Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AB2-051

Chesapeake 230kV 765.5MW Capacity / 884.5MW Energy

August / 2016

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 natural gas combined cycle generating facility located in the City of Chesapeake, Virginia. The installed facilities will have a total capability of 884.5 MW with 765.5 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is 1/01/2021. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AB2-051 will interconnect with the ITO transmission system at one of the following points of interconnection:

Option 1 will connect via a new three breaker ring bus switching station that connects on the Chesapeake 230kV substation ring bus.

Option 2 will connect via a new three breaker ring bus switching station that connects on the Elizabeth City – Greenwich 230kV line #2018.

Cost Summary

The AB2-051 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$1,200,000
Direct Connection Network Upgrades	$2,500,000
Non Direct Connection Network Upgrades	$tbd
Total Costs	**$3,700,000**

In addition, the AB2-051 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	$24,915,000
Previously Identified Upgrades	$0
Total Costs	**$24,915,000**

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

Attachment Facilities

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

Transmission: Construct approximately one span of 230 kV Attachment line between the generation substation and the existing Chesapeake 230 kV Substation. The estimated cost for this work is $600,000.

The estimated total cost of the Attachment Facilities is $1,200,000. It is estimated to take 18-24 months to complete. These costs do not include CIAC Tax Gross-up. The single line is shown below in Addendum 1.

Direct Connection Cost Estimate

Install two(2) 230 kV breakers at the existing Chesapeake 230 kV Switching Station and associated protection equipment. Estimated cost $2,500,000 dollars and this work will take 24-30 months.

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.

Reinforcement: Rebuild of the Chesterfield-Basin 230kV line. It is estimated to take 44 – 48 months to complete and it is estimated to cost $18,615,000 to resolve the deficiency.

Reinforcement: Upgrade the Chesapeake 230/115kV transformer. It is estimated to take 24-28 months to complete and it is estimated to cost $6,000,000 to resolve this deficiency.

Reinforcement: Replace Yadkin 230kV 210512 with 50kA breaker. It is estimated to take 12 months to complete and it is estimated to cost $300,000 to resolve this deficiency.

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

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.

Option One

Network Impacts

The Queue Project AB2-051 was evaluated as a 884.5 MW (Capacity 765.5 MW) injection at the Chesapeake 230kV substation in the ITO area. Project AB2-051 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-051 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
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 563	CONTINGENCY 'LN 563' OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 END
CHESA H3TYAD	CONTINGENCY 'CHESA H3TYAD' /* H3TYADKIN @ CHESAPEAKE OPEN BRANCH FROM BUS 314448 TO BUS 314449 CKT 1 /* CHESAPEAKE 230-115 TX#3 OPEN BRANCH FROM BUS 314449 TO BUS 314514 CKT 1 /* CHESAPEAKE - YADKIN END

Summer Peak Analysis - 2020

System Reinforcement responsible by ITO

#	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
1	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	114.61	119.71	ER	399	45.14
2	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	128.12	133.22	ER	399	45.14
3	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	128.3	133.39	ER	399	45.14

PJM baseline project (b2745) will eliminate the identified overloads. The scheduled in service date b2745 is 06/01/2020.

Generator Deliverability

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

#	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
4	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	87.23	91.9	ER	470	48.79	1

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

#	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

#	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
5	LFFB	CHESA H3TYAD	DVP - DVP	6CHESAPK 230/115 kV transformer	314449	314448	2	DC	20.29	111.2	ER	239	217.27	2

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

#	Area	Bus No.	Bus	Breaker	Rating Type	Duty Percent Without AB2-051	Duty Percent With AB2-051	Duty Percent Difference
6	DVP	777	YADKIN 2&4 230.kV	210512	S	99.06	112.33	13.27

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

None

Contribution to Previously Identified Overloads

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

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Cir.	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
7	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	114.61	119.71	ER	399	45.14	3
8	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	128.12	133.22	ER	399	45.14	4

#	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
9	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	128.3	133.39	ER	399	45.14	5

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	6CHARCTY-6LAKESD 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	**$**
# 2	6MESSER-6CHARCTY 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	**$**
# 3	6CHSTF B-6MESSER 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	
# 4	6CHSTF B-6BASIN 230 kV line	Rebuild of the Chesterfield-Basin 230kV line	Pending	**$18,615,000**

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
# 5	6CHESAPK 230/115 kV transformer	Upgrade Chesapeake 230/115kV transformer	Pending	**$6,000,000**
# 6	Yadkin 230kV breaker 210512	Replace 230kV breaker with a 50kA duty	Pending	**$300,000**
			Total New Network Upgrades	**$24,915,000**

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	6CHARCTY-6LAKESD 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	**$**
# 8	6MESSER-6CHARCTY 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	**$**
# 9	6CHSTF B-6MESSER 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	**$**
			Total New Network Upgrades	**$**

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
7	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	103.15	108.56	ER	470	56.37

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 #AB2-051 interconnection of a 884.5 MW Energy (765.5 MW Capacity) injection into the ITO's Transmission System, 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 – No deficiencies identified
2. Critical System Condition (No Surry 230 kV Unit) – No deficiencies identified.

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

Import/Export Analysis (Single Contingency) are tabulated in Table A and B below.

Table A: Import Study Results

Import Study Results			
Area	Summer 2020	Summer 2020 with AB2-051	Limiting Element
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

Table B: Export Study Results

Export Study Results			
Area	Summer 2020	Summer 2020 with AB2-051	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 interconnection will not impact ITO's import or export capability

Affected System Analysis & Mitigation

Duke, Progress & TVA Impacts:

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

Option Two

Network Impacts

The Queue Project AB2-051 was evaluated as a 884.5 MW (Capacity 765.5 MW) injection at the Dozier 230kV substation in the ITO area. Project AB2-051 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-051 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
LN 563	CONTINGENCY 'LN 563' OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 END
LN 2070	CONTINGENCY 'LN 2070' OPEN BRANCH FROM BUS 314465 TO BUS 314514 CKT 1 /* 6ELIZ R 230.00 - 6YADKIN 230.00 END
LN 2019	CONTINGENCY 'LN 2019' OPEN BRANCH FROM BUS 314474 TO BUS 314504 CKT 1 /* 6GRENWCH 230.00 - 6THALIA 230.00 END
LN 27	CONTINGENCY 'LN 27' OPEN BRANCH FROM BUS 314438 TO BUS 314483 CKT 1 /* 3STORE 115.00 - 3LONGC27 115.00 OPEN BRANCH FROM BUS 314438 TO BUS 314511 CKT 1 /* 3STORE 115.00 - 3VA BCH 115.00 OPEN BRANCH FROM BUS 314439 TO BUS 314447 CKT 1 /* 3BAYSIDE 115.00 - 3BURTN67 115.00 OPEN BRANCH FROM BUS 314439 TO BUS 314483 CKT 1 /* 3BAYSIDE 115.00 - 3LONGC27 115.00 OPEN BUS 314438 /* ISLAND OPEN BUS 314439 /* ISLAND OPEN BUS 314483 /* ISLAND END

Contingency Name	Description
245T2019	CONTINGENCY '245T2019' /* 245&2019 @ GREENWICH OPEN BRANCH FROM BUS 314472 TO BUS 314474 CKT 1 /* GREEN RUN - GREENWICH OPEN BRANCH FROM BUS 314474 TO BUS 314504 CKT 1 /* GREENWICH - THALIA END
LN 245-2019	CONTINGENCY 'LN 245-2019' OPEN BRANCH FROM BUS 314472 TO BUS 314474 CKT 1 /* 6GRN RUN 230.00 - 6GRENWCH 230.00 OPEN BRANCH FROM BUS 314474 TO BUS 314504 CKT 1 /* 6GRENWCH 230.00 - 6THALIA 230.00 END
2007T2019	CONTINGENCY '2007T2019' /* 2007T2019 @ THALIA OPEN BRANCH FROM BUS 314486 TO BUS 314504 CKT 1 /* LYNNHAVEN - THALIA OPEN BRANCH FROM BUS 314504 TO BUS 314474 CKT 1 /* THALIA - GREENWICH 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

