

***Generation Interconnection
Feasibility Study Report***

For

***PJM Generation Interconnection Request
Queue Position AB2-100***

***Clubhouse – Lakeview 230kV
67MW Capacity / 100MW Energy***

September / 2016

Introduction

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

Preface

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

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

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

General

The IC has proposed a solar generating facility located in Greenville County, NC. The installed facilities will have a total capability of 100 MW with 67 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is 12/1/2019. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AB2-100 will interconnect with the ITO transmission system via a new three breaker ring bus switching station that connects on the Clubhouse – Lakeview 230kV line.

Cost Summary

The AB2-100 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$1,800,000
Direct Connection Network Upgrades	\$5,200,000
Non Direct Connection Network Upgrades	\$800,000
Total Costs	\$7,800,000

In addition, the AB2-100 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	\$32,115,000
Previously Identified Upgrades	\$0
Total Costs	\$32,115,000

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

Attachment Facilities

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

Transmission: Construct approximately one span of 230 kV Attachment line between the generation substation and a new AB2-100 230 kV Switching Substation. The estimated cost for this work is \$1,200,000.

The estimated total cost of the Attachment Facilities is \$1,800,000. It is estimated to take 18-24 months to complete this work. These costs do not include CIAC Tax Gross-up. The single line is shown below in Attachment 1.

Direct Connection Cost Estimate

Substation: Establish the new 230 kV AB2-100 Switching Substation (interconnection substation). The estimated cost of this work scope is \$5,200,000. It is estimated to take 24-36 months to complete this work.

Non-Direct Connection Cost Estimate

Transmission: Install transmission structure in-line with transmission line to allow the proposed interconnection switching station to be interconnected with the transmission system. Estimated cost is \$800,000 dollars and is estimated to take 24-30 months to complete.

Remote Terminal Work: During the Facilities Study, ITO's System Protection Engineering Department will review transmission line protection as well as anti-islanding required to accommodate the new generation and interconnection substation. System Protection Engineering will determine the minimal acceptable protection requirements to reliably interconnect the proposed generating facility with the transmission system. The review is based on maintaining system reliability by reviewing ITO's protection requirements with the known transmission system configuration which includes generating facilities in the area. This review may determine that transmission line protection and communication upgrades are required at remote substations.

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

Reinforcement: Rebuild the AB2-100 TAP-Clubhouse 230kV line. It is estimated to take 44-48 months to complete and it is estimated to cost \$13,500,000 to resolve this deficiency.

Interconnection Customer Requirements

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

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

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 AB2-100 was evaluated as a 100.0 MW (Capacity 67.0 MW) injection tapping the Clubhouse-Lakeview 230kV line in the ITO area. Project AB2-100 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-100 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
LN 259	CONTINGENCY 'LN 259' OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 - 6CHSTF B 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
259T2003	CONTINGENCY '259T2003' /*_ CHESTERFIELD OPEN BRANCH FROM BUS 314287 TO BUS 314276 CKT 1 /*L259 CHESTERFIELD BASIN OPEN BRANCH FROM BUS 314287 TO BUS 314263 CKT 1 /*L2003 CHESTERFIELD TYLER OPEN BRANCH FROM BUS 314263 TO BUS 314299 CKT 1 /*L2003 TYLER HARROWGATE OPEN BRANCH FROM BUS 314299 TO BUS 314331 CKT 1 /*L2003 HARROWGATE POE OPEN BRANCH FROM BUS 314331 TO BUS 314329 CKT 2 /*POE TX6 230-115 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
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
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 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

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

Contingency Name	Description
562T563	CONTINGENCY '562T563' /*CARSON OPEN BRANCH FROM BUS 314902 TO BUS 314923 CKT 1 /*CARSON TO MIDLOTHIAN OPEN BRANCH FROM BUS 314914 TO BUS 314902 CKT 1 /*CARSON 500.00 - 8SEPTA 500.00 END

