Generation Interconnection
System Impact Study Report

For

PJM Generation Interconnection Request
Queue Position AC1-161

Septa 500kV
168.2 MW Capacity / 240 MW Energy

December 2017

Revised June 2020

Introduction

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

Preface

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

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

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

General

The IC has proposed a solar generating facility located in Isle of Wight County, VA. The installed facilities will have a total capability of 240 MW with 168.2 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is 10/01/2019. **This study does not imply an ITO commitment to this in-service date.**

Point of Interconnection

AC1-161 will interconnect with the ITO transmission system will connect into a new bay at Septa 500kV substation.

Cost Summary

The AC1-161 interconnection request will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 2,200,000
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades	$ 3,000,000
Allocation for New System Upgrades	$ 54,599
Contribution for Previously Identified Upgrades	$ 79,277
Total Costs	**$ 5,333,876**

Attachment Facilities

Generation Substation: Install metering and associated protection equipment. Estimated Cost $700,000.

Transmission: Build 0.5 miles of 500 kV Line. Estimated Cost $1,500,000.

The estimated total cost of the Attachment Facilities is $2,200,000. It is estimated to take 18-24 months to permit (VA CPCN Required) and complete this work. These preliminary cost estimates are based on typical engineering costs. A more detailed engineering cost estimates are normally done when the IC provides an exact site plan location for the generation substation during the Facility Study phase. These costs do not include CIAC Tax Gross-up. The single line is shown below in Attachment 1.

Direct Connection Cost Estimate

None

Non-Direct Connection Cost Estimate

Septa 500kV:

- Substation: Add an additional 500 kV Breaker at Septa 500 kV Switching Station may require substation expansion/re-arrangement. Estimated cost $1,500,000.

- Transmission: rearrange existing lines, Estimated Cost $1,500,000.

The estimated cost is $3,000,000 and is estimated to take 30-34 months to permit and construct.

Remote Terminal Work: During the Facilities Study, ITO's System Protection Engineering Department will review transmission line protection as well as anti-islanding required to accommodate the new generation and interconnection substation. System Protection

Engineering will determine the minimal acceptable protection requirements to reliably interconnect the proposed generating facility with the transmission system. The review is based on maintaining system reliability by reviewing ITO's protection requirements with the known transmission system configuration which includes generating facilities in the area. This review may determine that transmission line protection and communication upgrades are required at remote substations.

New System Reinforcements

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

Violation #	Ruling Violation #	Loading	Upgrade Description	Upgrade Cost	Allocated Cost
# 1		From 95.52% to 97.94%	n5464 - Replace wave trap at Chickahominy Substation. This will increase emergency rating to 3424 MVA (normal and emergency) and 3937 MVA load dump. Ratings after the upgrade: 3424/3424/3937	$500,000	$27,467
# 3, 15	15	From 100.27% to 101.25%	n6063 - Replace wave trap at both Ladysmith and Possum Point Substations for the Ladysmith – Possum Pt 500kV line #552. Estimated to take 14-16 months to engineer and construct. Ratings after the upgrade: 2598/2598/3637	$500,000	$31,530

Violation #	Ruling Violation #	Loading	Upgrade Description	Upgrade Cost	Allocated Cost
# 4		From 95.3% to 97.83%	n6055 - Replace wave trap at North Anna Substation for Midlothian – North Anna 500 kV line #576. Estimated to 12-16 months to engineer and construct. Ratings after the upgrade: 3424/3424/3938	$250,000	$27,132
# 5 - 7	5	From 115.27% to 118.42%	PJM baseline upgrade b3057: Rebuild 6.1 miles of Waller-Skiffes Creek 230 kV Line (#2154) between Waller and Kings Mill to current standards with a minimum summer emergency rating of 1047 MVA utilizing single circuit steel structures. Remove this 6.1 mile section of Line #58 between Waller and Kings Mill. Rebuild the 1.6 miles of Line #2154 and #19 between Kings Mill and Skiffes Creek to current standards with a minimum summer emergency rating of 1047 MVA at 230 kV for Line #2154 and 261 MVA at 115 kV for Line #19, utilizing double circuit steel structures. The baseline project has a projected in-service date of 12/30/2024. Ratings after the upgrade: 1047	$10,000,000	$0
# 8, 9	8	From 105.03% to 106.14%	n6217 - The line can be uprated by replacing a wave trap Ratings after the upgrade: 2914/2914/3351	$300,000	$51,936

Violation #	Ruling Violation #	Loading	Upgrade Description	Upgrade Cost	Allocated Cost
# 10 - 14	10	From 124.95% to 126.84%	n5483 - Replacing wave trap will increase the line's rating up to 2913 MVA (normal), 2913 MVA (emergency), and 3351 MVA (load dump).	$700,000	$47,747
			Total Estimate Allocated Cost of Network Upgrades		**$185,812**

