuild 500kV Line #581 Ladysmith to Chancellor - 15.2 miles long. Rating: 4330/4330/4979 Schedule: 06/14/24 Note: While the project AC1-216 does not have a cost allocation for this upgrade, project AC1-216 may require the upgrade to be in-service to be deliverable to the PJM system. If project AC1-216 comes into service prior to completion of the upgrade, an interim deliverability study for a particular Delivery Year will be required.	b3021	$44,380,000	**$0**

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	AC1-216 Allocation
# 1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20	6CHARCTY-6LAKESD 230 kV line	Description: Rebuild 21.32 miles of existing line between Chesterfield - Lakeside 230 kV Schedule: 6/1/2020 Note: While the project AC1-216 does not have a cost allocation for this upgrade, project AC1-216 may require the upgrade to be in-service to be deliverable to the PJM system. If project AC1-216 comes into service prior to completion of the upgrade, an interim deliverability study for a particular Delivery Year will be required.	b2745	$41,500.000	**$0**
# 3	8LDYSMTH-8POSSUM 500 kV line	Description: Replace wave trap at both Ladysmith and Possum Point substations for the Ladysmith – Possum Pt 500kV line #568. Note 1: As changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AC1-216 could become the driver and could receive a cost allocation. Note 2: While the project AC1-216 does not have a cost allocation for this upgrade, project AC1-216 may require the upgrade to be in-service to be deliverable to the PJM system. If project AC1-216 comes into service prior to completion of the upgrade, an interim deliverability study for a particular Delivery Year will be required.	n6063	$500,000	**$0**

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AC1-216 Allocation
# 13	6PRGEORG 230/115 kV transformer	Description: Replace the existing Prince George 230/115 kV transformer. Schedule: 12/31/20 Note 1: As changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AC1-216 could become the driver and could receive a cost allocation. Note 2: While the project AC1-216 does not have a cost allocation for this upgrade, project AC1-216 may require the upgrade to be in-service to be deliverable to the PJM system. If project AC1-216 comes into service prior to completion of the upgrade, an interim deliverability study for a particular Delivery Year will be required.	n5807	$3,441,235	**$0**
# 21	6CHSTF B-6BASIN 230 kV line	Description: Reconductor 0.14 miles of the Chesterfield to Basin 230kV line. This project is in-service.	b2990	$250,000	**$0**
				Total New Network Upgrades	**$0**

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.

Overload	Contingency				Bus				Loading %		Rating		MW
Number	Type	Name	Affected Area	Facility Description	From	To	Circuit	Power Flow	Initial	Final	Type	MVA	Contribution
22	N-1	LN 574	DVP - DVP	6FRRIVER-6STJOHN 230 kV line	314212	314150	1	AC	115.04	116.06	ER	749	9.04
23	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	AC	108.75	111.02	ER	375	10.05
24	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	122.37	124.64	ER	375	10.05
25	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	122.4	124.68	ER	375	10.05
26	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	AC	116.15	118.2	ER	449	10.87
27	N-1	LN 576	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	120.42	121.32	ER	2442	26.02
28	N-1	LN 576	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	149.25	150.35	ER	2442	31.41
29	N-1	LN 574	DVP - DVP	8MDLTHAN-8NO ANNA 500 kV line	314914	314918	1	AC	111.71	112.61	ER	2442	25.77

Light Load Analysis in 2020

Not required

ITO Analysis

ITO assessed the impact of the proposed Queue Project #AC1-216 interconnection of 97.9 MW of energy (Capacity 54.8 MW) for compliance with reliability criteria on ITO's Transmission System. The system was assessed using the summer 2020 RTEP case provided to ITO by PJM. When performing a generation analysis, ITO's main analysis will be load flow study results under single contingency and multiple facility contingency (both normal and stressed system conditions). ITO Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. A full listing of ITO's Planning Criteria and interconnection requirements can be found in the ITO's Facility Connection Requirements which are publicly available at: http://www.dom.com.

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

As part of its generation impact analysis ITO routinely evaluates the impact that a proposed new generation resource will have under maximum generation conditions, stress system conditions and import/export system conditions (greater than 20 MW). The results of these studies are discussed in more detail below.

Category B Analysis (Single Contingency):

- System Normal – No deficiencies identified
- Critical System Condition (No Surry 230 kV Unit) OR (Possum Point Unit #6 (230kV Unit) – No deficiencies identified.

Category C Analysis: (Multiple Facility Contingency)

- Bus Fault - No deficiencies identified
- Line Stuck Breaker - No deficiencies identified
- Tower Line – No deficiencies identified

As part of its generation impact analysis ITO routinely evaluates the impact that a proposed new generation resource (greater than 20 MW) will have under maximum generation conditions, stress system conditions and import/export system conditions. The results of these studies are discussed in Table A and B below.

