

**BEFORE THE
NORTH CAROLINA UTILITIES COMMISSION
RALEIGH, NORTH CAROLINA**

**CHERRY SOLAR, LLC
DOCKET NO. EMP-115, SUB 0**

**PRE-FILED SUPPLEMENTAL TESTIMONY
OF
LINDA NWADIKE**

March 10, 2021

INTRODUCTION

Q. PLEASE STATE YOUR NAME, TITLE, AND BUSINESS ADDRESS.

A. My name is Linda Nwadike. I am the Director of Permitting and Community Relations for SunEnergy1, LLC ("SunEnergy1" or the "Company"), the parent and an affiliate of the Applicant Cherry Solar, LLC ("Cherry Solar"). Cherry Solar is a North Carolina limited liability company that was formed on September 24, 2020. My business address is 192 Raceway Drive, Mooresville, North Carolina 28117.

Q1. Are there any network upgrades to DENC's or any affected system's transmission system required to accommodate the operation of the Applicant's proposed facility? If so, provide the amount of network upgrades on DENC's or any affected system's transmission system, if any, required to accommodate the operation of the Applicant's proposed facility.

A. PJM queue AC1-086 has six network upgrades for Dominion system reinforcements in Virginia and North Carolina, for which this generation project has been allocated a cost responsibility of \$2,676,883.

The system reinforcements are as follows:

- i. Uprate/rebuild 1.28 miles of the Lakeview-Carolina 230kV line 2141
- ii. Replace a wave trap at Chickahominy substation for Chickahominy-Elmont 500kV line #557
- iii. Replace a wave trap at North Anna Substation for Midlothian-North Anna 500kV line #576
- iv. Install a second, back to back breaker between existing line positions #241

1 and #2141 at the Lakeview substation

2 v. Replace the Elmont-Ladysmith 500kV line #574 wavetraps

3 vi. Replace Battleboro substation terminal equipment.

4 **Q2. If there are any required system upgrades does the Applicant have Levelized**
5 **Cost of Transmission (LCOT) information for the system upgrades? If so,**
6 **provide the LCOT information for any required transmission system**
7 **upgrades or modifications.**

8 A. Please see Exhibit 1

9 **Q3. Is there any interconnection study available for the proposed facility? If so,**
10 **provide any interconnection study received for the proposed facility. If the**
11 **Applicant has not received a study, provide a date by when the study is**
12 **expected to be completed.**

13 A. AC1-086 System Impact Study, Facilities Study and Feasibility Study are each
14 attached as Exhibits 2, 3 & 4, respectively.

15 **Q4. Is the Applicant aware of any system other than the studied system that is or**
16 **will be affected by the interconnection? If yes, explain the impact and basis.**

17 A. PJM Queue AC1-086 has completed the PJM study process and a PJM ISA has
18 been tendered. The PJM System Impact Study identified a contribution to a
19 previously identified overload on the Battleboro – Rocky Mount 115kV tie line.
20 The PJM Facilities Study Agreement required the Applicant to enter into an
21 Affected System Facilities Study with DEP. PJM's ISA does not require the
22 Applicant to resolve this affected system overload. The ISA recites that the AC1-
23 086 generation output may be curtailed until this overload is resolved.

1 DEP has issued a Generator Interconnection Affected System Study Report
2 identifying five PJM AC1 queue projects as needing to resolve the overload on
3 the Battleboro – Rocky Mount 115kV line. The AC1-086 queue is one of the five
4 identified PJM queue projects. Although the AC1-086 project benefits from the
5 resolution of the Battleboro – Rocky Mount 115kV line rebuild, the AC1-086
6 project does not trigger the need for this work. PJM System Impact restudies
7 identify this overload as existing prior to the studies for the AC1-034 queue,
8 which was the first project identified in the DEP report. The DEP report does not
9 identify the loading on the Battleboro – Rocky Mount 115kV line prior to the
10 PJM AC1 queue. See Exhibit 5

11 **Q5. Is the Applicant proposing to sell energy and capacity from the facility to a**
12 **distribution utility regulated by the Commission? If so, provide a discussion**
13 **of how the facility's output conforms to or varies from the regulated utility's**
14 **most recent IRP.**

15 A. No, the Applicant does not propose to sell energy or capacity from the facility to a
16 distribution utility regulated by this Commission.

17 **Q6. Is the Applicant proposing to sell energy and capacity from the proposed**
18 **facility to a distribution utility not regulated by the Commission but serving**
19 **retail customers in North Carolina (e.g. co-op or muni)? If so, discuss how**
20 **the facility's output conforms to or varies from the purchasing distribution**
21 **utility's long-range resource plan.**

1 A. No, the Applicant does not propose to sell energy or capacity from the facility to a
2 distribution utility that is not regulated by this Commission but serves retail
3 customers in North Carolina.

4 **Q7. Is the Applicant proposing to sell energy and capacity from the**
5 **proposed facility to a purchaser who is subject to a statutory or regulatory**
6 **mandate with respect to its energy sourcing (e.g., a REPS requirement or**
7 **Virginia's new statutory mandate for renewables)? If so, explain how, if at,**
8 **the proposed facility will assist or enable compliance with the mandate. In**
9 **addition, provide any contracts that support that compliance.**

10 A. No, the Applicant is not proposing to sell energy or capacity from the proposed
11 facility to a purchaser who is subject to a statutory mandate with respect to its
12 energy sourcing.

13 **Q8. Does the Applicant have an PPA agreements, REC sale contracts, or**
14 **contracts for compensation for environmental attributes for the output of the**
15 **proposed facility? If so, provide any PPA agreements, REC sale contracts, or**
16 **contracts for compensation for environmental attributes for the output of the**
17 **facility.**

18 A. The Applicant has a PPA agreement. A copy of the body of that PPA agreement is
19 attached as Exhibit 6.

20 **Q. DOES THIS CONCLUDE YOUR SUPPLEMENTAL TESTIMONY?**

21 A. Yes.

22
23
24
25

STATE OF NORTH CAROLINA
COUNTY OF IREDELL

VERIFICATION

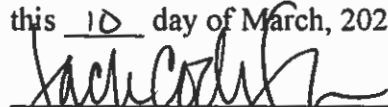
I, Linda Nwadike, being first duly sworn, depose and say that I am duly authorized to act on behalf of Cherry Solar, LLC as Director of Permitting and Community Relations for SunEnergy1, LLC, the parent and an affiliate of the Petitioner; that I have read the foregoing Pre-Filed Supplemental Testimony and that the same is true and accurate to my personal knowledge and belief except where otherwise indicated, and in those instances, I believe my answers to be true.

This 10 day of March, 2021.



Linda Nwadike
SunEnergy1, LLC

Sworn to and subscribed to before me
this 10 day of March, 2021.


Notary Public (Signature)

Jacob Cody Jannise
Notary Public (Printed)



My Commission Expires: March 16, 2024

PUBLIC-REDACTED

EXHIBIT 1

EXHIBIT 2

***Generation Interconnection
System Impact Study Report***

For

***PJM Generation Interconnection Request
Queue Position AC1-086***

***Thelma 230kV
123.7MW Capacity / 180MW Energy***

January 2018

Revised August 2020

Introduction

This System Impact Study (SIS) has been prepared in accordance with the PJM Open Access Transmission Tariff, Section 205, as well as the System Impact Study Agreement between Gaston Green Acres Solar, LLC, the Interconnection Customer (IC) and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company (VEPCO).

Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the IC. As a requirement for interconnection, the IC may be responsible for the cost of constructing Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

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

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

General

The IC has proposed a solar generating facility located in Gaston, NC (Northampton County). The installed facilities will have a total capability of 300 MW with 207.7 MW of this output being recognized by PJM as capacity. This queue request is for an additional 180 MW with 123.7 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is 12/31/2017. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AC1-086 will interconnect with the ITO transmission system via a tap into Thelma 230kV substation.

Cost Summary

The AC1-086 interconnection request will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$ 0
Direct Connection Network Upgrades	\$ 0
Non Direct Connection Network Upgrades	\$ 0
Allocation for New System Upgrades	\$ 2,653,570
Contribution for Previously Identified Upgrades	\$ 23,313
Total Costs	\$ 2,676,883

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

Attachment Facilities

The scope identified in queue AB1-132 is sufficient to accommodate this queue request from an Attachment Facilities and Thelma substation expansion perspective. The single line is shown below in Attachment 1.

Interconnection Customer Requirements

ITO's Facility Interconnection Requirements as posted on PJM's website

<http://www.pjm.com/~media/planning/plan-standards/private-dominion/facility-connection-requirements1.ashx>

An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

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

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

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

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

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

Revenue Metering and SCADA Requirements

PJM Requirements

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

Interconnected Transmission Owner Requirements

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

Network Impacts

The Queue Project AC1-086 was evaluated as a 180.0 MW (Capacity 123.7 MW) injection at Thelma 230kV substation in the ITO area. Project AC1-086 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-086 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
57602	CONTINGENCY '57602' /*NORTH ANNA OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /*MIDLOTHIAN TO NORTH ANNA (LINE 576) OPEN BRANCH FROM BUS 314914 TO BUS 314322 CKT 1 /*MIDLOTHIAN 500-230 (TX#2) OPEN BRANCH FROM BUS 314918 TO BUS 314232 CKT 1 /*NORTH ANNA 500-230 (TX#5) END
239T2141	CONTINGENCY '239T2141' /* LAKEVIEW OPEN BRANCH FROM BUS 314583 TO BUS 314579 CKT 1 /* 239 OPEN BRANCH FROM BUS 314579 TO BUS 314605 CKT 1 /* 2057 OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141 END
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

254T2141_A	CONTINGENCY '254T2141_A' /* LAKEVIEW OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141 OPEN BRANCH FROM BUS 314583 TO BUS 924510 CKT 1 /* 254 END
557T574	CONTINGENCY '557T574' /* ELMONT OPEN BRANCH FROM BUS 314908 TO BUS 314903 CKT 1 /*ELMONT TO CHICKAHOMINY (LINE 557) OPEN BRANCH FROM BUS 314903 TO BUS 314214 CKT 1 /*CHICKAHOMINY 500-230 (TX#1) OPEN BRANCH FROM BUS 314911 TO BUS 314908 CKT 1 /*ELMONT TO LADYSMITH (LINE 574) END
562T563	CONTINGENCY '562T563' /*CARSON OPEN BRANCH FROM BUS 314902 TO BUS 314923 CKT 1 /*CARSON TO MIDLOTHIAN OPEN BRANCH FROM BUS 314914 TO BUS 314902 CKT 1 /*CARSON 500.00 - 8SEPTA 500.00 END
563T576	CONTINGENCY '563T576' /*MIDLOTHIAN OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /*MIDLOTHIAN TO NORTH ANNA (LINE 576) OPEN BRANCH FROM BUS 314914 TO BUS 314322 CKT 1 /*MIDLOTHIAN 500-230 (TX#2) OPEN BRANCH FROM BUS 314914 TO BUS 314902 CKT 1 /*MIDLOTHIAN TO CARSON (LINE 563) END
BASIN 230 B#2	CONTINGENCY 'BASIN 230 B#2' /* OPEN BRANCH FROM BUS 314276 TO BUS 314339 CKT 1 OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 OPEN BRANCH FROM BUS 314276 TO BUS 314274 CKT 2 END
LN 2012	CONTINGENCY 'LN 2012' OPEN BRANCH FROM BUS 314266 TO BUS 314569 CKT 1 /* 6NORTHAMPTON230.00 - 6EARLEYS 230.00 OPEN BRANCH FROM BUS 314266 TO BUS 314599 CKT 1 /* 6NORTHAMPTON230.00 - 6ROA VAL 230.00

	OPEN BUS 314266 /* ISLAND 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 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 213	CONTINGENCY 'LN 213' OPEN BRANCH FROM BUS 314583 TO BUS 314611 CKT 1 /* 6LAKEVIEW 230.00 - 6THELMA 230.00 END
LN 2131A	CONTINGENCY 'LN 2131A' OPEN BRANCH FROM BUS 314662 TO BUS 916040 CKT 1 /* 6S HERTFORD 230.00 - Z1-036 TAP 230.00 OPEN BRANCH FROM BUS 314651 TO BUS 314662 CKT 1 /* 6WINFALL 230.00 - 6S HERTFORD 230.00 OPEN BUS 314662 /* ISLAND END

LN 225	CONTINGENCY 'LN 225' OPEN BRANCH FROM BUS 314583 TO BUS 314611 CKT 2 6LAKEVIEW 230.00 - 6THELMA 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 254_A	CONTINGENCY 'LN 254_A' OPEN BRANCH FROM BUS 314563 TO BUS 924510 CKT 1 6CLUBHSE 230.00 - AB2-100 TAP 230.00 /* END
LN 259	CONTINGENCY 'LN 259' OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 6BASIN 230.00 - 6CHSTF B 230.00 /* END
LN 259-2065	CONTINGENCY 'LN 259-2065' OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 6BASIN 230.00 - 6CHSTF B 230.00 /* OPEN BRANCH FROM BUS 314276 TO BUS 314339 CKT 1 6BASIN 230.00 - 6SPRUNCE 230.00 /* END
LN 54-2012_A	CONTINGENCY 'LN 54-2012_A' OPEN BRANCH FROM BUS 314559 TO BUS 921751 CKT 1 3CAROLNA 115.00 - AA2-053 TAP 115.00 /* OPEN BRANCH FROM BUS 314568 TO BUS 314625 CKT 1 3EARLEYS 115.00 - 3AULANDR 115.00 /* OPEN BRANCH FROM BUS 314581 TO BUS 314626 CKT 1 3JACKSON 115.00 - 3WOODLND 115.00 /* OPEN BRANCH FROM BUS 314625 TO BUS 314626 CKT 1 3AULANDR 115.00 - 3WOODLND 115.00 /* OPEN BUS 314581 /* ISLAND

	OPEN BUS 314625 /* ISLAND OPEN BUS 314626 /* ISLAND OPEN BRANCH FROM BUS 314266 TO BUS 314569 CKT 1 /* 6NORTHAMPTON230.00 - 6EARLEYS 230.00 OPEN BRANCH FROM BUS 314266 TO BUS 314599 CKT 1 /* 6NORTHAMPTON230.00 - 6ROA VAL 230.00 OPEN BUS 314266 /* ISLAND END
LN 54-2012_B	CONTINGENCY 'LN 54-2012_B' OPEN BRANCH FROM BUS 921751 TO BUS 314581 CKT 1 /* AA2- 053 TAP 115.00 - 3JACKSON 115.00 OPEN BRANCH FROM BUS 314568 TO BUS 314625 CKT 1 /* 3EARLEYS 115.00 - 3AULANDR 115.00 OPEN BRANCH FROM BUS 314581 TO BUS 314626 CKT 1 /* 3JACKSON 115.00 - 3WOODLND 115.00 OPEN BRANCH FROM BUS 314625 TO BUS 314626 CKT 1 /* 3AULANDR 115.00 - 3WOODLND 115.00 OPEN BUS 314581 /* ISLAND OPEN BUS 314625 /* ISLAND OPEN BUS 314626 /* ISLAND OPEN BRANCH FROM BUS 314266 TO BUS 314569 CKT 1 /* 6NORTHAMPTON230.00 - 6EARLEYS 230.00 OPEN BRANCH FROM BUS 314266 TO BUS 314599 CKT 1 /* 6NORTHAMPTON230.00 - 6ROA VAL 230.00 OPEN BUS 314266 /* ISLAND END
LN 557	CONTINGENCY 'LN 557' OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM 230.00 - 8CHCKAHM 500.00 OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM 500.00 - 8ELMONT 500.00 END
LN 563	CONTINGENCY 'LN 563' OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00

	END
LN 573	CONTINGENCY 'LN 573' OPEN BRANCH FROM BUS 314918 TO BUS 314934 CKT 1 /* 8NO ANNA 500.00 - 8SPOTSYL 500.00 END
LN 574	CONTINGENCY 'LN 574' OPEN BRANCH FROM BUS 314908 TO BUS 314911 CKT 1 /* 8ELMONT 500.00 - 8LDYSMTH 500.00 END
LN 576	CONTINGENCY 'LN 576' OPEN BRANCH FROM BUS 314322 TO BUS 314914 CKT 1 /* 6MDLTHAN 230.00 - 8MDLTHAN 500.00 OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 END
LN 594	CONTINGENCY 'LN 594' OPEN BRANCH FROM BUS 314916 TO BUS 314934 CKT 1 /* 8MORRSVL 500.00 - 8SPOTSYL 500.00 END
T672B	CONTINGENCY 'T672B' /* _ BASIN OPEN BRANCH FROM BUS 314276 TO BUS 314260 CKT 1 /*L284 BASIN VARINA OPEN BRANCH FROM BUS 314275 TO BUS 314276 CKT 1 /*L2055 BASIN BELLMEADE REMOVE MACHINE 1 FROM BUS 315053 /*BELMEADE GEN CT-1 REMOVE MACHINE 2 FROM BUS 315054 /*BELMEADE GEN CT-2 REMOVE MACHINE 3 FROM BUS 315055 /*BELMEADE GEN ST OPEN BRANCH FROM BUS 314274 TO BUS 314276 CKT 1 /*BASIN TX5 OPEN BRANCH FROM BUS 314274 TO BUS 314276 CKT 2 /*BASIN TX6 OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /*L259 BASIN CHESTERFIELD

	OPEN BRANCH FROM BUS 314276 TO BUS 314339 CKT 1 BASIN SPRUANCE NUG END	/*L2065
WT576	CONTINGENCY 'WT576' OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /*MIDLOTHIAN TO NORTH ANNA (LINE 576) OPEN BRANCH FROM BUS 314914 TO BUS 314322 CKT 1 /*MIDLOTHIAN 500-230 (TX#2) OPEN BRANCH FROM BUS 314918 TO BUS 314232 CKT 2 /*NORTH ANNA 500-230 (TX#6) END	/*NORTH ANNA

Summer Peak Analysis – 2020

Generator Deliverability

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

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Flowgate Appendix
	Type	Name			From	To	Ckt		Initial	Final	Type	MVA		
1	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	AC	98.16	100.39	ER	375	8.39	
2	N-1	LN 576	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	AC	95.82	97.89	ER	375	7.78	
3	N-1	LN 254_A	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	AC	80.68	100.83	ER	375	76.05	1
5	N-1	LN 576	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	56.06	57.02	ER	2442	27.98	3
6	N-1	LN 576	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	96.73	97.86	ER	2442	32.32	4
7	N-1	LN 563	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	86.7	87.64	ER	2442	27.04	
8	N-1	LN 2012	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	90.36	103.98	ER	375	52.62	

Multiple Facility Contingency

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

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Flowgate Appendix
	Type	Name			From	To	Ckt		Initial	Final	Type	MVA		
9	LFFB	562T563	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	98.81	100.92		459	11.43	
10	LFFB	T672B	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	97.49	99.76		459	12.26	
11	DCTL	LN 259-2065	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	96.53	98.78		459	12.18	
12	BUS	BASIN 230 B#2	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	96.27	98.53		459	12.2	
13	LFFB	562T563	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	98.83	100.95		459	11.43	
14	LFFB	T672B	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	97.52	99.79		459	12.26	
15	DCTL	LN 259-2065	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	96.56	98.81		459	12.18	
16	BUS	BASIN 230 B#2	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	96.3	98.56		459	12.2	
17	LFFB	562T563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	AC	99.87	102.27		549	15.52	5
18	LFFB	246T2034_A	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	AC	82.78	93.84		637	70.47	6
19	DCTL	LN 54-2012_B	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	AC	83	94.76		637	74.33	

20	LFFB	254T2141_A	DVP - DVP	6HORNRTN-6HATHAWAY 230 kV line	314579	313845	1	AC	86.56	120.17		541	179.64	7
21	LFFB	239T2141	DVP - DVP	6LAKEVEW-AB2-100 TAP 230 kV line	314583	924510	1	AC	75.44	112.86		459	179.8	8
22	LFFB	246T2034_A	DVP - DVP	6LAKEVEW-AB2-100 TAP 230 kV line	314583	924510	1	AC	79.79	94.9		459	71.96	
23	DCTL	LN 54-2012_B	DVP - DVP	6LAKEVEW-AB2-100 TAP 230 kV line	314583	924510	1	AC	80.7	97.04		459	77.52	
24	DCTL	LN 54-2012_A	DVP - DVP	6LAKEVEW-AB2-100 TAP 230 kV line	314583	924510	1	AC	77.35	93.69		459	77.52	
25	LFFB	57602	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	80.84	82.04		3351	47.03	
26	LFFB	WT576	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	80.84	82.04		3351	47.03	
27	LFFB	563T576	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	80.74	81.94		3351	47.03	
28	LFFB	557T574	DVP - DVP	8MDLTHAN-8NO ANNA 500 kV line	314914	314918	1	AC	76.28	77.62		3144	48.08	9
29	LFFB	239T2141	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	95.62	133.54		459	179.8	10
30	LFFB	246T2034_A	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	93.05	108.34		459	71.96	
31	DCTL	LN 54-2012_B	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	94.39	110.98		459	77.52	
32	DCTL	LN 54-2012_A	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	90.98	107.54		459	77.52	

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

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

None

Contribution to Previously Identified Overloads

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

#	Contingency		Affected Area	Facility Description	Bus		Ckt	Power Flow	Loading %		Rating		MW Contribution	Flowgate Appendix
	Type	Name			From	To			Initial	Final	Type	MVA		
33	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	AC	101.53	103.9		459	12.78	11
34	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	112.66	115.02		459	12.78	12
35	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	112.17	114.4	ER	375	8.39	
36	N-1	LN 576	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	109.55	111.63	ER	375	7.78	
37	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	112.69	115.05		459	12.78	13
38	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	111.85	114.08	ER	375	8.39	
39	N-1	LN 576	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	109.58	111.66	ER	375	7.78	
40	DCTL	LN 2058-2181	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	AC	137.04	149.69	ER	164	21.59	14

Steady-State Voltage Requirements

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

None

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

No mitigations were found to be required.

