Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC1-193

Handsome DP – Southampton 115kV 20.9 MW Capacity / 55 MW Energy

May / 2017

Introduction

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

Preface

The intent of the Feasibility Study is to determine a plan, with high level estimated cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the IC. The IC may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the IC may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the Feasibility Study, but the actual allocation will be deferred until the Impact Study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The IC is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by ITO, the costs may be included in the study.

General

The IC has proposed a solar generating facility located in Southampton County, VA. The installed facilities will have a total capability of 130 MW with 49.4 MW of this output being recognized by PJM as capacity. This queue request is for an additional 55 MW with 28.5 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is 12/31/2018. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AC1-193 will interconnect with the ITO transmission system via a new three breaker ring bus switching station that connects at the Handsome DP – Southampton 115kV line.

Cost Summary

The AC1-193 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$600,000
Direct Connection Network Upgrades	$0
Non Direct Connection Network Upgrades	$0
Total Costs	**$600,000**

In addition, the AC1-193 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	$9,700,000
Previously Identified Upgrades	$54,665,000
Total Costs	**$64,365,000**

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

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

Attachment Facilities

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

Transmission: None

The estimated total cost of the Attachment Facilities is $600,000. It is estimated to take 10-12 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.

Non-Direct Connection Cost Estimate

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

Reinforcement: Southampton – Watkins - Franklin – Union Camp 115kV: Replace wave trap and switches Southampton and Union Camp Substation. It is estimated to take 10-12 months to complete and it is estimated to cost $700,000 to resolve this deficiency.

Reinforcement: Suffolk - Holland – Union Camp 115kV: Replace wave trap and Suffolk and Union Camp Substation and rebuild the section of Line between Union Camp-Holland which is conductor limited. It is estimated to take 30 months to complete and it is estimated to cost $9,000,000 to resolve this deficiency.

Contribution to Previously Identified System Reinforcements

Reinforcement: Battleboro – Rocky Mt 115kV: Replace Battleboro substation terminal equipment. Estimated cost is $15,000.
Note: Duke/Progress Energy portion of this line will need to be studied under Duke's FERC tariff process.

Reinforcement: Replace wave trap at Clubhouse substation. Replace the wave trap on the Clubhouse – Sapony 230kV line to increase the emergency rating to 722MVA. It is estimated to take 12-16 months to complete and it is estimated to cost $150,000 to resolve this deficiency.

Reinforcement AB2-100 Tap – Lakeview 230 kV line #254: Rebuild the AB2-100 TAP-Lakeview 230kV line to increase its emergency line rating to a minimum of 460 MVA and its load dump rating to a minimum of 530 MVA. It is estimated to take 44-48 months to permit and construct a Virginia CPCN and potentially a certificate from the NC PUC will most likely be required for this rebuild, the estimated cost is $41,000,000 to resolve this deficiency.

Reinforcement: Rebuild the AB2-100 TAP-Clubhouse 230kV line: Estimated cost $13,500,000 and it is estimated to take 44-48 months to engineer, permit and construct.

Interconnection Customer Requirements

ITO's Facility Connection Requirements as posted on PJM's website
http://www.pjm.com/~/media/planning/plan-standards/private-dominion/facility-connection-requirements1.ashx

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

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

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

Revenue Metering and SCADA Requirements

PJM Requirements

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

Network Impacts

The Queue Project AC1-193 was evaluated as a 55.0 MW (Capacity 20.9 MW) injection tapping the Handsome-South Hampton 115kV line (direct connect to the AB2-171 project) in the ITO area. Project AC1-193 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-193 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
5632	CONTINGENCY '5632' /* BOYKINS OPEN BUS 314558 /* BOYKINS 115KV BUS OPEN BUS 314587 /* LINE 56 OPEN BUS 314604 /* LINE 56 END
10832	CONTINGENCY '10832' /* BOYKINS OPEN BUS 314558 /* BOYKINS 115KV BUS OPEN BUS 314589 /* LINE 108 OPEN BUS 314580 /* LINE 108 END
201262	CONTINGENCY '201262' /* EARLEYS OPEN BRANCH FROM BUS 314569 TO BUS 314266 CKT 1 /* 2012 OPEN BRANCH FROM BUS 314266 TO BUS 314599 CKT 1 /* 2012 OPEN BRANCH FROM BUS 314569 TO BUS 314568 CKT 1 /* TX. #3 END
246T2034_A	CONTINGENCY '246T2034_A' /* EARLEYS OPEN BRANCH FROM BUS 314569 TO BUS 314575 CKT 1 /* 246 OPEN BRANCH FROM BUS 314575 TO BUS 921571 CKT 1 /* 246 AA1-138 TAP 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 314616 CKT 1 /* 2034 OPEN BRANCH FROM BUS 314616 TO BUS 314613 CKT 1 /* TROWBRIDGE TX #1&2 END

Contingency Name	Description
DVP_P1-2: LN 2181	CONTINGENCY 'DVP_P1-2: LN 2181' 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 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
DVP_P1-2:2056_A	CONTINGENCY 'DVP_P1-2:2056_A' OPEN BRANCH FROM BUS 313845 TO BUS 927140 CKT 1 /* 6HATHAWAY 230.00 - AC1-208 TAP 230.00 END
LN 2058-2181	CONTINGENCY 'LN 2058-2181' 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 OPEN BRANCH FROM BUS 304222 TO BUS 313845 CKT 1 /* 6ROCKYMT230T230.00 - 6HATHAWAY 230.00 END
LN 238	CONTINGENCY 'LN 238' OPEN BRANCH FROM BUS 314282 TO BUS 314435 CKT 1 /* 6CARSON 230.00 - 6SAPONY 230.00 OPEN BRANCH FROM BUS 314435 TO BUS 314563 CKT 1 /* 6SAPONY 230.00 - 6CLUBHSE 230.00 OPEN BRANCH FROM BUS 314562 TO BUS 314563 CKT 1 /* 3CLUBHSE 115.00 - 6CLUBHSE 230.00 OPEN BUS 314435 /* ISLAND END
LN 246_B	CONTINGENCY 'LN 246_B' OPEN BRANCH FROM BUS 314537 TO BUS 921571 CKT 1 /* 6SUFFOLK 230.00 - AA1-138 TAP END
LN 56_A	CONTINGENCY 'LN 56_A' OPEN BRANCH FROM BUS 314259 TO BUS 314559 CKT Z1 /* 3CAR56_1 115.00 - 3CAROLNA 115.00 OPEN BRANCH FROM BUS 314259 TO BUS 921161 CKT 1 /* 3CAR56_1 115.00 - AA1-063A OPEN BUS 314259 /* ISLAND END