Summer Peak Analysis - 2020

System Reinforcement responsible by ITO

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
1	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	88.35	89.68	ER	399	5.34
2	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	119.77	120.71	ER	399	8.32
3	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	133.28	134.22	ER	399	8.32
4	LFFB	259T2003	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	103.7	104.45	ER	399	6.66
5	LFFB	T672B	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	101.88	102.79	ER	399	8.01
6	DCTL	LN 259-2065	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	100.97	101.87	ER	399	7.96
7	BF	BASIN 230 B#2	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	100.66	101.56	ER	399	7.97
8	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	101.88	103.22	ER	399	5.34
9	N-1	LN 576	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	101.21	102.41	ER	399	4.8
10	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	133.46	134.4	ER	399	8.32
11	LFFB	259T2003	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	103.85	104.6	ER	399	6.66
12	LFFB	T672B	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	102.06	102.96	ER	399	8.01
13	DCTL	LN 259-2065	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	101.15	102.04	ER	399	7.96

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
14	BF	BASIN 230 B#2	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	100.81	101.71	ER	399	7.97
15	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	102.03	103.37	ER	399	5.34
16	N-1	LN 576	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	101.38	102.59	ER	399	4.8
17	DCTL	LN 2058-2181	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	DC	109.73	112.36	ER	164	9.57

PJM baseline project (b2745) will eliminate the identified overloads # 1 through 16. The scheduled in service date b2745 is 06/01/2020.

PJM baseline project (b1794) will eliminate the identified ITO (DVP) portion of overload #17. The scheduled in service date b1794 is 06/01/2016.

Generator Deliverability

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

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
18	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	88.35	89.68	ER	399	5.34
19	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	92.38	93.74	ER	470	6.4

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	Facility Description	Bus	Cir.	Power	Loading %	Rating	MW	Ref
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	Type	Name	Area		From	To		Flow	Initial	Final	Type	MVA	Contribution	
20	LFFB	239T2141	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	84.87	109.9	ER	399	99.89	1
21	LFFB	246T2034_A	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	91.26	104.59	ER	399	53.19	

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		Cir.	Power Flow	Loading %		Rating		MW	Ref
#	Type	Name			From	To			Initial	Final	Type	MVA	Contribution	
22	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	119.77	120.71	ER	399	8.32	2
23	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	133.28	134.22	ER	399	8.32	3
24	LFFB	259T2003	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	103.7	104.45	ER	399	6.66	

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To	Cir.		Initial	Final	Type	MVA		
25	LFFB	T672B	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	101.88	102.79	ER	399	8.01	
26	DCTL	LN 259-2065	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	100.97	101.87	ER	399	7.96	
27	BUS	BASIN 230 B#2	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	100.66	101.56	ER	399	7.97	
28	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	101.88	103.22	ER	399	5.34	
29	N-1	LN 576	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	101.21	102.41	ER	399	4.8	
30	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	133.46	134.4	ER	399	8.32	4
31	LFFB	259T2003	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	103.85	104.6	ER	399	6.66	
32	LFFB	T672B	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	102.06	102.96	ER	399	8.01	
33	DCTL	LN 259-2065	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	101.15	102.04	ER	399	7.96	
34	BUS	BASIN 230 B#2	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	100.81	101.71	ER	399	7.97	
35	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	102.03	103.37	ER	399	5.34	
36	N-1	LN 576	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	101.38	102.59	ER	399	4.8	

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Ref
	Type	Name			From	To	Cir.		Initial	Final	Type	MVA		
37	LFFB	562T563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	109.59	110.54	ER	470	9.89	5
38	DCTL	LN 2058-2181	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	DC	109.73	112.36	ER	164	9.57	6

Steady-State Voltage Requirements

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

To be determined during Impact Study.

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

To be determined during Impact Study.

New System Reinforcements

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

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
# 1, 2, 18	6CHARCTY-6LAKESD 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 3 - 9	6MESSER-6CHARCTY 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 9 - 16	6CHSTF B-6MESSER 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
# 17	3BTLEBRO-3ROCKYMT115T 115 kV line	Build a new Hathaway 230/115kV substation	b1794	
# 19	6CHSTF B-6BASIN 230 kV line	Rebuild of the Chesterfield-Basin 230kV line	Pending	\$18,615,000
# 20, 21	AB2-100 TAP-6CLUBHSE 230 kV line	Rebuild the AB2-100 TAP-Clubhouse 230kV line	Pending	\$13,500,000
Total New Network Upgrades				\$32,115,000