New System Reinforcements

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

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AC1-086 Allocation															
# 3	6LAKEVEW-6CAROLNA 230 kV line	Uprate/rebuild approximately 1.28 miles of the Lakeview - Carolina 230 kV Line # 2141 to increase the line rating 1047 MVA (normal), 1047 MVA (emergency), and 1047 MVA (load dump). Estimated time 18 - 20 months. <table><tr><th>Queue</th><th>Impact (MW)</th><th>Cost</th></tr><tr><td>AC1-034</td><td>5.95</td><td>\$50,487</td></tr><tr><td>AC1-086</td><td>76.04</td><td>\$645,218</td></tr></table>	Queue	Impact (MW)	Cost	AC1-034	5.95	\$50,487	AC1-086	76.04	\$645,218	n6052	\$695,705	\$645,218						
Queue	Impact (MW)	Cost																		
AC1-034	5.95	\$50,487																		
AC1-086	76.04	\$645,218																		
# 17	6CHSTF B-6BASIN 230 kV line	Rebuild 0.14 miles of the Chesterfield to Basin 230kV line to increase its line rating to 706 MVA (normal), 706 MVA (emergency), and 812 MVA (load dump). This project is in-service	b2990	\$350,000	\$0															
# 5	8CHCKAHM-8ELMONT 500 kV line	Replace wave trap at Chickahominy Substation. This will increase emergency rating to 3424 MVA (normal and emergency) and 3937 MVA load dump. <table><tr><th>Queue</th><th>Impact (MW)</th><th>Cost</th></tr><tr><td>AC1-086</td><td>27.98</td><td>\$12,830</td></tr><tr><td>AC1-107</td><td>934.51</td><td>\$428,509</td></tr><tr><td>AC1-161</td><td>59.9</td><td>\$27,466</td></tr><tr><td>AC1-164</td><td>68.03</td><td>\$31,194</td></tr></table>	Queue	Impact (MW)	Cost	AC1-086	27.98	\$12,830	AC1-107	934.51	\$428,509	AC1-161	59.9	\$27,466	AC1-164	68.03	\$31,194	n5464	\$500,000	\$12,830
Queue	Impact (MW)	Cost																		
AC1-086	27.98	\$12,830																		
AC1-107	934.51	\$428,509																		
AC1-161	59.9	\$27,466																		
AC1-164	68.03	\$31,194																		

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AC1-086 Allocation																		
# 28	8MDLTHAN-8NO ANNA 500 kV line	Replace wave trap at North Anna Substation for Midlothian – North Anna 500 kV line #576. This will increase emergency rating to 3424 MVA. Estimated to 12-16 months to engineer and construct. <table><tr><th>Queue</th><th>Impact (MW)</th><th>Cost</th></tr><tr><td>AC1-086</td><td>33.04</td><td>\$11,572</td></tr><tr><td>AC1-107</td><td>505.6</td><td>\$177,075</td></tr><tr><td>AC1-161</td><td>77.47</td><td>\$27,132</td></tr><tr><td>AC1-164</td><td>77.54</td><td>\$27,157</td></tr><tr><td>AC1-189</td><td>20.17</td><td>\$7,064</td></tr></table>	Queue	Impact (MW)	Cost	AC1-086	33.04	\$11,572	AC1-107	505.6	\$177,075	AC1-161	77.47	\$27,132	AC1-164	77.54	\$27,157	AC1-189	20.17	\$7,064	n6055	\$250,000	\$11,572
Queue	Impact (MW)	Cost																					
AC1-086	33.04	\$11,572																					
AC1-107	505.6	\$177,075																					
AC1-161	77.47	\$27,132																					
AC1-164	77.54	\$27,157																					
AC1-189	20.17	\$7,064																					
# 8, 21-24, 29 - 32	AB2-100 TAP-6CLUBHSE 230 kV line	Rebuild the Lakeview - Clubhouse 230kV line #254 to increase its line rating to 1047 MVA (normal), 1047 MVA (emergency), and 1204 MVA (load dump). Target in-service date is 12/31/2024. A sensitivity study has been run for Queue Project AC1-086 due to the deactivation of the Roanoke Valley 1 and Roanoke Valley 2 facilities and it has been determined that this upgrade is no longer required for this project.	b3121	\$27,000,000	\$0																		
# 18 – 19	6CLUBHSE-6SAPONY 230 kV line	Replace wave trap at Clubhouse Substation. This will increase emergency rating to 722 MVA. Estimated time 12-16 months to engineer and construct. A sensitivity study has been run for Queue Project AC1-086 due to the deactivation of the Roanoke Valley 1 and Roanoke Valley 2 facilities and it has been determined that this upgrade is no longer required for this project.	n6051	\$150,000	\$0																		

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AC1-086 Allocation															
# 20	6HORNRTN-6HATHAWAY 230 kV line	Install a second, back-to-back breaker between existing line positions #241 and #2141 at the Lakeview substation. Estimated 14-24 months to complete. <table><tr><th>Queue</th><th>Impact (MW)</th><th>Cost</th></tr><tr><td>AC1-086</td><td>107.8</td><td>\$1,955,282</td></tr></table>	Queue	Impact (MW)	Cost	AC1-086	107.8	\$1,955,282	n6220	\$1,955,282	\$1,955,282									
Queue	Impact (MW)	Cost																		
AC1-086	107.8	\$1,955,282																		
# 6 – 7, 25 - 27	8ELMONT-8LDYSMTH 500 kV line	Replace the Elmont – Ladysmith 500kV line #557 wavetraps. This work is estimated to take 20-24 months to complete based on typical permitting parameters. Project will increase the line’s rating up to 2913 MVA (normal), 2913 MVA (emergency), and 3351 MVA (load dump) <table><tr><th>Queue</th><th>Impact (MW)</th><th>Cost</th></tr><tr><td>AC1-086</td><td>32.32</td><td>\$28,668</td></tr><tr><td>AC1-107</td><td>627.76</td><td>\$556,821</td></tr><tr><td>AC1-161</td><td>53.83</td><td>\$47,747</td></tr><tr><td>AC1-164</td><td>75.27</td><td>\$66,764</td></tr></table>	Queue	Impact (MW)	Cost	AC1-086	32.32	\$28,668	AC1-107	627.76	\$556,821	AC1-161	53.83	\$47,747	AC1-164	75.27	\$66,764	n5483	\$700,000	\$28,668
Queue	Impact (MW)	Cost																		
AC1-086	32.32	\$28,668																		
AC1-107	627.76	\$556,821																		
AC1-161	53.83	\$47,747																		
AC1-164	75.27	\$66,764																		
Total New Network Upgrades					\$2,653,570															

Contribution to Previously Identified System Reinforcements

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

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AC1-086 Allocation																		
# 1 – 2, 33 - 36	6CHARCTY- 6LAKESD 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line. b2745 went into service on 05/26/2020	b2745	\$41,500,000	\$0																		
# 9 - 12	6MESSER- 6CHARCTY 230 kV line																						
# 13 – 16, 37 - 39	6CHSTF B-6MESSER 230 kV line																						
# 40	3BTLEBRO- 3ROCKYMT115T 115 kV line	Replace Battleboro substation terminal equipment. Note: Duke/Progress Energy portion of this line will need to be studied under Duke’s FERC tariff process. <table><tr><th>Queue</th><th>Impact (MW)</th><th>Cost</th></tr><tr><td>AC1-034</td><td>27.15</td><td>\$29,316</td></tr><tr><td>AC1-086</td><td>21.59</td><td>\$23,313</td></tr><tr><td>AC1-099</td><td>17.44</td><td>\$18,832</td></tr><tr><td>AC1-189</td><td>7.90</td><td>\$8,530</td></tr><tr><td>AC1-208</td><td>18.53</td><td>\$20,009</td></tr></table>	Queue	Impact (MW)	Cost	AC1-034	27.15	\$29,316	AC1-086	21.59	\$23,313	AC1-099	17.44	\$18,832	AC1-189	7.90	\$8,530	AC1-208	18.53	\$20,009	n6118	\$100,000	\$23,313
Queue	Impact (MW)	Cost																					
AC1-034	27.15	\$29,316																					
AC1-086	21.59	\$23,313																					
AC1-099	17.44	\$18,832																					
AC1-189	7.90	\$8,530																					
AC1-208	18.53	\$20,009																					
Total New Network Upgrades					\$23,313																		

Potential Congestion due to Local Energy Deliverability

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

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

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contr
	Type	Name			From	To	Ckt		Initial	Final	Type	MVA	
41	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	AC	104.05	106.81	ER	375	12.2
42	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	AC	117.67	120.44	ER	375	12.2
43	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	AC	117.71	120.47	ER	375	12.2
44	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	AC	110.07	112.9	ER	449	14.98
45	N-1	LN 254_A	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	AC	105.13	111.7	ER	183	15.86
46	N-1	LN 2012	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	AC	82.93	95.12	ER	599	72.61
47	N-1	LN 2131A	DVP - DVP	6EARLEYS-6NUCO TP 230 kV line	314569	314575	1	AC	85.59	90.84	ER	572	35.07
48	N-1	LN 2012	DVP - DVP	6HORNRTN-6HATHAWAY 230 kV line	314579	313845	1	AC	90.14	104.43	ER	442	64.67
49	N-1	LN 254_A	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	AC	95.09	124.52	ER	375	110.66
50	N-1	LN 2012	DVP - DVP	6LAKEVEW-AB2-100 TAP 230 kV line	314583	924510	1	AC	94.72	114.52	ER	375	76.57
51	N-1	LN 238	DVP - DVP	6ROA VAL-6NORTHAMPTON 230 kV line	314599	314266	1	AC	89.3	101.64	ER	548	67.39
52	N-1	LN 225	DVP - DVP	6THELMA-6LAKEVEW 230 kV line	314611	314583	1	AC	76.64	117.01	ER	442	179.8
53	N-1	LN 213	DVP - DVP	6THELMA-6LAKEVEW 230 kV line	314611	314583	2	AC	94.91	144.86	ER	357	179.8
54	N-1	LN 557	DVP - DVP	8CARSON-8MDLTHAN 500 kV line	314902	314914	1	AC	84.14	85.67	ER	2442	42.38
55	N-1	LN 576	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	71.96	73.36	ER	2442	40.71
56	N-1	LN 594	DVP - DVP	8CHANCE-8BRISTER 500 kV line	314905	314900	1	AC	95.86	96.87	ER	2442	28.52
57	N-1	LN 576	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	110.79	112.44	ER	2442	47.03
58	Non	Non	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	76.55	77.54	NR	2442	28.52
59	N-1	LN 573	DVP - DVP	8LDYSMTH-8CHANCE 500 kV line	314911	314905	1	AC	90.28	91.19	ER	2738	28.88
60	N-1	LN 594	DVP - DVP	8LDYSMTH-8POSSUM 500 kV line	314911	314922	1	AC	90.81	91.71	ER	2442	25.41
61	N-1	LN 574	DVP - DVP	8MDLTHAN-8NO ANNA 500 kV line	314914	314918	1	AC	88.82	90.4	ER	2442	45.06
62	N-1	LN 2012	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	111.29	131.35	ER	375	76.57
63	Non	Non	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	83.46	99.17	NR	375	60.94

Light Load Analysis in 2020

Not required

ITO Analysis

ITO assessed the impact of the proposed Queue Project #AC1-086 interconnection of 180 MW of energy (Capacity 123.7 MW) for compliance with reliability criteria on ITO's Transmission System. The system was assessed using the summer 2020 RTEP case provided to ITO by PJM. When performing a generation analysis, ITO's main analysis will be load flow study results under single contingency and multiple facility contingency (both normal and stressed system conditions). ITO Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. A full listing of ITO's Planning Criteria and interconnection requirements can be found in the ITO's Facility Connection Requirements which are publicly available at: <http://www.dom.com>.

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

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

Category B Analysis (Single Contingency):

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

Category C Analysis: (Multiple Facility Contingency)

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

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

Table A: Import Study Results

Import Study Results			
Area	Summer 2020	Summer 2020 with AC1-086	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 AC1-086	Limiting Element
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

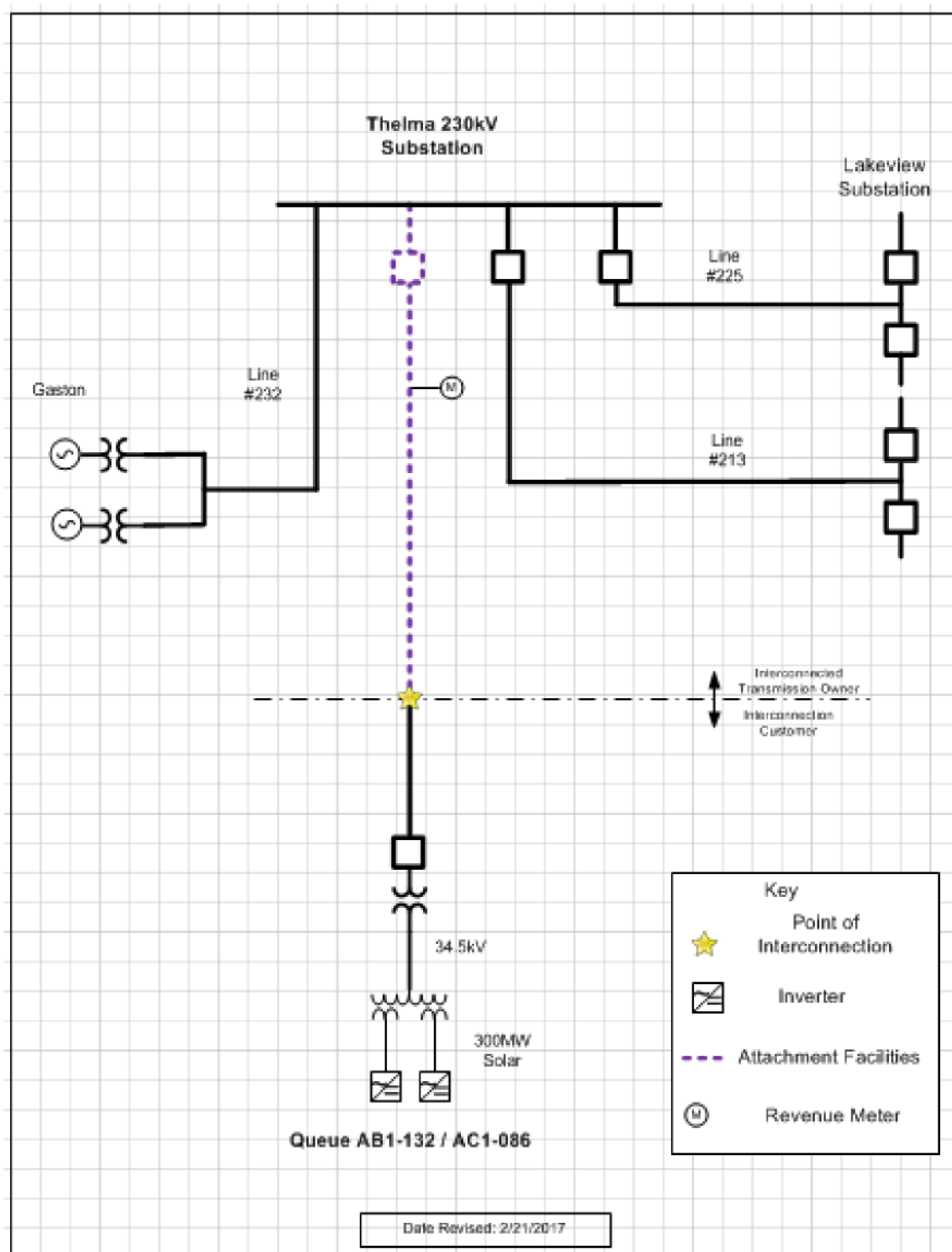
ITO's Planning Criteria indicates a need to have approximately 2000 MW of import and export capability. The results of these import and export studies indicate that the proposed AC1-086 (Transfer) will not impact ITO's import or export capability

Affected System Analysis & Mitigation

Duke Energy:

Enter into an Affected System Facilities Study agreement with Duke / Progress Energy (DEP) to determine how to mitigate Battleboro - Rocky Mt. 115kV overload. The upgrade will likely be a complete reconductor, probably replacing structures. The estimated cost \$15 million with an estimated duration of 36 months.

Attachment 1. System Configuration



Appendices

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

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

Appendix 1

(DVP - DVP) The 6LAKEVEW-6CAROLNA 230 kV line (from bus 314583 to bus 314561 ckt 1) loads from 80.68% to 100.83% (AC power flow) of its emergency rating (375 MVA) for the single line contingency outage of 'LN 254_A'. This project contributes approximately 76.05 MW to the thermal violation.