Table A: Import Study Results

Import Study Results			
Area	Summer 2020	Summer 2020 with AC1-216	Limiting Element
AEP	2000+	2000+	8ELMONT-8LDYSMTH 500 kV line under contingency of LN 256
APS	2000+	2000+	None
CPL	2000+	2000+	8ELMONT-8LDYSMTH 500 kV line under contingency of LN 256

PJM	2000+	2000+	8ELMONT-8LDYSMTH 500 kV line under contingency of LN 256

Table B: Export Study Results

Export Study Results			
Area	Summer 2020	Summer 2020 with AC1-216	Limiting Element
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

ITO's Planning Criteria indicates a need to have approximately 2000 MW of import and export capability. The results of these import and export studies indicate that the proposed AC1-216 (Transfer) will impact ITO's import or export capability

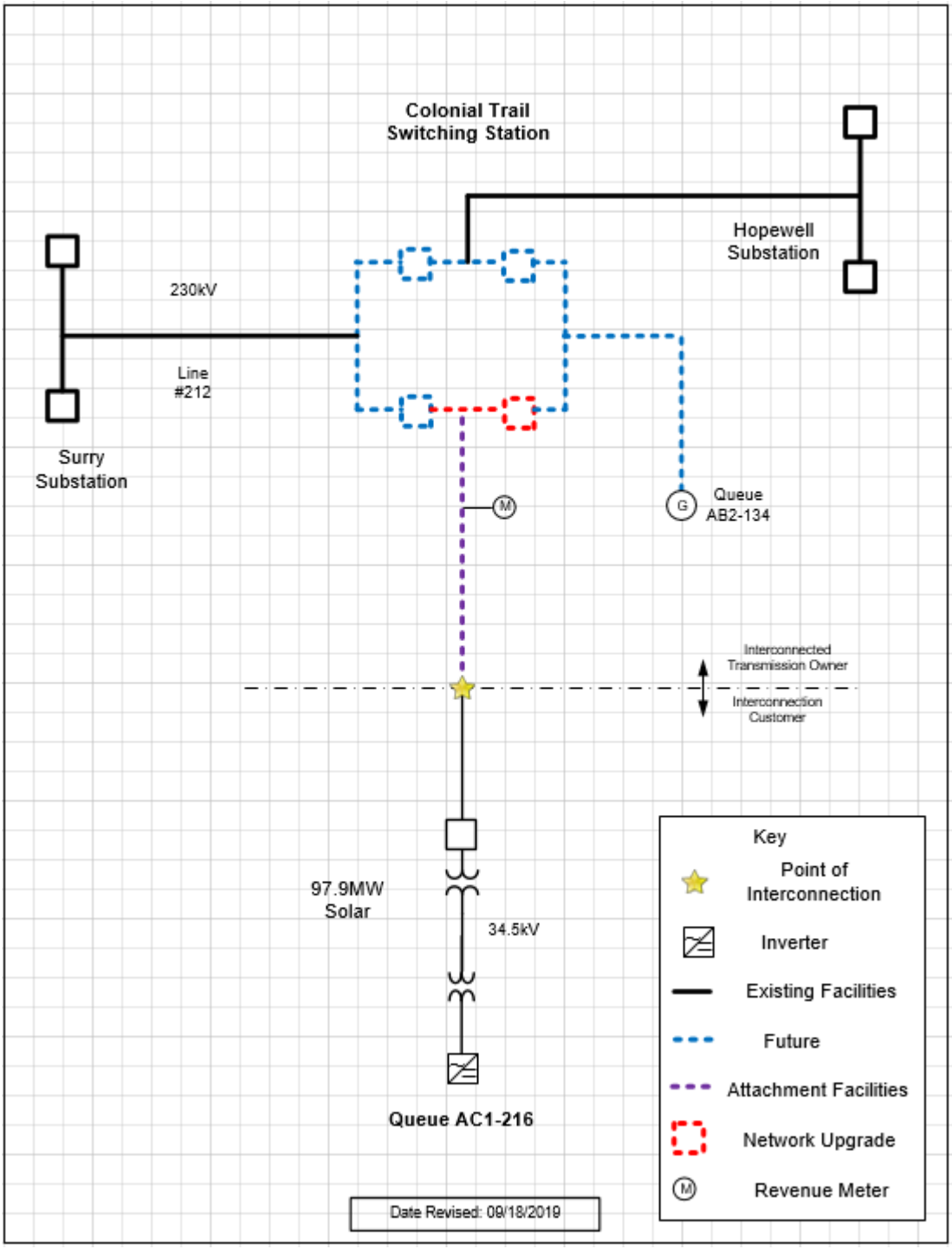
Affected System Analysis & Mitigation

Duke Energy:

None

Attachment 1.

System Configuration



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.

(DVP - DVP) The 8LDYSMTH-8CHANCE 500 kV line (from bus 314911 to bus 314905 ckt 1) loads from 99.99% to 100.33% (AC power flow) of its emergency rating (2738 MVA) for the single line contingency outage of 'LN 573'. This project contributes approximately 10.63 MW to the thermal violation.