Interconnection Customer Requirements

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

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

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

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

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

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

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

Revenue Metering and SCADA Requirements

PJM Requirements

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

Interconnected Transmission Owner Requirements

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

Network Impacts

The Queue Project AC1-161 was evaluated as a 240.0 MW (Capacity 168.2 MW) injection at the Septa 500 kV substation in the ITO area. Project AC1-161 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-161 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
57602	CONTINGENCY '57602' /*NORTH ANNA OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /*MIDLOTHIAN TO NORTH ANNA (LINE 576) OPEN BRANCH FROM BUS 314914 TO BUS 314322 CKT 1 /*MIDLOTHIAN 500-230 (TX#2) OPEN BRANCH FROM BUS 314918 TO BUS 314232 CKT 1 /*NORTH ANNA 500-230 (TX#5) END
557T574	CONTINGENCY '557T574' /* ELMONT OPEN BRANCH FROM BUS 314908 TO BUS 314903 CKT 1 /*ELMONT TO CHICKAHOMINY (LINE 557) OPEN BRANCH FROM BUS 314903 TO BUS 314214 CKT 1 /*CHICKAHOMINY 500-230 (TX#1) OPEN BRANCH FROM BUS 314911 TO BUS 314908 CKT 1 /*ELMONT TO LADYSMITH (LINE 574) END
563T576	CONTINGENCY '563T576' /*MIDLOTHIAN OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /*MIDLOTHIAN TO NORTH ANNA (LINE 576) OPEN BRANCH FROM BUS 314914 TO BUS 314322 CKT 1 /*MIDLOTHIAN 500-230 (TX#2) OPEN BRANCH FROM BUS 314914 TO BUS 314902 CKT 1 /*MIDLOTHIAN TO CARSON (LINE 563) END
LN 539	CONTINGENCY 'LN 539' OPEN BRANCH FROM BUS 314900 TO BUS 314919 CKT 1 /* 8BRISTER 500.00 - 8OX 500.00 END
LN 552	CONTINGENCY 'LN 552' OPEN BRANCH FROM BUS 314135 TO BUS 314905 CKT 1 /* 3CHANCE 115.00 - 8CHANCE 500.00 OPEN BRANCH FROM BUS 314900 TO BUS 314905 CKT 1 /* 8BRISTER 500.00 - 8CHANCE 500.00

	END
LN 557	CONTINGENCY 'LN 557' OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM 230.00 - 8CHCKAHM 500.00 OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM 500.00 - 8ELMONT 500.00 END
LN 563	CONTINGENCY 'LN 563' OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 END
LN 573	CONTINGENCY 'LN 573' OPEN BRANCH FROM BUS 314918 TO BUS 314934 CKT 1 /* 8NO ANNA 500.00 - 8SPOTSYL 500.00 END
LN 574	CONTINGENCY 'LN 574' OPEN BRANCH FROM BUS 314908 TO BUS 314911 CKT 1 /* 8ELMONT 500.00 - 8LDYSMTH 500.00 END
LN 576	CONTINGENCY 'LN 576' OPEN BRANCH FROM BUS 314322 TO BUS 314914 CKT 1 /* 6MDLTHAN 230.00 - 8MDLTHAN 500.00 OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00 END
LN 581	CONTINGENCY 'LN 581' OPEN BRANCH FROM BUS 314135 TO BUS 314905 CKT 2 /* 3CHANCE 115.00 - 8CHANCE 500.00 OPEN BRANCH FROM BUS 314905 TO BUS 314911 CKT 1 /* 8CHANCE 500.00 - 8LDYSMTH 500.00 END
LN 594	CONTINGENCY 'LN 594' OPEN BRANCH FROM BUS 314916 TO BUS 314934 CKT 1 /* 8MORRSVL 500.00 - 8SPOTSYL 500.00 END
WT576	CONTINGENCY 'WT576' /*NORTH ANNA OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /*MIDLOTHIAN TO NORTH ANNA (LINE 576) OPEN BRANCH FROM BUS 314914 TO BUS 314322 CKT 1 /*MIDLOTHIAN 500-230 (TX#2) OPEN BRANCH FROM BUS 314918 TO BUS 314232 CKT 2 /*NORTH ANNA 500-230 (TX#6) END

Summer Peak Analysis – 2020

Generator Deliverability

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

Contingency					Bus				Loading %		Rating			
#	Type	Name	Affected Area	Facility Description	From	To	Ckt	Power Flow	Initial	Final	Type	MVA	MW Contribution	Flowgate Appendix
1	N-1	LN 576	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	95.52	97.94	ER	2442	59.82	1
3	N-1	LN 581	DVP - DVP	8LDYSMTH-8POSSUM 500 kV line	314911	314922	1	AC	98.14	99.12	ER	2442	28.16	

Multiple Facility Contingency

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

Contingency					Bus				Loading %		Rating			
#	Type	Name	Affected Area	Facility Description	From	To	Ckt	Power Flow	Initial	Final	Type	MVA	MW Contribution	Flowgate Appendix
4	LFFB	557T574	DVP - DVP	8MDLTHAN-8NO ANNA 500 kV line	314914	314918	1	AC	95.3	97.83		3144	77.47	3

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

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

None

Contribution to Previously Identified Overloads

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

Contingency			Affected		Bus			Power	Loading %		Rating		MW	
#	Type	Name	Area	Facility Description	From	To	Cir.	Flow	Initial	Final	Type	MVA	Contribution	Ref
5	N-1	LN 557	DVP - DVP	6SKIFF CREEK-6KINGS M 230 kV line	314209	314386	1	AC	115.27	118.42	ER	442	14.15	4
6	N-1	LN 557	DVP - DVP	6PENNIMAN-6WALR209 230 kV line	314296	314415	1	AC	103.23	106.37	ER	442	14.15	5
7	N-1	LN 557	DVP - DVP	6KINGS M-6PENNIMAN 230 kV line	314386	314296	1	AC	107.06	110.21	ER	442	14.15	6
8	N-1	LN 594	DVP - DVP	8CHANCE-8BRISTER 500 kV line	314905	314900	1	AC	105.03	106.14	ER	2442	31.89	7
9	N-1	LN 573	DVP - DVP	8CHANCE-8BRISTER 500 kV line	314905	314900	1	AC	100.2	101.28	ER	2442	31.29	
10	N-1	LN 576	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	124.95	126.84	ER	2442	53.83	8
11	N-1	LN 563	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	112.25	114.17	ER	2442	46.69	
12	LFFB	57602	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	101.99	103.95		3351	76.78	
13	LFFB	WT576	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	101.99	103.95		3351	76.78	