Contingency Name	Description
LN 68	CONTINGENCY 'LN 68' OPEN BRANCH FROM BUS 314527 TO BUS 314536 CKT 1 /* 3HOLLAND 115.00 - 3SUFFOLK 115.00 OPEN BRANCH FROM BUS 314527 TO BUS 314539 CKT 1 /* 3HOLLAND 115.00 - 3UNCAMP 115.00 OPEN BUS 314527 /* ISLAND END

Summer Peak Analysis - 2020

Generator Deliverability

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

None

Multiple Facility Contingency

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

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Cir.	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
1	LFFB	5632	DVP - DVP	3FRNKLN-3UNCAMP 115 kV line	314524	314539	1	DC	84.31	100.73	LD	335	54.98	1
2	LFFB	10832	DVP - DVP	3FRNKLN-3UNCAMP 115 kV line	314524	314539	1	DC	84.31	100.73	ER	335	54.98	
3	LFFB	5632	DVP - DVP	3HOLLAND-3SUFFOLK 115 kV line	314527	314536	1	DC	85.35	101.77	LD	335	54.98	2
4	LFFB	10832	DVP - DVP	3HOLLAND-3SUFFOLK 115 kV line	314527	314536	1	DC	85.35	101.77	LD	335	54.98	
5	LFFB	10832	DVP - DVP	3UNCAMP-3HOLLAND 115 kV line	314539	314527	1	DC	91.41	107.83	LD	335	54.98	3
6	LFFB	5632	DVP - DVP	3UNCAMP-3HOLLAND 115 kV line	314539	314527	1	DC	91.41	107.83	LD	335	54.98	

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

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

None

Contribution to Previously Identified Overloads

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

Contingency			Affected		Bus			Power	Loading %		Rating		MW	
#	Type	Name	Area	Facility Description	From	To	Cir.	Flow	Initial	Final	Type	MVA	Contribution	Ref
7	DCTL	LN 2058-2181	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	DC	167.25	168.27	LD	164	3.72	4
8	LFFB	246T2034_A	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	DC	108.22	108.77	LD	637	7.73	5
9	LFFB	201262	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	DC	102.83	103.3	LD	637	6.71	
10	LFFB	246T2034_A	DVP - DVP	6LAKEVEW-AB2-100 TAP 230 kV line	314583	924510	1	DC	102.9	103.43	LD	459	5.35	6
11	LFFB	246T2034_A	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	123.5	124.02	LD	459	5.35	7

Steady-State Voltage Requirements

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

To be determined during Impact Study

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

To be determined during Impact Study

New System Reinforcements

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

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
# 1 – 2	3FRNKLN-3UNCAMP 115 kV line	Replace wave trap and switches Southampton and Union Camp Substation. Estimated time: 10 – 12 months.	Pending	**$700,000**
# 3 - 4	3HOLLAND-3SUFFOLK 115 kV line	Replace wave trap and Suffolk and Union Camp Substation and rebuild the section of Line between Union Camp-Holland which is conductor limited. Estimated time: 30 months.	Pending	**$9,000,000**
# 5 - 6	3UNCAMP-3HOLLAND 115 kV line			
			Total New Network Upgrades	**$9,700,000**

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
# 7	3BTLEBRO-3ROCKYMT115T 115 kV line	Upgrade Battleboro terminal equipment	Pending	**$15,000**

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
# 8 – 9	6CLUBHSE-6SAPONY 230 kV line	Replace wave trap at Clubhouse Substation. This will increase emergency rating 722 MVA. Estimated time: 12-16 months.	Pending	**$150,000**
# 10	6LAKEVEW-AB2-100 TAP 230 kV line	Rebuild the AB2-100 TAP-Lakeview 230kV line. Estimated time: 44-48 months.	Pending	**$41,000,000**
# 11	AB2-100 TAP-6CLUBHSE 230 kV line	Rebuild the AB2-100 TAP-Clubhouse 230kV line. Estimated time: 44-48 months.	Pending	**$13,500,000**
			Total New Network Upgrades	**$54,665,000**

Potential Congestion due to Local Energy Deliverability

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

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

	Contingency		Affected		Bus			Power	Loading %		Rating		MW
#	Type	Name	Area	Facility Description	From	To	Circuit	Flow	Initial	Final	Type	MVA	Contribution
12	N-1	DVP_P1-2: LN 2181	DVP - CPLE	6HATHAWAY-6ROCKYMT230T 230 kV line	313845	304222	1	DC	96.57	97.13	ER	386	4.83
13	N-1	LN 68	DVP - DVP	3CAR56_1-3CAROLNA 115 kV line	314259	314559	Z1	DC	114.4	130.26	ER	225	35.63
14	N-1	LN 56_A	DVP - DVP	3FRNKLN-3UNCAMP 115 kV line	314524	314539	1	DC	116.47	133.24	ER	225	37.69

