

***Generation Interconnection
Feasibility Study Report***

For

***PJM Generation Interconnection Request
Queue Position AB2-040***

***Brink 115kV
45.6MW Capacity / 80MW Energy***

August / 2016

Introduction

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

Preface

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

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

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

General

The IC has proposed a solar generating facility located in Greensville County, VA. The installed facilities will have a total capability of 80 MW with 45.6 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is 9/30/2018. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AB2-040 will interconnect with the ITO transmission system at one of the following points of interconnection:

Option 1 will connect via a new three breaker ring bus switching station that connects on the Brink 115kV substation.

Option 2 will connect via a new three breaker ring bus switching station that connects at the Clubhouse – Lakeview 230kV line.

Cost Summary

The AB2-040 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$1,500,000
Direct Connection Network Upgrades	\$4,500,000
Non Direct Connection Network Upgrades	\$ 800,000
Total Costs	\$6,800,000

In addition, the AB2-040 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	\$25,615,000
Previously Identified Upgrades	\$0
Total Costs	\$25,615,000

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 \$500,000.

Transmission: Construct approximately one span of 115 kV Attachment line between the generation substation and the existing Brink 115 kV Substation. The estimated cost for this work is \$1,000,000.

The estimated total cost of the Attachment Facilities is \$1,500,000. 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 AB2-040 Brinks Switching Substation (interconnection substation). The estimated cost of this work scope is \$4,500,000. 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.

Line #130 (Trego Tap- Trego 115kV line section): Wreck and rebuild approximately 0.8 mile of 115 kV Line to accommodate the proposed generation interconnection project. This work is estimated to take 20-24 months to complete based on typical permitting parameters and the estimated cost of \$1,500,000.

Reinforcement: Upgrade the Clubhouse 230/115kV transformer. It is estimated to take 24-28 months to complete and it is estimated to cost \$5,500,000 to resolve this deficiency.

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.

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.

Option One

Network Impacts

The Queue Project AB2-040 was evaluated as a 80.0 MW (Capacity 45.6 MW) injection at the Brink 115kV substation in the ITO area. Project AB2-040 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-040 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
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

Contingency Name	Description
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 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
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
T122C	CONTINGENCY 'T122C' /* CAROLINA OPEN BUS 314559 /* CAROLINA 115KV BUS OPEN BUS 315126 /* ROANOKE RAPIDS GEN 1 AND 2 OPEN BUS 315128 /* ROANOKE RAPIDS GEN 3 AND 4 OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 /* TX. #4 END
2202_A	CONTINGENCY '2202_A' /* CAROLINA OPEN BRANCH FROM BUS 314559 TO BUS 314571 CKT 1 /* LINE 22 OPEN BRANCH FROM BUS 314571 TO BUS 314702 CKT 1 /* LINE 22 OPEN BRANCH FROM BUS 314559 TO BUS 314259 CKT Z1 /* LINE 56 OPEN BRANCH FROM BUS 314559 TO BUS 921751 CKT 1 /* LINE 54 AA2-053 TAP OPEN BRANCH FROM BUS 314559 TO BUS 314600 CKT 1 /* LINE 130 OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 /* TX. #4 DECREASE BUS 314559 LOAD BY 100 PERCENT /* REMOVE ALL LOAD AT CAROLINA END

Contingency Name	Description
T132_A	CONTINGENCY 'T132_A' /* CAROLINA OPEN BRANCH FROM BUS 314559 TO BUS 314259 CKT Z1 /* LINE 56 OPEN BRANCH FROM BUS 314559 TO BUS 921751 CKT 1 /* LINE 54 AA2-053 TAP OPEN BRANCH FROM BUS 314559 TO BUS 314571 CKT 1 /* LINE 22 OPEN BRANCH FROM BUS 314559 TO BUS 314600 CKT 1 /* LINE 130 OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 /* TX. #4 DECREASE BUS 314559 LOAD BY 100 PERCENT /* REMOVE ALL LOAD AT CAROLINA END
5602_A	CONTINGENCY '5602_A' /* CAROLINA OPEN BRANCH FROM BUS 314559 TO BUS 314259 CKT Z1 /* LINE 56 OPEN BRANCH FROM BUS 314259 TO BUS 921161 CKT 1 /* LINE 56 AA1-063A TAP OPEN BRANCH FROM BUS 314559 TO BUS 921751 CKT 1 /* LINE 54 AA2-053 TAP OPEN BRANCH FROM BUS 314559 TO BUS 314571 CKT 1 /* LINE 22 OPEN BRANCH FROM BUS 314559 TO BUS 314600 CKT 1 /* LINE 130 OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 /* TX. #4 DECREASE BUS 314559 LOAD BY 100 PERCENT /* REMOVE ALL LOAD AT CAROLINA END

Contingency Name	Description
5402_A	CONTINGENCY '5402_A' /* CAROLINA OPEN BRANCH FROM BUS 314559 TO BUS 921751 CKT 1 /* LINE 54 AA2-053 TAP OPEN BRANCH FROM BUS 314581 TO BUS 314626 CKT 1 /* LINE 54 OPEN BRANCH FROM BUS 314626 TO BUS 314625 CKT 1 /* LINE 54 OPEN BRANCH FROM BUS 314625 TO BUS 314568 CKT 1 /* LINE 54 OPEN BRANCH FROM BUS 314559 TO BUS 314571 CKT 1 /* LINE 22 OPEN BRANCH FROM BUS 314559 TO BUS 314259 CKT Z1 /* LINE 56 OPEN BRANCH FROM BUS 314559 TO BUS 314600 CKT 1 /* LINE 130 OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1 /* TX. #4 DECREASE BUS 314559 LOAD BY 100 PERCENT /* REMOVE ALL LOAD AT CAROLINA 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