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Cir.	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
14	LFFB	563T576	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	101.9	103.86		3351	76.81	
15	N-1	LN 594	DVP - DVP	8LDYSMTH-8POSSUM 500 kV line	314911	314922	1	AC	100.27	101.25	ER	2442	27.77	9

Steady-State Voltage Requirements

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

None

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

To be completed during the Facility Study phase

New System Reinforcements

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

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AC1-161 Allocation

<table>
<tr><th>Violation #</th><th>Overloaded Facility</th><th>Upgrade Description</th><th>Network Upgrade Number</th><th>Upgrade Cost</th><th>AC1-161 Allocation</th></tr>
<tr><td># 1</td><td>8CHCKAHM-8ELMONT 500 kV line</td><td><u>Chickahominy-Elmont 500kV</u>
Replace wave trap at Chickahominy Substation. This will increase emergency rating to 3424 MVA (normal and emergency) and 3937 MVA load dump.

<table><tr><th>Queue</th><th>Impact (MW)</th><th>Cost</th></tr><tr><td>AC1-086</td><td>27.98</td><td>$12,829.90</td></tr><tr><td>AC1-107</td><td>934.51</td><td>$428,509.33</td></tr><tr><td>AC1-161</td><td>59.9</td><td>$27,466.43</td></tr><tr><td>AC1-164</td><td>68.03</td><td>$31,194.34</td></tr></table></td><td>n5464</td><td>$500,000</td><td>$27,467</td></tr>
<tr><td># 4</td><td>8MDLTHAN-8NO ANNA 500 kV line</td><td><u>Midlothian-North Anna 500kV</u>
Replace wave trap at North Anna Substation for Midlothian – North Anna 500 kV line #576. Estimated to 12-16 months to engineer and construct. Ratings after the upgrade: 3424/3424/3938

<table><tr><th>Queue</th><th>Impact (MW)</th><th>Cost</th></tr><tr><td>AC1-086</td><td>33.04</td><td>$11,571.54</td></tr><tr><td>AC1-107</td><td>505.6</td><td>$177,075.45</td></tr><tr><td>AC1-161</td><td>77.47</td><td>$27,132.19</td></tr><tr><td>AC1-164</td><td>77.54</td><td>$27,156.71</td></tr><tr><td>AC1-189</td><td>20.17</td><td>$7,064.11</td></tr></table></td><td>n6055</td><td>$250,000</td><td>$27,133</td></tr>
<tr><td colspan="5">Total New Network Upgrades</td><td>$54,600</td></tr>
</table>

Contribution to Previously Identified System Reinforcements

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

<table>
<tr><th>Violation #</th><th>Overloaded Facility</th><th>Upgrade Description</th><th>Network Upgrade Number</th><th>Upgrade Cost</th><th>AC1-161 Allocation</th></tr>
<tr><td># 3, 15</td><td>8LDYSMTH-8POSSUM 500 kV line</td><td><u>Ladysmith-Possum Point 500kV</u>
Replace wave trap at both Ladysmith and Possum Point Substations for the Ladysmith – Possum Pt 500kV line #552. Estimated to take 14-16 months to engineer and construct. Ratings after the upgrade: 2598/2598/3637

<table><tr><th>Queue</th><th>Impact (MW)</th><th>Cost</th></tr><tr><td>AC1-107</td><td>301.14</td><td>$341,900.06</td></tr><tr><td>AC1-158</td><td>74.26</td><td>$84,312.40</td></tr><tr><td>AC1-161</td><td>27.77</td><td>$31,529.16</td></tr><tr><td>AC1-164</td><td>37.22</td><td>$42,258.38</td></tr></table></td><td>n6063</td><td>$500,000</td><td>$31,530</td></tr>
</table>

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AC1-161 Allocation
# 5	6SKIFF CREEK-6KINGS M 230 kV line	**Skiffes Creek-Kings Mill-Waller-Penniman 230kV** Rebuild 6.1 miles of Waller-Skiffes Creek 230 kV Line (#2154) between Waller and Kings Mill to current standards with a minimum summer emergency rating of 1047 MVA utilizing single circuit steel structures. Remove this 6.1 mile section of Line #58 between Waller and Kings Mill. Rebuild the 1.6 miles of Line #2154 and #19 between Kings Mill and Skiffes Creek to current standards with a minimum summer emergency rating of 1047 MVA at 230 kV for Line #2154 and 261 MVA at 115 kV for Line #19, utilizing double circuit steel structures. The baseline project has a projected in-service date of 12/30/2024.	b3057	$10,000,000	$0
# 6	6PENNIMAN-6WALR209 230 kV line				
# 7	6KINGS M-6PENNIMAN 230 kV line				

<table>
<tr><th>Violation #</th><th>Overloaded Facility</th><th>Upgrade Description</th><th>Network Upgrade Number</th><th>Upgrade Cost</th><th>AC1-161 Allocation</th></tr>
<tr><td># 8 , 9</td><td>8CHANCE-8BRISTER 500 kV line</td><td><u>Chance-Brister 500kV</u>
Replace a wave trap on the Bristers – Chancellor 500kV line which is part of the baseline Network Upgrade b3019 to rebuild a 22 mile segment of the Bristers - Chancellor 500kV line #552.
Ratings after the upgrade: 2914/2914/3351
Time: 12-16 months

Queue Project AC1-161 presently does not receive cost allocation for the Network Upgrade.