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution
15	N-1	LN 68	DVP - DVP	3HANDSOM-AA2-088 TAP 115 kV line	314526	921981	1	DC	91.81	116.29	ER	225	54.98
16	N-1	LN 56_A	DVP - DVP	3HOLLAND-3SUFFOLK 115 kV line	314527	314536	1	DC	117.23	134.01	ER	225	37.69
17	N-1	LN 56_A	DVP - DVP	3S HAMPT-3WATKINS 115 kV line	314534	314541	1	DC	106.69	123.47	ER	225	37.69
18	N-1	LN 56_A	DVP - DVP	3UNCAMP-3HOLLAND 115 kV line	314539	314527	1	DC	126.27	143.04	ER	225	37.69
19	N-1	LN 68	DVP - DVP	3AHOSKIE-3EARLEYS 115 kV line	314551	314568	1	DC	97.46	111.18	ER	141	19.35
20	N-1	LN 68	DVP - DVP	3BOYKINS-3MURPHYS 115 kV line	314558	314589	1	DC	157.17	173.77	ER	117	19.35
21	N-1	LN 68	DVP - DVP	6CAROLNA 230/115 kV transformer	314559	314561	1	DC	96.82	103.58	ER	240	16.22
22	N-1	LN 246_B	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	DC	105.27	105.81	ER	599	7.09
23	N-1	LN 238	DVP - DVP	6HORNRTN-AC1-208 TAP 230 kV line	314579	927140	1	DC	109.66	110.93	ER	442	5.61
24	N-1	LN 68	DVP - DVP	3MAPLETN-3TUNIS 115 kV line	314580	314617	1	DC	141.34	157.94	ER	117	19.35
25	N-1	DVP_P1-2:2056_A	DVP - DVP	6LAKEVEW-AB2-100 TAP 230 kV line	314583	924510	1	DC	102.63	103.29	ER	375	5.5
26	N-1	LN 68	DVP - DVP	3MURPHYS-3MAPLETN 115 kV line	314589	314580	1	DC	145.8	162.4	ER	117	19.35

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution
27	N-1	LN 68	DVP - DVP	3SEABORD-AA1-063A TAP 115 kV line	314604	921161	1	DC	86.96	102.82	ER	225	35.63
28	N-1	LN 68	DVP - DVP	3TUNIS-3AHOSKIE 115 kV line	314617	314551	1	DC	95.14	108.69	ER	143	19.35
29	N-1	LN 68	DVP - DVP	AA1-063A TAP-3CAR56_1 115 kV line	921161	314259	1	DC	114.4	130.26	ER	225	35.63
30	N-1	LN 68	DVP - DVP	AA2-088 TAP-3BOYKINS 115 kV line	921981	314558	1	DC	136.31	160.78	ER	225	54.98
31	N-1	DVP_P1-2:2056_A	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	126.46	127.12	ER	375	5.5
32	N-1	LN 68	DVP - DVP	AB2-171 TAP-3HANDSOM 115 kV line	925140	314526	1	DC	92.88	117.36	ER	225	54.98
33	N-1	LN 238	DVP - DVP	AC1-208 TAP-6HATHAWAY 230 kV line	927140	313845	1	DC	109.59	110.86	ER	442	5.61

Light Load Analysis

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

ITO Analysis

ITO assessed the impact of the proposed Queue Project #AC1-193 interconnection of a 55.0 MW Energy (20.9 MW Capacity) injection into the ITO's Transmission System at AB2-171 at 115 kV, for compliance with NERC 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 (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 generation facility under all operating conditions. NERC Planning and Operating Reliability Criteria allow for the re-dispatch of generating units to resolve projected and actual deficiencies in real time and planning studies. Specifically NERC Category C Contingency Conditions (Bus Fault, Tower Line, N-1-1, and Stuck Breaker scenarios) allow for re-dispatch of generating units to resolve potential reliability deficiencies. For ITO's 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, the 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):

1. System Normal – Same as PJM identified deficiencies
2. Critical System Condition (No Surry 230 kV Unit) – Same as PJM identified deficiencies.

Category C Analysis: (Multiple Facility Analysis)

1. Bus Fault - No deficiencies identified
2. Line Stuck Breaker - No deficiencies identified
3. Tower Line – No deficiencies identified

The import and export conditions into and out of the ITO System are evaluated with any new interconnection greater than 20 MW, any new facility that is interconnected with the ITO System should not significantly decrement FCITC between utilities. These studies will be performed during the System Impact Study.