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	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	99.36	100.15	ER	399	3.18
2	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	99.53	100.33	ER	399	3.18
3	LFFB	T672B	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	99.82	100.45	ER	399	5.61
4	DCTL	LN 259-2065	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	98.92	99.55	ER	399	5.57
5	BF	BASIN 230 B#2	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	98.6	99.23	ER	399	5.58
6	LFFB	T672B	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	99.97	100.6	ER	399	5.61
7	DCTL	LN 259-2065	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	99.07	99.7	ER	399	5.57
8	BF	BASIN 230 B#2	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	98.75	99.38	ER	399	5.58
9	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	111.66	112.31	ER	399	5.84
10	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	125.19	125.85	ER	399	5.84
11	LFFB	259T2003	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	101.75	102.28	ER	399	4.69
12	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	125.34	126.0	ER	399	5.84
13	LFFB	259T2003	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	101.92	102.45	ER	399	4.69

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
14	DCTL	LN 2058-2181	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	DC	85.12	87.09	ER	164	7.19

Item 1 – 13 **PJM baseline project (b2745)** will eliminate the identified overloads. The scheduled in service date b2745 is 06/01/2020.

Item 14 **PJM baseline project (b1794)** will eliminate the identified overloads. 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	
15	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	99.36	100.15	ER	399	3.18
16	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	99.53	100.33	ER	399	3.18
17	Non	Non	DVP - DVP	3TREGO-3TREGOTP 115 kV line	314612	314615	1	DC	73.96	168.96	NR	48	45.6

Note:

- For item #17 please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

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		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
18	LFFB	T672B	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	99.82	100.45	ER	399	5.61
19	DCTL	LN 259-2065	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	98.92	99.55	ER	399	5.57
20	BUS	BASIN 230 B#2	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	98.6	99.23	ER	399	5.58
21	LFFB	T672B	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	99.97	100.6	ER	399	5.61
22	DCTL	LN 259-2065	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	99.07	99.7	ER	399	5.57
23	BF	BASIN 230 B#2	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	98.75	99.38	ER	399	5.58
24	LFFB	T122C	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	17.1	49.78	ER	194	63.51
25	LFFB	2202_A	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	16.2	48.84	ER	194	63.42
26	LFFB	T132_A	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	15.17	47.81	ER	194	63.42
27	LFFB	5602_A	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	15.12	47.76	ER	194	63.42
28	LFFB	5402_A	DVP - DVP	6CLUBHSE 230/115 kV transformer	314562	314563	1	DC	14.96	47.6	ER	194	63.42

Note:

- For item #24 please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

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		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
29	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	111.66	112.31	ER	399	5.84
30	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	125.19	125.85	ER	399	5.84
31	LFFB	259T2003	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	101.75	102.28	ER	399	4.69
32	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	125.34	126	ER	399	5.84
33	LFFB	259T2003	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	101.92	102.45	ER	399	4.69
34	LFFB	562T563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	106.62	107.29	ER	470	7.02
35	DCTL	LN 2058-2181	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	DC	85.12	87.09	ER	164	7.19

Note:

- For item #29 please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.
- For item #30 please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.
- For item #32 please refer to Appendix 5 for a table containing the generators having contribution to this flowgate.
- For item #34 please refer to Appendix 6 for a table containing the generators having contribution to this flowgate.
- For item #35 please refer to Appendix 7 for a table containing the generators having contribution to this flowgate.

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, 3 - 5, 10, 11, 15, 18 – 20,	6MESSER-6CHARCTY 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 2, 6 – 8, 12, 16, 21 – 23,	6CHSTF B-6MESSER 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 9	6CHARCTY-6LAKESD 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
#14	3BTLEBRO-3ROCKYMT115T 115 kV line	Build a new Hathaway 230/115kV substation by 6/1/2017	b1794	
# 17, 35	3TREGO-3TREGOTP 115 kV line	Rebuild of the Trego-Trego Tap 115kV line	TBD	\$1,500,000
# 24 - 28	6CLUBHSE 230/115 kV transformer	Upgrade the Clubhouse 230/115kV transformer	TBD	\$5,500,000
Total New Network Upgrades				\$7,000,000

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
# 1, 3 - 5, 10, 11, 15, 18 – 20, 30, 31	6MESSER-6CHARCTY 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 2, 6 – 8, 12, 16, 21 – 23, 32, 33	6CHSTF B-6MESSER 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
# 9, 29	6CHARCTY-6LAKESD 230 kV line	Rebuild 21.32 miles of the Chesterfield - Lakeside 230kV transmission line by 6/1/2020	b2745	\$
#34	6CHSTF B-6BASIN 230 kV line	Rebuild of the Chesterfield-Basin 230kV line	TBD	\$18,615,000
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	
36	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	84.78	85.41	ER	399	5.58
37	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	98.29	98.92	ER	399	5.58
38	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	98.47	99.1	ER	399	5.58
39	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	101.02	101.67	ER	470	6.78
40	Non	Non	DVP - DVP	3TREGO-3TREGOTP 115 kV line	314612	314615	1	DC	113.96	280.63	NR	48	80
41	Non	Non	DVP - DVP	AB1-173 TAP-3TREGO 115 kV line	923571	314612	1	DC	56.08	134.51	NR	102	80

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 #AB2-040 interconnection of a 80 MW Energy (45.6 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	Limiting Element

		AB2-040	
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 AB2-040	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 #14 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.