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
# 22	6CHARCTY-6LAKESD 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 23 - 29	6MESSER-6CHARCTY 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 30 - 36	6CHSTF B-6MESSER 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	
# 37	6CHSTF B-6BASIN 230 kV line	Rebuild of the Chesterfield-Basin 230kV line	Pending	\$18,615,000
# 38	3BTLEBRO-3ROCKYMT115T 115 kV line	Build a new Hathaway 230/115kV substation	b1794	

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
			Total New Network Upgrades	\$18,615,000

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	
22	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKE SD 230 kV line	314225	314227	1	DC	86.85	87.75	ER	399	7.97
23	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	100.38	101.28	ER	399	7.97
24	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	100.53	101.43	ER	399	7.97
25	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	109.27	110.19	ER	470	9.55
26	N-1	LN 254_A	DVP - DVP	6LAKEVIEW-6CAROLNA 230 kV line	314583	314561	1	DC	79.58	95.18	ER	399	62.22
27	N-1	LN 2012	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	83.8	97.79	ER	399	55.8

Light Load Analysis

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

ITO Analysis

ITO assessed the impact of the proposed Queue Project #AB2-100 interconnection of a 100.0 MW Energy (67.0 MW Capacity) injection into the ITO's Transmission System, for compliance with NERC Reliability Criteria on ITO's Transmission System. The system was assessed using the summer 2020 RTEP case provided to ITO by PJM. When performing a generation analysis, ITO's main analysis will be load flow study results under single contingency (both normal and stressed system conditions). ITO Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. A full listing of ITO's Planning Criteria and interconnection requirements can be found in the ITO's Facility Connection Requirements which are publicly available at: <http://www.dom.com>.

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

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

Category B Analysis (Single Contingency):

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

Category C Analysis: (Multiple Facility Analysis)

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

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

Table A: Import Study Results

Import Study Results			
Area	Summer 2020	Summer 2020 with AB2-100	Limiting Element
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

Table B: Export Study Results

Export Study Results			
Area	Summer 2020	Summer 2020 with AB2-100	Limiting Element
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

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

Affected System Analysis & Mitigation

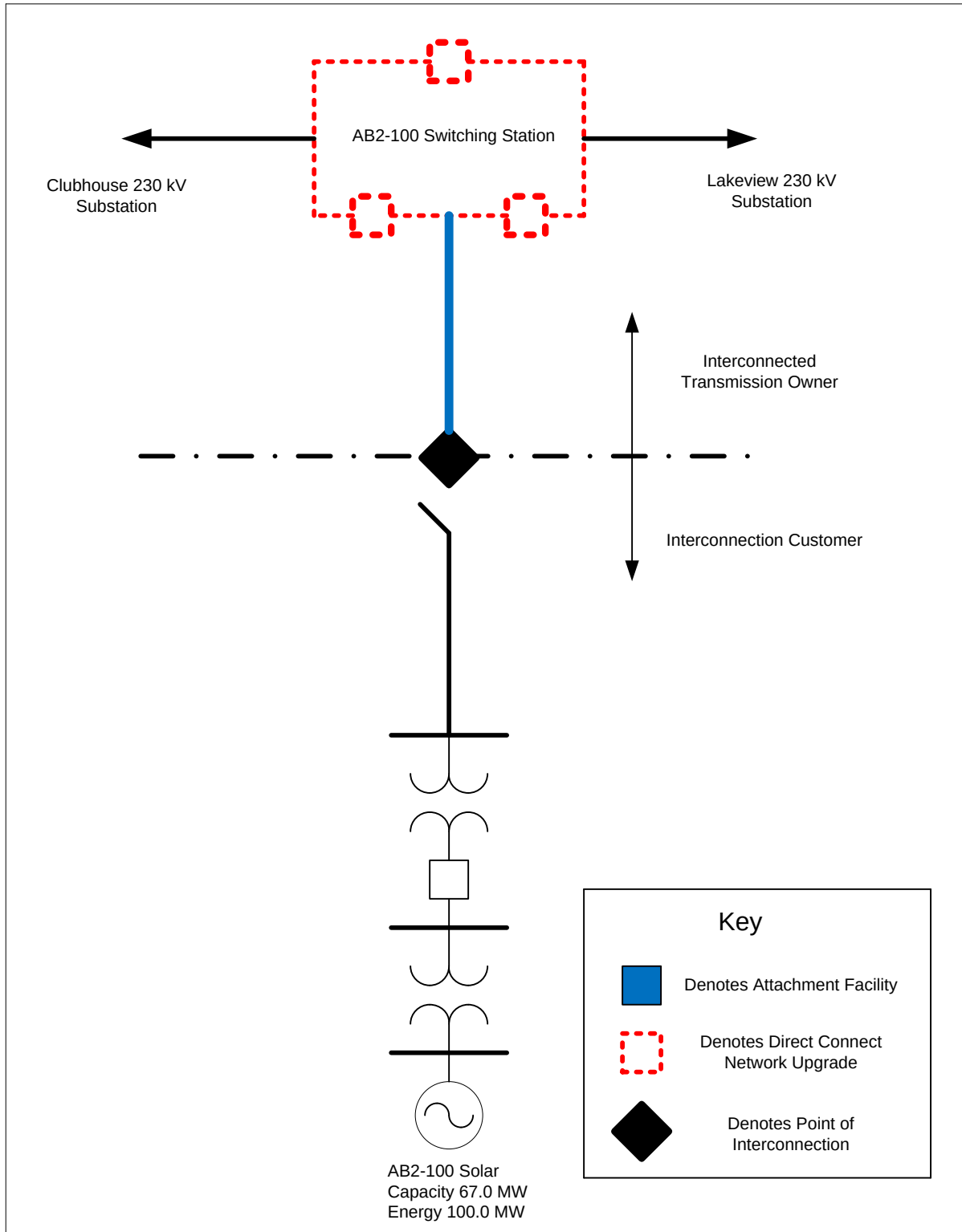
Duke, Progress & TVA Impacts:

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

Overload #17: 3BTLEBRO-3ROCKYMT115T 115 kV line overload was identified on PJM Queue projects in the AA2 queue with current rating of 94MVA. Duke Progress requires a project to enter into an Affected System Study with Duke Progress so that Duke Progress can determine if a network upgrade is required. In the AA2 queue, Duke Progress preliminary analysis has identified a network upgrade to increase the rating of the line rating from 94MVA to 164MVA. The network upgrade cost responsibility will be governed by the Duke Progress FERC tariff.

Attachment 1.

System Configuration



Attachment 2.

Flowgate Appendices – Option 1

Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gauge 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 AB2-100 TAP-6CLUBHSE 230 kV line (from bus 924510 to bus 314563 ckt 1) loads from 84.87% to 109.9% (**DC power flow**) of its emergency rating (399 MVA) for the line fault with failed breaker contingency outage of '239T2141'. This project contributes approximately 99.89 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

Bus Number	Bus Name	Full Contribution
315139	1GASTONA	21.53
315141	1GASTONB	21.53
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

Appendix 2

(DVP - DVP) The 6CHARCTY-6LAKESD 230 kV line (from bus 314225 to bus 314227 ckt 1) loads from 119.77% to 120.71% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 8.32 MW to the thermal violation.

CONTINGENCY 'LN 208-259'

OPEN BRANCH FROM BUS 314286 TO BUS 314309 CKT 1 /* 6CHSTF A
230.00 - 6IRON208 230.00

OPEN BRANCH FROM BUS 314309 TO BUS 314338 CKT 1 /* 6IRON208
230.00 - 6SOUWEST 230.00

OPEN BUS 314309 /* ISLAND

OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 -
6CHSTF B 230.00

END

Bus Number	Bus Name	Full Contribution
315065	1CHESTF6	37.23
315077	1HOPHCF1	2.16
315078	1HOPHCF2	2.16
315079	1HOPHCF3	2.16
315080	1HOPHCF4	3.27
315076	1HOPPOLC	1.84
315073	1STONECA	5.67
314784	1WEYRHSB	0.66
314314	3LOCKS	1.04
314539	3UNCAMP	0.86
314541	3WATKINS	0.25
314229	6MT R221	-0.33
292791	U1-032 E	2.95
900672	V4-068 E	0.11
901082	W1-029E	13.49
902241	W2-022 C OP1	0.49
902242	W2-022 E OP1	3.31
903520	W3-066 C1OP1	0.98
903531	W3-066 C2OP1	0.98
903522	W3-066 E1OP1	6.54
903532	W3-066 E2OP1	6.54
907092	X1-038 E	2.15
913392	Y1-086 E	0.63
914231	Y2-077	0.87