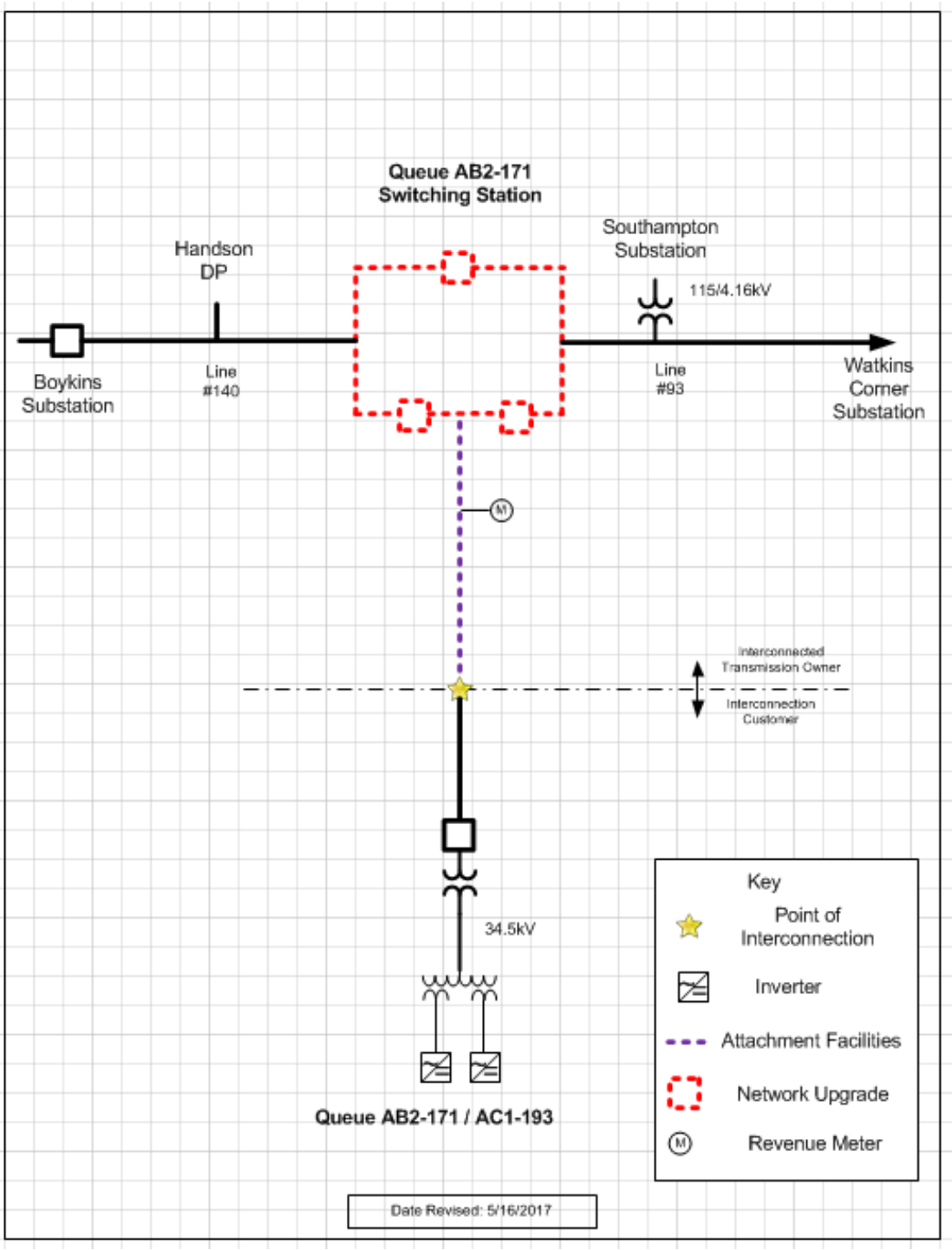
Affected System Analysis & Mitigation

Duke, Progress & TVA Impacts:

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

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

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

Appendix 1

(DVP - DVP) The 3FRNKLN-3UNCAMP 115 kV line (from bus 314524 to bus 314539 ckt 1) loads from 84.31% to 100.73% (**DC power flow**) of its load dump rating (335 MVA) for the line fault with failed breaker contingency outage of '5632'. This project contributes approximately 54.98 MW to the thermal violation.

```
CONTINGENCY '5632'                    /* BOYKINS
  OPEN BUS 314558                     /* BOYKINS 115KV BUS
  OPEN BUS 314587                     /* LINE 56
  OPEN BUS 314604                     /* LINE 56
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315115	*1SHAMPT1*	*11.94*
314541	*3WATKINS*	*4.*
921982	*AA2-088 C*	*37.99*
921983	*AA2-088 E*	*61.98*
923801	*AB2-015 C OP*	*49.98*
923802	*AB2-015 E OP*	*40.99*
925141	*AB2-171 C OP*	*28.49*
925142	*AB2-171 E OP*	*46.49*
927051	*AC1-193 C*	*20.89*
927052	*AC1-193 E*	*34.09*

Appendix 2

(DVP - DVP) The 3HOLLAND-3SUFFOLK 115 kV line (from bus 314527 to bus 314536 ckt 1) loads from 85.35% to 101.77% (**DC power flow**) of its load dump rating (335 MVA) for the line fault with failed breaker contingency outage of '5632'. This project contributes approximately 54.98 MW to the thermal violation.

```
CONTINGENCY '5632'                    /* BOYKINS
  OPEN BUS 314558                     /* BOYKINS 115KV BUS
  OPEN BUS 314587                     /* LINE 56
  OPEN BUS 314604                     /* LINE 56
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315115	*1SHAMPT1*	*11.94*
314539	*3UNCAMP*	*14.*
314541	*3WATKINS*	*4.*
907092	*X1-038 E*	*34.99*
921982	*AA2-088 C*	*37.99*
921983	*AA2-088 E*	*61.98*
923801	*AB2-015 C OP*	*49.98*
923802	*AB2-015 E OP*	*40.99*
925141	*AB2-171 C OP*	*28.49*
925142	*AB2-171 E OP*	*46.49*
927051	*AC1-193 C*	*20.89*
927052	*AC1-193 E*	*34.09*