Option Two

Network Impacts

The Queue Project AB2-040 was evaluated as a 80.0 MW (Capacity 45.6 MW) injection tapping the Clubhouse-Lakeview 230 kV line in the ITO area. Project AB2-040 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-040 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 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 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

Contingency Name	Description
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
DVP_P1-2:2056	CONTINGENCY 'DVP_P1-2:2056' OPEN BRANCH FROM BUS 313845 TO BUS 314579 CKT 1 /* 6HATHAWAY 230.00 - 6HORNRTN 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

Contingency Name	Description
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
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

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 56-2012_B	CONTINGENCY 'LN 56-2012_B' OPEN BRANCH FROM BUS 314259 TO BUS 314559 CKT Z1 /* 3CAR56_1 115.00 - 3CAROLNA 115.00 OPEN BRANCH FROM BUS 921161 TO BUS 314604 CKT 1 /* AA1-063A TAP 115.00 - 3SEABORD 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 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 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

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		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
1	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	99.57	100.48	ER	399	3.64
2	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	99.72	100.63	ER	399	3.64
3	N-1	LN 576	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	99.25	100.07	ER	399	3.27
4	N-1	LN 238	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	DC	70.72	77.71	ER	399	27.87
5	N-1	LN 254_A	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	DC	71.14	78.25	ER	399	28.37
6	N-1	LN 2012	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	74.44	80.81	ER	399	25.45
7	N-1	DVP_P1-2:2056	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	66.42	72.92	ER	399	25.96

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		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
8	LFFB	259T2003	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	88.41	89.01	ER	399	5.32
9	LFFB	T672B	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	86.49	87.21	ER	399	6.41
10	DCTL	LN 259-2065	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	85.59	86.31	ER	399	6.36
11	BUS	BASIN 230 B#2	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	85.27	85.99	ER	399	6.38
12	LFFB	T672B	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	100	100.72	ER	399	6.41
13	DCTL	LN 259-2065	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	99.1	99.82	ER	399	6.36
14	BUS	BASIN 230 B#2	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	98.78	99.5	ER	399	6.38
15	DCTL	LN 259-2065	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	99.27	99.99	ER	399	6.36
16	BUS	BASIN 230 B#2	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	98.96	99.68	ER	399	6.38
17	LFFB	239T2141	DVP - DVP	6CLUBHSE-6SAPONY 230 kV line	314563	314435	1	DC	47.29	57.15	ER	637	62.81
18	LFFB	23872	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	DC	78.88	91.14	ER	399	48.91
19	LFFB	238T2002	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	DC	78.59	90.85	ER	399	48.9

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
20	LFFB	239T2141	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	89.88	109.9	ER	399	79.91
21	DCTL	LN 54-2012_B	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	83.92	95.19	ER	399	44.97
22	DCTL	LN 56-2012_B	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	83.22	94.57	ER	399	45.31

Note:

- For item #17 please refer to Appendix 8 for a table containing the generators having contribution to this flowgate.
- For item #18 please refer to Appendix 9 for a table containing the generators having contribution to this flowgate.
- For item #20 please refer to Appendix 10 for a table containing the generators having contribution to this flowgate.

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	Facility Description	Bus	Circuit	Power	Loading %	Rating	MW
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	Type	Name	Area		From	To		Flow	Initial	Final	Type	MVA	Contribution
23	DCTL	LN 208-259	DVP - DVP	6CHARCTY-6LAKESD 230 kV line	314225	314227	1	DC	112.62	113.37	ER	399	6.66
24	DCTL	LN 208-259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	126.13	126.88	ER	399	6.66
25	LFFB	259T2003	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	101.92	102.52	ER	399	5.32
26	DCTL	LN 208-259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	126.31	127.06	ER	399	6.66
27	LFFB	259T2003	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	102.07	102.67	ER	399	5.32
28	LFFB	T672B	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	100.17	100.89	ER	399	6.41
29	DCTL	LN 2058-2181	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	DC	87.74	89.84	ER	164	7.66

Note:

- For item #23 please refer to Appendix 11 for a table containing the generators having contribution to this flowgate.
- For item #24 please refer to Appendix 12 for a table containing the generators having contribution to this flowgate.
- For item #26 please refer to Appendix 13 for a table containing the generators having contribution to this flowgate.
- For item #29 please refer to Appendix 14 for a table containing the generators having contribution to this flowgate.

Steady-State Voltage Requirements

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

To be determined during Impact Study.

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

To be determined during Impact Study.

Potential Congestion due to Local Energy Deliverability

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

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

#	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
30	N-1	LN 259	DVP - DVP	6CHARCTY-6LAKE SD 230 kV line	314225	314227	1	DC	84.96	85.68	ER	399	6.38
31	N-1	LN 259	DVP - DVP	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	98.49	99.22	ER	399	6.38
32	N-1	LN 259	DVP - DVP	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	98.65	99.37	ER	399	6.38
33	N-1	LN 563	DVP - DVP	6CHSTF B-6BASIN 230 kV line	314287	314276	1	DC	101.29	102.03	ER	470	7.64
34	N-1	LN 238	DVP - DVP	6LAKEVIEW-6CAROLINA 230 kV line	314583	314561	1	DC	78.39	90.65	ER	399	48.9
35	N-1	LN 2012	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	DC	80.53	91.71	ER	399	44.64

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 #AB2-040 interconnection of a 80 MW Energy (45.6 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 2019 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):

3. System Normal – No deficiencies identified
4. Critical System Condition (No Surry 230 kV Unit) – No deficiencies identified.