Summer Peak Analysis - 2020

Generator Deliverability

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

#	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	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	87.21	91.88	ER	470	48.75	6
2	N-1	LN 2070	DVP - DVP	6DOZIER-6GRENWCH 230 kV line	314464	314474	1	DC	45.62	152.81	ER	713	764.22	7
3	N-1	LN 2019	DVP - DVP	6ELIZ R-6YADKIN 230 kV line	314465	314514	1	DC	10.99	109.88	ER	583	576.56	
4	N-1	LN 27	DVP - DVP	6ELIZ R-6YADKIN 230 kV line	314465	314514	1	DC	10.14	107.94	ER	583	570.19	

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

#	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
5	LFFB	245T2019	DVP - DVP	6ELIZ R-6YADKIN 230 kV line	314465	314514	1	DC	17.96	134.72	ER	583	680.71	8
6	DCTL	LN 245-2019	DVP - DVP	6ELIZ R-6YADKIN 230 kV line	314465	314514	1	DC	17.96	134.72	ER	583	680.71	
7	LFFB	2007T2019	DVP - DVP	6ELIZ R-6YADKIN 230 kV line	314465	314514	1	DC	13.73	128	ER	583	666.19	

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

#	Area	Bus No.	Bus	Breaker	Rating Type	Duty Percent Without AB2-051	Duty Percent With AB2-051	Duty Percent Difference
8	DVP	777	YADKIN 2&4 230.kV	210512	S	99.06	108.52	9.46

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

None

Contribution to Previously Identified Overloads

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

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Cir.	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
9	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	114.44	119.53	ER	399	45.07	9
10	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	127.95	133.04	ER	399	45.07	10
11	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	128.12	133.21	ER	399	45.07	11

Steady-State Voltage Requirements

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

To be determined during Impact Study.

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

To be determined during Impact Study.

Potential Congestion due to Local Energy Deliverability

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

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

Contingency			Affected		Bus			Power	Loading %		Rating		MW
#	Type	Name	Area	Facility Description	From	To	Circuit	Flow	Initial	Final	Type	MVA	Contribution
12	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	102.99	108.39	ER	470	56.32
13	N-1	LN 2070	DVP - DVP	6DOZIER-6GRENWCH 230 kV line	314464	314474	1	DC	45.62	169.47	ER	713	883.02
14	N-1	LN 2019	DVP - DVP	6ELIZ R-6YADKIN 230 kV line	314465	314514	1	DC	11.1	125.37	ER	583	666.19

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 #AB2-051 interconnection of a 884.5 MW Energy (765.5 MW Capacity) injection into the ITO's Transmission System, 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 – No deficiencies identified
2. Critical System Condition (No Surry 230 kV Unit) – No deficiencies identified.

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

4. Import/Export Analysis (Single Contingency) are tabulated in Table A and B below.

Table A: Import Study Results

Import Study Results

Area	Summer 2020	Summer 2020 with AB2-051	Limiting Element
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

Table B: Export Study Results

Export Study Results			
Area	Summer 2020	Summer 2020 with AB2-051	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 interconnection will not impact ITO's import or export capability

Affected System Analysis & Mitigation

Duke, Progress & TVA Impacts:

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

Attachment 1.

Flowgate Appendices – Option 1

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 6CHSTF B-6BASIN 230 kV line (from bus 314287 to bus 314276 ckt 1) loads from 87.23% to 91.9% (**DC power flow**) of its emergency rating (470 MVA) for the single line contingency outage of 'LN 563'. This project contributes approximately 48.79 MW to the thermal violation.

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

Bus Number	*Bus Name*	*Full Contribution*
315065	*1CHESTF6*	*37.56*
315139	*1GASTONA*	*1.8*
315141	*1GASTONB*	*1.8*
315119	*1GRAVEL3*	*1.43*
315120	*1GRAVEL4*	*1.44*
315121	*1GRAVEL5*	*1.41*
315122	*1GRAVEL6*	*1.44*
315117	*1GRAVELC*	*0.49*
315077	*1HOPHCF1*	*2.02*
315078	*1HOPHCF2*	*2.02*
315079	*1HOPHCF3*	*2.02*
315080	*1HOPHCF4*	*3.07*
315076	*1HOPPOLC*	*1.73*
315116	*1SURRY 1*	*14.96*
314314	*3LOCKS*	*0.96*
902241	*W2-022 C OP1*	*0.62*
903520	*W3-066 C1OP1*	*1.23*
903531	*W3-066 C2OP1*	*1.23*
914231	*Y2-077*	*0.81*
921092	*AA1-049 C*	*0.86*
921162	*AA1-063AC*	*3.8*
921182	*AA1-067 C*	*0.65*
921532	*AA1-132 C*	*2.65*
921542	*AA1-133 C*	*3.53*
921552	*AA1-134 C*	*3.61*
921562	*AA1-135 C*	*3.66*
921572	*AA1-138 C*	*3.71*
921582	*AA1-139 C*	*5.29*
921752	*AA2-053 C*	*3.89*
921762	*AA2-057 C*	*2.9*
921772	*AA2-059 C*	*0.89*

921862	*AA2-068 C*	*0.93*
921982	*AA2-088 C*	*2.79*
922032	*AA2-105 C*	*1.01*
922072	*AA2-113 C*	*1.01*
922442	*AA2-165 C*	*0.39*
922472	*AA2-169 C*	*0.86*
922512	*AA2-174 C*	*0.18*
922522	*AA2-177 C*	*6.23*
922532	*AA2-178 C*	*3.67*
922542	*AA2-180 C*	*0.88*
922602	*AB1-013 C*	*1.11*
922722	*AB1-053 C*	*0.52*
922732	*AB1-054 C*	*2.95*
922882	*AB1-077 C*	*1.26*
922922	*AB1-081 C OP*	*3.46*
923262	*AB1-132 C OP*	*7.*
923572	*AB1-173 C OP*	*1.14*
923582	*AB1-173AC OP*	*1.14*
923801	*AB2-015 C OP*	*4.54*
923831	*AB2-022 C*	*0.83*
923851	*AB2-025 C*	*1.8*
923911	*AB2-031 C OP*	*1.14*
923941	*AB2-035 C*	*0.13*
923981	*AB2-039 C OP*	*6.17*
923991	*AB2-040 C OP*	*3.87*
924011	*AB2-042 C OP*	*7.15*
924071	*AB2-051 C OP*	*48.79*
924151	*AB2-059 C OP*	*4.08*
924381	*AB2-087 C*	*0.24*
924391	*AB2-088 C*	*0.17*
924491	*AB2-098 C*	*0.22*
924501	*AB2-099 C*	*0.25*
924511	*AB2-100 C*	*6.4*
924761	*AB2-128 C*	*5.48*
924811	*AB2-134 C OP*	*7.98*
924931	*AB2-147 C*	*1.35*
924941	*AB2-149 C OP*	*1.75*
924951	*AB2-150 C OP*	*1.35*
924961	*AB2-152*	*14.84*
925051	*AB2-160 C OP*	*3.87*
925061	*AB2-161 C OP*	*2.13*
925121	*AB2-169 C OP*	*2.51*
925141	*AB2-171 C OP*	*2.09*
925171	*AB2-174 C OP*	*3.67*
925281	*AB2-186 C*	*0.23*

925291	*AB2-188 C OP*	*0.91*
925331	*AB2-190 C*	*14.23*

Appendix 2

(DVP - DVP) The 6CHESAPK 230/115 kV transformer (from bus 314449 to bus 314448 ckt 2) loads from 20.29% to 111.2% (**DC power flow**) of its emergency rating (239 MVA) for the line fault with failed breaker contingency outage of 'CHESA H3TYAD'. This project contributes approximately 217.27 MW to the thermal violation.