CONTINGENCY '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*	*3.37*
315054	*1BELMED2*	*3.37*
315055	*1BELMED3*	*2.8*
315067	*1DARBY 1*	*3.07*
315068	*1DARBY 2*	*3.08*
315069	*1DARBY 3*	*3.12*
315070	*1DARBY 4*	*3.12*
315043	*1FRIVERA*	*4.15*
315044	*1FRIVERB*	*3.21*
315045	*1FRIVERC*	*4.15*
315046	*1FRIVERD*	*3.21*
315047	*1FRIVERE*	*3.21*
315048	*1FRIVERF*	*4.15*
315037	*1LDYSMT1*	*5.37*
315039	*1LDYSMT3*	*5.68*
315040	*1LDYSMT4*	*5.69*
315041	*1LDYSMT5*	*5.71*
315225	*1N ANNA1*	*46.55*
315226	*1N ANNA2*	*45.83*

315083	*1SPRUNCA*	*2.06*
315084	*1SPRUNCB*	*2.06*
315085	*1SPRUNCC*	*1.53*
315086	*1SPRUNCD*	*1.53*
315091	*1YORKTN2*	*31.95*
314309	*6IRON208*	*0.46*
314236	*6NRTHEST*	*0.22*
314251	*6S PUMP*	*1.07*
315074	*CIR_AB2-152*	*10.55*
297087	*V2-040*	*0.15*
921162	*AA1-063AC*	*8.01*
921292	*AA1-083*	*0.73*
921622	*AA1-145*	*12.38*
921752	*AA2-053 C*	*8.27*
921762	*AA2-057 C*	*6.51*
921982	*AA2-088 C*	*6.02*
922442	*AA2-165 C*	*0.89*
922512	*AA2-174 C*	*0.38*
922532	*AA2-178 C*	*9.71*
922682	*AB1-027 C*	*2.83*
922922	*AB1-081 C OP*	*7.97*
923262	*AB1-132 C OP*	*13.48*
923572	*AB1-173 C OP*	*2.16*
923582	*AB1-173AC OP*	*2.16*
923801	*AB2-015 C OP*	*9.41*
923831	*AB2-022 C*	*2.41*

923841	*AB2-024 C*	*2.67*
923851	*AB2-025 C*	*2.49*
923861	*AB2-026 C*	*2.32*
923911	*AB2-031 C OP*	*2.15*
923991	*AB2-040 C OP*	*7.05*
924021	*AB2-043 C OP*	*2.65*
924061	*AB2-050*	*4.07*
924151	*AB2-059 C*	*9.39*
924161	*AB2-060 C*	*7.63*
924241	*AB2-068 OP*	*219.2*
924321	*AB2-079 C OP*	*5.04*
924491	*AB2-098 C*	*0.53*
924501	*AB2-099 C*	*0.57*
924511	*AB2-100 C*	*11.36*
924811	*AB2-134 C OP*	*13.92*
925051	*AB2-160 C OP*	*5.88*
925061	*AB2-161 C OP*	*3.61*
925171	*AB2-174 C O1*	*6.77*
925281	*AB2-186 C*	*0.62*
925331	*AB2-190 C*	*21.69*
926261	*AC1-027 C*	*2.13*
926331	*AC1-034 C*	*6.08*
926351	*AC1-036 C*	*0.79*
926531	*AC1-054 C OP*	*6.42*
926591	*AC1-060*	*0.08*
926601	*AC1-061*	*0.04*

926621	*AC1-063*	*0.42*
926641	*AC1-065 C*	*3.63*
926851	*AC1-086 C*	*19.85*
926981	*AC1-099 C*	*7.68*
927061	*AC1-107 OP*	*330.86*
927181	*AC1-112 C*	*2.2*
927251	*AC1-118 C*	*2.03*
927411	*AC1-134*	*10.17*
927561	*AC1-147 C*	*2.4*
927711	*AC1-161 C OP*	*32.38*
927741	*AC1-164 C OP*	*44.*
927991	*AC1-189 C*	*7.96*
928011	*AC1-191 C OP*	*10.39*
928191	*AC1-208 C O1*	*8.39*
928271	*AC1-216 C OP*	*10.63*

Appendix 2

(DVP - DVP) The 8LDYSMTH-8POSSUM 500 kV line (from bus 314911 to bus 314922 ckt 1) loads from 99.84% to 100.17% (AC power flow) of its emergency rating (2442 MVA) for the single line contingency outage of 'LN 552'. This project contributes approximately 9.29 MW to the thermal violation.