Although Queue Project AC1-161 may not have cost responsibility for this upgrade, Queue Project AC1-161 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AC1-161 comes into service prior to completion of the upgrade, an interim study will be required.</td><td>n6217 / b3019</td><td>$300,000</td><td>$0</td></tr>
<tr><td># 10-14</td><td>8ELMONT-8LDYSMTH 500 kV line</td><td><u>Elmont-LadySmith 500kV</u>
Replacing wave trap will increase the line’s rating up to 2913 MVA (normal), 2913 MVA (emergency), and 3351 MVA (load dump).

<table><tr><th>Queue</th><th>Impact (MW)</th><th>Cost</th></tr><tr><td>AC1-086</td><td>32.32</td><td>$28,667.73</td></tr><tr><td>AC1-107</td><td>627.76</td><td>$556,821.00</td></tr><tr><td>AC1-161</td><td>53.83</td><td>$47,747.03</td></tr><tr><td>AC1-164</td><td>75.27</td><td>$66,764.24</td></tr></table></td><td>n5483</td><td>$700,000</td><td>$47,747</td></tr>
<tr><td colspan="5">Total Previously Identified Network Upgrades</td><td>$79,277</td></tr>
</table>

Potential Congestion due to Local Energy Deliverability

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

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

	Contingency		Affected		Bus			Power	Loading %		Rating		MW
#	Type	Name	Area	Facility Description	From	To	Circuit	Flow	Initial	Final	Type	MVA	Contribution
16	N-1	LN 557	DVP - DVP	6SKIFF CREEK-6KINGS M 230 kV line	314209	314386	1	AC	110.97	114.85	ER	442	20.19
17	N-1	LN 557	DVP - DVP	6PENNIMAN-6WALR209 230 kV line	314296	314415	1	AC	99.1	102.99	ER	442	20.19
18	N-1	LN 557	DVP - DVP	6KINGS M-6PENNIMAN 230 kV line	314386	314296	1	AC	102.92	106.8	ER	442	20.19
19	N-1	LN 557	DVP - DVP	8CARSON-8MDLTHAN 500 kV line	314902	314914	1	AC	107.04	110.22	ER	2442	75.03
20	N-1	LN 576	DVP - DVP	8CHCKAHM-8ELMONT 500 kV line	314903	314908	1	AC	112.38	115.83	ER	2442	85.35
21	N-1	LN 594	DVP - DVP	8CHANCE-8BRISTER 500 kV line	314905	314900	1	AC	116.94	118.55	ER	2442	45.5
22	N-1	LN 576	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	139.84	142.52	ER	2442	76.81
23	Non	Non	DVP - DVP	8ELMONT-8LDYSMTH 500 kV line	314908	314911	1	AC	100.21	101.93	NR	2442	49.93

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution
24	N-1	LN 573	DVP - DVP	8LDYSMTH-8CHANCE 500 kV line	314911	314905	1	AC	104.57	106.03	ER	2738	46.2
25	N-1	LN 594	DVP - DVP	8LDYSMTH-8POSSUM 500 kV line	314911	314922	1	AC	108.8	110.2	ER	2442	39.63
26	N-1	LN 574	DVP - DVP	8MDLTHAN-8NO ANNA 500 kV line	314914	314918	1	AC	104.42	107.25	ER	2442	68.7
27	N-1	LN 539	DVP - DVP	8MORRSVL-8LOUDOUN 500 kV line	314916	314913	1	AC	99.71	100.62	ER	2738	29.11
28	N-1	LN 552	DVP - DVP	8SPOTSYL-8MORRSVL 500 kV line	314934	314916	1	AC	98.87	100.4	ER	3219	49.69

Light Load Analysis in 2020

Not required

ITO Analysis

ITO assessed the impact of the proposed Queue Project #AC1-161 interconnection of 240 MW of energy (Capacity 168.2 MW) for compliance with reliability criteria on ITO's Transmission System. The system was assessed using the summer 2020 RTEP case provided to ITO by PJM. When performing a generation analysis, ITO's main analysis will be load flow study results under single contingency and multiple facility contingency (both normal and stressed system conditions). ITO Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. A full listing of ITO's Planning Criteria and interconnection requirements can be found in the ITO's Facility Connection Requirements which are publicly available at: http://www.dom.com.

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

reliability deficiencies. For ITO Planning Criteria the re-dispatch of generating units for these contingency conditions is allowed as long as the projected loading does not exceed 100% of a facility Load Dump Rating.