Category C Analysis: (Multiple Facility Analysis)

4. Bus Fault - No deficiencies identified
5. Line Stuck Breaker - No deficiencies identified
6. 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 AB2-040	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 AB2-040	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

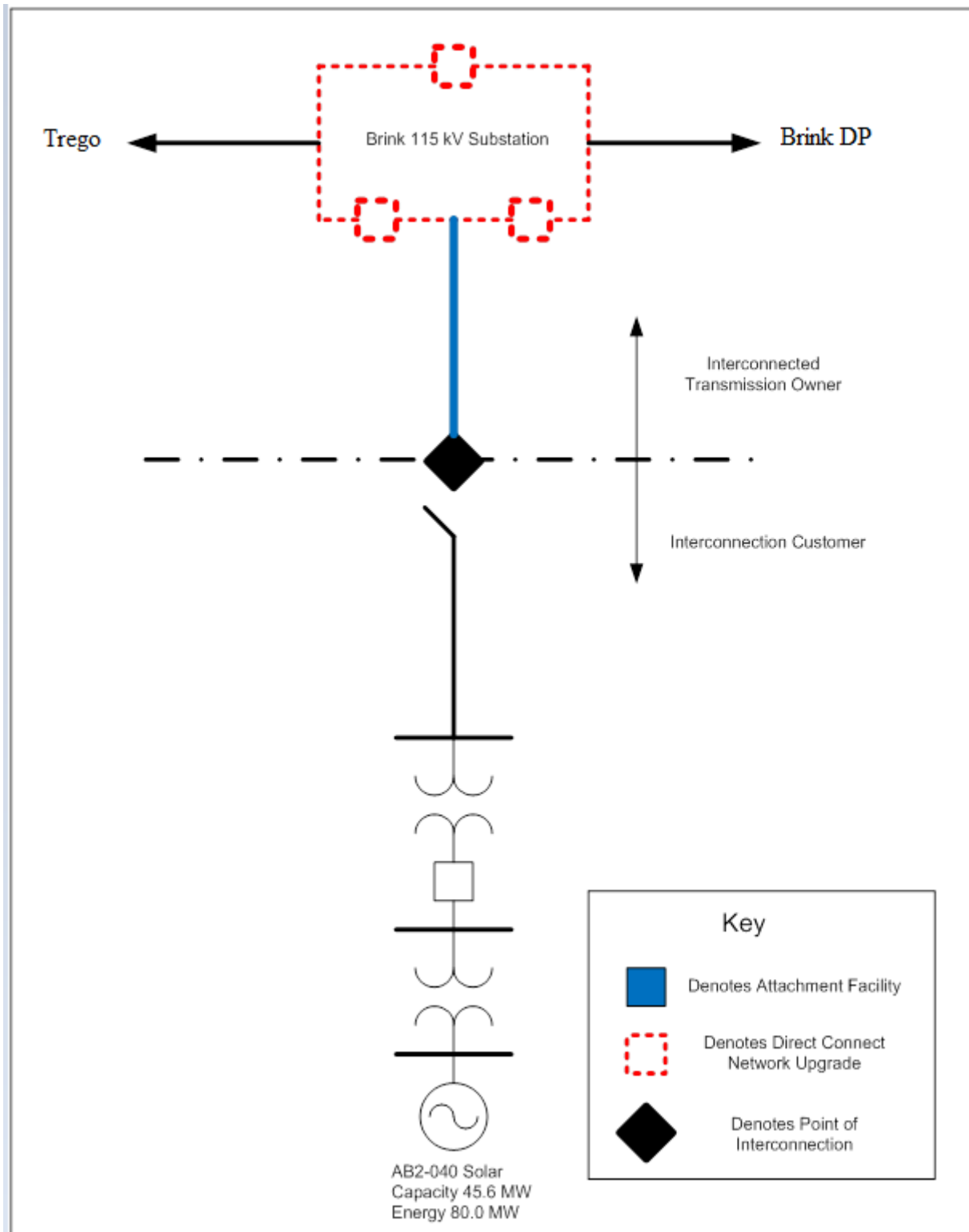
Duke, Progress & TVA Impacts:

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

Overload #29 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 3TREGO-3TREGOTP 115 kV line (from bus 314612 to bus 314615 ckt 1) loads from 73.96% to 168.96% (**DC power flow**) of its normal rating (48 MVA) for non-contingency condition. This project contributes approximately 45.6 MW to the thermal violation.

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
923572	AB1-173 C OP	13.5
923582	AB1-173AC OP	13.5
923911	AB2-031 C OP	13.4
923991	AB2-040 C OP	45.6

Appendix 2

(DVP - DVP) The 6CLUBHSE 230/115 kV transformer (from bus 314562 to bus 314563 ckt 1) loads from 17.1% to 49.78% (**DC power flow**) of its emergency rating (194 MVA) for the line fault with failed breaker contingency outage of 'T122C'. This project contributes approximately 63.51 MW to the thermal violation.