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

922602	AB1-013 C	0.89
922603	AB1-013 E	5.98
922722	AB1-053 C	0.44
922723	AB1-053 E	0.25
922732	AB1-054 C	2.47
922733	AB1-054 E	1.22
922882	AB1-077 C	1.01
922883	AB1-077 E	6.75
923262	AB1-132 C OP	5.97
923263	AB1-132 E OP	2.56
923572	AB1-173 C OP	0.99
923573	AB1-173 E OP	0.46
923582	AB1-173AC OP	0.99
923583	AB1-173AE OP	0.46
923801	AB2-015 C OP	3.8
923802	AB2-015 E OP	2.76
923831	AB2-022 C	0.66
923832	AB2-022 E	0.35
923851	AB2-025 C	1.62
923852	AB2-025 E	0.73
923911	AB2-031 C OP	0.98
923912	AB2-031 E OP	0.48
923981	AB2-039 C OP	5.76
923982	AB2-039 E OP	4.71
923991	AB2-040 C OP	3.33
923992	AB2-040 E OP	2.51
924011	AB2-042 C OP	6.68
924012	AB2-042 E OP	5.32
924071	AB2-051 C OP	39.06
924072	AB2-051 E OP	6.07
924381	AB2-087 C	0.19
924382	AB2-087 E	0.09
924501	AB2-099 C	0.2
924502	AB2-099 E	0.09
924511	AB2-100 C	5.58
924512	AB2-100 E	2.75
924761	AB2-128 C	4.78
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.19
924812	AB2-134 E OP	10.95
924931	AB2-147 C	1.18
924932	AB2-147 E	1.92
924941	AB2-149 C OP	1.56
924942	AB2-149 E OP	2.55
924951	AB2-150 C OP	1.18

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

Appendix 3

(DVP - DVP) The 6MESSER-6CHARCTY 230 kV line (from bus 314228 to bus 314225 ckt 1) loads from 133.28% to 134.22% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 8.32 MW to the thermal violation.

CONTINGENCY 'LN 208-259'

OPEN BRANCH FROM BUS 314286 TO BUS 314309 CKT 1 /* 6CHSTF A
230.00 - 6IRON208 230.00

OPEN BRANCH FROM BUS 314309 TO BUS 314338 CKT 1 /* 6IRON208
230.00 - 6SOUWEST 230.00

OPEN BUS 314309 /* ISLAND

OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 -
6CHSTF B 230.00

END

Bus Number	Bus Name	Full Contribution
315065	1CHESTF6	37.23
315077	1HOPHCF1	2.16
315078	1HOPHCF2	2.16
315079	1HOPHCF3	2.16
315080	1HOPHCF4	3.27
315076	1HOPPOLC	1.84
315073	1STONECA	5.67
314784	1WEYRHSB	0.66
314314	3LOCKS	1.04
314539	3UNCAMP	0.86
314541	3WATKINS	0.25
314229	6MT R221	-0.33
292791	U1-032 E	2.95
900672	V4-068 E	0.11
901082	W1-029E	13.49
902241	W2-022 C OP1	0.49
902242	W2-022 E OP1	3.31
903520	W3-066 C1OP1	0.98
903531	W3-066 C2OP1	0.98
903522	W3-066 E1OP1	6.54
903532	W3-066 E2OP1	6.54
907092	X1-038 E	2.15
913392	Y1-086 E	0.63
914231	Y2-077	0.87