CONTINGENCY 'LN 254_A'

OPEN BRANCH FROM BUS 314563 TO BUS 924510 CKT 1

/* 6CLUBHSE

230.00 - AB2-100 TAP 230.00

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315131	1EDGECEMA	1.89
315132	1EDGECEMB	1.89
315139	1GASTONA	12.12
315141	1GASTONB	12.12
315136	1ROSEMG1	7.92
315138	1ROSEMG2	3.71
315137	1ROSEMS1	4.92
917341	Z2-044 C	0.13
917511	Z2-088 C OP1	0.37
918411	AA1-050	0.31
922922	AB1-081 C OP	7.8
923262	AB1-132 C OP	51.64
924151	AB2-059 C	9.19
924511	AB2-100 C	41.19
926331	AC1-034 C	5.95
926851	AC1-086 C	76.05

Appendix 3

(DVP - DVP) The 8CHCKAHM-8ELMONT 500 kV line (from bus 314903 to bus 314908 ckt 1) loads from 56.06% to 57.02% (AC power flow) of its emergency rating (2442 MVA) for the single line contingency outage of 'LN 576'. This project contributes approximately 27.98 MW to the thermal violation.

CONTINGENCY 'LN 576'

OPEN BRANCH FROM BUS 314322 TO BUS 314914 CKT 1 /* 6MDLTHAN
230.00 - 8MDLTHAN 500.00

OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN
500.00 - 8NO ANNA 500.00

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315099	1CHESPKB	2.2
315108	1ELIZAR1	6.46
315109	1ELIZAR2	6.35
315110	1ELIZAR3	6.54
315233	1SURRY 2	58.85
315091	1YORKTN2	55.82
315092	1YORKTN3	47.96
314421	6WINCHST	0.27
315074	CIR_AB2-152	12.6
916191	Z1-068 C	0.09
921162	AA1-063AC	11.34
921752	AA2-053 C	11.82
921762	AA2-057 C	9.27
921982	AA2-088 C	8.67
922442	AA2-165 C	1.26
922512	AA2-174 C	0.54
922532	AA2-178 C	15.74

922682	AB1-027 C	2.42
922922	AB1-081 C OP	11.29
923262	AB1-132 C OP	19.
923572	AB1-173 C OP	2.96
923582	AB1-173AC OP	2.96
923801	AB2-015 C OP	15.64
923831	AB2-022 C	4.11
923841	AB2-024 C	4.1
923851	AB2-025 C	3.24
923911	AB2-031 C OP	2.94
923991	AB2-040 C OP	9.66
924021	AB2-043 C OP	3.28
924151	AB2-059 C	13.3
924161	AB2-060 C	9.39
924241	AB2-068 OP	619.11
924321	AB2-079 C OP	6.25
924491	AB2-098 C	0.78
924501	AB2-099 C	0.85
924511	AB2-100 C	15.34
924811	AB2-134 C OP	19.08
925051	AB2-160 C OP	6.37
925061	AB2-161 C OP	5.24
925171	AB2-174 C OI	9.22
925281	AB2-186 C	1.02
925331	AB2-190 C	30.32
926261	AC1-027 C	3.68

926331	ACI-034 C	8.62
926531	ACI-054 C OP	8.51
926591	ACI-060	0.1
926601	ACI-061	0.04
926621	ACI-063	0.62
926641	ACI-065 C	5.37
926851	ACI-086 C	27.98
926981	ACI-099 C	11.11
927041	ACI-105 C OP	5.85
927061	ACI-107 OP	934.51
927181	ACI-112 C	1.89
927561	ACI-147 C	4.14
927711	ACI-161 C OP	59.82
927741	ACI-164 C OP	68.05
927991	ACI-189 C	11.76
928191	ACI-208 C OI	11.97
928271	ACI-216 C OP	14.56

Appendix 4

(DVP - DVP) The 8ELMONT-8LDYSMTH 500 kV line (from bus 314908 to bus 314911 ckt 1) loads from 96.73% to 97.86% (AC power flow) of its emergency rating (2442 MVA) for the single line contingency outage of 'LN 576'. This project contributes approximately 32.32 MW to the thermal violation.

CONTINGENCY 'LN 576'

OPEN BRANCH FROM BUS 314322 TO BUS 314914 CKT 1 /* 6MDLTHAN
230.00 - 8MDLTHAN 500.00

OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN
500.00 - 8NO ANNA 500.00

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315058	1CHESTF3	5.82
315059	1CHESTF4	9.43
315060	1CHESTF5	20.
315061	1CHESTG7	7.84
315063	1CHESTG8	7.77
315062	1CHESTS7	3.56
315064	1CHESTS8	3.98
315067	1DARBY 1	5.11
315068	1DARBY 2	5.11
315069	1DARBY 3	5.18
315070	1DARBY 4	5.18
315233	1SURRY 2	50.84
315091	1YORKTN2	53.56
315092	1YORKTN3	45.92
314309	6IRON208	0.77
314236	6NRTHEST	0.37
314251	6S PUMP	1.73

315074	CIR_AB2-152	17.43
297087	V2-040	0.24
921162	AA1-063AC	13.05
921752	AA2-053 C	13.5
921762	AA2-057 C	10.67
921982	AA2-088 C	9.83
922442	AA2-165 C	1.45
922512	AA2-174 C	0.62
922532	AA2-178 C	16.
922682	AB1-027 C	4.78
922922	AB1-081 C OP	13.1
923262	AB1-132 C OP	21.95
923572	AB1-173 C OP	3.51
923582	AB1-173AC OP	3.51
923801	AB2-015 C OP	15.52
923831	AB2-022 C	3.98
923841	AB2-024 C	4.39
923851	AB2-025 C	4.
923861	AB2-026 C	3.53
923911	AB2-031 C OP	3.48
923991	AB2-040 C OP	11.44
924061	AB2-050	4.81
924151	AB2-059 C	15.43
924241	AB2-068 OP	415.53
924491	AB2-098 C	0.87
924501	AB2-099 C	0.93

924511	AB2-100 C	18.36
924811	AB2-134 C OP	23.03
925051	AB2-160 C OP	9.56
925061	AB2-161 C OP	5.91
925171	AB2-174 C OI	10.96
925281	AB2-186 C	1.02
925331	AB2-190 C	35.9
926261	AC1-027 C	3.51
926331	AC1-034 C	10.
926531	AC1-054 C OP	10.42
926591	AC1-060	0.13
926601	AC1-061	0.06
926621	AC1-063	0.67
926641	AC1-065 C	5.81
926851	AC1-086 C	32.32
926981	AC1-099 C	12.58
927061	AC1-107 OP	627.22
927181	AC1-112 C	3.72
927411	AC1-134	12.03
927561	AC1-147 C	3.96
927711	AC1-161 C OP	53.83
927741	AC1-164 C OP	75.28
927991	AC1-189 C	13.11
928011	AC1-191 C OP	16.39
928191	AC1-208 C OI	13.73
928271	AC1-216 C OP	17.58

Appendix 5

(DVP - DVP) The 6CHSTF B-6BASIN 230 kV line (from bus 314287 to bus 314276 ckt 1) loads from 99.87% to 102.27% (AC power flow) of its load dump rating (549 MVA) for the line fault with failed breaker contingency outage of '562T563'. This project contributes approximately 15.52 MW to the thermal violation.

CONTINGENCY '562T563'

/*CARSON

OPEN BRANCH FROM BUS 314902 TO BUS 314923 CKT 1

/*CARSON TO

MIDLOTHIAN

OPEN BRANCH FROM BUS 314914 TO BUS 314902 CKT 1

/*CARSON 500.00

- 8SEPTA 500.00

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315065	1CHESTF6	34.34
315077	1HOPHCF1	1.82
315078	1HOPHCF2	1.82
315079	1HOPHCF3	1.82
315080	1HOPHCF4	2.76
315076	1HOPPOLC	1.56
315073	1STONECA	5.23
314784	1WEYRHSB	0.81
314539	3UNCAMP	0.97
314541	3WATKINS	0.28
315074	CIR_AB2-152	7.35
315075	CIR_AB2-152	0.63
292791	U1-032 E	2.72
900672	V4-068 E	0.13
901082	W1-029E	15.86
907092	X1-038 E	2.43
913392	Y1-086 E	0.74

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

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

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

<i>927991</i>	<i>ACI-189 C</i>	<i>3.42</i>
<i>927992</i>	<i>ACI-189 E</i>	<i>1.7</i>
<i>928191</i>	<i>ACI-208 C OI</i>	<i>3.96</i>
<i>928192</i>	<i>ACI-208 E OI</i>	<i>1.76</i>
<i>928271</i>	<i>ACI-216 C OP</i>	<i>5.91</i>
<i>928272</i>	<i>ACI-216 E OP</i>	<i>4.65</i>

Appendix 6

(DVP - DVP) The 6CLUBHSE-6SAPONY 230 kV line (from bus 314563 to bus 314435 ckt 1) loads from 82.78% to 93.84% (AC 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 70.47 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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315132	1EDGECEMB	2.2
315139	1GASTONA	7.72
315141	1GASTONB	7.72
315126	1ROARAP2	2.99
315128	1ROARAP4	2.87
315134	1ROAVALA	11.05
315135	1ROAVALB	2.95
315136	1ROSEMG1	5.22
315138	1ROSEMG2	2.44
315137	1ROSEMS1	3.24
314704	3LAWRENC	0.81
900671	V4-068 C	0.18
900672	V4-068 E	0.55
917331	Z2-043 C	0.71

917332	Z2-043 E	1.7
917341	Z2-044 C	0.34
917342	Z2-044 E	0.82
917512	Z2-088 E OP1	10.1
921162	AA1-063AC	16.77
921163	AA1-063AE	7.91
918511	AA1-065 C OP	2.73
918512	AA1-065 E OP	7.51
921183	AA1-067 E	0.9
918561	AA1-072 C	0.11
918562	AA1-072 E	0.28
921752	AA2-053 C	17.03
921753	AA2-053 E	7.31
921762	AA2-057 C	10.91
921763	AA2-057 E	5.45
921982	AA2-088 C	12.17
921983	AA2-088 E	19.86
922442	AA2-165 C	1.49
922443	AA2-165 E	0.72
922512	AA2-174 C	0.78
922513	AA2-174 E	0.85
922922	AB1-081 C OP	11.81
922923	AB1-081 E OP	5.06
923262	AB1-132 C OP	32.88
923263	AB1-132 E OP	14.09
923572	AB1-173 C OP	5.51

923573	<i>AB1-173 E OP</i>	2.57
923582	<i>AB1-173AC OP</i>	5.51
923583	<i>AB1-173AE OP</i>	2.57
923911	<i>AB2-031 C OP</i>	5.47
923912	<i>AB2-031 E OP</i>	2.7
923991	<i>AB2-040 C OP</i>	17.97
923992	<i>AB2-040 E OP</i>	14.7
924021	<i>AB2-043 C OP</i>	3.02
924022	<i>AB2-043 E OP</i>	4.95
924151	<i>AB2-059 C</i>	13.92
924152	<i>AB2-059 E</i>	7.17
924161	<i>AB2-060 C</i>	8.56
924162	<i>AB2-060 E</i>	4.03
924321	<i>AB2-079 C OP</i>	5.68
924322	<i>AB2-079 E OP</i>	3.79
924491	<i>AB2-098 C</i>	0.7
924492	<i>AB2-098 E</i>	0.3
924501	<i>AB2-099 C</i>	1.04
924502	<i>AB2-099 E</i>	0.44
924511	<i>AB2-100 C</i>	37.61
924512	<i>AB2-100 E</i>	18.53
925122	<i>AB2-169 E</i>	4.7
925171	<i>AB2-174 C OI</i>	17.82
925172	<i>AB2-174 E OI</i>	16.12
926331	<i>AC1-034 C</i>	9.02
926332	<i>AC1-034 E</i>	6.8

926351	ACI-036 C	0.72
926352	ACI-036 E	1.17
926531	ACI-054 C OP	9.75
926532	ACI-054 E OP	4.49
926851	ACI-086 C	48.43
926852	ACI-086 E	22.04
926981	ACI-099 C	13.65
926982	ACI-099 E	8.1
927991	ACI-189 C	10.77
927992	ACI-189 E	5.37
928191	ACI-208 C OI	15.23
928192	ACI-208 E OI	6.76

Appendix 7

(DVP - DVP) The 6HORNRTN-6HATHAWAY 230 kV line (from bus 314579 to bus 313845 ckt 1) loads from 86.56% to 120.17% (AC power flow) of its load dump rating (541 MVA) for the line fault with failed breaker contingency outage of '254T2141_A'. This project contributes approximately 179.64 MW to the thermal violation.

CONTINGENCY '254T2141_A' /* LAKEVIEW
 OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141
 OPEN BRANCH FROM BUS 314583 TO BUS 924510 CKT 1 /* 254
 END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	19.68
315141	1GASTONB	19.68
315136	1ROSEMG1	14.13
315138	1ROSEMG2	6.62
315137	1ROSEMS1	8.77
923262	ABI-132 C OP	83.83
923263	ABI-132 E OP	35.93
926851	AC1-086 C	123.46
926852	AC1-086 E	56.19

Appendix 8

(DVP - DVP) The 6LAKEVIEW-AB2-100 TAP 230 kV line (from bus 314583 to bus 924510 ckt 1) loads from 75.44% to 112.86% (AC power flow) of its load dump rating (459 MVA) for the line fault with failed breaker contingency outage of '239T2141'. This project contributes approximately 179.8 MW to the thermal violation.

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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	19.69
315141	1GASTONB	19.69
923262	ABI-132 C OP	83.91
923263	ABI-132 E OP	35.96
926851	AC1-086 C	123.56
926852	AC1-086 E	56.24

Appendix 9

(DVP - DVP) The 8MDLTHAN-8NO ANNA 500 kV line (from bus 314914 to bus 314918 ckt 1) loads from 76.28% to 77.62% (AC power flow) of its load dump rating (3144 MVA) for the line fault with failed breaker contingency outage of '557T574'. This project contributes approximately 48.08 MW to the thermal violation.

CONTINGENCY '557T574' /* ELMONT
 OPEN BRANCH FROM BUS 314908 TO BUS 314903 CKT 1 /*ELMONT TO
 CHICKAHOMINY (LINE 557)
 OPEN BRANCH FROM BUS 314903 TO BUS 314214 CKT 1
 /*CHICKAHOMINY 500-230 (TX#1)
 OPEN BRANCH FROM BUS 314911 TO BUS 314908 CKT 1 /*ELMONT TO
 LADYSMITH (LINE 574)
 END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315102	1BRUNSWICKG1	15.79
315103	1BRUNSWICKG2	15.79
315104	1BRUNSWICKG3	15.79
315105	1BRUNSWICKS1	32.81
315108	1ELIZAR1	6.15
315109	1ELIZAR2	6.04
315110	1ELIZAR3	6.22
315073	1STONECA	10.31
315233	1SURRY 2	48.71
314784	1WEYRHSB	3.45
315091	1YORKTN2	48.04
314539	3UNCAMP	4.3
314541	3WATKINS	1.23
314189	6PAPERMILL	8.87
315074	CIR_AB2-152	14.5

292791	U1-032 E	5.37
900672	V4-068 E	0.47
901082	W1-029E	79.25
907092	X1-038 E	10.75
913392	Y1-086 E	3.78
916042	Z1-036 E	77.7
916191	Z1-068 C	0.08
916192	Z1-068 E	3.29
916301	Z1-086 C	96.09
916302	Z1-086 E	16.77
917122	Z2-027 E	1.83
917332	Z2-043 E	1.59
917342	Z2-044 E	0.88
917512	Z2-088 E OP1	12.41
921162	AA1-063AC	13.36
921163	AA1-063AE	6.3
918512	AA1-065 E OP	7.27
921183	AA1-067 E	1.14
918562	AA1-072 E	0.27
921583	AA1-139 E	11.2
921752	AA2-053 C	13.81
921753	AA2-053 E	5.93
921762	AA2-057 C	10.99
921763	AA2-057 E	5.5
921982	AA2-088 C	10.05
921983	AA2-088 E	16.4

922442	AA2-165 C	1.5
922443	AA2-165 E	0.72
922512	AA2-174 C	0.63
922513	AA2-174 E	0.69
922532	AA2-178 C	16.14
922533	AA2-178 E	6.92
922682	AB1-027 C	3.05
922683	AB1-027 E	1.31
922922	AB1-081 C OP	13.56
922923	AB1-081 E OP	5.81
923262	AB1-132 C OP	22.44
923263	AB1-132 E OP	9.62
923572	AB1-173 C OP	3.59
923573	AB1-173 E OP	1.68
923582	AB1-173AC OP	3.59
923583	AB1-173AE OP	1.68
923801	AB2-015 C OP	15.36
923802	AB2-015 E OP	12.6
923831	AB2-022 C	3.99
923832	AB2-022 E	2.15
923841	AB2-024 C	3.31
923842	AB2-024 E	1.49
923851	AB2-025 C	4.06
923852	AB2-025 E	1.82
923861	AB2-026 C	3.72
923862	AB2-026 E	1.67

923911	AB2-031 C OP	3.57
923912	AB2-031 E OP	1.76
923991	AB2-040 C OP	11.71
923992	AB2-040 E OP	9.58
924021	AB2-043 C OP	4.44
924022	AB2-043 E OP	7.28
924151	AB2-059 C	15.98
924152	AB2-059 E	8.23
924161	AB2-060 C	12.75
924162	AB2-060 E	6.
924241	AB2-068 OP	334.96
924321	AB2-079 C OP	8.45
924322	AB2-079 E OP	5.63
924491	AB2-098 C	0.89
924492	AB2-098 E	0.38
924501	AB2-099 C	0.94
924502	AB2-099 E	0.4
924511	AB2-100 C	18.7
924512	AB2-100 E	9.21
924811	AB2-134 C OP	20.17
924812	AB2-134 E OP	19.83
925051	AB2-160 C OP	8.33
925052	AB2-160 E OP	13.59
925061	AB2-161 C OP	5.65
925062	AB2-161 E OP	9.21
925122	AB2-169 E	9.41

925171	AB2-174 C OI	11.22
925172	AB2-174 E OI	10.15
925281	AB2-186 C	1.03
925282	AB2-186 E	0.44
925331	AB2-190 C	31.67
925332	AB2-190 E	13.57
926261	AC1-027 C	3.51
926262	AC1-027 E	2.
926331	AC1-034 C	10.35
926332	AC1-034 E	7.81
926351	AC1-036 C	1.31
926352	AC1-036 E	2.13
926531	AC1-054 C OP	10.79
926532	AC1-054 E OP	4.97
926591	AC1-060	0.1
926601	AC1-061	0.05
926611	AC1-062	0.42
926621	AC1-063	0.52
926641	AC1-065 C	4.5
926642	AC1-065 E	7.34
926851	AC1-086 C	33.04
926852	AC1-086 E	15.04
926981	AC1-099 C	12.91
926982	AC1-099 E	7.66
927041	AC1-105 C OP	7.88
927042	AC1-105 E OP	3.92

927061	ACI-107 OP	505.6
927181	ACI-112 C	2.37
927182	ACI-112 E	1.33
927561	ACI-147 C	3.94
927562	ACI-147 E	2.32
927711	ACI-161 C OP	54.3
927712	ACI-161 E OP	23.18
927741	ACI-164 C OP	53.5
927742	ACI-164 E OP	24.04
927991	ACI-189 C	13.47
927992	ACI-189 E	6.71
928191	ACI-208 C OI	14.11
928192	ACI-208 E OI	6.27
928271	ACI-216 C OP	15.39
928272	ACI-216 E OP	12.11
928321	ACI-221 C	3.13
928322	ACI-221 E	3.13
928331	ACI-222 C	5.04
928332	ACI-222 E	4.8

Appendix 10

(DVP - DVP) The AB2-100 TAP-6CLUBHSE 230 kV line (from bus 924510 to bus 314563 ckt 1) loads from 95.62% to 133.54% (AC power flow) of its load dump rating (459 MVA) for the line fault with failed breaker contingency outage of '239T2141'. This project contributes approximately 179.8 MW to the thermal violation.