CONTINGENCY 'CHESA H3TYAD' /* H3TYADKIN @ CHESAPEAKE
OPEN BRANCH FROM BUS 314448 TO BUS 314449 CKT 1 /* CHESAPEAKE 230-115 TX#3
OPEN BRANCH FROM BUS 314449 TO BUS 314514 CKT 1 /* CHESAPEAKE - YADKIN
END

Bus Number	*Bus Name*	*Full Contribution*
924071	*AB2-051 C OP*	*188.04*
924072	*AB2-051 E OP*	*29.23*

Appendix 3

(DVP - DVP) The 6CHARCTY-6LAKESD 230 kV line (from bus 314225 to bus 314227 ckt 1) loads from 114.61% to 119.71% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 45.14 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*	*37.23*
315077	*1HOPHCF1*	*2.16*
315078	*1HOPHCF2*	*2.16*
315079	*1HOPHCF3*	*2.16*
315080	*1HOPHCF4*	*3.27*
315076	*1HOPPOLC*	*1.84*
315073	*1STONECA*	*5.67*
314784	*1WEYRHSB*	*0.66*
314314	*3LOCKS*	*1.04*
314539	*3UNCAMP*	*0.86*
314541	*3WATKINS*	*0.25*
314229	*6MT R221*	*-0.33*
292791	*U1-032 E*	*2.95*
900672	*V4-068 E*	*0.11*
901082	*W1-029E*	*13.49*
902241	*W2-022 C OP1*	*0.49*
902242	*W2-022 E OP1*	*3.31*
903520	*W3-066 C1OP1*	*0.98*
903531	*W3-066 C2OP1*	*0.98*
903522	*W3-066 E1OP1*	*6.54*
903532	*W3-066 E2OP1*	*6.54*
907092	*X1-038 E*	*2.15*
913392	*Y1-086 E*	*0.63*
914231	*Y2-077*	*0.87*

916042	*Z1-036 E*	*13.59*
916192	*Z1-068 E*	*0.53*
917122	*Z2-027 E*	*0.31*
917332	*Z2-043 E*	*0.34*
917342	*Z2-044 E*	*0.18*
917592	*Z2-099 E*	*0.16*
921092	*AA1-049 C*	*0.68*
921093	*AA1-049 E*	*0.32*
921162	*AA1-063AC*	*3.19*
921163	*AA1-063AE*	*1.51*
918512	*AA1-065 E OP*	*1.48*
918562	*AA1-072 E*	*0.06*
921532	*AA1-132 C*	*2.1*
921533	*AA1-132 E*	*0.9*
921552	*AA1-134 C*	*2.89*
921553	*AA1-134 E*	*1.24*
921562	*AA1-135 C*	*2.95*
921563	*AA1-135 E*	*1.26*
921572	*AA1-138 C*	*3.*
921573	*AA1-138 E*	*1.29*
921752	*AA2-053 C*	*3.26*
921753	*AA2-053 E*	*1.4*
921762	*AA2-057 C*	*2.35*
921763	*AA2-057 E*	*1.17*
921772	*AA2-059 C*	*0.72*
921773	*AA2-059 E*	*0.33*
921862	*AA2-068 C*	*0.76*
921863	*AA2-068 E*	*0.35*
920022	*AA2-086 E*	*0.09*
921982	*AA2-088 C*	*2.33*
921983	*AA2-088 E*	*3.81*
922032	*AA2-105 C*	*0.85*
922033	*AA2-105 E*	*0.4*
922072	*AA2-113 C*	*0.85*
922073	*AA2-113 E*	*0.4*
922442	*AA2-165 C*	*0.32*
922443	*AA2-165 E*	*0.15*
922472	*AA2-169 C*	*0.71*
922473	*AA2-169 E*	*0.33*
922512	*AA2-174 C*	*0.15*
922513	*AA2-174 E*	*0.16*
922522	*AA2-177 C*	*6.39*
922523	*AA2-177 E*	*2.74*
922532	*AA2-178 C*	*2.96*
922533	*AA2-178 E*	*1.27*

922602	*AB1-013 C*	*0.89*
922603	*AB1-013 E*	*5.98*
922722	*AB1-053 C*	*0.44*
922723	*AB1-053 E*	*0.25*
922732	*AB1-054 C*	*2.47*
922733	*AB1-054 E*	*1.22*
922882	*AB1-077 C*	*1.01*
922883	*AB1-077 E*	*6.75*
923262	*AB1-132 C OP*	*5.97*
923263	*AB1-132 E OP*	*2.56*
923572	*AB1-173 C OP*	*0.99*
923573	*AB1-173 E OP*	*0.46*
923582	*AB1-173AC OP*	*0.99*
923583	*AB1-173AE OP*	*0.46*
923801	*AB2-015 C OP*	*3.8*
923802	*AB2-015 E OP*	*2.76*
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*
923981	*AB2-039 C OP*	*5.76*
923982	*AB2-039 E OP*	*4.71*
923991	*AB2-040 C OP*	*3.33*
923992	*AB2-040 E OP*	*2.51*
924011	*AB2-042 C OP*	*6.68*
924012	*AB2-042 E OP*	*5.32*
924071	*AB2-051 C OP*	*39.06*
924072	*AB2-051 E OP*	*6.07*
924381	*AB2-087 C*	*0.19*
924382	*AB2-087 E*	*0.09*
924501	*AB2-099 C*	*0.2*
924502	*AB2-099 E*	*0.09*
924511	*AB2-100 C*	*5.58*
924512	*AB2-100 E*	*2.75*
924761	*AB2-128 C*	*4.78*
924762	*AB2-128 E*	*1.88*
924811	*AB2-134 C OP*	*8.19*
924812	*AB2-134 E OP*	*10.95*
924931	*AB2-147 C*	*1.18*
924932	*AB2-147 E*	*1.92*
924941	*AB2-149 C OP*	*1.56*
924942	*AB2-149 E OP*	*2.55*
924951	*AB2-150 C OP*	*1.18*

924952	*AB2-150 E OP*	*1.92*
924961	*AB2-152*	*15.85*
925051	*AB2-160 C OP*	*4.19*
925052	*AB2-160 E OP*	*6.83*
925061	*AB2-161 C OP*	*1.99*
925062	*AB2-161 E OP*	*3.24*
925121	*AB2-169 C OP*	*2.02*
925122	*AB2-169 E OP*	*1.81*
925141	*AB2-171 C OP*	*1.75*
925142	*AB2-171 E OP*	*2.85*
925171	*AB2-174 C OP*	*3.17*
925172	*AB2-174 E OP*	*2.87*
925281	*AB2-186 C*	*0.18*
925282	*AB2-186 E*	*0.08*
925291	*AB2-188 C OP*	*0.73*
925292	*AB2-188 E OP*	*0.33*
925331	*AB2-190 C*	*14.6*
925332	*AB2-190 E*	*3.65*