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

922602	AB1-013 C	0.89
922603	AB1-013 E	5.98
922722	AB1-053 C	0.44
922723	AB1-053 E	0.25
922732	AB1-054 C	2.47
922733	AB1-054 E	1.22
922882	AB1-077 C	1.01
922883	AB1-077 E	6.75
923262	AB1-132 C OP	5.97
923263	AB1-132 E OP	2.56
923572	AB1-173 C OP	0.99
923573	AB1-173 E OP	0.46
923582	AB1-173AC OP	0.99
923583	AB1-173AE OP	0.46
923801	AB2-015 C OP	3.8
923802	AB2-015 E OP	2.76
923831	AB2-022 C	0.66
923832	AB2-022 E	0.35
923851	AB2-025 C	1.62
923852	AB2-025 E	0.73
923911	AB2-031 C OP	0.98
923912	AB2-031 E OP	0.48
923981	AB2-039 C OP	5.76
923982	AB2-039 E OP	4.71
923991	AB2-040 C OP	3.33
923992	AB2-040 E OP	2.51
924011	AB2-042 C OP	6.68
924012	AB2-042 E OP	5.32
924071	AB2-051 C OP	39.06
924072	AB2-051 E OP	6.07
924381	AB2-087 C	0.19
924382	AB2-087 E	0.09
924501	AB2-099 C	0.2
924502	AB2-099 E	0.09
924511	AB2-100 C	5.58
924512	AB2-100 E	2.75
924761	AB2-128 C	4.78
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.19
924812	AB2-134 E OP	10.95
924931	AB2-147 C	1.18
924932	AB2-147 E	1.92
924941	AB2-149 C OP	1.56
924942	AB2-149 E OP	2.55
924951	AB2-150 C OP	1.18

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

Appendix 4

(DVP - DVP) The 6CHSTF B-6MESSER 230 kV line (from bus 314287 to bus 314228 ckt 1) loads from 133.46% to 134.4% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 8.32 MW to the thermal violation.

CONTINGENCY 'LN 208-259'

OPEN BRANCH FROM BUS 314286 TO BUS 314309 CKT 1 /* 6CHSTF A
230.00 - 6IRON208 230.00

OPEN BRANCH FROM BUS 314309 TO BUS 314338 CKT 1 /* 6IRON208
230.00 - 6SOUWEST 230.00

OPEN BUS 314309 /* ISLAND

OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 6BASIN 230.00 -
6CHSTF B 230.00

END

Bus Number	Bus Name	Full Contribution
315065	1CHESTF6	37.23
315077	1HOPHCF1	2.16
315078	1HOPHCF2	2.16
315079	1HOPHCF3	2.16
315080	1HOPHCF4	3.27
315076	1HOPPOLC	1.84
315073	1STONECA	5.67
314784	1WEYRHSB	0.66
314314	3LOCKS	1.04
314539	3UNCAMP	0.86
314541	3WATKINS	0.25
314229	6MT R221	-0.33
292791	U1-032 E	2.95
900672	V4-068 E	0.11
901082	W1-029E	13.49
902241	W2-022 C OP1	0.49
902242	W2-022 E OP1	3.31
903520	W3-066 C1OP1	0.98
903531	W3-066 C2OP1	0.98
903522	W3-066 E1OP1	6.54
903532	W3-066 E2OP1	6.54
907092	X1-038 E	2.15
913392	Y1-086 E	0.63
914231	Y2-077	0.87

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

922602	AB1-013 C	0.89
922603	AB1-013 E	5.98
922722	AB1-053 C	0.44
922723	AB1-053 E	0.25
922732	AB1-054 C	2.47
922733	AB1-054 E	1.22
922882	AB1-077 C	1.01
922883	AB1-077 E	6.75
923262	AB1-132 C OP	5.97
923263	AB1-132 E OP	2.56
923572	AB1-173 C OP	0.99
923573	AB1-173 E OP	0.46
923582	AB1-173AC OP	0.99
923583	AB1-173AE OP	0.46
923801	AB2-015 C OP	3.8
923802	AB2-015 E OP	2.76
923831	AB2-022 C	0.66
923832	AB2-022 E	0.35
923851	AB2-025 C	1.62
923852	AB2-025 E	0.73
923911	AB2-031 C OP	0.98
923912	AB2-031 E OP	0.48
923981	AB2-039 C OP	5.76
923982	AB2-039 E OP	4.71
923991	AB2-040 C OP	3.33
923992	AB2-040 E OP	2.51
924011	AB2-042 C OP	6.68
924012	AB2-042 E OP	5.32
924071	AB2-051 C OP	39.06
924072	AB2-051 E OP	6.07
924381	AB2-087 C	0.19
924382	AB2-087 E	0.09
924501	AB2-099 C	0.2
924502	AB2-099 E	0.09
924511	AB2-100 C	5.58
924512	AB2-100 E	2.75
924761	AB2-128 C	4.78
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.19
924812	AB2-134 E OP	10.95
924931	AB2-147 C	1.18
924932	AB2-147 E	1.92
924941	AB2-149 C OP	1.56
924942	AB2-149 E OP	2.55
924951	AB2-150 C OP	1.18

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

Appendix 5

(DVP - DVP) The 6CHSTF B-6BASIN 230 kV line (from bus 314287 to bus 314276 ckt 1) loads from 109.59% to 110.54% (**DC power flow**) of its emergency rating (470 MVA) for the line fault with failed breaker contingency outage of '562T563'. This project contributes approximately 9.89 MW to the thermal violation.