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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	19.69
315141	1GASTONB	19.69
923262	ABI-132 C OP	83.91
923263	ABI-132 E OP	35.96
924511	AB2-100 C	66.92
924512	AB2-100 E	32.96
926851	AC1-086 C	123.56
926852	AC1-086 E	56.24

Appendix 11

(DVP - DVP) The 6CHARCTY-6LAKESD 230 kV line (from bus 314225 to bus 314227 ckt 1) loads from 101.53% to 103.9% (AC power flow) of its load dump rating (459 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 12.78 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

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

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

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

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

Appendix 12

(DVP - DVP) The 6MESSER-6CHARCTY 230 kV line (from bus 314228 to bus 314225 ckt 1) loads from 112.66% to 115.02% (AC power flow) of its load dump rating (459 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 12.78 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

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

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

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

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

Appendix 13

(DVP - DVP) The 6CHSTF B-6MESSER 230 kV line (from bus 314287 to bus 314228 ckt 1) loads from 112.69% to 115.05% (AC power flow) of its load dump rating (459 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 12.78 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

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

900672	V4-068 E	0.11
901082	W1-029E	13.48
907092	X1-038 E	2.14
913392	Y1-086 E	0.63
914231	Y2-077	0.79
916042	Z1-036 E	13.57
916192	Z1-068 E	0.53
917122	Z2-027 E	0.31
917332	Z2-043 E	0.34
917342	Z2-044 E	0.18
921162	AA1-063AC	3.19
921163	AA1-063AE	1.51
918512	AA1-065 E OP	1.48
918562	AA1-072 E	0.06
921752	AA2-053 C	3.26
921753	AA2-053 E	1.4
921762	AA2-057 C	2.34
921763	AA2-057 E	1.17
921982	AA2-088 C	2.33
921983	AA2-088 E	3.81
922442	AA2-165 C	0.32
922443	AA2-165 E	0.15
922512	AA2-174 C	0.15
922513	AA2-174 E	0.16
922532	AA2-178 C	2.96
922533	AA2-178 E	1.27

923262	AB1-132 C OP	5.96
923263	AB1-132 E OP	2.56
923572	AB1-173 C OP	0.98
923573	AB1-173 E OP	0.46
923582	AB1-173AC OP	0.98
923583	AB1-173AE OP	0.46
923801	AB2-015 C OP	3.06
923802	AB2-015 E OP	2.51
923831	AB2-022 C	0.66
923832	AB2-022 E	0.35
923851	AB2-025 C	1.62
923852	AB2-025 E	0.73
923911	AB2-031 C OP	0.98
923912	AB2-031 E OP	0.48
923991	AB2-040 C OP	3.21
923992	AB2-040 E OP	2.63
924501	AB2-099 C	0.2
924502	AB2-099 E	0.09
924511	AB2-100 C	6.21
924512	AB2-100 E	3.06
924811	AB2-134 C OP	8.19
924812	AB2-134 E OP	8.05
925051	AB2-160 C OP	4.18
925052	AB2-160 E OP	6.83
925061	AB2-161 C OP	1.99
925062	AB2-161 E OP	3.24

925122	AB2-169 E	1.8
925171	AB2-174 C OI	3.15
925172	AB2-174 E OI	2.85
925281	AB2-186 C	0.18
925282	AB2-186 E	0.08
925331	AB2-190 C	12.2
925332	AB2-190 E	5.23
926261	AC1-027 C	0.57
926262	AC1-027 E	0.32
926601	AC1-061	0.03
926851	AC1-086 C	8.78
926852	AC1-086 E	4.
926981	AC1-099 C	2.8
926982	AC1-099 E	1.66
927561	AC1-147 C	0.65
927562	AC1-147 E	0.38
928191	AC1-208 C OI	3.12
928192	AC1-208 E OI	1.39
928271	AC1-216 C OP	6.25
928272	AC1-216 E OP	4.91

Appendix 14

(DVP - CPLE) The 3BTLEBRO-3ROCKYMT115T 115 kV line (from bus 314554 to bus 304223 ckt 1) loads from 137.04% to 149.69% (AC power flow) of its emergency rating (164 MVA) for the tower line contingency outage of 'LN 2058-2181'. This project contributes approximately 21.59 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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315131	1EDGECEMA	2.44
315132	1EDGECEMB	2.44
315139	1GASTONA	2.37
315141	1GASTONB	2.37
315126	1ROARAP2	1.02
315128	1ROARAP4	0.98
315134	1ROAVALA	3.35
315135	1ROAVALB	0.89
315136	1ROSEMG1	1.91
315138	1ROSEMG2	0.89
315137	1ROSEMS1	1.18
900671	V4-068 C	0.06
900672	V4-068 E	0.19
917331	Z2-043 C	0.36

917332	Z2-043 E	0.86
917341	Z2-044 C	0.53
917342	Z2-044 E	1.26
917511	Z2-088 C OP1	0.68
917512	Z2-088 E OP1	6.22
918411	AA1-050	0.58
921162	AA1-063AC	5.73
921163	AA1-063AE	2.7
918512	AA1-065 E OP	2.03
921183	AA1-067 E	0.32
918561	AA1-072 C	0.05
918562	AA1-072 E	0.14
921752	AA2-053 C	5.82
921753	AA2-053 E	2.5
921762	AA2-057 C	13.08
921763	AA2-057 E	6.54
921982	AA2-088 C	4.15
921983	AA2-088 E	6.78
922442	AA2-165 C	1.78
922443	AA2-165 E	0.86
922512	AA2-174 C	0.27
922513	AA2-174 E	0.29
922922	AB1-081 C OP	20.25
922923	AB1-081 E OP	8.68
923262	AB1-132 C OP	10.08
923263	AB1-132 E OP	4.32

923572	<i>AB1-173 C OP</i>	<i>1.29</i>
923573	<i>AB1-173 E OP</i>	<i>0.6</i>
923582	<i>AB1-173AC OP</i>	<i>1.29</i>
923583	<i>AB1-173AE OP</i>	<i>0.6</i>
923911	<i>AB2-031 C OP</i>	<i>1.28</i>
923912	<i>AB2-031 E OP</i>	<i>0.63</i>
923991	<i>AB2-040 C OP</i>	<i>4.2</i>
923992	<i>AB2-040 E OP</i>	<i>3.44</i>
924151	<i>AB2-059 C</i>	<i>23.86</i>
924152	<i>AB2-059 E</i>	<i>12.29</i>
924491	<i>AB2-098 C</i>	<i>0.25</i>
924492	<i>AB2-098 E</i>	<i>0.11</i>
924501	<i>AB2-099 C</i>	<i>0.35</i>
924502	<i>AB2-099 E</i>	<i>0.15</i>
924511	<i>AB2-100 C</i>	<i>5.52</i>
924512	<i>AB2-100 E</i>	<i>2.72</i>
925122	<i>AB2-169 E</i>	<i>2.31</i>
925171	<i>AB2-174 C OI</i>	<i>3.84</i>
925172	<i>AB2-174 E OI</i>	<i>3.47</i>
926331	<i>AC1-034 C</i>	<i>15.46</i>
926332	<i>AC1-034 E</i>	<i>11.66</i>
926851	<i>AC1-086 C</i>	<i>14.84</i>
926852	<i>AC1-086 E</i>	<i>6.75</i>
926981	<i>AC1-099 C</i>	<i>10.95</i>
926982	<i>AC1-099 E</i>	<i>6.5</i>
927991	<i>AC1-189 C</i>	<i>5.28</i>

<i>927992</i>	<i>ACI-189 E</i>	<i>2.63</i>
<i>928191</i>	<i>ACI-208 C OI</i>	<i>12.83</i>
<i>928192</i>	<i>ACI-208 E OI</i>	<i>5.7</i>

EXHIBIT 3

***Generation Interconnection
Facility Study Report***

For

***PJM Generation Interconnection Request
Queue Position AC1-086***

***Thelma 230kV
123.7MW Capacity / 180MW Energy***

August, 2020

General

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff §207, as well as the Facilities Study Agreement between Gaston Green Acres Solar, LLC, (Interconnection Customer (IC)) and PJM Interconnection, LLC (Transmission Provider (TP)). North Carolina Electric and Power Company is the Interconnected Transmission Owner (ITO) and provided the input to develop this study.

Gaston, NC (Northampton County). The installed facilities will have a total capability of 300 MW with 207.7 MW of this output being recognized by PJM as capacity. This queue request is for an additional 180 MW with 123.7 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is 12/31/2017. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AC1-086 will interconnect with the ITO transmission system will connect into a new bay at Thelma 230kV substation being built to accommodate the AB1-132 project.

Cost Summary

The AC1-086 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$ 0
Direct Connection Network Upgrades	\$ 0
Non Direct Connection Network Upgrades	\$ 0
Allocation for New System Upgrades	\$ 2,653,570
Contribution for Previously Identified Upgrades	\$ 23,313
Total Costs	\$ 2,676,883

A. Transmission Owner Facilities Study Summary

1. Description of Project

Queue AC1-086 is a request to interconnect an additional 180 MW of solar generation to the 120 MW AB1-132 solar facility to be located in Northhampton County, North Carolina. The proposed generating facility will interconnect via a new breaker position at the ITO's Thelma 230kV substation.

Network Upgrade construction is estimated to be 14 - 24 months.

2. Amendments to the System Impact Study data or System Impact Study Results

None

3. Interconnection Customer's Milestone Schedule

- Commercial Operation of AC1-086 November 15, 2022

4. Scope of Customer's Work

IC will build a solar generating facility in Northhampton County, North Carolina. The generating facility will be comprised of solar arrays. AC1-086 consists of 90 x SMA SC 3300-US inverters and 90 x 34.5/0.385 kV 2.0 MVA GSU transformers. The project is connected to the Point of Interconnection (POI) at Thelma 230 kV substation via a bank of 3 x 230/34.5/13.8 kV 36/48/60 MVA transformers.

5. Description of Facilities Included in the Facilities Study

The scope of the project AC1-086 includes necessary network upgrades to reliably connect the generation to the ITO 230 kV transmission network. The project requires the replacement of wave traps at Chickahominy, North Anna, Elmont, and Ladysmith substations. Additionally, the Lakeview substation requires expansion to accommodate a new breaker between the #241 and #2141 circuits and the rebuild of 1.28 of the Lakeview – Carolina 230kV line #2141. Finally, the project requires the uprate of the Battleboro – Rocky Mt. 115kV line, with the work at the Dominion Battleboro terminal detailed here.

6. Total Costs of Transmission Owner Facilities included in Facilities Study

Work Description	Direct		Indirect		Total Cost
	Labor	Material	Labor	Material	
Rebuild Lakeview - Carolina Line #2141 (n6052)	\$389,019	\$176,428	\$61,439	\$18,333	\$645,218
Replace wave trap at Chickahominy Substation (n5464)	\$5,751	\$4,775	\$1,578	\$727	\$12,830
Replace wave trap at North Anna Substation for Midlothian – North Anna 500 kV line #576 (n6055)	\$5,187	\$4,307	\$1,423	\$655	\$11,572
Install back-to-back breaker at Lakeview substation (n6220)	\$1,070,412	\$657,420	\$159,543	\$67,907	\$1,955,282
Replace wave trap on the Elmont - Ladysmith 500kV line (n5483)	\$12,849	\$10,669	\$3,526	\$1,624	\$28,668
Upgrade breaker leads at Battleboro on the line to Rocky Mt. (n6118)	\$10,449	\$8,676	\$2,867	\$1,320	\$23,313
Total Network Upgrades	\$1,493,667	\$862,275	\$230,375	\$90,565	\$2,676,882
Total Project Costs	\$2,720,269	\$1,609,491	\$454,800	\$186,828	\$4,971,388

7. Summary of Milestone Schedules for Completion of Work Included in Facilities Study:

Facilities are estimated to take 14 - 24 months to construct and this is based on the ability to obtain outages to construct and test the proposed facilities.

Proposed Schedule

- Detailed design: 6-12 months
- Permitting: 6-12 months (Timeline runs concurrent with design)
- Construction 8-12 months

B. Transmission Owner Facilities Study Results

1. Attachment Facilities

None

2. Transmission Line – Upgrades

PJM Network Upgrade #n6052 – Rebuild 1.3 miles of the Lakeview – Carolina 230kV line #2141:

The existing line is approximately 1.4 miles long (1.3 miles of 795 ACSR 45/7 – “Tern” and 0.1 miles of 1033 ACSR 45/7 – “Ortolan”). The line consists of nine (9) V-Series Towers, two (2) tubular steel backbones, one (1) monopole structure, and one (1) switch tower.

Lakeview Substation scope of work includes replacement of two 2000 Amp switches with new 3000 Amp.

Lakeview substation scope:

1. Install two (2), 230 kV, 3000 Amp, center break disconnect switches
2. Install conductor, connectors, foundations, steel and grounding material as per engineering standards.
3. Remove existing 2000 Amp switches and accessories

REMOVAL:

1. Remove (1) span (*approximately 0.1 miles*) of 3 phase 1033 ACSR 45/7 – “Ortolan” conductor from Lakeview Substation (Structure 2141/1) to Structure 2141/2.
2. Remove *approximately* 1.3 miles of 3 phase 795 ACSR 45/7 – “Tern” conductor from Structure 2141/2 to Carolina Substation (Structure 2141/13).
3. Remove insulator hardware from Structure 2141/1 to Structure 2141/13 associated with the phase conductor being removed. This will consist of removing approximately:
 - a. (12) suspension insulator assemblies
 - b. (14) idler suspension assemblies
 - c. (2) suspension training insulator assemblies
 - d. (48) dead-end insulator assemblies

INSTALLATION:

1. Modify (5) existing T0415003 dead end towers to accommodate proposed conductor; modifications included in this estimate are for the installation of dead end conductor assemblies and replacement of failing angle members.
 - a. Tower modifications will need to be completed on Structure 2141/2 (4V Tower + 15’ Leg Extension), 2141/5 (4V Tower + 10’ Leg Extension), 2141/7 (4V Tower + 15’ Leg Extension), and 2141/9 (4V Tower + 15’ Leg Extension).
 - b. Install (2) new members on the bottom arm of the structures to reinforce angle members 4V74A.
 - c. Install thirty (30) DE Insulator Assemblies:
 - d. One (1) project specific DE insulator assembly (32.337B) shall be installed on structure 2141/10.

- e. Install fourteen (14) idler suspension assemblies.
2. Modify (4) existing T0412019 suspension towers to accommodate proposed conductor; modifications included in this estimate are for the installation of suspension conductor assemblies.
 - a. Install twelve (12) suspension insulator assemblies.
3. Modify (2) existing backbone structures to accommodate proposed conductor; modifications included in this estimate are for the installation of suspension conductor assemblies.
 - a. Three (3) dead-end insulator assemblies on structure 2141/1.
 - b. Six (6) dead-end insulator assemblies on structure 2141/12.
4. Modify (1) existing monopole structure to accommodate proposed conductor; modifications included in this estimate are for the installation of dead end conductor assemblies.
 - c. Install six (6) dead-end insulator assemblies.
 - d. Install two (2) suspension training insulator assemblies.
5. Modify (1) existing switch tower to accommodate proposed conductor; modifications included in this estimate are for the installation of dead end conductor assemblies.
 - e. Install three (3) dead-end insulator assemblies.
6. Install approximately 1.4 miles of 3-phase 768.2 ACSS/TW/HS-285 – “Maumee” from existing Lakeview Substation (Structure 2141/1) to existing Carolina Substation (Structure 2141/13).

ESTIMATE ASSUMPTIONS:

1. Line #239, the adjacent circuit on Towers 2141/2 to 2141/7, was modeled using available information to support the analysis of Line #2141 and associated towers. Line #239, other than how it affects Line #2141, is not covered under the scope of project GITAC1034.
2. The PLS-Tower models that were provided by Dominion accurately represent the existing towers. A full model check will need to be performed during detailed design to confirm.
3. The line analysis does not take into account any physical or conditional degradation of the structures.
 - a. A formal conditional analysis of all structures is recommended.
4. No foundation analysis was performed as part of this estimate, and is outside the current scope of this project.
5. Station backbones will have adequate capacity based on GITAC1034 design loads.
6. Analysis results are based on NESC minimum requirements and a structure usage limit of 100%.
7. The LiDAR survey provided is accurate and governs over the structure coordinates that can be found in the SAP Line Data database. Due to the narrow tolerances in the design, it is recommended that additional survey points be taken of the structures (C/L, leg base(s), and conductor attachment points at a minimum) prior to finalization.

DESIGN NOTES:

1. Per Dominion standards, failing members are to be reinforced not replaced. However, to be conservative both methods were checked.

- a. DAE (3"x3"x0.25") angle type was used to model the reinforcement on the failing member.
 - b. Failing members were replaced with 3"x3"x0.25" and analyzed; towers passed.
2. Section Usage Comparison: Due to terrain limitations within section 2141/2 – 2141/5, the sag of the phase conductor is limited by clearance requirements. Below is a chart comparing the results of the conductor at a MOT of 250°C/482°F, Max Sag and at a MOT of 210°C/410°F, Max Sag.
 - a. The existing conductor (795 ACSR 45/7 – “Tern”) at MOT (90°C/194°F) does not have any additional buffer over the 2017 NESC ground clearance requirement of 22.5’.
 - b. The other sections though-out the line were able to be preliminarily adjusted to limit the amount of section usage, load on the tower members, and usage of insulator assemblies.
3. Crossing span clearances were checked utilizing provided LiDAR. During final design, it is recommended that the crossing spans are modeled appropriately.

Based on this review it has been recognized that the bottom phase connecting 2141/10 – 2141/11 has a structure clearance violation. The estimate reflects a custom insulator assembly that should be installed to mitigate the violation.

3. New Substation/Switchyard Facilities

None

4. Upgrades to Substation / Switchyard Facilities

PJM Network Upgrade #n6220 – Install a second, back-to-back breaker between existing line positions #241 and #2141 at the Lakeview substation

The AC1-086 project caused an overload on the Hornertown-Hathaway 230kV line, but it was determined that the contingency causing this overload could be mitigate by adding a second breaker at Lakeview substation.

This project will install a “back-to-back” breaker configuration between the 254 and 2141 lines at Lakeview station.

Note: Currently, the scope and estimate assume DVP standard spread footer foundations. Once the soil information is received and if it is decided to change that to “pile foundations” then DVP team should be informed at the earliest to adjust the project estimate.