Appendix 4

(DVP - DVP) The 6MESSER-6CHARCTY 230 kV line (from bus 314228 to bus 314225 ckt 1) loads from 128.12% to 133.22% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 45.14 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*	*37.23*
315077	*1HOPHCF1*	*2.16*
315078	*1HOPHCF2*	*2.16*
315079	*1HOPHCF3*	*2.16*
315080	*1HOPHCF4*	*3.27*
315076	*1HOPPOLC*	*1.84*
315073	*1STONECA*	*5.67*
314784	*1WEYRHSB*	*0.66*
314314	*3LOCKS*	*1.04*
314539	*3UNCAMP*	*0.86*
314541	*3WATKINS*	*0.25*
314229	*6MT R221*	*-0.33*
292791	*U1-032 E*	*2.95*
900672	*V4-068 E*	*0.11*
901082	*W1-029E*	*13.49*
902241	*W2-022 C OP1*	*0.49*
902242	*W2-022 E OP1*	*3.31*
903520	*W3-066 C1OP1*	*0.98*
903531	*W3-066 C2OP1*	*0.98*
903522	*W3-066 E1OP1*	*6.54*
903532	*W3-066 E2OP1*	*6.54*
907092	*X1-038 E*	*2.15*
913392	*Y1-086 E*	*0.63*
914231	*Y2-077*	*0.87*

916042	*Z1-036 E*	*13.59*
916192	*Z1-068 E*	*0.53*
917122	*Z2-027 E*	*0.31*
917332	*Z2-043 E*	*0.34*
917342	*Z2-044 E*	*0.18*
917592	*Z2-099 E*	*0.16*
921092	*AA1-049 C*	*0.68*
921093	*AA1-049 E*	*0.32*
921162	*AA1-063AC*	*3.19*
921163	*AA1-063AE*	*1.51*
918512	*AA1-065 E OP*	*1.48*
918562	*AA1-072 E*	*0.06*
921532	*AA1-132 C*	*2.1*
921533	*AA1-132 E*	*0.9*
921552	*AA1-134 C*	*2.89*
921553	*AA1-134 E*	*1.24*
921562	*AA1-135 C*	*2.95*
921563	*AA1-135 E*	*1.26*
921572	*AA1-138 C*	*3.*
921573	*AA1-138 E*	*1.29*
921752	*AA2-053 C*	*3.26*
921753	*AA2-053 E*	*1.4*
921762	*AA2-057 C*	*2.35*
921763	*AA2-057 E*	*1.17*
921772	*AA2-059 C*	*0.72*
921773	*AA2-059 E*	*0.33*
921862	*AA2-068 C*	*0.76*
921863	*AA2-068 E*	*0.35*
920022	*AA2-086 E*	*0.09*
921982	*AA2-088 C*	*2.33*
921983	*AA2-088 E*	*3.81*
922032	*AA2-105 C*	*0.85*
922033	*AA2-105 E*	*0.4*
922072	*AA2-113 C*	*0.85*
922073	*AA2-113 E*	*0.4*
922442	*AA2-165 C*	*0.32*
922443	*AA2-165 E*	*0.15*
922472	*AA2-169 C*	*0.71*
922473	*AA2-169 E*	*0.33*
922512	*AA2-174 C*	*0.15*
922513	*AA2-174 E*	*0.16*
922522	*AA2-177 C*	*6.39*
922523	*AA2-177 E*	*2.74*
922532	*AA2-178 C*	*2.96*
922533	*AA2-178 E*	*1.27*

922602	*AB1-013 C*	*0.89*
922603	*AB1-013 E*	*5.98*
922722	*AB1-053 C*	*0.44*
922723	*AB1-053 E*	*0.25*
922732	*AB1-054 C*	*2.47*
922733	*AB1-054 E*	*1.22*
922882	*AB1-077 C*	*1.01*
922883	*AB1-077 E*	*6.75*
923262	*AB1-132 C OP*	*5.97*
923263	*AB1-132 E OP*	*2.56*
923572	*AB1-173 C OP*	*0.99*
923573	*AB1-173 E OP*	*0.46*
923582	*AB1-173AC OP*	*0.99*
923583	*AB1-173AE OP*	*0.46*
923801	*AB2-015 C OP*	*3.8*
923802	*AB2-015 E OP*	*2.76*
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*
923981	*AB2-039 C OP*	*5.76*
923982	*AB2-039 E OP*	*4.71*
923991	*AB2-040 C OP*	*3.33*
923992	*AB2-040 E OP*	*2.51*
924011	*AB2-042 C OP*	*6.68*
924012	*AB2-042 E OP*	*5.32*
924071	*AB2-051 C OP*	*39.06*
924072	*AB2-051 E OP*	*6.07*
924381	*AB2-087 C*	*0.19*
924382	*AB2-087 E*	*0.09*
924501	*AB2-099 C*	*0.2*
924502	*AB2-099 E*	*0.09*
924511	*AB2-100 C*	*5.58*
924512	*AB2-100 E*	*2.75*
924761	*AB2-128 C*	*4.78*
924762	*AB2-128 E*	*1.88*
924811	*AB2-134 C OP*	*8.19*
924812	*AB2-134 E OP*	*10.95*
924931	*AB2-147 C*	*1.18*
924932	*AB2-147 E*	*1.92*
924941	*AB2-149 C OP*	*1.56*
924942	*AB2-149 E OP*	*2.55*
924951	*AB2-150 C OP*	*1.18*

924952	*AB2-150 E OP*	*1.92*
924961	*AB2-152*	*15.85*
925051	*AB2-160 C OP*	*4.19*
925052	*AB2-160 E OP*	*6.83*
925061	*AB2-161 C OP*	*1.99*
925062	*AB2-161 E OP*	*3.24*
925121	*AB2-169 C OP*	*2.02*
925122	*AB2-169 E OP*	*1.81*
925141	*AB2-171 C OP*	*1.75*
925142	*AB2-171 E OP*	*2.85*
925171	*AB2-174 C OP*	*3.17*
925172	*AB2-174 E OP*	*2.87*
925281	*AB2-186 C*	*0.18*
925282	*AB2-186 E*	*0.08*
925291	*AB2-188 C OP*	*0.73*
925292	*AB2-188 E OP*	*0.33*
925331	*AB2-190 C*	*14.6*
925332	*AB2-190 E*	*3.65*

Appendix 5

(DVP - DVP) The 6CHSTF B-6MESSER 230 kV line (from bus 314287 to bus 314228 ckt 1) loads from 128.3% to 133.39% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 45.14 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*	*37.23*
315077	*1HOPHCF1*	*2.16*
315078	*1HOPHCF2*	*2.16*
315079	*1HOPHCF3*	*2.16*
315080	*1HOPHCF4*	*3.27*
315076	*1HOPPOLC*	*1.84*
315073	*1STONECA*	*5.67*
314784	*1WEYRHSB*	*0.66*
314314	*3LOCKS*	*1.04*
314539	*3UNCAMP*	*0.86*
314541	*3WATKINS*	*0.25*
314229	*6MT R221*	*-0.33*
292791	*U1-032 E*	*2.95*
900672	*V4-068 E*	*0.11*
901082	*W1-029E*	*13.49*
902241	*W2-022 C OP1*	*0.49*
902242	*W2-022 E OP1*	*3.31*
903520	*W3-066 C1OP1*	*0.98*
903531	*W3-066 C2OP1*	*0.98*
903522	*W3-066 E1OP1*	*6.54*
903532	*W3-066 E2OP1*	*6.54*
907092	*X1-038 E*	*2.15*
913392	*Y1-086 E*	*0.63*
914231	*Y2-077*	*0.87*