CONTINGENCY '562T563'

/*CARSON

OPEN BRANCH FROM BUS 314902 TO BUS 314923 CKT 1

/*CARSON TO

MIDLOTHIAN

OPEN BRANCH FROM BUS 314914 TO BUS 314902 CKT 1

/*CARSON 500.00

- 8SEPTA 500.00

END

Bus Number	Bus Name	Full Contribution
315065	1CHESTF6	37.57
315077	1HOPHCF1	1.99
315078	1HOPHCF2	1.99
315079	1HOPHCF3	1.99
315080	1HOPHCF4	3.03
315076	1HOPPOLC	1.7
315073	1STONECA	5.24
314784	1WEYRHSB	0.81
314314	3LOCKS	0.97
314539	3UNCAMP	1.01
314541	3WATKINS	0.29
292791	U1-032 E	2.73
900672	V4-068 E	0.13
901082	W1-029E	15.92
902241	W2-022 C OP1	0.62
902242	W2-022 E OP1	4.13
907092	X1-038 E	2.52
913392	Y1-086 E	0.74
914231	Y2-077	0.8
916042	Z1-036 E	16.2
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
917592	Z2-099 E	0.19
LTF	AA1-058	0.31

921162	AA1-063AC	3.88
921163	AA1-063AE	1.83
921172	AA1-064 C	3.54
921173	AA1-064 E	1.67
918512	AA1-065 E OP	1.82
921182	AA1-067 C	0.67
921183	AA1-067 E	0.29
918562	AA1-072 E	0.07
921552	AA1-134 C	3.42
921553	AA1-134 E	1.46
921562	AA1-135 C	3.71
921563	AA1-135 E	1.59
921572	AA1-138 C	3.57
921573	AA1-138 E	1.53
921752	AA2-053 C	3.99
921753	AA2-053 E	1.71
921762	AA2-057 C	3.01
921763	AA2-057 E	1.51
921772	AA2-059 C	0.86
921773	AA2-059 E	0.39
921862	AA2-068 C	0.96
921863	AA2-068 E	0.44
920022	AA2-086 E	0.1
921982	AA2-088 C	2.79
921983	AA2-088 E	4.56
922032	AA2-105 C	1.05
922033	AA2-105 E	0.49
922072	AA2-113 C	1.05
922073	AA2-113 E	0.49
922442	AA2-165 C	0.41
922443	AA2-165 E	0.2
922472	AA2-169 C	0.9
922473	AA2-169 E	0.42
922512	AA2-174 C	0.18
922513	AA2-174 E	0.2
922522	AA2-177 C	6.06
922523	AA2-177 E	2.6
922532	AA2-178 C	3.58
922533	AA2-178 E	1.53
922602	AB1-013 C	1.08
922603	AB1-013 E	7.23
922722	AB1-053 C	0.53
922723	AB1-053 E	0.3
922732	AB1-054 C	2.96
922733	AB1-054 E	1.46

922882	AB1-077 C	1.19
922883	AB1-077 E	7.96
922922	AB1-081 C OP	3.65
922923	AB1-081 E OP	1.56
923262	AB1-132 C OP	7.23
923263	AB1-132 E OP	3.1
923572	AB1-173 C OP	1.19
923573	AB1-173 E OP	0.55
923582	AB1-173AC OP	1.19
923583	AB1-173AE OP	0.55
923801	AB2-015 C OP	4.48
923802	AB2-015 E OP	3.25
923831	AB2-022 C	0.77
923832	AB2-022 E	0.42
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
923941	AB2-035 C	0.14
923942	AB2-035 E	0.06
923981	AB2-039 C OP	6.11
923982	AB2-039 E OP	5.
923991	AB2-040 C OP	4.01
923992	AB2-040 E OP	3.02
924011	AB2-042 C OP	6.75
924012	AB2-042 E OP	5.38
924151	AB2-059 C OP	4.3
924152	AB2-059 E OP	2.21
924381	AB2-087 C	0.24
924382	AB2-087 E	0.11
924391	AB2-088 C	0.17
924392	AB2-088 E	0.08
924401	AB2-089 C	0.81
924402	AB2-089 E	0.42
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	6.62
924512	AB2-100 E	3.26
924761	AB2-128 C	5.67
924762	AB2-128 E	2.23
924811	AB2-134 C OP	7.77
924812	AB2-134 E OP	10.38
924931	AB2-147 C	1.41