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

Category B Analysis (Single Contingency):

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

Category C Analysis: (Multiple Facility Contingency)

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

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

Table A: Import Study Results

Import Study Results			
Area	Summer 2020	Summer 2020 with AC1-161	Limiting Element
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

Table B: Export Study Results

Export Study Results			
Area	Summer 2020	Summer 2020 with AC1-161	Limiting Element
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

ITO's Planning Criteria indicates a need to have approximately 2000 MW of import and export capability. The results of these import and export studies indicate that the proposed AC1-161 (Transfer) will not impact ITO's import or export capability

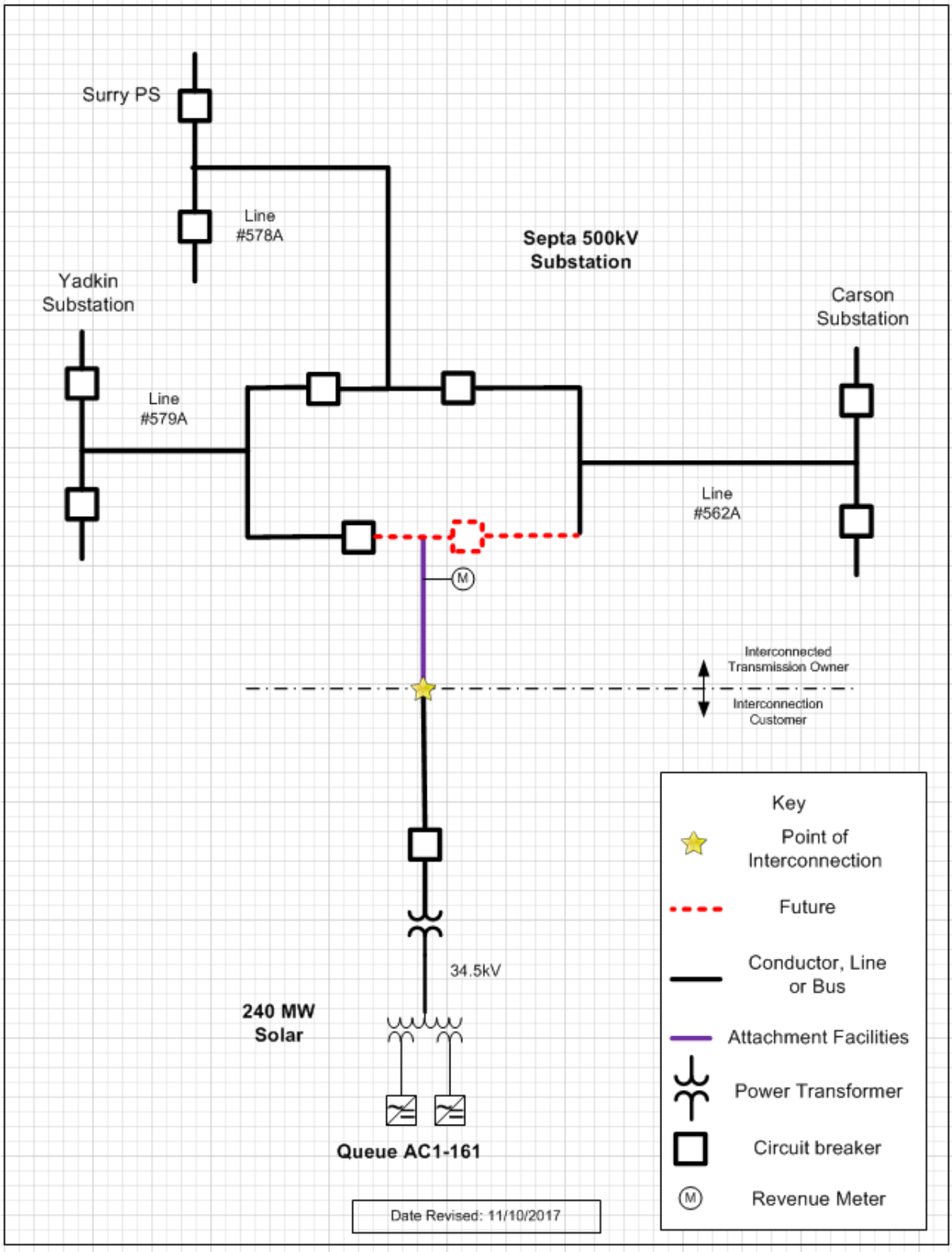
Affected System Analysis & Mitigation

Duke Energy:

None

Attachment 1.

System Configuration



Appendices

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

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

Appendix 1

(DVP - DVP) The 8CHCKAHM-8ELMONT 500 kV line (from bus 314903 to bus 314908 ckt 1) loads from 95.52% to 97.94% (AC power flow) of its emergency rating (2442 MVA) for the single line contingency outage of 'LN 576'. This project contributes approximately 59.82 MW to the thermal violation.

CONTINGENCY 'LN 576'
 OPEN BRANCH FROM BUS 314322 TO BUS 314914 CKT 1 /* 6MDLTHAN 230.00 - 8MDLTHAN 500.00
 OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00
 END

Bus Number	*Bus Name*	*Full Contribution*
315099	*1CHESPKB*	*2.2*
315108	*1ELIZAR1*	*6.46*
315109	*1ELIZAR2*	*6.35*
315110	*1ELIZAR3*	*6.54*
315233	*1SURRY 2*	*58.85*
315091	*1YORKTN2*	*55.82*
315092	*1YORKTN3*	*47.96*
314421	*6WINCHST*	*0.27*
315074	*CIR_AB2-152*	*12.6*
916191	*Z1-068 C*	*0.09*
921162	*AA1-063AC*	*11.34*
921752	*AA2-053 C*	*11.82*
921762	*AA2-057 C*	*9.27*
921982	*AA2-088 C*	*8.67*
922442	*AA2-165 C*	*1.26*
922512	*AA2-174 C*	*0.54*
922532	*AA2-178 C*	*15.74*
922682	*AB1-027 C*	*2.42*