CONTINGENCY 'T122C'

/* CAROLINA

OPEN BUS 314559

/* CAROLINA 115KV BUS

OPEN BUS 315126

/* ROANOKE RAPIDS GEN 1 AND 2

OPEN BUS 315128

/* ROANOKE RAPIDS GEN 3 AND 4

OPEN BRANCH FROM BUS 314559 TO BUS 314561 CKT 1

/* TX. #4

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315159	1KERR 2	1.27
315163	1KERR 6	1.25
315164	1KERR 7	1.25
314704	3LAWRENC	1.43
922472	AA2-169 C	1.68
922473	AA2-169 E	0.77
923572	AB1-173 C OP	10.72
923573	AB1-173 E OP	5.
923582	AB1-173AC OP	10.72
923583	AB1-173AE OP	5.
923911	AB2-031 C OP	10.64
923912	AB2-031 E OP	5.24
923991	AB2-040 C OP	36.2
923992	AB2-040 E OP	27.31
924021	AB2-043 C OP	3.15
924022	AB2-043 E OP	5.16
924161	AB2-060 C OP	7.15
924162	AB2-060 E OP	3.37
924251	AB2-069 C OP	2.46
924252	AB2-069 E OP	3.88
924301	AB2-077 C OP	1.93
924302	AB2-077 E OP	1.29
924311	AB2-078 C OP	1.93
924312	AB2-078 E OP	1.29
924321	AB2-079 C OP	1.93
924322	AB2-079 E OP	1.29
924401	AB2-089 C	1.61

924402	AB2-089 E	0.83
924411	AB2-090 C	3.96
924412	AB2-090 E	2.03
924931	AB2-147 C	11.39
924932	AB2-147 E	18.59
924951	AB2-150 C OP	11.39
924952	AB2-150 E OP	18.59
925171	AB2-174 C OP	33.34
925172	AB2-174 E OP	30.17
925221	AB2-176 C	1.63
925222	AB2-176 E	0.7

Appendix 3

(DVP - DVP) The 6CHARCTY-6LAKESD 230 kV line (from bus 314225 to bus 314227 ckt 1) loads from 111.66% to 112.31% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 5.84 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	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	0.65
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	13.58
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	1.51
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	3.
921573	AA1-138 E	1.29
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	0.72
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	3.8
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	1.21
922882	AB1-077 C	1.01
922883	AB1-077 E	6.74
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	3.8
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	5.75
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	6.67
924012	AB2-042 E OP	5.32
924071	AB2-051 C OP	39.05
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	5.57
924512	AB2-100 E	2.74
924761	AB2-128 C	4.77
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.19
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	4.18
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	2.01
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

Appendix 4

(DVP - DVP) The 6MESSER-6CHARCTY 230 kV line (from bus 314228 to bus 314225 ckt 1) loads from 125.19% to 125.85% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 5.84 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	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	0.65
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	13.58
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	1.51
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	3.
921573	AA1-138 E	1.29
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	0.72
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	3.8
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	1.21
922882	AB1-077 C	1.01
922883	AB1-077 E	6.74
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	3.8
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	5.75
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	6.67
924012	AB2-042 E OP	5.32
924071	AB2-051 C OP	39.05
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	5.57
924512	AB2-100 E	2.74
924761	AB2-128 C	4.77
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.19
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	4.18
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	2.01
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

Appendix 5

(DVP - DVP) The 6CHSTF B-6MESSER 230 kV line (from bus 314287 to bus 314228 ckt 1) loads from 125.34% to 126.0% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 5.84 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	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	0.65
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	13.58
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	1.51
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	3.
921573	AA1-138 E	1.29
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	0.72
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	3.8
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	1.21
922882	AB1-077 C	1.01
922883	AB1-077 E	6.74
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	3.8
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	5.75
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	6.67
924012	AB2-042 E OP	5.32
924071	AB2-051 C OP	39.05
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	5.57
924512	AB2-100 E	2.74
924761	AB2-128 C	4.77
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.19
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	4.18
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	2.01
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

Appendix 6

(DVP - DVP) The 6CHSTF B-6BASIN 230 kV line (from bus 314287 to bus 314276 ckt 1) loads from 106.62% to 107.29% (**DC power flow**) of its emergency rating (470 MVA) for the line fault with failed breaker contingency outage of '562T563'. This project contributes approximately 7.02 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	37.56
315077	1HOPHCF1	1.99
315078	1HOPHCF2	1.99
315079	1HOPHCF3	1.99
315080	1HOPHCF4	3.02
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	15.91
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	16.18
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	3.18
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	1.66
918512	AA1-065 E OP	1.81
921182	AA1-067 C	0.67
921183	AA1-067 E	0.29
918562	AA1-072 E	0.07
921552	AA1-134 C	3.41
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	4.55
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	6.05
922523	AA2-177 E	2.59
922532	AA2-178 C	3.58
922533	AA2-178 E	1.53
922602	AB1-013 C	1.08
922603	AB1-013 E	7.22
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	7.95
922922	AB1-081 C OP	3.64
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.
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	4.29
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	7.76
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	2.78
924951	AB2-150 C OP	1.41
924952	AB2-150 E OP	2.3
924961	AB2-152	14.64
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	3.44
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	3.37
925171	AB2-174 C OP	3.8
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

Appendix 7

(DVP - CPLE) The 3BTLEBRO-3ROCKYMT115T 115 kV line (from bus 314554 to bus 304223 ckt 1) loads from 85.12% to 87.09% (**DC power flow**) of its emergency rating (164 MVA) for the tower line contingency outage of 'LN 2058-2181'. This project contributes approximately 7.19 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	2.63
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	6.1
917592	Z2-099 E	0.2
918411	AA1-050	0.62