CONTINGENCY '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

Bus Number	*Bus Name*	*Full Contribution*
315060	*1CHESTF5*	*10.55*
315061	*1CHESTG7*	*4.14*
315063	*1CHESTG8*	*4.1*
315062	*1CHESTS7*	*1.88*
315064	*1CHESTS8*	*2.1*
315067	*1DARBY 1*	*2.72*
315068	*1DARBY 2*	*2.72*
315069	*1DARBY 3*	*2.76*
315070	*1DARBY 4*	*2.76*
315043	*1FRIVERA*	*3.7*
315044	*1FRIVERB*	*2.86*
315045	*1FRIVERC*	*3.7*
315046	*1FRIVERD*	*2.86*
315047	*1FRIVERE*	*2.86*
315048	*1FRIVERF*	*3.7*
315225	*1N ANNA1*	*32.36*
315226	*1N ANNA2*	*31.86*

315091	*1YORKTN2*	*27.97*
314309	*6IRON208*	*0.41*
314236	*6NRTHEST*	*0.2*
314251	*6S PUMP*	*0.94*
315074	*CIR_AB2-152*	*9.25*
297087	*V2-040*	*0.13*
921162	*AA1-063AC*	*7.09*
921292	*AA1-083*	*0.65*
921622	*AA1-145*	*11.02*
921752	*AA2-053 C*	*7.32*
921982	*AA2-088 C*	*5.33*
922512	*AA2-174 C*	*0.34*
922532	*AA2-178 C*	*8.5*
922682	*AB1-027 C*	*2.52*
923262	*AB1-132 C OP*	*11.88*
923572	*AB1-173 C OP*	*1.91*
923582	*AB1-173AC OP*	*1.91*
923801	*AB2-015 C OP*	*8.18*
923831	*AB2-022 C*	*2.1*
923841	*AB2-024 C*	*2.35*
923851	*AB2-025 C*	*2.16*
923861	*AB2-026 C*	*2.05*
923911	*AB2-031 C OP*	*1.9*
923991	*AB2-040 C OP*	*6.22*
924061	*AB2-050*	*3.62*
924241	*AB2-068 OP*	*198.62*

924501	*AB2-099 C*	*0.5*
924511	*AB2-100 C*	*9.94*
924811	*AB2-134 C OP*	*12.18*
925051	*AB2-160 C OP*	*5.13*
925061	*AB2-161 C OP*	*3.14*
925171	*AB2-174 C O1*	*5.97*
925281	*AB2-186 C*	*0.54*
925331	*AB2-190 C*	*18.97*
926261	*AC1-027 C*	*1.85*
926591	*AC1-060*	*0.07*
926601	*AC1-061*	*0.03*
926621	*AC1-063*	*0.37*
926641	*AC1-065 C*	*3.16*
926851	*AC1-086 C*	*17.5*
927061	*AC1-107 OP*	*299.81*
927181	*AC1-112 C*	*1.97*
927411	*AC1-134*	*9.06*
927561	*AC1-147 C*	*2.08*
927711	*AC1-161 C OP*	*28.09*
927741	*AC1-164 C OP*	*39.04*
928011	*AC1-191 C OP*	*9.15*
928271	*AC1-216 C OP*	*9.29*

Appendix 3

(DVP - DVP) The 6CHARCTY-6LAKESD 230 kV line (from bus 314225 to bus 314227 ckt 1) loads from 105.75% to 107.82% (AC power flow) of its load dump rating (459 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 11.16 MW to the thermal violation.

CONTINGENCY 'LN 208-259'
OPEN BRANCH FROM BUS 314286 TO BUS 314309 CKT 1 /* 6CHSTF A 230.00 - 6IRON208 230.00
OPEN BRANCH FROM BUS 314309 TO BUS 314338 CKT 1 /* 6IRON208 230.00 - 6SOUWEST 230.00
OPEN BUS 314309 /* ISLAND
OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHSTF B 230.00
END

Bus Number	*Bus Name*	*Full Contribution*
315065	*1CHESTF6*	*34.05*
315077	*1HOPHCF1*	*1.97*
315078	*1HOPHCF2*	*1.97*
315079	*1HOPHCF3*	*1.97*
315080	*1HOPHCF4*	*2.99*
315076	*1HOPPOLC*	*1.69*
315073	*1STONECA*	*5.67*
314784	*1WEYRHSB*	*0.65*
314539	*3UNCAMP*	*0.86*
314541	*3WATKINS*	*0.24*
314229	*6MT R221*	*-0.33*
315074	*CIR_AB2-152*	*7.97*
315075	*CIR_AB2-152*	*0.68*
292791	*U1-032 E*	*2.95*
900672	*V4-068 E*	*0.11*

901082	*W1-029E*	*13.48*
907092	*X1-038 E*	*2.14*
913392	*Y1-086 E*	*0.63*
914231	*Y2-077*	*0.79*
916042	*Z1-036 E*	*13.57*
916192	*Z1-068 E*	*0.53*
917122	*Z2-027 E*	*0.31*
917332	*Z2-043 E*	*0.34*
917342	*Z2-044 E*	*0.18*
921162	*AA1-063AC*	*3.19*
921163	*AA1-063AE*	*1.51*
918512	*AA1-065 E OP*	*1.48*
918562	*AA1-072 E*	*0.06*
921752	*AA2-053 C*	*3.26*
921753	*AA2-053 E*	*1.4*
921762	*AA2-057 C*	*2.34*
921763	*AA2-057 E*	*1.17*
921982	*AA2-088 C*	*2.33*
921983	*AA2-088 E*	*3.81*
922442	*AA2-165 C*	*0.32*
922443	*AA2-165 E*	*0.15*
922512	*AA2-174 C*	*0.15*
922513	*AA2-174 E*	*0.16*
922532	*AA2-178 C*	*2.96*
922533	*AA2-178 E*	*1.27*
923262	*AB1-132 C OP*	*5.96*