Appendix 3

(DVP - DVP) The 3UNCAMP-3HOLLAND 115 kV line (from bus 314539 to bus 314527 ckt 1) loads from 91.41% to 107.83% (**DC power flow**) of its load dump rating (335 MVA) for the line fault with failed breaker contingency outage of '10832'. This project contributes approximately 54.98 MW to the thermal violation.

```
CONTINGENCY '10832'                    /* BOYKINS
  OPEN BUS 314558                      /* BOYKINS 115KV BUS
  OPEN BUS 314589                      /* LINE 108
  OPEN BUS 314580                      /* LINE 108
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315115	*1SHAMPT1*	*11.94*
314539	*3UNCAMP*	*14.*
314541	*3WATKINS*	*4.*
907092	*X1-038 E*	*34.99*
921982	*AA2-088 C*	*37.99*
921983	*AA2-088 E*	*61.98*
923801	*AB2-015 C OP*	*49.98*
923802	*AB2-015 E OP*	*40.99*
925141	*AB2-171 C OP*	*28.49*
925142	*AB2-171 E OP*	*46.49*
927051	*AC1-193 C*	*20.89*
927052	*AC1-193 E*	*34.09*

Appendix 4

(DVP - CPLE) The 3BTLEBRO-3ROCKYMT115T 115 kV line (from bus 314554 to bus 304223 ckt 1) loads from 167.25% to 168.27% (**DC power flow**) of its load dump rating (164 MVA) for the tower line contingency outage of 'LN 2058-2181'. This project contributes approximately 3.72 MW to the thermal violation.

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

Bus Number	*Bus Name*	*Full Contribution*
315131	*1EDGECMA*	*2.54*
315132	*1EDGECMB*	*2.54*
315139	*1GASTONA*	*2.41*
315141	*1GASTONB*	*2.41*
315126	*1ROARAP2*	*1.*
315128	*1ROARAP4*	*0.96*
315134	*1ROAVALA*	*3.42*
315135	*1ROAVALB*	*0.91*
315136	*1ROSEMG1*	*1.96*
315138	*1ROSEMG2*	*0.92*
315137	*1ROSEMS1*	*1.21*
900672	*V4-068 E*	*0.15*
917331	*Z2-043 C*	*0.36*
917332	*Z2-043 E*	*0.83*
917341	*Z2-044 C*	*0.55*
917342	*Z2-044 E*	*1.25*
917511	*Z2-088 C OP1*	*0.71*
917512	*Z2-088 E OP1*	*6.1*
917592	*Z2-099 E*	*0.2*
918411	*AA1-050*	*0.59*
LTF	*AA1-055*	*9.47*
921162	*AA1-063AC*	*4.88*
921163	*AA1-063AE*	*2.3*
918512	*AA1-065 E OP*	*1.96*
921182	*AA1-067 C*	*0.73*

921183	*AA1-067 E*	*0.31*
918561	*AA1-072 C*	*0.05*
918562	*AA1-072 E*	*0.14*
921562	*AA1-135 C*	*4.03*
921563	*AA1-135 E*	*1.73*
921752	*AA2-053 C*	*5.42*
921753	*AA2-053 E*	*2.33*
921762	*AA2-057 C*	*12.88*
921763	*AA2-057 E*	*6.44*
921862	*AA2-068 C*	*3.3*
921863	*AA2-068 E*	*1.52*
920022	*AA2-086 E*	*0.11*
921982	*AA2-088 C*	*2.94*
921983	*AA2-088 E*	*4.8*
922442	*AA2-165 C*	*1.76*
922443	*AA2-165 E*	*0.85*
922512	*AA2-174 C*	*0.25*
922513	*AA2-174 E*	*0.27*
922722	*AB1-053 C*	*0.84*
922723	*AB1-053 E*	*0.47*
922732	*AB1-054 C*	*3.16*
922733	*AB1-054 E*	*1.55*
922922	*AB1-081 C OP*	*20.07*
922923	*AB1-081 E OP*	*8.6*
923262	*AB1-132 C OP*	*9.76*
923263	*AB1-132 E OP*	*4.18*
923572	*AB1-173 C OP*	*1.21*
923573	*AB1-173 E OP*	*0.57*
923582	*AB1-173AC OP*	*1.21*
923583	*AB1-173AE OP*	*0.57*
923911	*AB2-031 C OP*	*1.2*
923912	*AB2-031 E OP*	*0.59*
923941	*AB2-035 C*	*0.37*
923942	*AB2-035 E*	*0.16*
923991	*AB2-040 C OP*	*3.95*
923992	*AB2-040 E OP*	*3.23*
924151	*AB2-059 C OP*	*23.66*
924152	*AB2-059 E OP*	*12.19*
924381	*AB2-087 C*	*0.31*
924382	*AB2-087 E*	*0.15*
924391	*AB2-088 C*	*0.47*
924392	*AB2-088 E*	*0.23*
924491	*AB2-098 C*	*0.24*
924492	*AB2-098 E*	*0.1*
924501	*AB2-099 C*	*0.32*

924502	*AB2-099 E*	*0.14*
924511	*AB2-100 C*	*6.41*
924512	*AB2-100 E*	*3.16*
924761	*AB2-128 C*	*5.49*
924762	*AB2-128 E*	*2.16*
924931	*AB2-147 C*	*1.14*
924932	*AB2-147 E*	*1.86*
924951	*AB2-150 C OP*	*1.14*
924952	*AB2-150 E OP*	*1.86*
925141	*AB2-171 C OP*	*1.93*
925142	*AB2-171 E OP*	*3.14*
925171	*AB2-174 C OP*	*3.57*
925172	*AB2-174 E OP*	*3.23*
925591	*AC1-034 C OP*	*7.52*
925592	*AC1-034 E OP*	*5.67*
926071	*AC1-086 C*	*14.37*
926072	*AC1-086 E*	*6.54*
926201	*AC1-098 C*	*8.*
926202	*AC1-098 E*	*4.76*
926211	*AC1-099 C*	*2.68*
926212	*AC1-099 E*	*1.57*
926771	*AC1-163 C*	*1.14*
926772	*AC1-163 E*	*0.53*
927021	*AC1-189 C*	*5.15*
927022	*AC1-189 E*	*2.56*
927051	*AC1-193 C*	*1.41*
927052	*AC1-193 E*	*2.31*
927111	*AC1-206 C OP*	*5.11*
927112	*AC1-206 E OP*	*2.42*
927141	*AC1-208 C*	*10.06*
927142	*AC1-208 E*	*4.47*

Appendix 5

(DVP - DVP) The 6CLUBHSE-6SAPONY 230 kV line (from bus 314563 to bus 314435 ckt 1) loads from 108.22% to 108.77% (**DC power flow**) of its load dump rating (637 MVA) for the line fault with failed breaker contingency outage of '246T2034_A'. This project contributes approximately 7.73 MW to the thermal violation.