<i>LTF</i>	<i>AA1-053</i>	<i>6.09</i>
<i>LTF</i>	<i>AA1-054</i>	<i>5.29</i>
<i>LTF</i>	<i>AA1-055</i>	<i>9.44</i>
<i>921162</i>	<i>AA1-063AC</i>	<i>4.88</i>
<i>921163</i>	<i>AA1-063AE</i>	<i>2.3</i>
<i>918512</i>	<i>AA1-065 E OP</i>	<i>1.96</i>
<i>921182</i>	<i>AA1-067 C</i>	<i>0.73</i>
<i>921183</i>	<i>AA1-067 E</i>	<i>0.31</i>
<i>918561</i>	<i>AA1-072 C</i>	<i>0.06</i>
<i>918562</i>	<i>AA1-072 E</i>	<i>0.14</i>
<i>921562</i>	<i>AA1-135 C</i>	<i>4.03</i>
<i>921563</i>	<i>AA1-135 E</i>	<i>1.73</i>
<i>921752</i>	<i>AA2-053 C</i>	<i>5.42</i>
<i>921753</i>	<i>AA2-053 E</i>	<i>2.33</i>
<i>921762</i>	<i>AA2-057 C</i>	<i>12.89</i>
<i>921763</i>	<i>AA2-057 E</i>	<i>6.44</i>
<i>921862</i>	<i>AA2-068 C</i>	<i>3.3</i>
<i>921863</i>	<i>AA2-068 E</i>	<i>1.52</i>
<i>920022</i>	<i>AA2-086 E</i>	<i>0.11</i>
<i>921982</i>	<i>AA2-088 C</i>	<i>2.94</i>
<i>921983</i>	<i>AA2-088 E</i>	<i>4.8</i>
<i>922032</i>	<i>AA2-105 C</i>	<i>1.71</i>
<i>922033</i>	<i>AA2-105 E</i>	<i>0.8</i>
<i>922072</i>	<i>AA2-113 C</i>	<i>1.71</i>
<i>922073</i>	<i>AA2-113 E</i>	<i>0.8</i>
<i>922442</i>	<i>AA2-165 C</i>	<i>1.76</i>
<i>922443</i>	<i>AA2-165 E</i>	<i>0.85</i>
<i>922512</i>	<i>AA2-174 C</i>	<i>0.25</i>
<i>922513</i>	<i>AA2-174 E</i>	<i>0.27</i>
<i>922722</i>	<i>AB1-053 C</i>	<i>0.84</i>
<i>922723</i>	<i>AB1-053 E</i>	<i>0.47</i>
<i>922732</i>	<i>AB1-054 C</i>	<i>3.16</i>
<i>922733</i>	<i>AB1-054 E</i>	<i>1.55</i>
<i>922922</i>	<i>AB1-081 C OP</i>	<i>20.08</i>
<i>922923</i>	<i>AB1-081 E OP</i>	<i>8.6</i>
<i>923262</i>	<i>AB1-132 C OP</i>	<i>9.76</i>
<i>923263</i>	<i>AB1-132 E OP</i>	<i>4.18</i>
<i>923572</i>	<i>AB1-173 C OP</i>	<i>1.21</i>
<i>923573</i>	<i>AB1-173 E OP</i>	<i>0.57</i>
<i>923582</i>	<i>AB1-173AC OP</i>	<i>1.21</i>
<i>923583</i>	<i>AB1-173AE OP</i>	<i>0.57</i>
<i>923911</i>	<i>AB2-031 C OP</i>	<i>1.2</i>
<i>923912</i>	<i>AB2-031 E OP</i>	<i>0.59</i>
<i>923941</i>	<i>AB2-035 C</i>	<i>0.37</i>
<i>923942</i>	<i>AB2-035 E</i>	<i>0.16</i>

923991	AB2-040 C OP	4.1
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	0.25
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

Appendix 8

(DVP - DVP) The 6CLUBHSE-6SAPONY 230 kV line (from bus 314563 to bus 314435 ckt 1) loads from 47.29% to 57.15% (**DC power flow**) of its emergency rating (637 MVA) for the line fault with failed breaker contingency outage of '239T2141'. This project contributes approximately 62.81 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	16.92
315141	1GASTONB	16.92
315159	1KERR 2	1.19
315164	1KERR 7	1.17
315126	1ROARAP2	1.59
315128	1ROARAP4	1.53
314704	3LAWRENC	1.
921162	AA1-063AC	6.84
921163	AA1-063AE	3.22
921752	AA2-053 C	7.37
921753	AA2-053 E	3.16
922032	AA2-105 C	2.07
922033	AA2-105 E	0.97
922072	AA2-113 C	2.07
922073	AA2-113 E	0.97
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	10.52
923912	AB2-031 E OP	5.18
923991	AB2-040 C OP	35.8
923992	AB2-040 E OP	27.01
924161	AB2-060 C OP	13.37

924162	AB2-060 E OP	6.29
924251	AB2-069 C OP	2.24
924252	AB2-069 E OP	3.54
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	7.84
924932	AB2-147 E	12.79
924951	AB2-150 C OP	11.93
924952	AB2-150 E OP	19.47
925171	AB2-174 C OP	32.98
925172	AB2-174 E OP	29.84
925221	AB2-176 C	1.29
925222	AB2-176 E	0.55

Appendix 9

(DVP - DVP) The 6LAKEVIEW-6CAROLNA 230 kV line (from bus 314583 to bus 314561 ckt 1) loads from 78.88% to 91.14% (**DC power flow**) of its emergency rating (399 MVA) for the line fault with failed breaker contingency outage of '23872'. This project contributes approximately 48.91 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	2.04
315132	1EDGECEMB	2.04
315139	1GASTONA	13.18
315141	1GASTONB	13.18
315136	1ROSEMG1	8.61
315138	1ROSEMG2	4.03
315137	1ROSEMS1	5.34
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
923911	AB2-031 C OP	8.19
923912	AB2-031 E OP	4.04
923941	AB2-035 C	0.25
923942	AB2-035 E	0.11
923991	AB2-040 C OP	27.88
923992	AB2-040 E OP	21.03
924151	AB2-059 C OP	11.85
924152	AB2-059 E OP	6.11
924391	AB2-088 C	0.33