Purchase and install substation material:

1. Approximately 50’ x 152’ site preparation and grading as required for expansion of the station.
2. Approximately 260 linear FT of 5/8” Chain Link fence to match existing fence.
3. One (1), 230 kV, 3000A, 63kAIC, SF-6 Circuit Breaker.
4. One (1), 230 kV, 3000A, 3-Phase Center Break Gang Operated Switch.
5. Four (4), 230kV, Relay Accuracy CCVTs.
6. Three (3), 180 kV, 144 kV MCOV surge arresters.

7. One (1), 10' x 17'-4" control enclosure expansion.
8. One (1), 125 VDC, 500 Ah Station Battery and 75 Amp Charger (size to be verified during detail engineering).
9. Station Stone as required.
10. Steel structures as required including switch stands, bus supports, and CCVT supports.
11. Foundations as required including control house, equipment, and bus support stands.
12. Conductors, connectors, conduits, control cables, cable trough, and grounding materials as per engineering standards.

Purchase and install relay material:

1. One (1), 1510 – 24" Dual SEL-351-7 Transmission Breaker w/ Reclosing Panel
2. One (1), 4510 - SEL-2411 Breaker Annunciator
3. One (1), 4506 – 3 Phase CCVT Potential M.U. Box
4. One (1), 1109 – 24" Dual SEL-587Z Transmission Bus Panel
5. One (1), 4200_W1 – Bus Differential C.T. M.U. Box
6. One (1), 4507 – 1 Phase CCVT Potential M.U. Box
7. One (1), 7601-EW1 – SEL-547 Voltage Balance Relay
8. One (1), 5609 – Fiber Optic Management Panel
9. One (1), 4526_A – Circuit Breaker Fiber Optic M.U. Box
10. One (1), SEL 2411 I/O Module

PJM Network Upgrade #n5464 – Line #557 Chickahominy – Elmont: Replace wave traps at Chickahominy substation on line #557 to Elmont. Estimated to take 14-16 months to engineer and construct. Costs include the following:

Purchase and install at Chickahominy:

1. Two (2), 500 kV, 5000 amp wave traps
2. Two (2), line tuners, down-leads and conduits
3. Conductor, connectors, steel structures, foundations and grounding material according to current engineering standards.

PJM Network Upgrade #n6055 – Line #576 Midlothian – North Anna: Replace wave trap at North Anna substation on the #576 line. Estimated to take 14-16 months to engineer and construct. Costs include the following:

Purchase and install at North Anna:

1. One (1), 500 kV, 5000 amp wave trap
2. One (1), line tuner, down-leads and conduits
3. Conductor, connectors, steel structures, foundations and grounding material according to current engineering standards

PJM Network Upgrade #n5483 – Line #574 Ladysmith – Elmont: Replace wave traps at Ladysmith and Elmont substations on the #574 line. Estimated to take 14-16 months to engineer and construct. Costs include the following:

Purchase and install at Ladysmith:

1. Two (2), 500 kV, 5000 amp wave traps
2. Two (2), line tuners, down-leads and conduits
3. Conductor, connectors, steel structures, foundations and grounding material according to current engineering standards.

Purchase and install at Elmont:

1. Two (2), 500 kV, 5000 amp wave traps
2. Two (2), line tuners, down-leads and conduits

Conductor, connectors, steel structures, foundations and grounding material according to current engineering standards.

PJM Network Upgrade #n6118- Battleboro – Rocky Mt 115kV: Replace Battleboro substation terminal equipment. Upgrading the breaker leads at Battleboro will bring the rating to 239/239/239 MVA.

Purchase and install at Battleboro substation:

1. Install- 2-795 AAC conductors and connectors as required
2. Remove- existing 1-795 AAC conductors and connectors

5. Metering & Communications

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 Section 8 of Attachment O Appendix 2.

ITO Requirements

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

At the IC's expense, the ITO will supply and own at the Point of Interconnection bi-directional revenue metering equipment that will provide the following data:

- a. Hourly compensated MWh received from the Customer Facility to the ITO;
- b. Hourly compensated MVARh received from the Customer Facility to the ITO;
- c. Hourly compensated MWh delivered from the ITO to the Customer Facility; and
- d. Hourly compensated MVARh delivered from the ITO to the Customer Facility.

The IC will supply and own metering equipment that will provide Instantaneous net MW and MVar per unit values in accordance with PJM Manuals M-01 and M-14D, and Sections 8.1 through 8.5 of Appendix 2 to the ISA;

The IC will access revenue meter via wireless transceivers or fiber cabling to meter with RS-485 or Ethernet communication port for dial-up reads. IC must provide revenue and real time data to PJM from Interconnection Customer Market Operations Center per “PJM Telemetry Data Exchange Summary” document available at PJM.com.

Attachment 1. Single Line

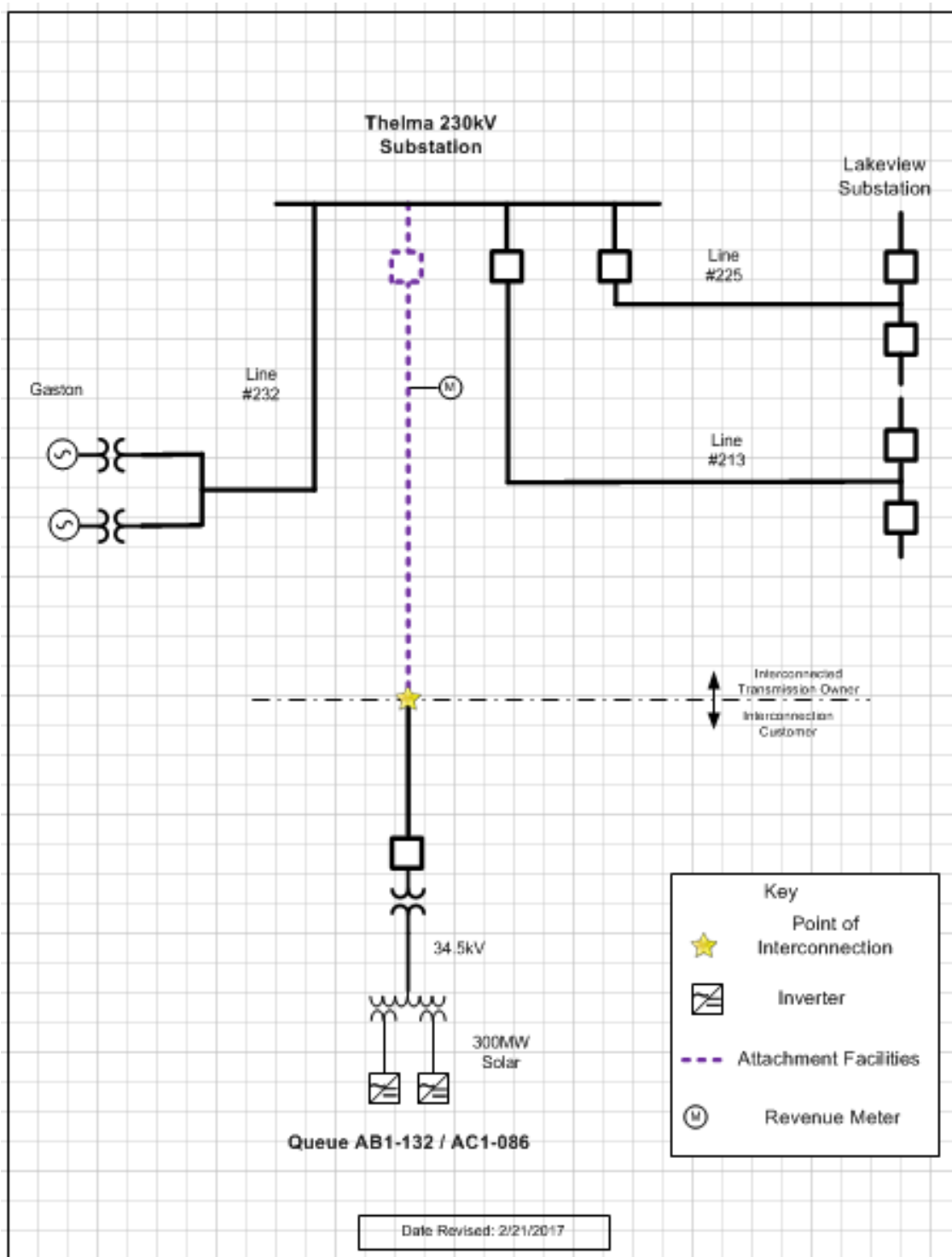


EXHIBIT 4

***Generation Interconnection
Feasibility Study Report***

For

***PJM Generation Interconnection Request
Queue Position AC1-086***

***Thelma 230kV
123.7 MW Capacity / 180 MW Energy***

Revised 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 Gaston Green Acres Solar, LLC, the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company (VEPCO).

Preface

The intent of the 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 Gaston, NC (Northampton County). The installed facilities will have a total capability of 300 MW with 207.7 MW of this output being recognized by PJM as capacity. This queue request is for an additional 180 MW with 123.7 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is 12/31/2017. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AC1-086 will interconnect with the ITO transmission system via a tap into Thelma 230kV substation.

Cost Summary

The AC1-086 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$0
Direct Connection Network Upgrades	\$0
Non Direct Connection Network Upgrades	\$0
Total Costs	\$0

In addition, the AC1-086 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	\$127,150,000
Previously Identified Upgrades	\$110,430,000
Total Costs	\$237,580,000

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.

Transmission Owner Scope of Work

Attachment Facilities

The scope identified in queue AB1-132 is sufficient to accommodate this queue request from an Attachment Facilities and Thelma substation expansion perspective. The single line is shown below in Attachment 1.

Non-Direct Connection Cost Estimate

New System Reinforcement

Reinforcement: Carolina – Lakeview 230 kV line #2141. Uprate/rebuild approximately 1.4 miles of 230 kV Line to increase the line rating by 15% to 360 MVA. It is estimated to take 18-20 months to permit and construct and it is estimated to cost \$3,500,000 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: Carson - Midlothian 500 kV: replace wave trap at both Carson and Midlothian 500kV Substations. This will increase emergency rating by 31% to 2403 MVA. Estimated cost \$500,000 and it is estimated to 12-16 months to engineer and construct.

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: AC1-208 Tap-Hornertown 230kV line #2056: Rebuild approximately 9.7 miles of the AC1-208 TAP-Hornertown 230kV line #2056 to increase its emergency line rating to a minimum of 620 MVA and its load dump rating to a minimum of 730 MVA. Estimated cost is \$25,000,000 and it is estimated to take 30-36 months to engineer, permit and construct.

Reinforcement: AC1-208 Tap – Hathaway 230 kV line # 2056: Rebuild the AC1-208 TAP-Hathaway 230kV line to increase its emergency line rating to a minimum of 620 MVA and its load dump rating to a minimum of 730 MVA. Rebuild / Uprate approximately 19 miles of Line #2056. Estimated cost is \$57,000,000 with an estimated 30-36 months to complete.

Contributions to Previously Identified System Reinforcements

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: 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: Belmont - Ladysmith 500kV: Wreck and rebuild the line for a higher capacity since the overload exceeds the conductor rating. It is estimated to cost \$78,300,000 and it is estimate to take 36-48 months to engineer, permit and construct.

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>

An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

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 AC1-086 was evaluated as a 180.0 MW (Capacity 123.7 MW) injection at the Thelma 230kV substation in the ITO area. Project AC1-086 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-086 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
23872	CONTINGENCY '23872' /* _ CARSON OPEN BRANCH FROM BUS 314282 TO BUS 314435 CKT 1 /*L238 CARSON SAPONY OPEN BRANCH FROM BUS 314435 TO BUS 314563 CKT 1 /*L238 SAPONY CLUBHOUSE OPEN BRANCH FROM BUS 314563 TO BUS 314562 CKT 1 /*CLUBHOUSE TX1 230-115 OPEN BRANCH FROM BUS 314282 TO BUS 314902 CKT 1 /*CARSON TX2 500-230 OPEN BRANCH FROM BUS 314282 TO BUS 314455 CKT 1 /*CARSON SC172 END
238T2002	CONTINGENCY '238T2002' /* _ CARSON OPEN BRANCH FROM BUS 314331 TO BUS 314288 CKT 1 /*L2002 POE COGENTRIX OPEN BRANCH FROM BUS 314288 TO BUS 314282 CKT 1 /*L2002 COGENTRIX CARSON OPEN BRANCH FROM BUS 314331 TO BUS 314329 CKT 1 /*POE TX5 230-115 OPEN BRANCH FROM BUS 314282 TO BUS 314435 CKT 1 /*L238 CARSON SAPONY OPEN BRANCH FROM BUS 314435 TO BUS 314563 CKT 1 /*L238 SAPONY CLUBHOUSE OPEN BRANCH FROM BUS 314563 TO BUS 314562 CKT 1 /*CLUBHOUSE TX1 230-115 END
239T2141	CONTINGENCY '239T2141' /* LAKEVIEW OPEN BRANCH FROM BUS 314583 TO BUS 314579 CKT 1 /* 239 OPEN BRANCH FROM BUS 314579 TO BUS 314605 CKT 1 /* 2057 OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141 END

Contingency Name	Description
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
254T2141_A	CONTINGENCY '254T2141_A' /* LAKEVIEW OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141 OPEN BRANCH FROM BUS 314583 TO BUS 924510 CKT 1 /* 254 END
557T574	CONTINGENCY '557T574' /* ELMONT OPEN BRANCH FROM BUS 314908 TO BUS 314903 CKT 1 /*ELMONT TO CHICKAHOMINY (LINE 557) OPEN BRANCH FROM BUS 314903 TO BUS 314214 CKT 1 /*CHICKAHOMINY 500-230 (TX#1) OPEN BRANCH FROM BUS 314911 TO BUS 314908 CKT 1 /*ELMONT TO LADYSMITH (LINE 574) END
562T563	CONTINGENCY '562T563' /*CARSON OPEN BRANCH FROM BUS 314902 TO BUS 314923 CKT 1 /*CARSON TO MIDLOTHIAN OPEN BRANCH FROM BUS 314914 TO BUS 314902 CKT 1 /*CARSON 500.00 - 8SEPTA 500.00 END
BASIN 230 B#2	CONTINGENCY 'BASIN 230 B#2' /* OPEN BRANCH FROM BUS 314276 TO BUS 314339 CKT 1 OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 OPEN BRANCH FROM BUS 314276 TO BUS 314274 CKT 2 END
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

Contingency Name	Description
H2T557	CONTINGENCY '563T576' /*MIDLOTHIAN OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /*MIDLOTHIAN TO NORTH ANNA (LINE 576) OPEN BRANCH FROM BUS 314914 TO BUS 314322 CKT 1 /*MIDLOTHIAN 500-230 (TX#2) OPEN BRANCH FROM BUS 314914 TO BUS 314902 CKT 1 /*MIDLOTHIAN TO CARSON (LINE 563) END
LN 2012	CONTINGENCY 'LN 2012' OPEN BRANCH FROM BUS 314266 TO BUS 314569 CKT 1 /* 6NORTHAMPTON230.00 - 6EARLEYS 230.00 OPEN BRANCH FROM BUS 314266 TO BUS 314599 CKT 1 /* 6NORTHAMPTON230.00 - 6ROA VAL 230.00 OPEN BUS 314266 /* ISLAND 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 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 2131A	CONTINGENCY 'LN 2131A' OPEN BRANCH FROM BUS 314662 TO BUS 916040 CKT 1 /* 6S HERTFORD 230.00 - Z1-036 TAP 230.00 OPEN BRANCH FROM BUS 314651 TO BUS 314662 CKT 1 /* 6WINFALL 230.00 - 6S HERTFORD 230.00 OPEN BUS 314662 /* ISLAND END

Contingency Name	Description
LN 217	CONTINGENCY 'LN 217' OPEN BRANCH FROM BUS 314225 TO BUS 314227 CKT 1 /* 6CHARCTY 230.00 - 6LAKESD 230.00 OPEN BRANCH FROM BUS 314225 TO BUS 314228 CKT 1 /* 6CHARCTY 230.00 - 6MESSER 230.00 OPEN BRANCH FROM BUS 314228 TO BUS 314287 CKT 1 /* 6MESSER 230.00 - 6CHSTF B 230.00 OPEN BUS 314225 /* ISLAND OPEN BUS 314228 /* ISLAND END
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 254_A	CONTINGENCY 'LN 254_A' OPEN BRANCH FROM BUS 314563 TO BUS 924510 CKT 1 /* 6CLUBHSE 230.00 - AB2-100 TAP 230.00 END
LN 259	CONTINGENCY 'LN 259' OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHSTF B 230.00 END
LN 259-2065	CONTINGENCY 'LN 259-2065' OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHSTF B 230.00 OPEN BRANCH FROM BUS 314276 TO BUS 314339 CKT 1 /* 6BASIN 230.00 - 6SPRUNCE 230.00 END

Contingency Name	Description
LN 54-2012_B	CONTINGENCY 'LN 54-2012_B' OPEN BRANCH FROM BUS 921751 TO BUS 314581 CKT 1 /* AA2-053 TAP 115.00 - 3JACKSON 115.00 OPEN BRANCH FROM BUS 314568 TO BUS 314625 CKT 1 /* 3EARLEYS 115.00 - 3AULANDR 115.00 OPEN BRANCH FROM BUS 314581 TO BUS 314626 CKT 1 /* 3JACKSON 115.00 - 3WOODLND 115.00 OPEN BRANCH FROM BUS 314625 TO BUS 314626 CKT 1 /* 3AULANDR 115.00 - 3WOODLND 115.00 OPEN BUS 314581 /* ISLAND OPEN BUS 314625 /* ISLAND OPEN BUS 314626 /* ISLAND OPEN BRANCH FROM BUS 314266 TO BUS 314569 CKT 1 /* 6NORTHAMPTON230.00 - 6EARLEYS 230.00 OPEN BRANCH FROM BUS 314266 TO BUS 314599 CKT 1 /* 6NORTHAMPTON230.00 - 6ROA VAL 230.00 OPEN BUS 314266 /* ISLAND END
LN 557	CONTINGENCY 'LN 557' OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM 230.00 - 8CHCKAHM 500.00 OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM 500.00 - 8ELMONT 500.00 END
LN 56-2012_A	CONTINGENCY 'LN 56-2012_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 TAP 115.00 OPEN BRANCH FROM BUS 314558 TO BUS 314587 CKT 1 /* 3BOYKINS 115.00 - 3MARGTSV 115.00 OPEN BRANCH FROM BUS 314587 TO BUS 314604 CKT 1 /* 3MARGTSV 115.00 - 3SEABORD 115.00 OPEN BUS 314259 /* ISLAND OPEN BUS 314587 /* ISLAND OPEN BUS 314604 /* ISLAND OPEN BRANCH FROM BUS 314266 TO BUS 314569 CKT 1 /* 6NORTHAMPTON230.00 - 6EARLEYS 230.00 OPEN BRANCH FROM BUS 314266 TO BUS 314599 CKT 1 /* 6NORTHAMPTON230.00 - 6ROA VAL 230.00 OPEN BUS 314266 /* ISLAND END