916042	*Z1-036 E*	*13.59*
916192	*Z1-068 E*	*0.53*
917122	*Z2-027 E*	*0.31*
917332	*Z2-043 E*	*0.34*
917342	*Z2-044 E*	*0.18*
917592	*Z2-099 E*	*0.16*
921092	*AA1-049 C*	*0.68*
921093	*AA1-049 E*	*0.32*
921162	*AA1-063AC*	*3.19*
921163	*AA1-063AE*	*1.51*
918512	*AA1-065 E OP*	*1.48*
918562	*AA1-072 E*	*0.06*
921532	*AA1-132 C*	*2.1*
921533	*AA1-132 E*	*0.9*
921552	*AA1-134 C*	*2.89*
921553	*AA1-134 E*	*1.24*
921562	*AA1-135 C*	*2.95*
921563	*AA1-135 E*	*1.26*
921572	*AA1-138 C*	*3.*
921573	*AA1-138 E*	*1.29*
921752	*AA2-053 C*	*3.26*
921753	*AA2-053 E*	*1.4*
921762	*AA2-057 C*	*2.35*
921763	*AA2-057 E*	*1.17*
921772	*AA2-059 C*	*0.72*
921773	*AA2-059 E*	*0.33*
921862	*AA2-068 C*	*0.76*
921863	*AA2-068 E*	*0.35*
920022	*AA2-086 E*	*0.09*
921982	*AA2-088 C*	*2.33*
921983	*AA2-088 E*	*3.81*
922032	*AA2-105 C*	*0.85*
922033	*AA2-105 E*	*0.4*
922072	*AA2-113 C*	*0.85*
922073	*AA2-113 E*	*0.4*
922442	*AA2-165 C*	*0.32*
922443	*AA2-165 E*	*0.15*
922472	*AA2-169 C*	*0.71*
922473	*AA2-169 E*	*0.33*
922512	*AA2-174 C*	*0.15*
922513	*AA2-174 E*	*0.16*
922522	*AA2-177 C*	*6.39*
922523	*AA2-177 E*	*2.74*
922532	*AA2-178 C*	*2.96*
922533	*AA2-178 E*	*1.27*

922602	*AB1-013 C*	*0.89*
922603	*AB1-013 E*	*5.98*
922722	*AB1-053 C*	*0.44*
922723	*AB1-053 E*	*0.25*
922732	*AB1-054 C*	*2.47*
922733	*AB1-054 E*	*1.22*
922882	*AB1-077 C*	*1.01*
922883	*AB1-077 E*	*6.75*
923262	*AB1-132 C OP*	*5.97*
923263	*AB1-132 E OP*	*2.56*
923572	*AB1-173 C OP*	*0.99*
923573	*AB1-173 E OP*	*0.46*
923582	*AB1-173AC OP*	*0.99*
923583	*AB1-173AE OP*	*0.46*
923801	*AB2-015 C OP*	*3.8*
923802	*AB2-015 E OP*	*2.76*
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*
923981	*AB2-039 C OP*	*5.76*
923982	*AB2-039 E OP*	*4.71*
923991	*AB2-040 C OP*	*3.33*
923992	*AB2-040 E OP*	*2.51*
924011	*AB2-042 C OP*	*6.68*
924012	*AB2-042 E OP*	*5.32*
924071	*AB2-051 C OP*	*39.06*
924072	*AB2-051 E OP*	*6.07*
924381	*AB2-087 C*	*0.19*
924382	*AB2-087 E*	*0.09*
924501	*AB2-099 C*	*0.2*
924502	*AB2-099 E*	*0.09*
924511	*AB2-100 C*	*5.58*
924512	*AB2-100 E*	*2.75*
924761	*AB2-128 C*	*4.78*
924762	*AB2-128 E*	*1.88*
924811	*AB2-134 C OP*	*8.19*
924812	*AB2-134 E OP*	*10.95*
924931	*AB2-147 C*	*1.18*
924932	*AB2-147 E*	*1.92*
924941	*AB2-149 C OP*	*1.56*
924942	*AB2-149 E OP*	*2.55*
924951	*AB2-150 C OP*	*1.18*

924952	*AB2-150 E OP*	*1.92*
924961	*AB2-152*	*15.85*
925051	*AB2-160 C OP*	*4.19*
925052	*AB2-160 E OP*	*6.83*
925061	*AB2-161 C OP*	*1.99*
925062	*AB2-161 E OP*	*3.24*
925121	*AB2-169 C OP*	*2.02*
925122	*AB2-169 E OP*	*1.81*
925141	*AB2-171 C OP*	*1.75*
925142	*AB2-171 E OP*	*2.85*
925171	*AB2-174 C OP*	*3.17*
925172	*AB2-174 E OP*	*2.87*
925281	*AB2-186 C*	*0.18*
925282	*AB2-186 E*	*0.08*
925291	*AB2-188 C OP*	*0.73*
925292	*AB2-188 E OP*	*0.33*
925331	*AB2-190 C*	*14.6*
925332	*AB2-190 E*	*3.65*

Appendix 6

(DVP - DVP) The 6CHSTF B-6BASIN 230 kV line (from bus 314287 to bus 314276 ckt 1) loads from 87.21% to 91.88% (**DC power flow**) of its emergency rating (470 MVA) for the single line contingency outage of 'LN 563'. This project contributes approximately 48.75 MW to the thermal violation.

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

Bus Number	*Bus Name*	*Full Contribution*
315065	*1CHESTF6*	*37.56*
315139	*1GASTONA*	*1.8*
315141	*1GASTONB*	*1.8*
315119	*1GRAVEL3*	*1.43*
315120	*1GRAVEL4*	*1.44*
315121	*1GRAVEL5*	*1.41*
315122	*1GRAVEL6*	*1.44*
315117	*1GRAVELC*	*0.49*
315077	*1HOPHCF1*	*2.02*
315078	*1HOPHCF2*	*2.02*
315079	*1HOPHCF3*	*2.02*
315080	*1HOPHCF4*	*3.07*
315076	*1HOPPOLC*	*1.73*
315116	*1SURRY 1*	*14.96*
314314	*3LOCKS*	*0.96*
902241	*W2-022 C OP1*	*0.62*
903520	*W3-066 C1OP1*	*1.23*
903531	*W3-066 C2OP1*	*1.23*
914231	*Y2-077*	*0.81*
921092	*AA1-049 C*	*0.86*
921162	*AA1-063AC*	*3.8*
921182	*AA1-067 C*	*0.65*
921532	*AA1-132 C*	*2.65*
921542	*AA1-133 C*	*3.53*
921552	*AA1-134 C*	*3.61*
921562	*AA1-135 C*	*3.66*
921572	*AA1-138 C*	*3.71*
921582	*AA1-139 C*	*5.29*
921752	*AA2-053 C*	*3.89*
921762	*AA2-057 C*	*2.9*