923263	*AB1-132 E OP*	*2.56*
923572	*AB1-173 C OP*	*0.98*
923573	*AB1-173 E OP*	*0.46*
923582	*AB1-173AC OP*	*0.98*
923583	*AB1-173AE OP*	*0.46*
923801	*AB2-015 C OP*	*3.06*
923802	*AB2-015 E OP*	*2.51*
923831	*AB2-022 C*	*0.66*
923832	*AB2-022 E*	*0.35*
923851	*AB2-025 C*	*1.62*
923852	*AB2-025 E*	*0.73*
923911	*AB2-031 C OP*	*0.98*
923912	*AB2-031 E OP*	*0.48*
923991	*AB2-040 C OP*	*3.21*
923992	*AB2-040 E OP*	*2.63*
924501	*AB2-099 C*	*0.2*
924502	*AB2-099 E*	*0.09*
924511	*AB2-100 C*	*6.21*
924512	*AB2-100 E*	*3.06*
924811	*AB2-134 C OP*	*8.19*
924812	*AB2-134 E OP*	*8.05*
925051	*AB2-160 C OP*	*4.18*
925052	*AB2-160 E OP*	*6.83*
925061	*AB2-161 C OP*	*1.99*
925062	*AB2-161 E OP*	*3.24*
925122	*AB2-169 E*	*1.8*

925171	*AB2-174 C O1*	*3.15*
925172	*AB2-174 E O1*	*2.85*
925281	*AB2-186 C*	*0.18*
925282	*AB2-186 E*	*0.08*
925331	*AB2-190 C*	*12.2*
925332	*AB2-190 E*	*5.23*
926261	*AC1-027 C*	*0.57*
926262	*AC1-027 E*	*0.32*
926601	*AC1-061*	*0.03*
926851	*AC1-086 C*	*8.78*
926852	*AC1-086 E*	*4.*
926981	*AC1-099 C*	*2.8*
926982	*AC1-099 E*	*1.66*
927561	*AC1-147 C*	*0.65*
927562	*AC1-147 E*	*0.38*
928191	*AC1-208 C O1*	*3.12*
928192	*AC1-208 E O1*	*1.39*
928271	*AC1-216 C OP*	*6.25*
928272	*AC1-216 E OP*	*4.91*

Appendix 4

(DVP - DVP) The 6MESSER-6CHARCTY 230 kV line (from bus 314228 to bus 314225 ckt 1) loads from 116.87% to 118.94% (AC power flow) of its load dump rating (459 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 11.16 MW to the thermal violation.

CONTINGENCY 'LN 208-259'
OPEN BRANCH FROM BUS 314286 TO BUS 314309 CKT 1 /* 6CHSTF A 230.00 - 6IRON208 230.00
OPEN BRANCH FROM BUS 314309 TO BUS 314338 CKT 1 /* 6IRON208 230.00 - 6SOUWEST 230.00
OPEN BUS 314309 /* ISLAND
OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHSTF B 230.00
END

Bus Number	*Bus Name*	*Full Contribution*
315065	*1CHESTF6*	*34.05*
315077	*1HOPHCF1*	*1.97*
315078	*1HOPHCF2*	*1.97*
315079	*1HOPHCF3*	*1.97*
315080	*1HOPHCF4*	*2.99*
315076	*1HOPPOLC*	*1.69*
315073	*1STONECA*	*5.67*
314784	*1WEYRHSB*	*0.65*
314539	*3UNCAMP*	*0.86*
314541	*3WATKINS*	*0.24*
314229	*6MT R221*	*-0.33*
315074	*CIR_AB2-152*	*7.97*
315075	*CIR_AB2-152*	*0.68*
292791	*U1-032 E*	*2.95*
900672	*V4-068 E*	*0.11*

901082	*W1-029E*	*13.48*
907092	*X1-038 E*	*2.14*
913392	*Y1-086 E*	*0.63*
914231	*Y2-077*	*0.79*
916042	*Z1-036 E*	*13.57*
916192	*Z1-068 E*	*0.53*
917122	*Z2-027 E*	*0.31*
917332	*Z2-043 E*	*0.34*
917342	*Z2-044 E*	*0.18*
921162	*AA1-063AC*	*3.19*
921163	*AA1-063AE*	*1.51*
918512	*AA1-065 E OP*	*1.48*
918562	*AA1-072 E*	*0.06*
921752	*AA2-053 C*	*3.26*
921753	*AA2-053 E*	*1.4*
921762	*AA2-057 C*	*2.34*
921763	*AA2-057 E*	*1.17*
921982	*AA2-088 C*	*2.33*
921983	*AA2-088 E*	*3.81*
922442	*AA2-165 C*	*0.32*
922443	*AA2-165 E*	*0.15*
922512	*AA2-174 C*	*0.15*
922513	*AA2-174 E*	*0.16*
922532	*AA2-178 C*	*2.96*
922533	*AA2-178 E*	*1.27*
923262	*AB1-132 C OP*	*5.96*