924932	AB2-147 E	2.3
924941	AB2-149 C OP	1.71
924942	AB2-149 E OP	2.79
924951	AB2-150 C OP	1.41
924952	AB2-150 E OP	2.3
924961	AB2-152	14.65
925051	AB2-160 C OP	3.9
925052	AB2-160 E OP	6.36
925061	AB2-161 C OP	2.11
925062	AB2-161 E OP	3.45
925121	AB2-169 C OP	2.52
925122	AB2-169 E OP	2.26
925141	AB2-171 C OP	2.07
925142	AB2-171 E OP	3.38
925171	AB2-174 C OP	3.81
925172	AB2-174 E OP	3.44
925281	AB2-186 C	0.22
925282	AB2-186 E	0.09
925291	AB2-188 C OP	0.88
925292	AB2-188 E OP	0.4
925331	AB2-190 C	13.84
925332	AB2-190 E	3.46

Appendix 6

(DVP - CPLE) The 3BTLEBRO-3ROCKYMT115T 115 kV line (from bus 314554 to bus 304223 ckt 1) loads from 109.73% to 112.36% (**DC power flow**) of its emergency rating (164 MVA) for the tower line contingency outage of 'LN 2058-2181'. This project contributes approximately 9.57 MW to the thermal violation.

CONTINGENCY 'LN 2058-2181'

OPEN BUS 304226 /* ISLAND: 6PA-RMOUNT#4115.00

OPEN BRANCH FROM BUS 304226 TO BUS 314591 CKT 1 /* 6PA-
RMOUNT#4230.00 - 6NASH 230.00

OPEN BRANCH FROM BUS 313845 TO BUS 314591 CKT 1 /* 6HATHAWAY
230.00 - 6NASH 230.00

OPEN BUS 314591 /* ISLAND: 6NASH 230.00

OPEN BRANCH FROM BUS 304222 TO BUS 313845 CKT 1 /*
6ROCKYMT230T230.00 - 6HATHAWAY 230.00

END

Bus Number	Bus Name	Full Contribution
315131	1EDGECEMA	2.63
315132	1EDGECEMB	2.63
315139	1GASTONA	2.5
315141	1GASTONB	2.5
315126	1ROARAP2	1.04
315128	1ROARAP4	1.
315134	1ROAVALA	3.54
315135	1ROAVALB	0.94
315136	1ROSEMG1	2.03
315138	1ROSEMG2	0.95
315137	1ROSEMS1	1.26
314541	3WATKINS	0.26
900672	V4-068 E	0.15
902241	W2-022 C OP1	0.61
902242	W2-022 E OP1	4.07
917331	Z2-043 C	0.38
917332	Z2-043 E	0.83
917341	Z2-044 C	0.57
917342	Z2-044 E	1.25
917511	Z2-088 C OP1	0.73
917512	Z2-088 E OP1	6.09
917592	Z2-099 E	0.2
918411	AA1-050	0.62

LTF	AA1-053	6.16
LTF	AA1-054	5.36
LTF	AA1-055	9.54
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	0.06
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
922032	AA2-105 C	1.71
922033	AA2-105 E	0.8
922072	AA2-113 C	1.71
922073	AA2-113 E	0.8
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	4.09
923992	AB2-040 E OP	3.09
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	1.11
924932	AB2-147 E	1.81
924951	AB2-150 C OP	1.11
924952	AB2-150 E OP	1.81
925121	AB2-169 C OP	2.48
925122	AB2-169 E OP	2.22
925141	AB2-171 C OP	1.88
925142	AB2-171 E OP	3.07
925171	AB2-174 C OP	3.57
925172	AB2-174 E OP	3.23