921772	*AA2-059 C*	*0.89*
921862	*AA2-068 C*	*0.93*
921982	*AA2-088 C*	*2.79*
922032	*AA2-105 C*	*1.01*
922072	*AA2-113 C*	*1.01*
922442	*AA2-165 C*	*0.39*
922472	*AA2-169 C*	*0.86*
922512	*AA2-174 C*	*0.18*
922522	*AA2-177 C*	*6.23*
922532	*AA2-178 C*	*3.67*
922542	*AA2-180 C*	*0.88*
922602	*AB1-013 C*	*1.11*
922722	*AB1-053 C*	*0.52*
922732	*AB1-054 C*	*2.95*
922882	*AB1-077 C*	*1.26*
922922	*AB1-081 C OP*	*3.46*
923262	*AB1-132 C OP*	*7.*
923572	*AB1-173 C OP*	*1.14*
923582	*AB1-173AC OP*	*1.14*
923801	*AB2-015 C OP*	*4.54*
923831	*AB2-022 C*	*0.83*
923851	*AB2-025 C*	*1.8*
923911	*AB2-031 C OP*	*1.28*
923941	*AB2-035 C*	*0.13*
923981	*AB2-039 C OP*	*6.17*
923991	*AB2-040 C OP*	*4.36*
924011	*AB2-042 C OP*	*5.59*
924071	*AB2-051 C OP*	*48.75*
924151	*AB2-059 C OP*	*4.1*
924161	*AB2-060 C OP*	*3.31*
924381	*AB2-087 C*	*0.24*
924391	*AB2-088 C*	*0.17*
924491	*AB2-098 C*	*0.22*
924501	*AB2-099 C*	*0.25*
924511	*AB2-100 C*	*6.4*
924761	*AB2-128 C*	*5.48*
924811	*AB2-134 C OP*	*7.98*
924931	*AB2-147 C*	*1.35*
924941	*AB2-149 C OP*	*1.7*
924951	*AB2-150 C OP*	*1.64*
924961	*AB2-152*	*14.84*
925051	*AB2-160 C OP*	*4.43*
925061	*AB2-161 C OP*	*2.48*
925121	*AB2-169 C OP*	*2.5*
925141	*AB2-171 C OP*	*2.09*

925171	*AB2-174 C OP*	*4.01*
925281	*AB2-186 C*	*0.23*
925291	*AB2-188 C OP*	*0.91*
925331	*AB2-190 C*	*14.23*

Appendix 7

(DVP - DVP) The 6DOZIER-6GRENWCH 230 kV line (from bus 314464 to bus 314474 ckt 1) loads from 45.62% to 152.81% (**DC power flow**) of its emergency rating (713 MVA) for the single line contingency outage of 'LN 2070'. This project contributes approximately 764.22 MW to the thermal violation.

CONTINGENCY 'LN 2070'
OPEN BRANCH FROM BUS 314465 TO BUS 314514 CKT 1 /* 6ELIZ R 230.00 - 6YADKIN 230.00
END

Bus Number	*Bus Name*	*Full Contribution*
315108	*1ELIZAR1*	*21.4*
315109	*1ELIZAR2*	*21.03*
315110	*1ELIZAR3*	*21.67*
924071	*AB2-051 C OP*	*764.22*

Appendix 8

(DVP - DVP) The 6ELIZ R-6YADKIN 230 kV line (from bus 314465 to bus 314514 ckt 1) loads from 17.96% to 134.72% (**DC power flow**) of its emergency rating (583 MVA) for the line fault with failed breaker contingency outage of '245T2019'. This project contributes approximately 680.71 MW to the thermal violation.

CONTINGENCY '245T2019' /* 245&2019 @ GREENWICH
OPEN BRANCH FROM BUS 314472 TO BUS 314474 CKT 1 /* GREEN RUN - GREENWICH
OPEN BRANCH FROM BUS 314474 TO BUS 314504 CKT 1 /* GREENWICH - THALIA
END

Bus Number	*Bus Name*	*Full Contribution*
315108	*1ELIZAR1*	*18.57*
315109	*1ELIZAR2*	*18.25*
315110	*1ELIZAR3*	*18.81*
924071	*AB2-051 C OP*	*589.13*
924072	*AB2-051 E OP*	*91.58*

Appendix 9

(DVP - DVP) The 6CHARCTY-6LAKESD 230 kV line (from bus 314225 to bus 314227 ckt 1) loads from 114.44% to 119.53% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 45.07 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*	*37.23*
315077	*1HOPHCF1*	*2.16*
315078	*1HOPHCF2*	*2.16*
315079	*1HOPHCF3*	*2.16*
315080	*1HOPHCF4*	*3.27*
315076	*1HOPPOLC*	*1.84*
315073	*1STONECA*	*5.67*
314784	*1WEYRHSB*	*0.66*
314314	*3LOCKS*	*1.04*
314539	*3UNCAMP*	*0.86*
314541	*3WATKINS*	*0.25*
314229	*6MT R221*	*-0.33*
292791	*U1-032 E*	*2.95*
900672	*V4-068 E*	*0.11*
901082	*W1-029E*	*13.49*
902241	*W2-022 C OP1*	*0.49*
902242	*W2-022 E OP1*	*3.31*
903520	*W3-066 C1OP1*	*0.98*
903531	*W3-066 C2OP1*	*0.98*
903522	*W3-066 E1OP1*	*6.54*
903532	*W3-066 E2OP1*	*6.54*
907092	*X1-038 E*	*2.15*
913392	*Y1-086 E*	*0.63*
914231	*Y2-077*	*0.87*
916042	*Z1-036 E*	*13.59*

916192	*Z1-068 E*	*0.53*
917122	*Z2-027 E*	*0.31*
917332	*Z2-043 E*	*0.34*
917342	*Z2-044 E*	*0.18*
917592	*Z2-099 E*	*0.16*
921092	*AA1-049 C*	*0.68*
921093	*AA1-049 E*	*0.32*
921162	*AA1-063AC*	*3.19*
921163	*AA1-063AE*	*1.51*
918512	*AA1-065 E OP*	*1.48*
918562	*AA1-072 E*	*0.06*
921532	*AA1-132 C*	*2.1*
921533	*AA1-132 E*	*0.9*
921552	*AA1-134 C*	*2.89*
921553	*AA1-134 E*	*1.24*
921562	*AA1-135 C*	*2.95*
921563	*AA1-135 E*	*1.26*
921572	*AA1-138 C*	*3.*
921573	*AA1-138 E*	*1.29*
921752	*AA2-053 C*	*3.26*
921753	*AA2-053 E*	*1.4*
921762	*AA2-057 C*	*2.35*
921763	*AA2-057 E*	*1.17*
921772	*AA2-059 C*	*0.72*
921773	*AA2-059 E*	*0.33*
921862	*AA2-068 C*	*0.76*
921863	*AA2-068 E*	*0.35*
920022	*AA2-086 E*	*0.09*
921982	*AA2-088 C*	*2.33*
921983	*AA2-088 E*	*3.81*
922032	*AA2-105 C*	*0.85*
922033	*AA2-105 E*	*0.4*
922072	*AA2-113 C*	*0.85*
922073	*AA2-113 E*	*0.4*
922442	*AA2-165 C*	*0.32*
922443	*AA2-165 E*	*0.15*
922472	*AA2-169 C*	*0.71*
922473	*AA2-169 E*	*0.33*
922512	*AA2-174 C*	*0.15*
922513	*AA2-174 E*	*0.16*
922522	*AA2-177 C*	*6.39*
922523	*AA2-177 E*	*2.74*
922532	*AA2-178 C*	*2.96*
922533	*AA2-178 E*	*1.27*
922602	*AB1-013 C*	*0.89*