922922	*AB1-081 C OP*	*11.29*
923262	*AB1-132 C OP*	*19.*
923572	*AB1-173 C OP*	*2.96*
923582	*AB1-173AC OP*	*2.96*
923801	*AB2-015 C OP*	*15.64*
923831	*AB2-022 C*	*4.11*
923841	*AB2-024 C*	*4.1*
923851	*AB2-025 C*	*3.24*
923911	*AB2-031 C OP*	*2.94*
923991	*AB2-040 C OP*	*9.66*
924021	*AB2-043 C OP*	*3.28*
924151	*AB2-059 C*	*13.3*
924161	*AB2-060 C*	*9.39*
924241	*AB2-068 OP*	*619.11*
924321	*AB2-079 C OP*	*6.25*
924491	*AB2-098 C*	*0.78*
924501	*AB2-099 C*	*0.85*
924511	*AB2-100 C*	*15.34*
924811	*AB2-134 C OP*	*19.08*
925051	*AB2-160 C OP*	*6.37*
925061	*AB2-161 C OP*	*5.24*
925171	*AB2-174 C O1*	*9.22*
925281	*AB2-186 C*	*1.02*
925331	*AB2-190 C*	*30.32*
926261	*AC1-027 C*	*3.68*
926331	*AC1-034 C*	*8.62*

926531	*AC1-054 C OP*	*8.51*
926591	*AC1-060*	*0.1*
926601	*AC1-061*	*0.04*
926621	*AC1-063*	*0.62*
926641	*AC1-065 C*	*5.37*
926851	*AC1-086 C*	*27.98*
926981	*AC1-099 C*	*11.11*
927041	*AC1-105 C OP*	*5.85*
927061	*AC1-107 OP*	*934.51*
927181	*AC1-112 C*	*1.89*
927561	*AC1-147 C*	*4.14*
927711	*AC1-161 C OP*	*59.82*
927741	*AC1-164 C OP*	*68.05*
927991	*AC1-189 C*	*11.76*
928191	*AC1-208 C O1*	*11.97*
928271	*AC1-216 C OP*	*14.56*

Appendix 3

(DVP - DVP) The 8MDLTHAN-8NO ANNA 500 kV line (from bus 314914 to bus 314918 ckt 1) loads from 95.3% to 97.83% (AC power flow) of its load dump rating (3144 MVA) for the line fault with failed breaker contingency outage of '557T574'. This project contributes approximately 77.47 MW to the thermal violation.

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

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

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

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

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

925171	*AB2-174 C O1*	*11.22*
925172	*AB2-174 E O1*	*10.15*
925281	*AB2-186 C*	*1.03*
925282	*AB2-186 E*	*0.44*
925331	*AB2-190 C*	*31.67*
925332	*AB2-190 E*	*13.57*
926261	*AC1-027 C*	*3.51*
926262	*AC1-027 E*	*2.*
926331	*AC1-034 C*	*10.35*
926332	*AC1-034 E*	*7.81*
926351	*AC1-036 C*	*1.31*
926352	*AC1-036 E*	*2.13*
926531	*AC1-054 C OP*	*10.79*
926532	*AC1-054 E OP*	*4.97*
926591	*AC1-060*	*0.1*
926601	*AC1-061*	*0.05*
926611	*AC1-062*	*0.42*
926621	*AC1-063*	*0.52*
926641	*AC1-065 C*	*4.5*
926642	*AC1-065 E*	*7.34*
926851	*AC1-086 C*	*33.04*
926852	*AC1-086 E*	*15.04*
926981	*AC1-099 C*	*12.91*
926982	*AC1-099 E*	*7.66*
927041	*AC1-105 C OP*	*7.88*
927042	*AC1-105 E OP*	*3.92*

927061	*AC1-107 OP*	*505.6*
927181	*AC1-112 C*	*2.37*
927182	*AC1-112 E*	*1.33*
927561	*AC1-147 C*	*3.94*
927562	*AC1-147 E*	*2.32*
927711	*AC1-161 C OP*	*54.3*
927712	*AC1-161 E OP*	*23.18*
927741	*AC1-164 C OP*	*53.5*
927742	*AC1-164 E OP*	*24.04*
927991	*AC1-189 C*	*13.47*
927992	*AC1-189 E*	*6.71*
928191	*AC1-208 C O1*	*14.11*
928192	*AC1-208 E O1*	*6.27*
928271	*AC1-216 C OP*	*15.39*
928272	*AC1-216 E OP*	*12.11*
928321	*AC1-221 C*	*3.13*
928322	*AC1-221 E*	*3.13*
928331	*AC1-222 C*	*5.04*
928332	*AC1-222 E*	*4.8*

Appendix 4

(DVP - DVP) The 6SKIFF CREEK-6KINGS M 230 kV line (from bus 314209 to bus 314386 ckt 1) loads from 115.27% to 118.42% (AC power flow) of its emergency rating (442 MVA) for the single line contingency outage of 'LN 557'. This project contributes approximately 14.15 MW to the thermal violation.