```
CONTINGENCY '246T2034_A'                                    /* EARLEYS
  OPEN BRANCH FROM BUS 314569 TO BUS 314575 CKT 1           /* 246
  OPEN BRANCH FROM BUS 314575 TO BUS 921571 CKT 1           /* 246 AA1-138
TAP
  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 314616 CKT 1           /* 2034
  OPEN BRANCH FROM BUS 314616 TO BUS 314613 CKT 1           /* TROWBRIDGE
TX #1&2
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315132	*1EDGECMB*	*2.14*
315139	*1GASTONA*	*7.67*
315141	*1GASTONB*	*7.67*
315126	*1ROARAP2*	*2.78*
315128	*1ROARAP4*	*2.67*
315134	*1ROAVALA*	*10.91*
315135	*1ROAVALB*	*2.91*
315136	*1ROSEMG1*	*5.18*
315138	*1ROSEMG2*	*2.43*
315137	*1ROSEMS1*	*3.21*
314704	*3LAWRENC*	*0.81*
314541	*3WATKINS*	*0.52*
900671	*V4-068 C*	*0.13*
900672	*V4-068 E*	*0.36*
917331	*Z2-043 C*	*0.66*
917332	*Z2-043 E*	*1.49*
917341	*Z2-044 C*	*0.33*
917342	*Z2-044 E*	*0.74*
917512	*Z2-088 E OP1*	*9.27*
917592	*Z2-099 E*	*0.48*
LTF	*AA1-058*	*0.57*
921162	*AA1-063AC*	*12.86*
921163	*AA1-063AE*	*6.07*
918511	*AA1-065 C OP*	*2.6*
918512	*AA1-065 E OP*	*6.78*

921182	*AA1-067 C*	*1.92*
921183	*AA1-067 E*	*0.82*
918561	*AA1-072 C*	*0.1*
918562	*AA1-072 E*	*0.25*
921562	*AA1-135 C*	*12.3*
921563	*AA1-135 E*	*5.27*
921752	*AA2-053 C*	*14.96*
921753	*AA2-053 E*	*6.42*
921762	*AA2-057 C*	*9.81*
921763	*AA2-057 E*	*4.91*
921862	*AA2-068 C*	*3.27*
921863	*AA2-068 E*	*1.5*
LTF	*AA2-074*	*2.64*
920022	*AA2-086 E*	*0.26*
921982	*AA2-088 C*	*6.85*
921983	*AA2-088 E*	*11.18*
922442	*AA2-165 C*	*1.34*
922443	*AA2-165 E*	*0.65*
922472	*AA2-169 C*	*2.96*
922473	*AA2-169 E*	*1.36*
922512	*AA2-174 C*	*0.69*
922513	*AA2-174 E*	*0.74*
922722	*AB1-053 C*	*2.22*
922723	*AB1-053 E*	*1.25*
922732	*AB1-054 C*	*7.44*
922733	*AB1-054 E*	*3.66*
922922	*AB1-081 C OP*	*10.86*
922923	*AB1-081 E OP*	*4.65*
923262	*AB1-132 C OP*	*31.01*
923263	*AB1-132 E OP*	*13.29*
923572	*AB1-173 C OP*	*5.12*
923573	*AB1-173 E OP*	*2.39*
923582	*AB1-173AC OP*	*5.12*
923583	*AB1-173AE OP*	*2.39*
923911	*AB2-031 C OP*	*5.09*
923912	*AB2-031 E OP*	*2.51*
923941	*AB2-035 C*	*0.4*
923942	*AB2-035 E*	*0.17*
923991	*AB2-040 C OP*	*16.7*
923992	*AB2-040 E OP*	*13.67*
924021	*AB2-043 C OP*	*2.78*
924022	*AB2-043 E OP*	*4.57*
924151	*AB2-059 C OP*	*12.8*
924152	*AB2-059 E OP*	*6.59*
924301	*AB2-077 C OP*	*1.74*

924302	*AB2-077 E OP*	*1.16*
924311	*AB2-078 C OP*	*1.74*
924312	*AB2-078 E OP*	*1.16*
924321	*AB2-079 C OP*	*1.74*
924322	*AB2-079 E OP*	*1.16*
924381	*AB2-087 C*	*0.86*
924382	*AB2-087 E*	*0.4*
924391	*AB2-088 C*	*0.52*
924392	*AB2-088 E*	*0.25*
924401	*AB2-089 C*	*2.43*
924402	*AB2-089 E*	*1.25*
924411	*AB2-090 C*	*3.51*
924412	*AB2-090 E*	*1.8*
924491	*AB2-098 C*	*0.64*
924492	*AB2-098 E*	*0.27*
924501	*AB2-099 C*	*0.84*
924502	*AB2-099 E*	*0.36*
924511	*AB2-100 C*	*31.41*
924512	*AB2-100 E*	*15.47*
924761	*AB2-128 C*	*26.91*
924762	*AB2-128 E*	*10.59*
924931	*AB2-147 C*	*6.65*
924932	*AB2-147 E*	*10.85*
924951	*AB2-150 C OP*	*6.65*
924952	*AB2-150 E OP*	*10.85*
925141	*AB2-171 C OP*	*4.01*
925142	*AB2-171 E OP*	*6.54*
925171	*AB2-174 C OP*	*16.93*
925172	*AB2-174 E OP*	*15.32*
925221	*AB2-176 C*	*1.44*
925222	*AB2-176 E*	*0.62*
925591	*AC1-034 C OP*	*8.17*
925592	*AC1-034 E OP*	*6.16*
925781	*AC1-054 C OP*	*8.73*
925782	*AC1-054 E OP*	*4.02*
926071	*AC1-086 C*	*45.67*
926072	*AC1-086 E*	*20.79*
926201	*AC1-098 C*	*9.07*
926202	*AC1-098 E*	*5.4*
926211	*AC1-099 C*	*3.04*
926212	*AC1-099 E*	*1.78*
926281	*AC1-106*	*2.31*
926771	*AC1-163 C*	*3.04*
926772	*AC1-163 E*	*1.42*
927021	*AC1-189 C*	*9.87*