923263	*AB1-132 E OP*	*2.56*
923572	*AB1-173 C OP*	*0.98*
923573	*AB1-173 E OP*	*0.46*
923582	*AB1-173AC OP*	*0.98*
923583	*AB1-173AE OP*	*0.46*
923801	*AB2-015 C OP*	*3.06*
923802	*AB2-015 E OP*	*2.51*
923831	*AB2-022 C*	*0.66*
923832	*AB2-022 E*	*0.35*
923851	*AB2-025 C*	*1.62*
923852	*AB2-025 E*	*0.73*
923911	*AB2-031 C OP*	*0.98*
923912	*AB2-031 E OP*	*0.48*
923991	*AB2-040 C OP*	*3.21*
923992	*AB2-040 E OP*	*2.63*
924501	*AB2-099 C*	*0.2*
924502	*AB2-099 E*	*0.09*
924511	*AB2-100 C*	*6.21*
924512	*AB2-100 E*	*3.06*
924811	*AB2-134 C OP*	*8.19*
924812	*AB2-134 E OP*	*8.05*
925051	*AB2-160 C OP*	*4.18*
925052	*AB2-160 E OP*	*6.83*
925061	*AB2-161 C OP*	*1.99*
925062	*AB2-161 E OP*	*3.24*
925122	*AB2-169 E*	*1.8*

925171	*AB2-174 C O1*	*3.15*
925172	*AB2-174 E O1*	*2.85*
925281	*AB2-186 C*	*0.18*
925282	*AB2-186 E*	*0.08*
925331	*AB2-190 C*	*12.2*
925332	*AB2-190 E*	*5.23*
926261	*AC1-027 C*	*0.57*
926262	*AC1-027 E*	*0.32*
926601	*AC1-061*	*0.03*
926851	*AC1-086 C*	*8.78*
926852	*AC1-086 E*	*4.*
926981	*AC1-099 C*	*2.8*
926982	*AC1-099 E*	*1.66*
927561	*AC1-147 C*	*0.65*
927562	*AC1-147 E*	*0.38*
928191	*AC1-208 C O1*	*3.12*
928192	*AC1-208 E O1*	*1.39*
928271	*AC1-216 C OP*	*6.25*
928272	*AC1-216 E OP*	*4.91*

Appendix 5

(DVP - DVP) The 6PRGEORG 230/115 kV transformer (from bus 314269 to bus 314291 ckt 1) loads from 104.66% to 113.36% (AC power flow) of its load dump rating (220 MVA) for the tower line contingency outage of 'LN 211-228'. This project contributes approximately 19.42 MW to the thermal violation.

CONTINGENCY 'LN 211-228'
OPEN BRANCH FROM BUS 314287 TO BUS 314303 CKT 1 /* 6CHSTF B 230.00 - 6HOPEWLL 230.00
OPEN BRANCH FROM BUS 314278 TO BUS 314286 CKT 1 /* 6BERMUDA 230.00 - 6CHSTF A 230.00
OPEN BRANCH FROM BUS 314278 TO BUS 314303 CKT 1 /* 6BERMUDA 230.00 - 6HOPEWLL 230.00
OPEN BUS 314278 /* ISLAND
END

Bus Number	*Bus Name*	*Full Contribution*
315119	*1GRAVEL3*	*1.79*
315120	*1GRAVEL4*	*1.8*
315121	*1GRAVEL5*	*1.77*
315122	*1GRAVEL6*	*1.8*
315077	*1HOPHCF1*	*3.77*
315078	*1HOPHCF2*	*3.77*
315079	*1HOPHCF3*	*3.77*
315080	*1HOPHCF4*	*5.72*
315076	*1HOPPOLC*	*3.22*
315073	*1STONECA*	*10.82*
315116	*1SURRY 1*	*18.72*
315074	*CIR_AB2-152*	*15.21*
315075	*CIR_AB2-152*	*1.3*
292791	*U1-032 E*	*5.63*
914231	*Y2-077*	*1.51*

924811	*AB2-134 C OP*	*14.25*
924812	*AB2-134 E OP*	*14.01*
925331	*AB2-190 C*	*20.81*
925332	*AB2-190 E*	*8.92*
928271	*AC1-216 C OP*	*10.87*
928272	*AC1-216 E OP*	*8.55*

Appendix 6

(DVP - DVP) The 6CHSTF B-6MESSER 230 kV line (from bus 314287 to bus 314228 ckt 1) loads from 116.9% to 118.97% (AC power flow) of its load dump rating (459 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 11.16 MW to the thermal violation.