CONTINGENCY 'LN 557'
OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM 230.00 - 8CHCKAHM 500.00
OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM 500.00 - 8ELMONT 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315099	*1CHESPKB*	*0.5*
315108	*1ELIZAR1*	*1.46*
315109	*1ELIZAR2*	*1.44*
315110	*1ELIZAR3*	*1.48*
315233	*1SURRY 2*	*15.09*
315091	*1YORKTN2*	*24.01*
315092	*1YORKTN3*	*20.73*
314421	*6WINCHST*	*0.11*
916191	*Z1-068 C*	*0.02*
922532	*AA2-178 C*	*3.32*
923801	*AB2-015 C OP*	*3.42*
923831	*AB2-022 C*	*0.92*
924241	*AB2-068 OP*	*103.8*
925281	*AB2-186 C*	*0.22*
926261	*AC1-027 C*	*0.83*
927061	*AC1-107 OP*	*156.67*
927561	*AC1-147 C*	*0.94*

927711	*AC1-161 C OP*	*14.15*

Appendix 5

(DVP - DVP) The 6PENNIMAN-6WALR209 230 kV line (from bus 314296 to bus 314415 ckt 1) loads from 103.23% to 106.37% (AC power flow) of its emergency rating (442 MVA) for the single line contingency outage of 'LN 557'. This project contributes approximately 14.15 MW to the thermal violation.

CONTINGENCY 'LN 557'
OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM 230.00 - 8CHCKAHM 500.00
OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM 500.00 - 8ELMONT 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315099	*1CHESPKB*	*0.5*
315108	*1ELIZAR1*	*1.46*
315109	*1ELIZAR2*	*1.44*
315110	*1ELIZAR3*	*1.48*
315233	*1SURRY 2*	*15.09*
315091	*1YORKTN2*	*24.01*
315092	*1YORKTN3*	*20.73*
314421	*6WINCHST*	*0.11*
916191	*Z1-068 C*	*0.02*
922532	*AA2-178 C*	*3.32*
923801	*AB2-015 C OP*	*3.42*
923831	*AB2-022 C*	*0.92*
924241	*AB2-068 OP*	*103.8*
925281	*AB2-186 C*	*0.22*
926261	*AC1-027 C*	*0.83*
927061	*AC1-107 OP*	*156.67*
927561	*AC1-147 C*	*0.94*

927711	*AC1-161 C OP*	*14.15*

Appendix 6

(DVP - DVP) The 6KINGS M-6PENNIMAN 230 kV line (from bus 314386 to bus 314296 ckt 1) loads from 107.06% to 110.21% (AC power flow) of its emergency rating (442 MVA) for the single line contingency outage of 'LN 557'. This project contributes approximately 14.15 MW to the thermal violation.

CONTINGENCY 'LN 557'
OPEN BRANCH FROM BUS 314214 TO BUS 314903 CKT 1 /* 6CHCKAHM 230.00 - 8CHCKAHM 500.00
OPEN BRANCH FROM BUS 314903 TO BUS 314908 CKT 1 /* 8CHCKAHM 500.00 - 8ELMONT 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315099	*1CHESPKB*	*0.5*
315108	*1ELIZAR1*	*1.46*
315109	*1ELIZAR2*	*1.44*
315110	*1ELIZAR3*	*1.48*
315233	*1SURRY 2*	*15.09*
315091	*1YORKTN2*	*24.01*
315092	*1YORKTN3*	*20.73*
314421	*6WINCHST*	*0.11*
916191	*Z1-068 C*	*0.02*
922532	*AA2-178 C*	*3.32*
923801	*AB2-015 C OP*	*3.42*
923831	*AB2-022 C*	*0.92*
924241	*AB2-068 OP*	*103.8*
925281	*AB2-186 C*	*0.22*
926261	*AC1-027 C*	*0.83*
927061	*AC1-107 OP*	*156.67*
927561	*AC1-147 C*	*0.94*

927711	*AC1-161 C OP*	*14.15*

Appendix 7

(DVP - DVP) The 8CHANCE-8BRISTER 500 kV line (from bus 314905 to bus 314900 ckt 1) loads from 105.03% to 106.14% (AC power flow) of its emergency rating (2442 MVA) for the single line contingency outage of 'LN 594'. This project contributes approximately 31.89 MW to the thermal violation.

CONTINGENCY 'LN 594'
OPEN BRANCH FROM BUS 314916 TO BUS 314934 CKT 1 /* 8MORRSVL 500.00 - 8SPOTSYL 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315053	*1BELMED1*	*3.32*
315054	*1BELMED2*	*3.32*
315055	*1BELMED3*	*2.75*
315067	*1DARBY 1*	*3.02*
315068	*1DARBY 2*	*3.03*
315069	*1DARBY 3*	*3.07*
315070	*1DARBY 4*	*3.07*
315043	*1FRIVERA*	*4.07*
315044	*1FRIVERB*	*3.15*
315045	*1FRIVERC*	*4.07*
315046	*1FRIVERD*	*3.15*
315047	*1FRIVERE*	*3.15*
315048	*1FRIVERF*	*4.07*
315225	*1N ANNA1*	*45.91*
315226	*1N ANNA2*	*45.2*
315083	*1SPRUNCA*	*2.03*
315084	*1SPRUNCB*	*2.03*
315085	*1SPRUNCC*	*1.51*