922603	*AB1-013 E*	*5.98*
922722	*AB1-053 C*	*0.44*
922723	*AB1-053 E*	*0.25*
922732	*AB1-054 C*	*2.47*
922733	*AB1-054 E*	*1.22*
922882	*AB1-077 C*	*1.01*
922883	*AB1-077 E*	*6.75*
923262	*AB1-132 C OP*	*5.97*
923263	*AB1-132 E OP*	*2.56*
923572	*AB1-173 C OP*	*0.99*
923573	*AB1-173 E OP*	*0.46*
923582	*AB1-173AC OP*	*0.99*
923583	*AB1-173AE OP*	*0.46*
923801	*AB2-015 C OP*	*3.8*
923802	*AB2-015 E OP*	*2.76*
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*	*1.11*
923912	*AB2-031 E OP*	*0.55*
923981	*AB2-039 C OP*	*5.76*
923982	*AB2-039 E OP*	*4.71*
923991	*AB2-040 C OP*	*3.79*
923992	*AB2-040 E OP*	*2.86*
924011	*AB2-042 C OP*	*5.26*
924012	*AB2-042 E OP*	*4.19*
924071	*AB2-051 C OP*	*39.*
924072	*AB2-051 E OP*	*6.06*
924161	*AB2-060 C OP*	*2.79*
924162	*AB2-060 E OP*	*1.31*
924381	*AB2-087 C*	*0.19*
924382	*AB2-087 E*	*0.09*
924501	*AB2-099 C*	*0.2*
924502	*AB2-099 E*	*0.09*
924511	*AB2-100 C*	*5.58*
924512	*AB2-100 E*	*2.75*
924761	*AB2-128 C*	*4.78*
924762	*AB2-128 E*	*1.88*
924811	*AB2-134 C OP*	*8.19*
924812	*AB2-134 E OP*	*10.95*
924931	*AB2-147 C*	*1.18*
924932	*AB2-147 E*	*1.92*
924941	*AB2-149 C OP*	*1.51*
924942	*AB2-149 E OP*	*2.47*

924951	*AB2-150 C OP*	*1.45*
924952	*AB2-150 E OP*	*2.37*
924961	*AB2-152*	*15.85*
925051	*AB2-160 C OP*	*4.05*
925052	*AB2-160 E OP*	*6.61*
925061	*AB2-161 C OP*	*2.37*
925062	*AB2-161 E OP*	*3.87*
925121	*AB2-169 C OP*	*2.01*
925122	*AB2-169 E OP*	*1.8*
925141	*AB2-171 C OP*	*1.75*
925142	*AB2-171 E OP*	*2.85*
925171	*AB2-174 C OP*	*3.49*
925172	*AB2-174 E OP*	*3.16*
925281	*AB2-186 C*	*0.18*
925282	*AB2-186 E*	*0.08*
925291	*AB2-188 C OP*	*0.73*
925292	*AB2-188 E OP*	*0.33*
925331	*AB2-190 C*	*14.6*
925332	*AB2-190 E*	*3.65*

Appendix 10

(DVP - DVP) The 6MESSER-6CHARCTY 230 kV line (from bus 314228 to bus 314225 ckt 1) loads from 127.95% to 133.04% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 45.07 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*	*37.23*
315077	*1HOPHCF1*	*2.16*
315078	*1HOPHCF2*	*2.16*
315079	*1HOPHCF3*	*2.16*
315080	*1HOPHCF4*	*3.27*
315076	*1HOPPOLC*	*1.84*
315073	*1STONECA*	*5.67*
314784	*1WEYRHSB*	*0.66*
314314	*3LOCKS*	*1.04*
314539	*3UNCAMP*	*0.86*
314541	*3WATKINS*	*0.25*
314229	*6MT R221*	*-0.33*
292791	*U1-032 E*	*2.95*
900672	*V4-068 E*	*0.11*
901082	*W1-029E*	*13.49*
902241	*W2-022 C OP1*	*0.49*
902242	*W2-022 E OP1*	*3.31*
903520	*W3-066 C1OP1*	*0.98*
903531	*W3-066 C2OP1*	*0.98*
903522	*W3-066 E1OP1*	*6.54*
903532	*W3-066 E2OP1*	*6.54*
907092	*X1-038 E*	*2.15*
913392	*Y1-086 E*	*0.63*
914231	*Y2-077*	*0.87*

916042	*Z1-036 E*	*13.59*
916192	*Z1-068 E*	*0.53*
917122	*Z2-027 E*	*0.31*
917332	*Z2-043 E*	*0.34*
917342	*Z2-044 E*	*0.18*
917592	*Z2-099 E*	*0.16*
921092	*AA1-049 C*	*0.68*
921093	*AA1-049 E*	*0.32*
921162	*AA1-063AC*	*3.19*
921163	*AA1-063AE*	*1.51*
918512	*AA1-065 E OP*	*1.48*
918562	*AA1-072 E*	*0.06*
921532	*AA1-132 C*	*2.1*
921533	*AA1-132 E*	*0.9*
921552	*AA1-134 C*	*2.89*
921553	*AA1-134 E*	*1.24*
921562	*AA1-135 C*	*2.95*
921563	*AA1-135 E*	*1.26*
921572	*AA1-138 C*	*3.*
921573	*AA1-138 E*	*1.29*
921752	*AA2-053 C*	*3.26*
921753	*AA2-053 E*	*1.4*
921762	*AA2-057 C*	*2.35*
921763	*AA2-057 E*	*1.17*
921772	*AA2-059 C*	*0.72*
921773	*AA2-059 E*	*0.33*
921862	*AA2-068 C*	*0.76*
921863	*AA2-068 E*	*0.35*
920022	*AA2-086 E*	*0.09*
921982	*AA2-088 C*	*2.33*
921983	*AA2-088 E*	*3.81*
922032	*AA2-105 C*	*0.85*
922033	*AA2-105 E*	*0.4*
922072	*AA2-113 C*	*0.85*
922073	*AA2-113 E*	*0.4*
922442	*AA2-165 C*	*0.32*
922443	*AA2-165 E*	*0.15*
922472	*AA2-169 C*	*0.71*
922473	*AA2-169 E*	*0.33*
922512	*AA2-174 C*	*0.15*
922513	*AA2-174 E*	*0.16*
922522	*AA2-177 C*	*6.39*
922523	*AA2-177 E*	*2.74*
922532	*AA2-178 C*	*2.96*
922533	*AA2-178 E*	*1.27*

922602	*AB1-013 C*	*0.89*
922603	*AB1-013 E*	*5.98*
922722	*AB1-053 C*	*0.44*
922723	*AB1-053 E*	*0.25*
922732	*AB1-054 C*	*2.47*
922733	*AB1-054 E*	*1.22*
922882	*AB1-077 C*	*1.01*
922883	*AB1-077 E*	*6.75*
923262	*AB1-132 C OP*	*5.97*
923263	*AB1-132 E OP*	*2.56*
923572	*AB1-173 C OP*	*0.99*
923573	*AB1-173 E OP*	*0.46*
923582	*AB1-173AC OP*	*0.99*
923583	*AB1-173AE OP*	*0.46*
923801	*AB2-015 C OP*	*3.8*
923802	*AB2-015 E OP*	*2.76*
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*	*1.11*
923912	*AB2-031 E OP*	*0.55*
923981	*AB2-039 C OP*	*5.76*
923982	*AB2-039 E OP*	*4.71*
923991	*AB2-040 C OP*	*3.79*
923992	*AB2-040 E OP*	*2.86*
924011	*AB2-042 C OP*	*5.26*
924012	*AB2-042 E OP*	*4.19*
924071	*AB2-051 C OP*	*39.*
924072	*AB2-051 E OP*	*6.06*
924161	*AB2-060 C OP*	*2.79*
924162	*AB2-060 E OP*	*1.31*
924381	*AB2-087 C*	*0.19*
924382	*AB2-087 E*	*0.09*
924501	*AB2-099 C*	*0.2*
924502	*AB2-099 E*	*0.09*
924511	*AB2-100 C*	*5.58*
924512	*AB2-100 E*	*2.75*
924761	*AB2-128 C*	*4.78*
924762	*AB2-128 E*	*1.88*
924811	*AB2-134 C OP*	*8.19*
924812	*AB2-134 E OP*	*10.95*
924931	*AB2-147 C*	*1.18*
924932	*AB2-147 E*	*1.92*
924941	*AB2-149 C OP*	*1.51*