924392	<i>AB2-088 E</i>	<i>0.16</i>
924511	<i>AB2-100 C</i>	<i>40.96</i>
924512	<i>AB2-100 E</i>	<i>20.18</i>
924761	<i>AB2-128 C</i>	<i>35.09</i>
924762	<i>AB2-128 E</i>	<i>13.82</i>
924951	<i>AB2-150 C OP</i>	<i>9.29</i>
924952	<i>AB2-150 E OP</i>	<i>15.16</i>
925171	<i>AB2-174 C OP</i>	<i>25.68</i>
925172	<i>AB2-174 E OP</i>	<i>23.23</i>

Appendix 10

(DVP - DVP) The AB2-100 TAP-6CLUBHSE 230 kV line (from bus 924510 to bus 314563 ckt 1) loads from 89.88% 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 79.91 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	21.53
315141	1GASTONB	21.53
923262	AB1-132 C OP	83.91
923263	AB1-132 E OP	35.96
923911	AB2-031 C OP	13.39
923912	AB2-031 E OP	6.59
923991	AB2-040 C OP	45.55
923992	AB2-040 E OP	34.36
924511	AB2-100 C	66.93
924512	AB2-100 E	32.96
924761	AB2-128 C	57.34
924762	AB2-128 E	22.57
925171	AB2-174 C OP	41.95
925172	AB2-174 E OP	37.96

Appendix 11

(DVP - DVP) The 6CHARCTY-6LAKESD 230 kV line (from bus 314225 to bus 314227 ckt 1) loads from 112.62% to 113.37% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 6.66 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	37.23
315077	1HOPHCF1	2.16
315078	1HOPHCF2	2.16
315079	1HOPHCF3	2.16
315080	1HOPHCF4	3.27
315076	1HOPPOLC	1.84
315073	1STONECA	5.67
314784	1WEYRHSB	0.66
314314	3LOCKS	1.04
314539	3UNCAMP	0.86
314541	3WATKINS	0.25
314229	6MT R221	-0.33
292791	U1-032 E	2.95
900672	V4-068 E	0.11
901082	W1-029E	13.49
902241	W2-022 C OP1	0.49
902242	W2-022 E OP1	3.31
903520	W3-066 C1OP1	0.98
903531	W3-066 C2OP1	0.98
903522	W3-066 E1OP1	6.54
903532	W3-066 E2OP1	6.54
907092	X1-038 E	2.15
913392	Y1-086 E	0.63
914231	Y2-077	0.87

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

922602	AB1-013 C	0.89
922603	AB1-013 E	5.98
922722	AB1-053 C	0.44
922723	AB1-053 E	0.25
922732	AB1-054 C	2.47
922733	AB1-054 E	1.22
922882	AB1-077 C	1.01
922883	AB1-077 E	6.75
923262	AB1-132 C OP	5.97
923263	AB1-132 E OP	2.56
923572	AB1-173 C OP	0.99
923573	AB1-173 E OP	0.46
923582	AB1-173AC OP	0.99
923583	AB1-173AE OP	0.46
923801	AB2-015 C OP	3.8
923802	AB2-015 E OP	2.76
923831	AB2-022 C	0.66
923832	AB2-022 E	0.35
923851	AB2-025 C	1.62
923852	AB2-025 E	0.73
923911	AB2-031 C OP	1.11
923912	AB2-031 E OP	0.55
923981	AB2-039 C OP	5.76
923982	AB2-039 E OP	4.71
923991	AB2-040 C OP	3.79
923992	AB2-040 E OP	2.86
924011	AB2-042 C OP	5.26
924012	AB2-042 E OP	4.19
924071	AB2-051 C OP	39.
924072	AB2-051 E OP	6.06
924161	AB2-060 C OP	2.79
924162	AB2-060 E OP	1.31
924381	AB2-087 C	0.19
924382	AB2-087 E	0.09
924501	AB2-099 C	0.2
924502	AB2-099 E	0.09
924511	AB2-100 C	5.58
924512	AB2-100 E	2.75
924761	AB2-128 C	4.78
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.19
924812	AB2-134 E OP	10.95
924931	AB2-147 C	1.18
924932	AB2-147 E	1.92
924941	AB2-149 C OP	1.51

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

Appendix 12

(DVP - DVP) The 6MESSER-6CHARCTY 230 kV line (from bus 314228 to bus 314225 ckt 1) loads from 126.13% to 126.88% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 6.66 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	37.23
315077	1HOPHCF1	2.16
315078	1HOPHCF2	2.16
315079	1HOPHCF3	2.16
315080	1HOPHCF4	3.27
315076	1HOPPOLC	1.84
315073	1STONECA	5.67
314784	1WEYRHSB	0.66
314314	3LOCKS	1.04
314539	3UNCAMP	0.86
314541	3WATKINS	0.25
314229	6MT R221	-0.33
292791	U1-032 E	2.95
900672	V4-068 E	0.11
901082	W1-029E	13.49
902241	W2-022 C OP1	0.49
902242	W2-022 E OP1	3.31
903520	W3-066 C1OP1	0.98
903531	W3-066 C2OP1	0.98
903522	W3-066 E1OP1	6.54
903532	W3-066 E2OP1	6.54
907092	X1-038 E	2.15
913392	Y1-086 E	0.63
914231	Y2-077	0.87