CONTINGENCY 'LN 208-259'
OPEN BRANCH FROM BUS 314286 TO BUS 314309 CKT 1 /* 6CHSTF A 230.00 - 6IRON208 230.00
OPEN BRANCH FROM BUS 314309 TO BUS 314338 CKT 1 /* 6IRON208 230.00 - 6SOUWEST 230.00
OPEN BUS 314309 /* ISLAND
OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHSTF B 230.00
END

Bus Number	*Bus Name*	*Full Contribution*
315065	*1CHESTF6*	*34.05*
315077	*1HOPHCF1*	*1.97*
315078	*1HOPHCF2*	*1.97*
315079	*1HOPHCF3*	*1.97*
315080	*1HOPHCF4*	*2.99*
315076	*1HOPPOLC*	*1.69*
315073	*1STONECA*	*5.67*
314784	*1WEYRHSB*	*0.65*
314539	*3UNCAMP*	*0.86*
314541	*3WATKINS*	*0.24*
314229	*6MT R221*	*-0.33*
315074	*CIR_AB2-152*	*7.97*
315075	*CIR_AB2-152*	*0.68*
292791	*U1-032 E*	*2.95*
900672	*V4-068 E*	*0.11*

901082	*W1-029E*	*13.48*
907092	*X1-038 E*	*2.14*
913392	*Y1-086 E*	*0.63*
914231	*Y2-077*	*0.79*
916042	*Z1-036 E*	*13.57*
916192	*Z1-068 E*	*0.53*
917122	*Z2-027 E*	*0.31*
917332	*Z2-043 E*	*0.34*
917342	*Z2-044 E*	*0.18*
921162	*AA1-063AC*	*3.19*
921163	*AA1-063AE*	*1.51*
918512	*AA1-065 E OP*	*1.48*
918562	*AA1-072 E*	*0.06*
921752	*AA2-053 C*	*3.26*
921753	*AA2-053 E*	*1.4*
921762	*AA2-057 C*	*2.34*
921763	*AA2-057 E*	*1.17*
921982	*AA2-088 C*	*2.33*
921983	*AA2-088 E*	*3.81*
922442	*AA2-165 C*	*0.32*
922443	*AA2-165 E*	*0.15*
922512	*AA2-174 C*	*0.15*
922513	*AA2-174 E*	*0.16*
922532	*AA2-178 C*	*2.96*
922533	*AA2-178 E*	*1.27*
923262	*AB1-132 C OP*	*5.96*

923263	*AB1-132 E OP*	*2.56*
923572	*AB1-173 C OP*	*0.98*
923573	*AB1-173 E OP*	*0.46*
923582	*AB1-173AC OP*	*0.98*
923583	*AB1-173AE OP*	*0.46*
923801	*AB2-015 C OP*	*3.06*
923802	*AB2-015 E OP*	*2.51*
923831	*AB2-022 C*	*0.66*
923832	*AB2-022 E*	*0.35*
923851	*AB2-025 C*	*1.62*
923852	*AB2-025 E*	*0.73*
923911	*AB2-031 C OP*	*0.98*
923912	*AB2-031 E OP*	*0.48*
923991	*AB2-040 C OP*	*3.21*
923992	*AB2-040 E OP*	*2.63*
924501	*AB2-099 C*	*0.2*
924502	*AB2-099 E*	*0.09*
924511	*AB2-100 C*	*6.21*
924512	*AB2-100 E*	*3.06*
924811	*AB2-134 C OP*	*8.19*
924812	*AB2-134 E OP*	*8.05*
925051	*AB2-160 C OP*	*4.18*
925052	*AB2-160 E OP*	*6.83*
925061	*AB2-161 C OP*	*1.99*
925062	*AB2-161 E OP*	*3.24*
925122	*AB2-169 E*	*1.8*

925171	*AB2-174 C O1*	*3.15*
925172	*AB2-174 E O1*	*2.85*
925281	*AB2-186 C*	*0.18*
925282	*AB2-186 E*	*0.08*
925331	*AB2-190 C*	*12.2*
925332	*AB2-190 E*	*5.23*
926261	*AC1-027 C*	*0.57*
926262	*AC1-027 E*	*0.32*
926601	*AC1-061*	*0.03*
926851	*AC1-086 C*	*8.78*
926852	*AC1-086 E*	*4.*
926981	*AC1-099 C*	*2.8*
926982	*AC1-099 E*	*1.66*
927561	*AC1-147 C*	*0.65*
927562	*AC1-147 E*	*0.38*
928191	*AC1-208 C O1*	*3.12*
928192	*AC1-208 E O1*	*1.39*
928271	*AC1-216 C OP*	*6.25*
928272	*AC1-216 E OP*	*4.91*

Appendix 7

(DVP - DVP) The 6CHSTF B-6BASIN 230 kV line (from bus 314287 to bus 314276 ckt 1) loads from 105.01% to 106.64% (AC power flow) of its load dump rating (549 MVA) for the line fault with failed breaker contingency outage of '562T563'. This project contributes approximately 10.57 MW to the thermal violation.