927022	*AC1-189 E*	*4.91*
927051	*AC1-193 C*	*2.94*
927052	*AC1-193 E*	*4.79*
927111	*AC1-206 C OP*	*38.59*
927112	*AC1-206 E OP*	*18.24*
927141	*AC1-208 C*	*15.04*
927142	*AC1-208 E*	*6.68*
927211	*AC1-215 C*	*9.17*
927212	*AC1-215 E*	*4.16*

Appendix 6

(DVP - DVP) The 6LAKEVEW-AB2-100 TAP 230 kV line (from bus 314583 to bus 924510 ckt 1) loads from 102.9% to 103.43% (**DC power flow**) of its load dump rating (459 MVA) for the line fault with failed breaker contingency outage of '246T2034_A'. This project contributes approximately 5.35 MW to the thermal violation.

```
CONTINGENCY '246T2034_A'                                    /* EARLEYS
  OPEN BRANCH FROM BUS 314569 TO BUS 314575 CKT 1           /* 246
  OPEN BRANCH FROM BUS 314575 TO BUS 921571 CKT 1           /* 246 AA1-138
TAP
  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 314616 CKT 1           /* 2034
  OPEN BRANCH FROM BUS 314616 TO BUS 314613 CKT 1           /* TROWBRIDGE
TX #1&2
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315131	*1EDGECMA*	*2.07*
315132	*1EDGECMB*	*2.07*
315139	*1GASTONA*	*7.99*
315141	*1GASTONB*	*7.99*
315126	*1ROARAP2*	*1.71*
315128	*1ROARAP4*	*1.64*
315134	*1ROAVALA*	*11.09*
315135	*1ROAVALB*	*2.96*
315136	*1ROSEMG1*	*5.36*
315138	*1ROSEMG2*	*2.51*
315137	*1ROSEMS1*	*3.33*
314784	*1WEYRHSB*	*1.17*
900671	*V4-068 C*	*0.1*
900672	*V4-068 E*	*0.28*
917331	*Z2-043 C*	*0.56*
917332	*Z2-043 E*	*1.27*
917341	*Z2-044 C*	*0.29*
917342	*Z2-044 E*	*0.65*
917511	*Z2-088 C OP1*	*1.03*
917512	*Z2-088 E OP1*	*8.87*
917591	*Z2-099 C*	*0.14*
917592	*Z2-099 E*	*0.33*
918411	*AA1-050*	*0.87*
LTF	*AA1-058*	*0.53*
921162	*AA1-063AC*	*8.21*

921163	*AA1-063AE*	*3.87*
918511	*AA1-065 C OP*	*2.47*
918512	*AA1-065 E OP*	*6.44*
921182	*AA1-067 C*	*1.83*
921183	*AA1-067 E*	*0.78*
918561	*AA1-072 C*	*0.08*
918562	*AA1-072 E*	*0.21*
921562	*AA1-135 C*	*11.7*
921563	*AA1-135 E*	*5.01*
921752	*AA2-053 C*	*10.03*
921753	*AA2-053 E*	*4.31*
921762	*AA2-057 C*	*8.1*
921763	*AA2-057 E*	*4.05*
921862	*AA2-068 C*	*2.57*
921863	*AA2-068 E*	*1.18*
LTF	*AA2-074*	*2.29*
920021	*AA2-086 C*	*0.08*
920022	*AA2-086 E*	*0.18*
921982	*AA2-088 C*	*4.76*
921983	*AA2-088 E*	*7.76*
922442	*AA2-165 C*	*1.1*
922443	*AA2-165 E*	*0.53*
922472	*AA2-169 C*	*1.51*
922473	*AA2-169 E*	*0.69*
922512	*AA2-174 C*	*0.46*
922513	*AA2-174 E*	*0.5*
922722	*AB1-053 C*	*2.3*
922723	*AB1-053 E*	*1.29*
922732	*AB1-054 C*	*5.17*
922733	*AB1-054 E*	*2.54*
922922	*AB1-081 C OP*	*10.09*
922923	*AB1-081 E OP*	*4.32*
923262	*AB1-132 C OP*	*32.27*
923263	*AB1-132 E OP*	*13.83*
923941	*AB2-035 C*	*0.39*
923942	*AB2-035 E*	*0.17*
924151	*AB2-059 C OP*	*11.89*
924152	*AB2-059 E OP*	*6.12*
924381	*AB2-087 C*	*0.76*
924382	*AB2-087 E*	*0.36*
924391	*AB2-088 C*	*0.5*
924392	*AB2-088 E*	*0.24*
924491	*AB2-098 C*	*0.61*
924492	*AB2-098 E*	*0.26*
924501	*AB2-099 C*	*0.72*

924502	*AB2-099 E*	*0.31*
925121	*AB2-169 C OP*	*4.42*
925122	*AB2-169 E OP*	*3.96*
925141	*AB2-171 C OP*	*2.77*
925142	*AB2-171 E OP*	*4.52*
925591	*AC1-034 C OP*	*7.86*
925592	*AC1-034 E OP*	*5.93*
926071	*AC1-086 C*	*47.52*
926072	*AC1-086 E*	*21.63*
926201	*AC1-098 C*	*7.29*
926202	*AC1-098 E*	*4.35*
926211	*AC1-099 C*	*2.44*
926212	*AC1-099 E*	*1.44*
926771	*AC1-163 C*	*2.6*
926772	*AC1-163 E*	*1.22*
927021	*AC1-189 C*	*9.42*
927022	*AC1-189 E*	*4.69*
927051	*AC1-193 C*	*2.03*
927052	*AC1-193 E*	*3.32*
927141	*AC1-208 C*	*15.19*
927142	*AC1-208 E*	*6.75*

Appendix 7

(DVP - DVP) The AB2-100 TAP-6CLUBHSE 230 kV line (from bus 924510 to bus 314563 ckt 1) loads from 123.5% to 124.02% (**DC power flow**) of its load dump rating (459 MVA) for the line fault with failed breaker contingency outage of '246T2034_A'. This project contributes approximately 5.35 MW to the thermal violation.