924942	*AB2-149 E OP*	*2.47*
924951	*AB2-150 C OP*	*1.45*
924952	*AB2-150 E OP*	*2.37*
924961	*AB2-152*	*15.85*
925051	*AB2-160 C OP*	*4.05*
925052	*AB2-160 E OP*	*6.61*
925061	*AB2-161 C OP*	*2.37*
925062	*AB2-161 E OP*	*3.87*
925121	*AB2-169 C OP*	*2.01*
925122	*AB2-169 E OP*	*1.8*
925141	*AB2-171 C OP*	*1.75*
925142	*AB2-171 E OP*	*2.85*
925171	*AB2-174 C OP*	*3.49*
925172	*AB2-174 E OP*	*3.16*
925281	*AB2-186 C*	*0.18*
925282	*AB2-186 E*	*0.08*
925291	*AB2-188 C OP*	*0.73*
925292	*AB2-188 E OP*	*0.33*
925331	*AB2-190 C*	*14.6*
925332	*AB2-190 E*	*3.65*

Appendix 11

(DVP - DVP) The 6CHSTF B-6MESSER 230 kV line (from bus 314287 to bus 314228 ckt 1) loads from 128.12% to 133.21% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 45.07 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*	*37.23*
315077	*1HOPHCF1*	*2.16*
315078	*1HOPHCF2*	*2.16*
315079	*1HOPHCF3*	*2.16*
315080	*1HOPHCF4*	*3.27*
315076	*1HOPPOLC*	*1.84*
315073	*1STONECA*	*5.67*
314784	*1WEYRHSB*	*0.66*
314314	*3LOCKS*	*1.04*
314539	*3UNCAMP*	*0.86*
314541	*3WATKINS*	*0.25*
314229	*6MT R221*	*-0.33*
292791	*U1-032 E*	*2.95*
900672	*V4-068 E*	*0.11*
901082	*W1-029E*	*13.49*
902241	*W2-022 C OP1*	*0.49*
902242	*W2-022 E OP1*	*3.31*
903520	*W3-066 C1OP1*	*0.98*
903531	*W3-066 C2OP1*	*0.98*
903522	*W3-066 E1OP1*	*6.54*
903532	*W3-066 E2OP1*	*6.54*
907092	*X1-038 E*	*2.15*
913392	*Y1-086 E*	*0.63*
914231	*Y2-077*	*0.87*

916042	*Z1-036 E*	*13.59*
916192	*Z1-068 E*	*0.53*
917122	*Z2-027 E*	*0.31*
917332	*Z2-043 E*	*0.34*
917342	*Z2-044 E*	*0.18*
917592	*Z2-099 E*	*0.16*
921092	*AA1-049 C*	*0.68*
921093	*AA1-049 E*	*0.32*
921162	*AA1-063AC*	*3.19*
921163	*AA1-063AE*	*1.51*
918512	*AA1-065 E OP*	*1.48*
918562	*AA1-072 E*	*0.06*
921532	*AA1-132 C*	*2.1*
921533	*AA1-132 E*	*0.9*
921552	*AA1-134 C*	*2.89*
921553	*AA1-134 E*	*1.24*
921562	*AA1-135 C*	*2.95*
921563	*AA1-135 E*	*1.26*
921572	*AA1-138 C*	*3.*
921573	*AA1-138 E*	*1.29*
921752	*AA2-053 C*	*3.26*
921753	*AA2-053 E*	*1.4*
921762	*AA2-057 C*	*2.35*
921763	*AA2-057 E*	*1.17*
921772	*AA2-059 C*	*0.72*
921773	*AA2-059 E*	*0.33*
921862	*AA2-068 C*	*0.76*
921863	*AA2-068 E*	*0.35*
920022	*AA2-086 E*	*0.09*
921982	*AA2-088 C*	*2.33*
921983	*AA2-088 E*	*3.81*
922032	*AA2-105 C*	*0.85*
922033	*AA2-105 E*	*0.4*
922072	*AA2-113 C*	*0.85*
922073	*AA2-113 E*	*0.4*
922442	*AA2-165 C*	*0.32*
922443	*AA2-165 E*	*0.15*
922472	*AA2-169 C*	*0.71*
922473	*AA2-169 E*	*0.33*
922512	*AA2-174 C*	*0.15*
922513	*AA2-174 E*	*0.16*
922522	*AA2-177 C*	*6.39*
922523	*AA2-177 E*	*2.74*
922532	*AA2-178 C*	*2.96*
922533	*AA2-178 E*	*1.27*

922602	*AB1-013 C*	*0.89*
922603	*AB1-013 E*	*5.98*
922722	*AB1-053 C*	*0.44*
922723	*AB1-053 E*	*0.25*
922732	*AB1-054 C*	*2.47*
922733	*AB1-054 E*	*1.22*
922882	*AB1-077 C*	*1.01*
922883	*AB1-077 E*	*6.75*
923262	*AB1-132 C OP*	*5.97*
923263	*AB1-132 E OP*	*2.56*
923572	*AB1-173 C OP*	*0.99*
923573	*AB1-173 E OP*	*0.46*
923582	*AB1-173AC OP*	*0.99*
923583	*AB1-173AE OP*	*0.46*
923801	*AB2-015 C OP*	*3.8*
923802	*AB2-015 E OP*	*2.76*
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*	*1.11*
923912	*AB2-031 E OP*	*0.55*
923981	*AB2-039 C OP*	*5.76*
923982	*AB2-039 E OP*	*4.71*
923991	*AB2-040 C OP*	*3.79*
923992	*AB2-040 E OP*	*2.86*
924011	*AB2-042 C OP*	*5.26*
924012	*AB2-042 E OP*	*4.19*
924071	*AB2-051 C OP*	*39.*
924072	*AB2-051 E OP*	*6.06*
924161	*AB2-060 C OP*	*2.79*
924162	*AB2-060 E OP*	*1.31*
924381	*AB2-087 C*	*0.19*
924382	*AB2-087 E*	*0.09*
924501	*AB2-099 C*	*0.2*
924502	*AB2-099 E*	*0.09*
924511	*AB2-100 C*	*5.58*
924512	*AB2-100 E*	*2.75*
924761	*AB2-128 C*	*4.78*
924762	*AB2-128 E*	*1.88*
924811	*AB2-134 C OP*	*8.19*
924812	*AB2-134 E OP*	*10.95*
924931	*AB2-147 C*	*1.18*
924932	*AB2-147 E*	*1.92*
924941	*AB2-149 C OP*	*1.51*

924942	*AB2-149 E OP*	*2.47*
924951	*AB2-150 C OP*	*1.45*
924952	*AB2-150 E OP*	*2.37*
924961	*AB2-152*	*15.85*
925051	*AB2-160 C OP*	*4.05*
925052	*AB2-160 E OP*	*6.61*
925061	*AB2-161 C OP*	*2.37*
925062	*AB2-161 E OP*	*3.87*
925121	*AB2-169 C OP*	*2.01*
925122	*AB2-169 E OP*	*1.8*
925141	*AB2-171 C OP*	*1.75*
925142	*AB2-171 E OP*	*2.85*
925171	*AB2-174 C OP*	*3.49*
925172	*AB2-174 E OP*	*3.16*
925281	*AB2-186 C*	*0.18*
925282	*AB2-186 E*	*0.08*
925291	*AB2-188 C OP*	*0.73*
925292	*AB2-188 E OP*	*0.33*
925331	*AB2-190 C*	*14.6*
925332	*AB2-190 E*	*3.65*