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 573	CONTINGENCY 'LN 573' OPEN BRANCH FROM BUS 314918 TO BUS 314934 CKT 1 /* 8NO ANNA 500.00 - 8SPOTSYL 500.00 END
LN 574	CONTINGENCY 'LN 574' OPEN BRANCH FROM BUS 314908 TO BUS 314911 CKT 1 /* 8ELMONT 500.00 - 8LDYSMTH 500.00 END
LN 576	CONTINGENCY 'LN 576' OPEN BRANCH FROM BUS 314322 TO BUS 314914 CKT 1 /* 6MDLTHAN 230.00 - 8MDLTHAN 500.00 OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 END
LN 581	CONTINGENCY 'LN 581' OPEN BRANCH FROM BUS 314135 TO BUS 314905 CKT 2 /* 3CHANCE 115.00 - 8CHANCE 500.00 OPEN BRANCH FROM BUS 314905 TO BUS 314911 CKT 1 /* 8CHANCE 500.00 - 8LDYSMTH 500.00 END
LN 594	CONTINGENCY 'LN 594' OPEN BRANCH FROM BUS 314916 TO BUS 314934 CKT 1 /* 8MORRSVL 500.00 - 8SPOTSYL 500.00 END

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

Summer Peak Analysis - 2020

System Reinforcement responsible by ITO

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To	Circuit		Initial	Final	Type	MVA	
1	LFFB	T672B	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	98.84	100.04	LD	459	12.23
2	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	126.84	128.09	LD	459	12.76
3	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	108.76	109.76	ER	375	8.37
4	N-1	LN 576	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	105.81	106.75	ER	375	7.78
5	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	138.6	139.86	LD	459	12.76
6	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	123.15	124.16	ER	375	8.37
7	N-1	LN 576	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	120.21	121.15	ER	375	7.78
8	LFFB	T672B	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	110.6	111.8	LD	459	12.23
9	LFFB	562T563	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	110.58	111.7	LD	459	11.39
10	DCTL	LN 259-2065	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	109.18	110.37	LD	459	12.15
11	BF	BASIN 230 B#2	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	108.95	110.14	LD	459	12.17
12	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	138.76	140.01	LD	459	12.76
13	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	123.34	124.35	ER	375	8.37

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
14	N-1	LN 576	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	120.4	121.33	ER	375	7.78
15	LFFB	T672B	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	110.75	111.95	LD	459	12.23
16	LFFB	562T563	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	110.74	111.85	LD	459	11.39
17	DCTL	LN 259-2065	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	109.33	110.52	LD	459	12.15
18	BF	BASIN 230 B#2	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	109.1	110.29	LD	459	12.17
19	DCTL	LN 2058-2181	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	DC	109.1	110.29	ER	164	12.17

PJM baseline project (b2745) will eliminate the identified overloads 1 through 18. 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		Affected Area	Facility Description	Bus		Cir.	Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To			Initial	Final	Type	MVA		
20	N-1	LN 254_A	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	DC	96.79	117.31	ER	375	76.96	
21	N-1	LN 238	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	DC	95.91	116.07	ER	375	75.61	
22	N-1	LN 2012	DVP - DVP	6LAKEVEW-AB2-100 TAP 230 kV line	314583	924510	1	DC	81.15	94.92	ER	375	51.64	1
23	N-1	LN 557	DVP - DVP	8CARSON-8MDLTHAN 500 kV line	314902	314914	1	DC	89.49	90.03	ER	2442	29.38	2

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To	Cir.		Initial	Final	Type	MVA		
24	N-1	LN 2012	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	99.6	113.37	ER	375	51.64	
25	N-1	DVP_P1-2:2056_A	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	90.58	104.76	ER	375	53.19	

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		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To	Cir.		Initial	Final	Type	MVA		
26	LFFB	T672B	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	98.84	100.04	LD	459	12.23	
27	LFFB	239T2141	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	DC	88.74	110.93	LD	637	141.33	3
28	LFFB	246T2034_A	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	DC	92.85	103.28	LD	637	66.46	
29	DCTL	LN 54-2012_B	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	DC	91.62	102.92	LD	637	71.99	
30	DCTL	LN 56-2012_A	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	DC	90.49	102.01	LD	637	73.37	
31	LFFB	254T2141_A	DVP - DVP	6HORNRTN-AC1-208 TAP 230 kV line	314579	927140	1	DC	89.16	122.37	LD	541	179.65	4
32	LFFB	23872	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	DC	93.88	117.85	LD	459	110.05	5

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To	Cir.		Initial	Final	Type	MVA		
33	LFFB	238T2002	DVP - DVP	6LAKEVIEW-6CAROLNA 230 kV line	314583	314561	1	DC	93.62	117.59	LD	459	110.03	
34	LFFB	557T574	DVP - DVP	8CARSON-8MDLTHAN 500 kV line	314902	314914	1	DC	92.99	93.62	LD	3144	45.7	
35	LFFB	H2T557	DVP - DVP	8CARSON-8MDLTHAN 500 kV line	314902	314914	1	DC	85.31	85.91	LD	3144	43.85	
36	DCTL	LN 54-2012_B	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	99.18	115.74	LD	459	76.02	
37	DCTL	LN 56-2012_A	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	96.12	112.88	LD	459	76.94	
38	LFFB	254T2141_A	DVP - DVP	AC1-208 TAP-6HATHAWAY 230 kV line	927140	313845	1	DC	89.1	122.31	LD	541	179.65	6

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

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

None

Contribution to Previously Identified Overloads

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

Contingency			Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Ref
#	Type	Name			From	To	Cir.		Initial	Final	Type	MVA		
39	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	126.84	128.09	LD	459	12.76	7
40	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	108.76	109.76	ER	375	8.37	
41	N-1	LN 576	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	105.81	106.75	ER	375	7.78	
42	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	138.6	139.86	LD	459	12.76	8
43	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	123.15	124.16	ER	375	8.37	
44	N-1	LN 576	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	120.21	121.15	ER	375	7.78	
45	LFFB	T672B	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	110.6	111.8	LD	459	12.23	
46	LFFB	562T563	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	110.58	111.7	LD	459	11.39	
47	DCTL	LN 259-2065	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	109.18	110.37	LD	459	12.15	
48	BUS	BASIN 230 B#2	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	108.95	110.14	LD	459	12.17	
49	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	138.76	140.01	LD	459	12.76	9
50	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	123.34	124.35	ER	375	8.37	

Contingency			Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Ref
#	Type	Name			From	To	Cir.		Initial	Final	Type	MVA		
51	N-1	LN 576	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	120.4	121.33	ER	375	7.78	
52	LFFB	T672B	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	110.75	111.95	LD	459	12.23	
53	LFFB	562T563	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	110.74	111.85	LD	459	11.39	
54	DCTL	LN 259-2065	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	109.33	110.52	LD	459	12.15	
55	BUS	BASIN 230 B#2	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	109.1	110.29	LD	459	12.17	
56	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	117.04	118.07	ER	449	10.3	10
57	N-1	LN 217	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	101.04	102.03	ER	449	9.91	
58	DCTL	LN 2058-2181	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	DC	141.55	154.3	ER	164	20.91	11
59	N-1	LN 576	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	DC	111.72	112.32	ER	2442	32.75	12
60	N-1	LN 563	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	DC	100.63	101.13	ER	2442	27.43	
61	LFFB	239T2141	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	112.94	152.11	LD	459	179.8	13
62	LFFB	246T2034_A	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	101.14	116.21	LD	459	69.15	

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 – 4, 26	6CHARCTY-6LAKE SD 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 5 – 11	6MESSER-6CHARCTY 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 12 – 18	6CHSTF B-6MESSER 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 19	3BTLEBRO-3ROCKYMT115T 115 kV line	Upgrade Battleboro terminal equipment	Pending	\$15,000
# 20, 21, 32, 33	6LAKEVIEW-6CAROLNA 230 kV line	Upgrade/rebuild approximately 1.4 miles of 230 kV Line to increase the line rating by 15% to 360 MVA. Estimated time: 18-20 months.	Pending	\$3,500,000
# 22	6LAKEVIEW-AB2-100 TAP 230 kV line	Rebuild the AB2-100 TAP-Lakeview 230kV line. Estimated time: 44-48 months.	Pending	\$41,000,000

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
# 23, 34, 35	8CARSON-8MDLTHAN 500 kV line	Replace wave trap at both Carson and Midlothian 500kV Substations. This will increase emergency rating by 31% to 3424 MVA. Estimated time: 12-16 months.	Pending	\$500,000
# 24, 25, 36, 37	AB2-100 TAP-6CLUBHSE 230 kV line	Rebuild the AB2-100 TAP-Clubhouse 230kV line. Estimated time: 44-48 months.	Pending	\$13,500,000
# 27 – 30	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
# 31	6HORNRTN-AC1-208 TAP 230 kV line	Rebuild the AC1-208 TAP-Hornerstown 230kV line to increase its emergency line rating to a minimum of 620 MVA and its load dump rating to a minimum of 730 MVA. Rebuild/Uprate is approximately 9.7 miles of Line #2056. Estimated time: 30-36 months.	Pending	\$25,000,000
# 38	AC1-208 TAP-6HATHAWAY 230 kV line	Rebuild the AC1-208 TAP-Hathaway 230kV line to increase its emergency line rating to a minimum of 620 MVA and its load dump rating to a minimum of 730 MVA. Estimated time 30-36 months.	Pending	\$57,000,000
Total New Network Upgrades				\$141,165,000

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
# 39 – 41	6CHARCTY-6LAKESD 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 42 – 48	6MESSER-6CHARCTY 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
# 49 – 55	6CHSTF B-6MESSER 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 56, 57	6CHSTF B-6BASIN 230 kV line	Rebuild of the Chesterfield-Basin 230kV line. Estimated time: 44-48 months.	Pending	\$18,615,000
# 58	3BTLEBRO-3ROCKYMT115T 115 kV line	Upgrade Battleboro terminal equipment	Pending	\$15,000
# 59, 60	8ELMONT-8LDYSMTH 500 kV line	Wreck and rebuild the line for a higher capacity since the overload exceeds the conductor rating. Estimated time: 36-48 months.	Pending	\$78,300,000
# 61, 62	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				\$110,430,000

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 Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
63	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	118.69	120.15	ER	375	12.18

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
64	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	133.09	134.55	ER	375	12.18
65	N-1	LN 238	DVP - DVP	6NORTHAMPTON-6EARLEYS 230 kV line	314266	314569	1	DC	87.44	99.19	ER	559	65.72
66	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	133.27	134.74	ER	375	12.18
67	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	141.46	142.97	ER	449	14.99
68	N-1	LN 2012	DVP - DVP	6CAROLNA 230/115 kV transformer	314561	314559	1	DC	83.37	100.29	ER	240	40.59
69	N-1	LN 2012	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	DC	93.06	104.82	ER	599	70.4
70	N-1	LN 2131A	DVP - DVP	6EARLEYS-6NUCO TP 230 kV line	314569	314575	1	DC	102.53	105.07	ER	572	32.25
71	N-1	LN 2131A	DVP - DVP	6NUCO TP-AA1-138 TAP 230 kV line	314575	921571	1	DC	95.72	98.27	ER	572	32.25
72	N-1	LN 238	DVP - DVP	6HORNRTN-AC1-208 TAP 230 kV line	314579	927140	1	DC	93.45	109.21	ER	442	69.62
73	N-1	LN 238	DVP - DVP	6LAKEVIEW-6CAROLNA 230 kV line	314583	314561	1	DC	114.38	143.71	ER	375	110.02
74	N-1	LN 2012	DVP - DVP	6LAKEVIEW-AB2-100 TAP 230 kV line	314583	924510	1	DC	91.21	111.24	ER	375	75.15
75	N-1	LN 238	DVP - DVP	6ROA VAL-6NORTHAMPTON 230 kV line	314599	314266	1	DC	93.15	105.14	ER	548	65.72

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To	Circuit		Initial	Final	Type	MVA	
78	N-1	LN 557	DVP - DVP	8CARSON-8MDLTHAN 500 kV line	314902	314914	1	DC	108.81	109.57	ER	2442	42.76
79	N-1	LN 576	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	DC	95.45	96.2	ER	2442	41.42
80	N-1	LN 594	DVP - DVP	8CHANCE-8BRISTER 500 kV line	314905	314900	1	DC	108.31	108.84	ER	2442	28.87
81	N-1	LN 576	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	DC	130.43	131.31	ER	2442	47.65
82	N-1	LN 573	DVP - DVP	8LDYSMTH-8CHANCE 500 kV line	314911	314905	1	DC	102.37	102.85	ER	2738	29.25
83	N-1	LN 574	DVP - DVP	8MDLTHAN-8NO ANNA 500 kV line	314914	314918	1	DC	112.59	113.43	ER	2442	45.48
84	N-1	LN 581	DVP - DVP	8NO ANNA-8SPOTSYL 500 kV line	314918	314934	1	DC	96.91	97.36	ER	3219	32.31
85	N-1	LN 2131A	DVP - DVP	AA1-138 TAP-6SUFFOLK 230 kV line	921571	314537	1	DC	105.23	107.77	ER	572	32.25
86	N-1	LN 2012	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	117.45	137.49	ER	375	75.15
87	N-1	LN 238	DVP - DVP	AC1-208 TAP-6HATHAWAY 230 kV line	927140	313845	1	DC	93.38	109.14	ER	442	69.62

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 #AC1-086 interconnection of a 180 MW Energy (123.7 MW Capacity) injection into the ITO's Transmission System at Thelma 230 kV Substation, 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

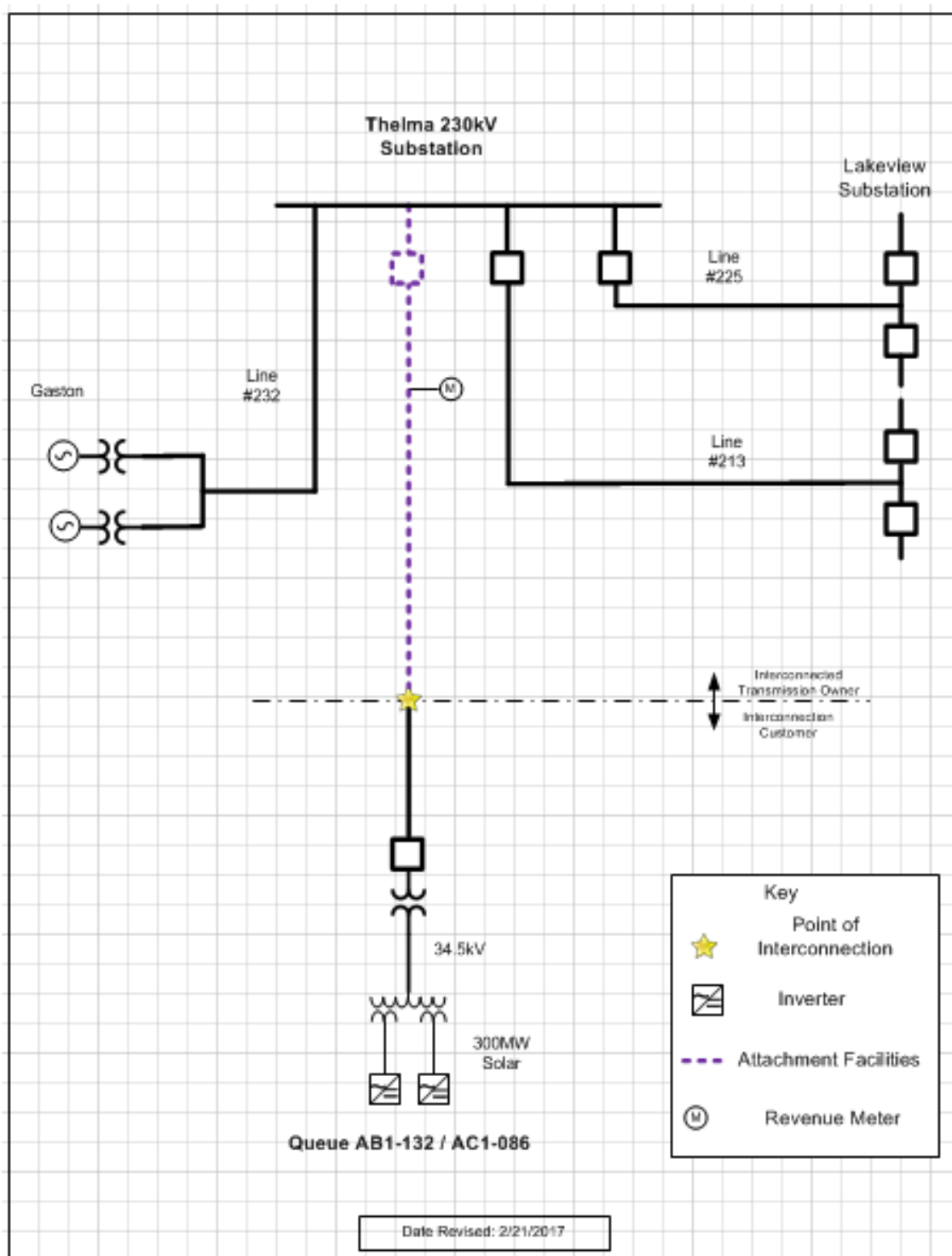
The import and export conditions into and out of the ITO System are evaluated with any new interconnection greater than 20 MW, any new facility that is interconnected with the ITO System should not significantly decrement FCITC between utilities. These studies will be performed during the System Impact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



Flowgate Appendices

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 6LAKEVEW-AB2-100 TAP 230 kV line (from bus 314583 to bus 924510 ckt 1) loads from 81.15% to 94.92% (**DC power flow**) of its emergency rating (375 MVA) for the single line contingency outage of 'LN 2012'. This project contributes approximately 51.64 MW to the thermal violation.

CONTINGENCY 'LN 2012'

OPEN BRANCH FROM BUS 314266 TO BUS 314569 CKT 1 /*

6NORTHAMPTON230.00 - 6EARLEYS 230.00

OPEN BRANCH FROM BUS 314266 TO BUS 314599 CKT 1 /*

6NORTHAMPTON230.00 - 6ROA VAL 230.00

OPEN BUS 314266 /* ISLAND

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315131	1EDGECEMA	1.83
315132	1EDGECEMB	1.83
315139	1GASTONA	8.68
315141	1GASTONB	8.68
315159	1KERR 2	0.58
315161	1KERR 4	0.57
315162	1KERR 5	0.57
315163	1KERR 6	0.57
315164	1KERR 7	0.57
315126	1ROARAP2	1.66
315128	1ROARAP4	1.59
315134	1ROAVALA	12.68
315135	1ROAVALB	3.38
315136	1ROSEMG1	5.76
315138	1ROSEMG2	2.7
315137	1ROSEMS1	3.57
315115	1SHAMPT1	0.85
900671	V4-068 C	0.06
917331	Z2-043 C	0.27
917341	Z2-044 C	0.24
917511	Z2-088 C OP1	0.65
917591	Z2-099 C	0.11
918411	AA1-050	0.54
LTF	AA1-058	0.36

921162	AA1-063AC	7.41
921182	AA1-067 C	0.9
918561	AA1-072 C	0.04
921562	AA1-135 C	4.
921752	AA2-053 C	8.07
921762	AA2-057 C	6.56
921862	AA2-068 C	2.02
920021	AA2-086 C	0.06
921982	AA2-088 C	3.58
922442	AA2-165 C	0.89
922472	AA2-169 C	1.45
922512	AA2-174 C	0.37
922722	AB1-053 C	2.47
922732	AB1-054 C	3.89
922922	AB1-081 C OP	8.71
923262	AB1-132 C OP	35.07
923801	AB2-015 C OP	3.18
923941	AB2-035 C	0.29
924151	AB2-059 C OP	10.27
924381	AB2-087 C	0.27
924391	AB2-088 C	0.38
924401	AB2-089 C	1.01
924491	AB2-098 C	0.3
924501	AB2-099 C	0.29
925121	AB2-169 C OP	2.39
925141	AB2-171 C OP	2.13
925591	AC1-034 C OP	5.94
925781	AC1-054 C OP	3.91
926071	AC1-086 C	51.64
926201	AC1-098 C	5.06
926211	AC1-099 C	1.69
926771	AC1-163 C	1.04
927021	AC1-189 C	5.31
927051	AC1-193 C	1.56
927141	AC1-208 C	15.32

Appendix 2

(DVP - DVP) The 8CARSON-8MDLTHAN 500 kV line (from bus 314902 to bus 314914 ckt 1) loads from 89.49% to 90.03% (**DC power flow**) of its emergency rating (2442 MVA) for the single line contingency outage of 'LN 557'. This project contributes approximately 29.38 MW to the thermal violation.