```
CONTINGENCY '246T2034_A'                                    /* EARLEYS
  OPEN BRANCH FROM BUS 314569 TO BUS 314575 CKT 1           /* 246
  OPEN BRANCH FROM BUS 314575 TO BUS 921571 CKT 1           /* 246 AA1-138
TAP
  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 314616 CKT 1           /* 2034
  OPEN BRANCH FROM BUS 314616 TO BUS 314613 CKT 1           /* TROWBRIDGE
TX #1&2
  END
```

Bus Number	*Bus Name*	*Full Contribution*
315131	*1EDGECMA*	*2.07*
315132	*1EDGECMB*	*2.07*
315139	*1GASTONA*	*7.99*
315141	*1GASTONB*	*7.99*
315126	*1ROARAP2*	*1.71*
315128	*1ROARAP4*	*1.64*
315134	*1ROAVALA*	*11.09*
315135	*1ROAVALB*	*2.96*
315136	*1ROSEMG1*	*5.36*
315138	*1ROSEMG2*	*2.51*
315137	*1ROSEMS1*	*3.33*
900671	*V4-068 C*	*0.1*
900672	*V4-068 E*	*0.28*
917331	*Z2-043 C*	*0.56*
917332	*Z2-043 E*	*1.27*
917341	*Z2-044 C*	*0.29*
917342	*Z2-044 E*	*0.65*
917511	*Z2-088 C OP1*	*1.03*
917512	*Z2-088 E OP1*	*8.87*
917591	*Z2-099 C*	*0.14*
917592	*Z2-099 E*	*0.33*
918411	*AA1-050*	*0.87*
LTF	*AA1-058*	*0.53*
921162	*AA1-063AC*	*8.21*
921163	*AA1-063AE*	*3.87*

918511	*AA1-065 C OP*	*2.47*
918512	*AA1-065 E OP*	*6.44*
921182	*AA1-067 C*	*1.83*
921183	*AA1-067 E*	*0.78*
918561	*AA1-072 C*	*0.08*
918562	*AA1-072 E*	*0.21*
921562	*AA1-135 C*	*11.7*
921563	*AA1-135 E*	*5.01*
921752	*AA2-053 C*	*10.03*
921753	*AA2-053 E*	*4.31*
921762	*AA2-057 C*	*8.1*
921763	*AA2-057 E*	*4.05*
921862	*AA2-068 C*	*2.57*
921863	*AA2-068 E*	*1.18*
LTF	*AA2-074*	*2.29*
920021	*AA2-086 C*	*0.08*
920022	*AA2-086 E*	*0.18*
921982	*AA2-088 C*	*4.76*
921983	*AA2-088 E*	*7.76*
922442	*AA2-165 C*	*1.1*
922443	*AA2-165 E*	*0.53*
922472	*AA2-169 C*	*1.51*
922473	*AA2-169 E*	*0.69*
922512	*AA2-174 C*	*0.46*
922513	*AA2-174 E*	*0.5*
922722	*AB1-053 C*	*2.3*
922723	*AB1-053 E*	*1.29*
922732	*AB1-054 C*	*5.17*
922733	*AB1-054 E*	*2.54*
922922	*AB1-081 C OP*	*10.09*
922923	*AB1-081 E OP*	*4.32*
923262	*AB1-132 C OP*	*32.27*
923263	*AB1-132 E OP*	*13.83*
923941	*AB2-035 C*	*0.39*
923942	*AB2-035 E*	*0.17*
924151	*AB2-059 C OP*	*11.89*
924152	*AB2-059 E OP*	*6.12*
924381	*AB2-087 C*	*0.76*
924382	*AB2-087 E*	*0.36*
924391	*AB2-088 C*	*0.5*
924392	*AB2-088 E*	*0.24*
924491	*AB2-098 C*	*0.61*
924492	*AB2-098 E*	*0.26*
924501	*AB2-099 C*	*0.72*
924502	*AB2-099 E*	*0.31*

924511	*AB2-100 C*	*35.63*
924512	*AB2-100 E*	*17.55*
924761	*AB2-128 C*	*30.53*
924762	*AB2-128 E*	*12.02*
925121	*AB2-169 C OP*	*4.42*
925122	*AB2-169 E OP*	*3.96*
925141	*AB2-171 C OP*	*2.77*
925142	*AB2-171 E OP*	*4.52*
925591	*AC1-034 C OP*	*7.86*
925592	*AC1-034 E OP*	*5.93*
926071	*AC1-086 C*	*47.52*
926072	*AC1-086 E*	*21.63*
926201	*AC1-098 C*	*7.29*
926202	*AC1-098 E*	*4.35*
926211	*AC1-099 C*	*2.44*
926212	*AC1-099 E*	*1.44*
926771	*AC1-163 C*	*2.6*
926772	*AC1-163 E*	*1.22*
927021	*AC1-189 C*	*9.42*
927022	*AC1-189 E*	*4.69*
927051	*AC1-193 C*	*2.03*
927052	*AC1-193 E*	*3.32*
927141	*AC1-208 C*	*15.19*
927142	*AC1-208 E*	*6.75*