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

922602	AB1-013 C	0.89
922603	AB1-013 E	5.98
922722	AB1-053 C	0.44
922723	AB1-053 E	0.25
922732	AB1-054 C	2.47
922733	AB1-054 E	1.22
922882	AB1-077 C	1.01
922883	AB1-077 E	6.75
923262	AB1-132 C OP	5.97
923263	AB1-132 E OP	2.56
923572	AB1-173 C OP	0.99
923573	AB1-173 E OP	0.46
923582	AB1-173AC OP	0.99
923583	AB1-173AE OP	0.46
923801	AB2-015 C OP	3.8
923802	AB2-015 E OP	2.76
923831	AB2-022 C	0.66
923832	AB2-022 E	0.35
923851	AB2-025 C	1.62
923852	AB2-025 E	0.73
923911	AB2-031 C OP	1.11
923912	AB2-031 E OP	0.55
923981	AB2-039 C OP	5.76
923982	AB2-039 E OP	4.71
923991	AB2-040 C OP	3.79
923992	AB2-040 E OP	2.86
924011	AB2-042 C OP	5.26
924012	AB2-042 E OP	4.19
924071	AB2-051 C OP	39.
924072	AB2-051 E OP	6.06
924161	AB2-060 C OP	2.79
924162	AB2-060 E OP	1.31
924381	AB2-087 C	0.19
924382	AB2-087 E	0.09
924501	AB2-099 C	0.2
924502	AB2-099 E	0.09
924511	AB2-100 C	5.58
924512	AB2-100 E	2.75
924761	AB2-128 C	4.78
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.19
924812	AB2-134 E OP	10.95
924931	AB2-147 C	1.18
924932	AB2-147 E	1.92
924941	AB2-149 C OP	1.51

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

Appendix 13

(DVP - DVP) The 6CHSTF B-6MESSER 230 kV line (from bus 314287 to bus 314228 ckt 1) loads from 126.31% to 127.06% (**DC power flow**) of its emergency rating (399 MVA) for the tower line contingency outage of 'LN 208-259'. This project contributes approximately 6.66 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	37.23
315077	1HOPHCF1	2.16
315078	1HOPHCF2	2.16
315079	1HOPHCF3	2.16
315080	1HOPHCF4	3.27
315076	1HOPPOLC	1.84
315073	1STONECA	5.67
314784	1WEYRHSB	0.66
314314	3LOCKS	1.04
314539	3UNCAMP	0.86
314541	3WATKINS	0.25
314229	6MT R221	-0.33
292791	U1-032 E	2.95
900672	V4-068 E	0.11
901082	W1-029E	13.49
902241	W2-022 C OP1	0.49
902242	W2-022 E OP1	3.31
903520	W3-066 C1OP1	0.98
903531	W3-066 C2OP1	0.98
903522	W3-066 E1OP1	6.54
903532	W3-066 E2OP1	6.54
907092	X1-038 E	2.15
913392	Y1-086 E	0.63
914231	Y2-077	0.87

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

922602	AB1-013 C	0.89
922603	AB1-013 E	5.98
922722	AB1-053 C	0.44
922723	AB1-053 E	0.25
922732	AB1-054 C	2.47
922733	AB1-054 E	1.22
922882	AB1-077 C	1.01
922883	AB1-077 E	6.75
923262	AB1-132 C OP	5.97
923263	AB1-132 E OP	2.56
923572	AB1-173 C OP	0.99
923573	AB1-173 E OP	0.46
923582	AB1-173AC OP	0.99
923583	AB1-173AE OP	0.46
923801	AB2-015 C OP	3.8
923802	AB2-015 E OP	2.76
923831	AB2-022 C	0.66
923832	AB2-022 E	0.35
923851	AB2-025 C	1.62
923852	AB2-025 E	0.73
923911	AB2-031 C OP	1.11
923912	AB2-031 E OP	0.55
923981	AB2-039 C OP	5.76
923982	AB2-039 E OP	4.71
923991	AB2-040 C OP	3.79
923992	AB2-040 E OP	2.86
924011	AB2-042 C OP	5.26
924012	AB2-042 E OP	4.19
924071	AB2-051 C OP	39.
924072	AB2-051 E OP	6.06
924161	AB2-060 C OP	2.79
924162	AB2-060 E OP	1.31
924381	AB2-087 C	0.19
924382	AB2-087 E	0.09
924501	AB2-099 C	0.2
924502	AB2-099 E	0.09
924511	AB2-100 C	5.58
924512	AB2-100 E	2.75
924761	AB2-128 C	4.78
924762	AB2-128 E	1.88
924811	AB2-134 C OP	8.19
924812	AB2-134 E OP	10.95
924931	AB2-147 C	1.18
924932	AB2-147 E	1.92
924941	AB2-149 C OP	1.51

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

Appendix 14

(DVP - CPLE) The 3BTLEBRO-3ROCKYMT115T 115 kV line (from bus 314554 to bus 304223 ckt 1) loads from 87.74% to 89.84% (**DC power flow**) of its emergency rating (164 MVA) for the tower line contingency outage of 'LN 2058-2181'. This project contributes approximately 7.66 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	2.63
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
314784	1WEYRHSB	0.77
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
922472	AA2-169 C	0.85
922473	AA2-169 E	0.39
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
923801	AB2-015 C OP	4.03

923802	AB2-015 E OP	2.92
923911	AB2-031 C OP	1.28
923912	AB2-031 E OP	0.63
923941	AB2-035 C	0.37
923942	AB2-035 E	0.16
923991	AB2-040 C OP	4.36
923992	AB2-040 E OP	3.29
924151	AB2-059 C OP	15.3
924152	AB2-059 E OP	7.88
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	1.14
924952	AB2-150 E OP	1.87
925121	AB2-169 C OP	2.51
925122	AB2-169 E OP	2.25
925141	AB2-171 C OP	1.93
925142	AB2-171 E OP	3.16
925171	AB2-174 C OP	4.02
925172	AB2-174 E OP	3.64