CONTINGENCY 'LN 557'

OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM
230.00 - 8CHCKAHM 500.00

OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM
500.00 - 8ELMONT 500.00

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315102	1BRUNSWICKG1	17.73
315103	1BRUNSWICKG2	17.73
315104	1BRUNSWICKG3	17.73
315105	1BRUNSWICKS1	36.84
315099	1CHESPKB	2.03
315108	1ELIZAR1	5.98
315109	1ELIZAR2	5.88
315110	1ELIZAR3	6.06
315233	1SURRY 2	48.13
315091	1YORKTN2	38.41
916191	Z1-068 C	0.08
916301	Z1-086 C	108.23
LTF	Z2-067	27.58
921092	AA1-049 C	3.92
LTF	AA1-058	1.22
921162	AA1-063AC	12.23
921172	AA1-064 C	15.51
921182	AA1-067 C	2.46
921532	AA1-132 C	12.11
921542	AA1-133 C	16.2
921552	AA1-134 C	15.68
921562	AA1-135 C	13.6
921572	AA1-138 C	15.27
921582	AA1-139 C	24.3
921752	AA2-053 C	12.43

921762	AA2-057 C	10.05
921772	AA2-059 C	3.72
921862	AA2-068 C	3.17
LTF	AA2-074	8.21
921982	AA2-088 C	9.53
922442	AA2-165 C	1.37
922472	AA2-169 C	2.96
922512	AA2-174 C	0.57
922522	AA2-177 C	10.18
922532	AA2-178 C	14.85
922602	AB1-013 C	4.48
922722	AB1-053 C	1.51
922732	AB1-054 C	10.06
922922	AB1-081 C OP	12.49
923262	AB1-132 C OP	19.95
923572	AB1-173 C OP	3.15
923582	AB1-173AC OP	3.15
923801	AB2-015 C OP	12.92
923831	AB2-022 C	3.69
923851	AB2-025 C	3.4
923911	AB2-031 C OP	3.13
923941	AB2-035 C	0.48
923981	AB2-039 C OP	11.06
923991	AB2-040 C OP	10.26
924021	AB2-043 C OP	3.64
924071	AB2-051 C OP	221.45
924151	AB2-059 C OP	14.72
924241	AB2-068 OP	313.95
924301	AB2-077 C OP	2.32
924311	AB2-078 C OP	2.32
924321	AB2-079 C OP	2.32
924381	AB2-087 C	0.84
924391	AB2-088 C	0.61
924401	AB2-089 C	2.75
924411	AB2-090 C	4.59
924491	AB2-098 C	0.82
924501	AB2-099 C	0.87
924511	AB2-100 C	16.03
924761	AB2-128 C	13.73

924811	AB2-134 C OP	13.05
924931	AB2-147 C	3.52
924941	AB2-149 C OP	4.83
924951	AB2-150 C OP	3.52
925061	AB2-161 C OP	4.47
925121	AB2-169 C OP	9.71
925141	AB2-171 C OP	7.29
925171	AB2-174 C OP	9.79
925221	AB2-176 C	1.89
925281	AB2-186 C	0.97
925291	AB2-188 C OP	3.66
925331	AB2-190 C	23.27
925361	AC1-007 C OP	1.
925521	AC1-027 C	3.24
925591	AC1-034 C OP	9.7
925691	AC1-045 C	2.63
925701	AC1-046 C	2.83
925711	AC1-047 C	3.75
925781	AC1-054 C OP	9.41
926071	AC1-086 C	29.38
926201	AC1-098 C	8.81
926211	AC1-099 C	2.95
926271	AC1-105 C OP	7.02
926281	AC1-106	3.03
926291	AC1-107 OP	473.89
926661	AC1-147 C	3.63
926741	AC1-159 C	219.74
926751	AC1-161 C OP	52.59
926771	AC1-163 C	3.13
926781	AC1-164 C OP	65.4
927021	AC1-189 C	12.41
927051	AC1-193 C	5.34
927141	AC1-208 C	12.7
927211	AC1-215 C	12.6
927221	AC1-216 C OP	9.96
927251	AC1-221 C	3.98
927261	AC1-222 C	5.96

Appendix 3

(DVP - DVP) The 6CLUBHSE-6SAPONY 230 kV line (from bus 314563 to bus 314435 ckt 1) loads from 88.74% to 110.93% (**DC power flow**) of its load dump rating (637 MVA) for the line fault with failed breaker contingency outage of '239T2141'. This project contributes approximately 141.33 MW to the thermal violation.

CONTINGENCY '239T2141'

/* LAKEVIEW

OPEN BRANCH FROM BUS 314583 TO BUS 314579 CKT 1 /* 239
 OPEN BRANCH FROM BUS 314579 TO BUS 314605 CKT 1 /* 2057
 OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141
 END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	16.32
315141	1GASTONB	16.32
315159	1KERR 2	1.15
315164	1KERR 7	1.13
315126	1ROARAP2	1.53
315128	1ROARAP4	1.47
314704	3LAWRENC	0.96
921162	AA1-063AC	6.84
921163	AA1-063AE	3.22
921752	AA2-053 C	7.37
921753	AA2-053 E	3.16
922472	AA2-169 C	1.83
922473	AA2-169 E	0.84
922512	AA2-174 C	0.34
922513	AA2-174 E	0.37
923262	AB1-132 C OP	65.96
923263	AB1-132 E OP	28.27
923572	AB1-173 C OP	5.09
923573	AB1-173 E OP	2.38
923582	AB1-173AC OP	5.09
923583	AB1-173AE OP	2.38
923911	AB2-031 C OP	5.05
923912	AB2-031 E OP	2.49
923991	AB2-040 C OP	16.59
923992	AB2-040 E OP	13.57
924021	AB2-043 C OP	2.48

924022	AB2-043 E OP	4.07
924301	AB2-077 C OP	1.53
924302	AB2-077 E OP	1.02
924311	AB2-078 C OP	1.53
924312	AB2-078 E OP	1.02
924321	AB2-079 C OP	1.53
924322	AB2-079 E OP	1.02
924401	AB2-089 C	1.61
924402	AB2-089 E	0.83
924411	AB2-090 C	3.12
924412	AB2-090 E	1.6
924511	AB2-100 C	52.61
924512	AB2-100 E	25.91
924761	AB2-128 C	45.07
924762	AB2-128 E	17.75
924931	AB2-147 C	8.12
924932	AB2-147 E	13.25
924951	AB2-150 C OP	8.12
924952	AB2-150 E OP	13.25
925171	AB2-174 C OP	18.36
925172	AB2-174 E OP	16.61
925221	AB2-176 C	1.29
925222	AB2-176 E	0.55
925781	AC1-054 C OP	5.63
925782	AC1-054 E OP	2.59
926071	AC1-086 C	97.13
926072	AC1-086 E	44.21
926281	AC1-106	2.06
927111	AC1-206 C OP	53.31
927112	AC1-206 E OP	25.2
927211	AC1-215 C	8.2
927212	AC1-215 E	3.72

Appendix 4

(DVP - DVP) The 6HORNRTN-AC1-208 TAP 230 kV line (from bus 314579 to bus 927140 ckt 1) loads from 89.16% to 122.37% (**DC power flow**) of its load dump rating (541 MVA) for the line fault with failed breaker contingency outage of '254T2141_A'. This project contributes approximately 179.65 MW to the thermal violation.

CONTINGENCY '254T2141_A'

/* LAKEVIEW

OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141

OPEN BRANCH FROM BUS 314583 TO BUS 924510 CKT 1 /* 254

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	20.75
315141	1GASTONB	20.75
315136	1ROSEMG1	14.9
315138	1ROSEMG2	6.98
315137	1ROSEMS1	9.24
922722	AB1-053 C	6.39
922723	AB1-053 E	3.59
923262	AB1-132 C OP	83.83
923263	AB1-132 E OP	35.93
926071	AC1-086 C	123.46
926072	AC1-086 E	56.19

Appendix 5

(DVP - DVP) The 6LAKEVEW-6CAROLNA 230 kV line (from bus 314583 to bus 314561 ckt 1) loads from 93.88% to 117.85% (**DC power flow**) of its load dump rating (459 MVA) for the line fault with failed breaker contingency outage of '23872'. This project contributes approximately 110.05 MW to the thermal violation.

CONTINGENCY '23872' /*_ CARSON
 OPEN BRANCH FROM BUS 314282 TO BUS 314435 CKT 1 /*L238 CARSON
 SAPONY
 OPEN BRANCH FROM BUS 314435 TO BUS 314563 CKT 1 /*L238 SAPONY
 CLUBHOUSE
 OPEN BRANCH FROM BUS 314563 TO BUS 314562 CKT 1 /*CLUBHOUSE
 TX1 230-115
 OPEN BRANCH FROM BUS 314282 TO BUS 314902 CKT 1 /*CARSON TX2
 500-230
 OPEN BRANCH FROM BUS 314282 TO BUS 314455 CKT 1 /*CARSON SC172
 END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315131	1EDGECEMA	1.97
315132	1EDGECEMB	1.97
315139	1GASTONA	12.71
315141	1GASTONB	12.71
315136	1ROSEMG1	8.31
315138	1ROSEMG2	3.89
315137	1ROSEMS1	5.15
922722	AB1-053 C	3.56
922723	AB1-053 E	2.
922922	AB1-081 C OP	7.68
922923	AB1-081 E OP	3.29
923262	AB1-132 C OP	51.36
923263	AB1-132 E OP	22.01
923941	AB2-035 C	0.25
923942	AB2-035 E	0.11
924151	AB2-059 C OP	9.06
924152	AB2-059 E OP	4.66
924391	AB2-088 C	0.33
924392	AB2-088 E	0.16
924511	AB2-100 C	40.96

924512	<i>AB2-100 E</i>	20.18
924761	<i>AB2-128 C</i>	35.09
924762	<i>AB2-128 E</i>	13.82
925591	<i>AC1-034 C OP</i>	5.17
925592	<i>AC1-034 E OP</i>	3.9
926071	<i>AC1-086 C</i>	75.63
926072	<i>AC1-086 E</i>	34.42
927111	<i>AC1-206 C OP</i>	41.51
927112	<i>AC1-206 E OP</i>	19.63
927141	<i>AC1-208 C</i>	20.4
927142	<i>AC1-208 E</i>	9.06

Appendix 6

(DVP - DVP) The AC1-208 TAP-6HATHAWAY 230 kV line (from bus 927140 to bus 313845 ckt 1) loads from 89.1% to 122.31% (**DC power flow**) of its load dump rating (541 MVA) for the line fault with failed breaker contingency outage of '254T2141_A'. This project contributes approximately 179.65 MW to the thermal violation.

CONTINGENCY '254T2141_A'

/* LAKEVIEW

OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1

/* 2141

OPEN BRANCH FROM BUS 314583 TO BUS 924510 CKT 1

/* 254

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	20.75
315141	1GASTONB	20.75
315136	1ROSEMG1	14.9
315138	1ROSEMG2	6.98
315137	1ROSEMS1	9.24
922722	AB1-053 C	6.39
922723	AB1-053 E	3.59
923262	AB1-132 C OP	83.83
923263	AB1-132 E OP	35.93
926071	AC1-086 C	123.46
926072	AC1-086 E	56.19
927141	AC1-208 C	55.29
927142	AC1-208 E	24.55

Appendix 7

(DVP - DVP) The 6CHARCTY-6LAKESD 230 kV line (from bus 314225 to bus 314227 ckt 1) loads from 126.84% to 128.09% (**DC power flow**) of its load dump rating (459 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 12.76 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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315065	1CHESTF6	35.89
315077	1HOPHCF1	2.08
315078	1HOPHCF2	2.08
315079	1HOPHCF3	2.08
315080	1HOPHCF4	3.16
315076	1HOPPOLC	1.78
315073	1STONECA	5.66
314784	1WEYRHSB	0.65
314539	3UNCAMP	0.86
314541	3WATKINS	0.24
314229	6MT R221	-0.33
315074	CIR_AB2-152	0.89
315075	CIR_AB2-152	0.87
292791	U1-032 E	2.95
900672	V4-068 E	0.11
901082	W1-029E	13.46
907092	X1-038 E	2.14
913392	Y1-086 E	0.63
914231	Y2-077	0.84
916042	Z1-036 E	13.56
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
921162	AA1-063AC	3.19
921163	AA1-063AE	1.5
918512	AA1-065 E OP	1.48
918562	AA1-072 E	0.06
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	2.99
921573	AA1-138 E	1.28
921752	AA2-053 C	3.25
921753	AA2-053 E	1.4
921762	AA2-057 C	2.34
921763	AA2-057 E	1.17
921772	AA2-059 C	0.71
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	3.8
922442	AA2-165 C	0.32
922443	AA2-165 E	0.15
922472	AA2-169 C	0.71
922473	AA2-169 E	0.32
922512	AA2-174 C	0.15
922513	AA2-174 E	0.16
922522	AA2-177 C	6.38
922523	AA2-177 E	2.74
922532	AA2-178 C	2.95
922533	AA2-178 E	1.27
922602	AB1-013 C	0.89
922603	AB1-013 E	5.97
922722	AB1-053 C	0.44
922723	AB1-053 E	0.25
922732	AB1-054 C	2.46

922733	AB1-054 E	1.21
923262	AB1-132 C OP	5.96
923263	AB1-132 E OP	2.55
923572	AB1-173 C OP	0.98
923573	AB1-173 E OP	0.46
923582	AB1-173AC OP	0.98
923583	AB1-173AE OP	0.46
923801	AB2-015 C OP	3.06
923802	AB2-015 E OP	2.51
923831	AB2-022 C	0.66
923832	AB2-022 E	0.35
923851	AB2-025 C	1.62
923852	AB2-025 E	0.73
923911	AB2-031 C OP	0.98
923912	AB2-031 E OP	0.48
923981	AB2-039 C OP	4.91
923982	AB2-039 E OP	3.97
923991	AB2-040 C OP	3.21
923992	AB2-040 E OP	2.62
924071	AB2-051 C OP	38.98
924072	AB2-051 E OP	5.35
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	5.57
924512	AB2-100 E	2.74
924761	AB2-128 C	4.77
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.18
924812	AB2-134 E OP	10.94
924931	AB2-147 C	1.2
924932	AB2-147 E	1.96
924941	AB2-149 C OP	1.58
924942	AB2-149 E OP	2.58
924951	AB2-150 C OP	1.2
924952	AB2-150 E OP	1.96
924961	AB2-152	2.21
925051	AB2-160 C OP	4.18

925052	AB2-160 E OP	6.82
925061	AB2-161 C OP	1.99
925062	AB2-161 E OP	3.24
925121	AB2-169 C OP	2.01
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	14.59
925332	AB2-190 E	3.65
925361	AC1-007 C OP	0.24
925362	AC1-007 E OP	0.39
925521	AC1-027 C	0.57
925522	AC1-027 E	0.32
925691	AC1-045 C	0.53
925692	AC1-045 E	0.29
925821	AC1-061	0.03
926071	AC1-086 C	8.77
926072	AC1-086 E	3.99
926201	AC1-098 C	2.1
926202	AC1-098 E	1.25
926211	AC1-099 C	0.7
926212	AC1-099 E	0.41
926661	AC1-147 C	0.65
926662	AC1-147 E	0.38
926741	AC1-159 C	38.68
926771	AC1-163 C	0.73
926772	AC1-163 E	0.34
927051	AC1-193 C	1.28
927052	AC1-193 E	2.09
927111	AC1-206 C OP	6.47
927112	AC1-206 E OP	3.06
927141	AC1-208 C	3.25
927142	AC1-208 E	1.44

927221	AC1-216 C OP	6.25
927222	AC1-216 E OP	4.91

Appendix 8

(DVP - DVP) The 6MESSER-6CHARCTY 230 kV line (from bus 314228 to bus 314225 ckt 1) loads from 138.6% to 139.86% (**DC power flow**) of its load dump rating (459 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 12.76 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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315065	1CHESTF6	35.89
315077	1HOPHCF1	2.08
315078	1HOPHCF2	2.08
315079	1HOPHCF3	2.08
315080	1HOPHCF4	3.16
315076	1HOPPOLC	1.78
315073	1STONECA	5.66
314784	1WEYRHSB	0.65
314539	3UNCAMP	0.86
314541	3WATKINS	0.24
314229	6MT R221	-0.33
315074	CIR_AB2-152	0.89
315075	CIR_AB2-152	0.87
292791	U1-032 E	2.95
900672	V4-068 E	0.11
901082	W1-029E	13.46
907092	X1-038 E	2.14
913392	Y1-086 E	0.63
914231	Y2-077	0.84
916042	Z1-036 E	13.56
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
921162	AA1-063AC	3.19
921163	AA1-063AE	1.5
918512	AA1-065 E OP	1.48
918562	AA1-072 E	0.06
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	2.99
921573	AA1-138 E	1.28
921752	AA2-053 C	3.25
921753	AA2-053 E	1.4
921762	AA2-057 C	2.34
921763	AA2-057 E	1.17
921772	AA2-059 C	0.71
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	3.8
922442	AA2-165 C	0.32
922443	AA2-165 E	0.15
922472	AA2-169 C	0.71
922473	AA2-169 E	0.32
922512	AA2-174 C	0.15
922513	AA2-174 E	0.16
922522	AA2-177 C	6.38
922523	AA2-177 E	2.74
922532	AA2-178 C	2.95
922533	AA2-178 E	1.27
922602	AB1-013 C	0.89
922603	AB1-013 E	5.97
922722	AB1-053 C	0.44
922723	AB1-053 E	0.25
922732	AB1-054 C	2.46