CONTINGENCY '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*	*34.34*
315077	*1HOPHCF1*	*1.82*
315078	*1HOPHCF2*	*1.82*
315079	*1HOPHCF3*	*1.82*
315080	*1HOPHCF4*	*2.76*
315076	*1HOPPOLC*	*1.56*
315073	*1STONECA*	*5.23*
314784	*1WEYRHSB*	*0.81*
314539	*3UNCAMP*	*0.97*
314541	*3WATKINS*	*0.28*
315074	*CIR_AB2-152*	*7.35*
315075	*CIR_AB2-152*	*0.63*
292791	*U1-032 E*	*2.72*
900672	*V4-068 E*	*0.13*
901082	*W1-029E*	*15.86*
907092	*X1-038 E*	*2.43*
913392	*Y1-086 E*	*0.74*

914231	*Y2-077*	*0.73*
916042	*Z1-036 E*	*16.15*
916192	*Z1-068 E*	*0.61*
916302	*Z1-086 E*	*3.97*
917122	*Z2-027 E*	*0.36*
917332	*Z2-043 E*	*0.42*
917342	*Z2-044 E*	*0.24*
917512	*Z2-088 E OP1*	*3.19*
921162	*AA1-063AC*	*3.94*
921163	*AA1-063AE*	*1.86*
918512	*AA1-065 E OP*	*1.82*
921183	*AA1-067 E*	*0.29*
918562	*AA1-072 E*	*0.07*
921583	*AA1-139 E*	*2.08*
921752	*AA2-053 C*	*4.01*
921753	*AA2-053 E*	*1.72*
921762	*AA2-057 C*	*3.02*
921763	*AA2-057 E*	*1.51*
921982	*AA2-088 C*	*2.88*
921983	*AA2-088 E*	*4.7*
922442	*AA2-165 C*	*0.41*
922443	*AA2-165 E*	*0.2*
922512	*AA2-174 C*	*0.18*
922513	*AA2-174 E*	*0.2*
922532	*AA2-178 C*	*3.57*
922533	*AA2-178 E*	*1.53*

922922	*AB1-081 C OP*	*3.65*
922923	*AB1-081 E OP*	*1.56*
923262	*AB1-132 C OP*	*7.24*
923263	*AB1-132 E OP*	*3.1*
923572	*AB1-173 C OP*	*1.19*
923573	*AB1-173 E OP*	*0.56*
923582	*AB1-173AC OP*	*1.19*
923583	*AB1-173AE OP*	*0.56*
923801	*AB2-015 C OP*	*3.47*
923802	*AB2-015 E OP*	*2.84*
923831	*AB2-022 C*	*0.77*
923832	*AB2-022 E*	*0.41*
923851	*AB2-025 C*	*1.86*
923852	*AB2-025 E*	*0.84*
923911	*AB2-031 C OP*	*1.18*
923912	*AB2-031 E OP*	*0.58*
923991	*AB2-040 C OP*	*3.88*
923992	*AB2-040 E OP*	*3.17*
924151	*AB2-059 C*	*4.3*
924152	*AB2-059 E*	*2.21*
924491	*AB2-098 C*	*0.22*
924492	*AB2-098 E*	*0.1*
924501	*AB2-099 C*	*0.25*
924502	*AB2-099 E*	*0.11*
924511	*AB2-100 C*	*7.29*
924512	*AB2-100 E*	*3.59*

924811	*AB2-134 C OP*	*7.75*
924812	*AB2-134 E OP*	*7.62*
925051	*AB2-160 C OP*	*3.89*
925052	*AB2-160 E OP*	*6.35*
925061	*AB2-161 C OP*	*2.1*
925062	*AB2-161 E OP*	*3.43*
925122	*AB2-169 E*	*2.25*
925171	*AB2-174 C O1*	*3.79*
925172	*AB2-174 E O1*	*3.43*
925281	*AB2-186 C*	*0.22*
925282	*AB2-186 E*	*0.09*
925331	*AB2-190 C*	*11.61*
925332	*AB2-190 E*	*4.97*
926261	*AC1-027 C*	*0.65*
926262	*AC1-027 E*	*0.37*
926331	*AC1-034 C*	*2.78*
926332	*AC1-034 E*	*2.1*
926531	*AC1-054 C OP*	*2.81*
926532	*AC1-054 E OP*	*1.29*
926601	*AC1-061*	*0.03*
926851	*AC1-086 C*	*10.67*
926852	*AC1-086 E*	*4.85*
926981	*AC1-099 C*	*3.54*
926982	*AC1-099 E*	*2.1*
927561	*AC1-147 C*	*0.74*
927562	*AC1-147 E*	*0.43*

927991	*AC1-189 C*	*3.42*
927992	*AC1-189 E*	*1.7*
928191	*AC1-208 C O1*	*3.96*
928192	*AC1-208 E O1*	*1.76*
928271	*AC1-216 C OP*	*5.91*
928272	*AC1-216 E OP*	*4.65*