922733	AB1-054 E	1.21
923262	AB1-132 C OP	5.96
923263	AB1-132 E OP	2.55
923572	AB1-173 C OP	0.98
923573	AB1-173 E OP	0.46
923582	AB1-173AC OP	0.98
923583	AB1-173AE OP	0.46
923801	AB2-015 C OP	3.06
923802	AB2-015 E OP	2.51
923831	AB2-022 C	0.66
923832	AB2-022 E	0.35
923851	AB2-025 C	1.62
923852	AB2-025 E	0.73
923911	AB2-031 C OP	0.98
923912	AB2-031 E OP	0.48
923981	AB2-039 C OP	4.91
923982	AB2-039 E OP	3.97
923991	AB2-040 C OP	3.21
923992	AB2-040 E OP	2.62
924071	AB2-051 C OP	38.98
924072	AB2-051 E OP	5.35
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	5.57
924512	AB2-100 E	2.74
924761	AB2-128 C	4.77
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.18
924812	AB2-134 E OP	10.94
924931	AB2-147 C	1.2
924932	AB2-147 E	1.96
924941	AB2-149 C OP	1.58
924942	AB2-149 E OP	2.58
924951	AB2-150 C OP	1.2
924952	AB2-150 E OP	1.96
924961	AB2-152	2.21
925051	AB2-160 C OP	4.18

925052	AB2-160 E OP	6.82
925061	AB2-161 C OP	1.99
925062	AB2-161 E OP	3.24
925121	AB2-169 C OP	2.01
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	14.59
925332	AB2-190 E	3.65
925361	AC1-007 C OP	0.24
925362	AC1-007 E OP	0.39
925521	AC1-027 C	0.57
925522	AC1-027 E	0.32
925691	AC1-045 C	0.53
925692	AC1-045 E	0.29
925821	AC1-061	0.03
926071	AC1-086 C	8.77
926072	AC1-086 E	3.99
926201	AC1-098 C	2.1
926202	AC1-098 E	1.25
926211	AC1-099 C	0.7
926212	AC1-099 E	0.41
926661	AC1-147 C	0.65
926662	AC1-147 E	0.38
926741	AC1-159 C	38.68
926771	AC1-163 C	0.73
926772	AC1-163 E	0.34
927051	AC1-193 C	1.28
927052	AC1-193 E	2.09
927111	AC1-206 C OP	6.47
927112	AC1-206 E OP	3.06
927141	AC1-208 C	3.25
927142	AC1-208 E	1.44

927221	AC1-216 C OP	6.25
927222	AC1-216 E OP	4.91

Appendix 9

(DVP - DVP) The 6CHSTF B-6MESSER 230 kV line (from bus 314287 to bus 314228 ckt 1) loads from 138.76% to 140.01% (**DC power flow**) of its load dump rating (459 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 12.76 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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315065	1CHESTF6	35.89
315077	1HOPHCF1	2.08
315078	1HOPHCF2	2.08
315079	1HOPHCF3	2.08
315080	1HOPHCF4	3.16
315076	1HOPPOLC	1.78
315073	1STONECA	5.66
314784	1WEYRHSB	0.65
314539	3UNCAMP	0.86
314541	3WATKINS	0.24
314229	6MT R221	-0.33
315074	CIR_AB2-152	0.89
315075	CIR_AB2-152	0.87
292791	U1-032 E	2.95
900672	V4-068 E	0.11
901082	W1-029E	13.46
907092	X1-038 E	2.14
913392	Y1-086 E	0.63
914231	Y2-077	0.84
916042	Z1-036 E	13.56
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
921162	AA1-063AC	3.19
921163	AA1-063AE	1.5
918512	AA1-065 E OP	1.48
918562	AA1-072 E	0.06
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	2.99
921573	AA1-138 E	1.28
921752	AA2-053 C	3.25
921753	AA2-053 E	1.4
921762	AA2-057 C	2.34
921763	AA2-057 E	1.17
921772	AA2-059 C	0.71
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	3.8
922442	AA2-165 C	0.32
922443	AA2-165 E	0.15
922472	AA2-169 C	0.71
922473	AA2-169 E	0.32
922512	AA2-174 C	0.15
922513	AA2-174 E	0.16
922522	AA2-177 C	6.38
922523	AA2-177 E	2.74
922532	AA2-178 C	2.95
922533	AA2-178 E	1.27
922602	AB1-013 C	0.89
922603	AB1-013 E	5.97
922722	AB1-053 C	0.44
922723	AB1-053 E	0.25
922732	AB1-054 C	2.46

922733	AB1-054 E	1.21
923262	AB1-132 C OP	5.96
923263	AB1-132 E OP	2.55
923572	AB1-173 C OP	0.98
923573	AB1-173 E OP	0.46
923582	AB1-173AC OP	0.98
923583	AB1-173AE OP	0.46
923801	AB2-015 C OP	3.06
923802	AB2-015 E OP	2.51
923831	AB2-022 C	0.66
923832	AB2-022 E	0.35
923851	AB2-025 C	1.62
923852	AB2-025 E	0.73
923911	AB2-031 C OP	0.98
923912	AB2-031 E OP	0.48
923981	AB2-039 C OP	4.91
923982	AB2-039 E OP	3.97
923991	AB2-040 C OP	3.21
923992	AB2-040 E OP	2.62
924071	AB2-051 C OP	38.98
924072	AB2-051 E OP	5.35
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	5.57
924512	AB2-100 E	2.74
924761	AB2-128 C	4.77
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.18
924812	AB2-134 E OP	10.94
924931	AB2-147 C	1.2
924932	AB2-147 E	1.96
924941	AB2-149 C OP	1.58
924942	AB2-149 E OP	2.58
924951	AB2-150 C OP	1.2
924952	AB2-150 E OP	1.96
924961	AB2-152	2.21
925051	AB2-160 C OP	4.18

925052	AB2-160 E OP	6.82
925061	AB2-161 C OP	1.99
925062	AB2-161 E OP	3.24
925121	AB2-169 C OP	2.01
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	14.59
925332	AB2-190 E	3.65
925361	AC1-007 C OP	0.24
925362	AC1-007 E OP	0.39
925521	AC1-027 C	0.57
925522	AC1-027 E	0.32
925691	AC1-045 C	0.53
925692	AC1-045 E	0.29
925821	AC1-061	0.03
926071	AC1-086 C	8.77
926072	AC1-086 E	3.99
926201	AC1-098 C	2.1
926202	AC1-098 E	1.25
926211	AC1-099 C	0.7
926212	AC1-099 E	0.41
926661	AC1-147 C	0.65
926662	AC1-147 E	0.38
926741	AC1-159 C	38.68
926771	AC1-163 C	0.73
926772	AC1-163 E	0.34
927051	AC1-193 C	1.28
927052	AC1-193 E	2.09
927111	AC1-206 C OP	6.47
927112	AC1-206 E OP	3.06
927141	AC1-208 C	3.25
927142	AC1-208 E	1.44

927221	AC1-216 C OP	6.25
927222	AC1-216 E OP	4.91

Appendix 10

(DVP - DVP) The 6CHSTF B-6BASIN 230 kV line (from bus 314287 to bus 314276 ckt 1) loads from 117.04% to 118.07% (**DC power flow**) of its emergency rating (449 MVA) for the single line contingency outage of 'LN 563'. This project contributes approximately 10.3 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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315065	1CHESTF6	36.2
315141	1GASTONB	1.73
315119	1GRAVEL3	1.38
315120	1GRAVEL4	1.38
315121	1GRAVEL5	1.36
315122	1GRAVEL6	1.39
315117	1GRAVELC	0.47
315077	1HOPHCF1	1.95
315078	1HOPHCF2	1.95
315079	1HOPHCF3	1.95
315080	1HOPHCF4	2.95
315076	1HOPPOLC	1.66
315116	1SURRY 1	14.41
314314	3LOCKS	0.96
315074	CIR_AB2-152	0.83
315075	CIR_AB2-152	0.82
914231	Y2-077	0.78
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	3.52
921552	AA1-134 C	3.61
921562	AA1-135 C	3.65
921572	AA1-138 C	3.7
921582	AA1-139 C	5.28
921752	AA2-053 C	3.88

921762	AA2-057 C	2.89
921772	AA2-059 C	0.89
921862	AA2-068 C	0.93
921982	AA2-088 C	2.78
922442	AA2-165 C	0.39
922472	AA2-169 C	0.86
922512	AA2-174 C	0.18
922522	AA2-177 C	6.22
922532	AA2-178 C	3.67
922602	AB1-013 C	1.11
922722	AB1-053 C	0.52
922732	AB1-054 C	2.95
922922	AB1-081 C OP	3.46
923262	AB1-132 C OP	6.99
923572	AB1-173 C OP	1.14
923582	AB1-173AC OP	1.14
923801	AB2-015 C OP	3.66
923831	AB2-022 C	0.83
923851	AB2-025 C	1.79
923911	AB2-031 C OP	1.13
923941	AB2-035 C	0.13
923981	AB2-039 C OP	5.27
923991	AB2-040 C OP	3.73
924071	AB2-051 C OP	48.69
924151	AB2-059 C OP	4.07
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	6.39
924761	AB2-128 C	5.48
924811	AB2-134 C OP	7.97
924931	AB2-147 C	1.38
924941	AB2-149 C OP	1.77
924951	AB2-150 C OP	1.38
924961	AB2-152	2.07
925051	AB2-160 C OP	3.86
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	3.66
925281	AB2-186 C	0.23
925291	AB2-188 C OP	0.9
925331	AB2-190 C	14.22
925361	AC1-007 C OP	0.27
925521	AC1-027 C	0.71
925591	AC1-034 C OP	2.65
925691	AC1-045 C	0.64
925701	AC1-046 C	0.61
925711	AC1-047 C	0.81
925821	AC1-061	0.03
926071	AC1-086 C	10.3
926201	AC1-098 C	2.56
926211	AC1-099 C	0.86
926661	AC1-147 C	0.81
926741	AC1-159 C	48.32
926771	AC1-163 C	0.88
927021	AC1-189 C	3.3
927051	AC1-193 C	1.53
927141	AC1-208 C	3.95
927221	AC1-216 C OP	6.09

Appendix 11

(DVP - CPLE) The 3BTLEBRO-3ROCKYMT115T 115 kV line (from bus 314554 to bus 304223 ckt 1) loads from 141.55% to 154.3% (**DC power flow**) of its emergency rating (164 MVA) for the tower line contingency outage of 'LN 2058-2181'. This project contributes approximately 20.91 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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315131	1EDGECEMA	2.54
315132	1EDGECEMB	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 12

(DVP - DVP) The 8ELMONT-8LDYSMTH 500 kV line (from bus 314908 to bus 314911 ckt 1) loads from 111.72% to 112.32% (**DC power flow**) of its emergency rating (2442 MVA) for the single line contingency outage of 'LN 576'. This project contributes approximately 32.75 MW to the thermal violation.

CONTINGENCY 'LN 576'

OPEN BRANCH FROM BUS 314322 TO BUS 314914 CKT 1 /* 6MDLTHAN
230.00 - 8MDLTHAN 500.00

OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN
500.00 - 8NO ANNA 500.00

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315058	1CHESTF3	6.16
315059	1CHESTF4	9.98
315060	1CHESTF5	21.16
315061	1CHESTG7	8.29
315063	1CHESTG8	8.22
315062	1CHESTS7	3.77
315064	1CHESTS8	4.21
315067	1DARBY 1	5.4
315068	1DARBY 2	5.41
315069	1DARBY 3	5.48
315070	1DARBY 4	5.48
315233	1SURRY 2	53.75
315091	1YORKTN2	53.71
315092	1YORKTN3	48.55
314309	6IRON208	0.81
314236	6NRTHEST	0.39
314251	6S PUMP	1.75
297087	V2-040	0.26
LTF	Z2-067	28.75
921092	AA1-049 C	4.23
LTF	AA1-058	1.25
921162	AA1-063AC	13.64
921182	AA1-067 C	2.63
921532	AA1-132 C	13.05
921542	AA1-133 C	17.45

921552	AA1-134 C	17.03
921562	AA1-135 C	14.68
921572	AA1-138 C	16.68
921582	AA1-139 C	26.18
921752	AA2-053 C	13.8
921772	AA2-059 C	4.03
921862	AA2-068 C	3.44
LTF	AA2-074	8.44
921982	AA2-088 C	10.63
922512	AA2-174 C	0.63
922522	AA2-177 C	18.02
922532	AA2-178 C	16.1
922602	AB1-013 C	4.86
922682	AB1-027 C	4.79
922722	AB1-053 C	1.67
922732	AB1-054 C	11.21
923262	AB1-132 C OP	22.24
923272	AB1-135 C OP	4.79
923572	AB1-173 C OP	3.57
923582	AB1-173AC OP	3.57
923642	AB1-181	3.49
923643	AB1-181 2	3.49
923644	AB1-181 3	3.49
923801	AB2-015 C OP	14.45
923831	AB2-022 C	3.99
923841	AB2-024 C	4.41
923851	AB2-025 C	4.03
923861	AB2-026 C	3.55
923911	AB2-031 C OP	3.55
923981	AB2-039 C OP	14.57
923991	AB2-040 C OP	11.65
924071	AB2-051 C OP	241.44
924241	AB2-068 OP	416.7
LTF	AB2-075	4.54
LTF	AB2-076	5.34
924381	AB2-087 C	0.92
924491	AB2-098 C	0.88
924501	AB2-099 C	0.95
924511	AB2-100 C	18.19

924761	AB2-128 C	15.59
924811	AB2-134 C OP	23.1
924931	AB2-147 C	4.05
924941	AB2-149 C OP	5.87
924951	AB2-150 C OP	4.05
924961	AB2-152	4.86
925051	AB2-160 C OP	9.6
925061	AB2-161 C OP	5.89
925121	AB2-169 C OP	10.47
925141	AB2-171 C OP	8.14
925171	AB2-174 C OP	11.16
925281	AB2-186 C	1.05
925291	AB2-188 C OP	3.97
925331	AB2-190 C	41.18
925361	AC1-007 C OP	1.21
925521	AC1-027 C	3.52
925691	AC1-045 C	3.04
925701	AC1-046 C	3.05
925711	AC1-047 C	4.04
925811	AC1-060	4.44
925821	AC1-061	0.06
925841	AC1-063	0.67
925861	AC1-065 C	5.83
926071	AC1-086 C	32.75
926201	AC1-098 C	9.59
926211	AC1-099 C	3.21
926291	AC1-107 OP	628.98
926411	AC1-112 C	3.73
926661	AC1-147 C	3.97
926741	AC1-159 C	239.58
926751	AC1-161 C OP	53.99
926771	AC1-163 C	3.43
926781	AC1-164 C OP	86.8
927041	AC1-191 C	18.31
927051	AC1-193 C	5.97
927221	AC1-216 C OP	17.63

Appendix 13

(DVP - DVP) The AB2-100 TAP-6CLUBHSE 230 kV line (from bus 924510 to bus 314563 ckt 1) loads from 112.94% to 152.11% (**DC power flow**) of its load dump rating (459 MVA) for the line fault with failed breaker contingency outage of '239T2141'. This project contributes approximately 179.8 MW to the thermal violation.

CONTINGENCY '239T2141'

/* LAKEVIEW

OPEN BRANCH FROM BUS 314583 TO BUS 314579 CKT 1 /* 239

OPEN BRANCH FROM BUS 314579 TO BUS 314605 CKT 1 /* 2057

OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	20.76
315141	1GASTONB	20.76
923262	AB1-132 C OP	83.91
923263	AB1-132 E OP	35.96
924511	AB2-100 C	66.93
924512	AB2-100 E	32.96
924761	AB2-128 C	57.34
924762	AB2-128 E	22.57
926071	AC1-086 C	123.56
926072	AC1-086 E	56.24

EXHIBIT 5

Generator Interconnection Affected System Study Report

PJM Interconnection Cluster AC1



**May 6, 2020
Duke Energy Progress
Transmission Department**

PURPOSE

The purpose of this study was to determine under what conditions the DEP transmission system can accommodate PJM's interconnection cluster AC1. Cluster AC1 includes generation throughout the PJM interconnection, but only those with an impact on the DEP system were included in this study. The size and in-service dates of the projects vary. The following PJM queue requests are included in this analysis:

AC1-034
AC1-086
AC1-098/099
AC1-189
AC1-208

ASSUMPTIONS

The following affected system study results are from a PJM power-flow model that reflects specific conditions of the system at points in time consistent with the generator interconnection requests being evaluated. The cases include the most recent information for load, generation additions, transmission additions, interchange, and other pertinent data necessary for analysis. Future years may include transmission, generation, and interchange modifications that are not budgeted for and for which no firm commitments have been made. Further, DEP retains the right to make modifications to power-flow cases as needed if additional information is available or if specific scenarios necessitate changes. For the systems surrounding the study area, data is based on the ERAG MMWG model. The suitability of the model for use by others is the sole responsibility of the user. Prior queued generator interconnection requests were considered in this analysis.

The results of this analysis are based on the Interconnection Customer's queue requests including generation equipment data provided. If the facilities' technical data or interconnection points to the transmission system change, the results of this analysis may need to be reevaluated.

RESULTS

Power Flow Analysis Results

Facilities that may require upgrade within the first three to five years following the in-service date are identified. Based on projected load growth on the DEP transmission system, facilities of concern are those with post-contingency loadings of 95% or greater of their thermal rating and low voltage of 0.92 pu and below, for the requested in-service year. The identification of these facilities is crucial due to the construction lead times necessary for certain system upgrades. This process will ensure that appropriate focus is given to these problem areas to investigate whether construction of upgrade projects is achievable to accommodate the requested interconnection service.

Contingency analysis study results show that interconnection of these generation facilities result in the following thermal issue on the DEP system. Based on study results for 2020 summer, Table 1 shows thermal facility loadings:

Table 1: Power Flow Thermal Results

Transmission Facility	Loading %	Contingency
Rocky Mount – Battleboro (DVP) 115 kV Line	160	Rocky Mount-Hathaway (DVP) Double Circuit 230 kV Lines

Estimate of Resolutions for Power Flow Impacts

The DEP Rocky Mount-Battleboro 115 kV Line will need to be reconductored with 1590 ACSR conductor or equivalent. All ancillary equipment, including any breakers, wave traps, and CT ratios at both ends of the line will need to be uprated to 2000A or greater.

Reconductor

Description: Reconductor/rebuild 8.5 miles of the DEP Rocky Mount-Battleboro 115 kV Line to 1590 ACSR conductor or equivalent

Estimated Cost: \$21,980,250 (DEP cost only)

Line Equipment upgrades

Description: Upgrade any ancillary line equipment at both the DEP and DVP ends of the line to 2000A or greater to enable the full conductor rating.

Estimated Cost: \$658,377 (DEP cost only)

NC Utility Tax(2.5%): \$565,966

Total Power-flow Cost Estimate: **\$23,204,593 (DEP cost only)**

Estimated Schedule: 12/31/2022

SUMMARY

This Generator Interconnection Affected System Study assessed the impact on the Duke Energy Progress system of new generation facilities interconnecting to the Dominion transmission system as part of the PJM AC1 cluster. Power flow analysis found an overloading issue that must be mitigated. A full reconductor/rebuild of the Rocky Mount-Battleboro 115 kV Line will be necessary. Estimates are that the Rocky Mount-Battleboro 115 kV Line can be upgraded by December 31, 2022 if a written agreement to proceed is obtained by July 4, 2020.

Power-flow	\$23,204,593
Stability	\$0
Short Circuit	\$0
<u>Interconnection</u>	<u>\$0</u>
Total Estimate	\$23,204,593

Study Completed by: William Quaintance
Bill Quaintance, PE, Duke Energy Progress

Reviewed by: Mark Byrd
Mark Byrd, PE, Duke Energy Progress

Public-Redacted

EXHIBIT 6