315086	*1SPRUNCD*	*1.51*
315091	*1YORKTN2*	*31.45*
314309	*6IRON208*	*0.46*
314236	*6NRTHEST*	*0.22*
314251	*6S PUMP*	*1.05*
315074	*CIR_AB2-152*	*10.39*
297087	*V2-040*	*0.14*
921162	*AA1-063AC*	*7.91*
921292	*AA1-083*	*0.71*
921622	*AA1-145*	*12.14*
921752	*AA2-053 C*	*8.17*
921762	*AA2-057 C*	*6.43*
921982	*AA2-088 C*	*5.95*
922442	*AA2-165 C*	*0.88*
922512	*AA2-174 C*	*0.37*
922532	*AA2-178 C*	*9.58*
922682	*AB1-027 C*	*2.78*
922922	*AB1-081 C OP*	*7.88*
923262	*AB1-132 C OP*	*13.31*
923572	*AB1-173 C OP*	*2.14*
923582	*AB1-173AC OP*	*2.14*
923801	*AB2-015 C OP*	*9.27*
923831	*AB2-022 C*	*2.38*
923841	*AB2-024 C*	*2.63*
923851	*AB2-025 C*	*2.46*
923861	*AB2-026 C*	*2.32*

923911	*AB2-031 C OP*	*2.12*
923991	*AB2-040 C OP*	*6.97*
924021	*AB2-043 C OP*	*2.64*
924061	*AB2-050*	*3.99*
924151	*AB2-059 C*	*9.29*
924161	*AB2-060 C*	*7.59*
924241	*AB2-068 OP*	*215.35*
924321	*AB2-079 C OP*	*5.02*
924491	*AB2-098 C*	*0.52*
924501	*AB2-099 C*	*0.56*
924511	*AB2-100 C*	*11.22*
924811	*AB2-134 C OP*	*13.71*
925021	*AB2-158 C*	*8.79*
925051	*AB2-160 C OP*	*5.79*
925061	*AB2-161 C OP*	*3.55*
925171	*AB2-174 C O1*	*6.69*
925281	*AB2-186 C*	*0.61*
925331	*AB2-190 C*	*21.36*
926261	*AC1-027 C*	*2.09*
926331	*AC1-034 C*	*6.02*
926351	*AC1-036 C*	*0.79*
926531	*AC1-054 C OP*	*6.36*
926591	*AC1-060*	*0.08*
926601	*AC1-061*	*0.04*
926621	*AC1-063*	*0.41*
926641	*AC1-065 C*	*3.56*

926751	*AC1-076 C*	*4.72*
926851	*AC1-086 C*	*19.6*
926981	*AC1-099 C*	*7.59*
927061	*AC1-107 OP*	*325.06*
927181	*AC1-112 C*	*2.17*
927251	*AC1-118 C*	*1.98*
927411	*AC1-134*	*9.98*
927561	*AC1-147 C*	*2.36*
927681	*AC1-158 C*	*88.25*
927711	*AC1-161 C OP*	*31.89*
927741	*AC1-164 C OP*	*43.26*
927991	*AC1-189 C*	*7.87*
928011	*AC1-191 C OP*	*10.2*
928191	*AC1-208 C O1*	*8.29*
928271	*AC1-216 C OP*	*10.46*

Appendix 8

(DVP - DVP) The 8ELMONT-8LDYSMTH 500 kV line (from bus 314908 to bus 314911 ckt 1) loads from 124.95% to 126.84% (AC power flow) of its emergency rating (2442 MVA) for the single line contingency outage of 'LN 576'. This project contributes approximately 53.83 MW to the thermal violation.

CONTINGENCY 'LN 576'
OPEN BRANCH FROM BUS 314322 TO BUS 314914 CKT 1 /* 6MDLTHAN 230.00 - 8MDLTHAN 500.00
OPEN BRANCH FROM BUS 314914 TO BUS 314918 CKT 1 /* 8MDLTHAN 500.00 - 8NO ANNA 500.00
END

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

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

924511	*AB2-100 C*	*18.36*
924811	*AB2-134 C OP*	*23.03*
925051	*AB2-160 C OP*	*9.56*
925061	*AB2-161 C OP*	*5.91*
925171	*AB2-174 C O1*	*10.96*
925281	*AB2-186 C*	*1.02*
925331	*AB2-190 C*	*35.9*
926261	*AC1-027 C*	*3.51*
926331	*AC1-034 C*	*10.*
926531	*AC1-054 C OP*	*10.42*
926591	*AC1-060*	*0.13*
926601	*AC1-061*	*0.06*
926621	*AC1-063*	*0.67*
926641	*AC1-065 C*	*5.81*
926851	*AC1-086 C*	*32.32*
926981	*AC1-099 C*	*12.58*
927061	*AC1-107 OP*	*627.22*
927181	*AC1-112 C*	*3.72*
927411	*AC1-134*	*12.03*
927561	*AC1-147 C*	*3.96*
927711	*AC1-161 C OP*	*53.83*
927741	*AC1-164 C OP*	*75.28*
927991	*AC1-189 C*	*13.11*
928011	*AC1-191 C OP*	*16.39*
928191	*AC1-208 C O1*	*13.73*
928271	*AC1-216 C OP*	*17.58*

Appendix 9

(DVP - DVP) The 8LDYSMTH-8POSSUM 500 kV line (from bus 314911 to bus 314922 ckt 1) loads from 100.27% to 101.25% (AC power flow) of its emergency rating (2442 MVA) for the single line contingency outage of 'LN 594'. This project contributes approximately 27.77 MW to the thermal violation.

CONTINGENCY 'LN 594'
OPEN BRANCH FROM BUS 314916 TO BUS 314934 CKT 1 /* 8MORRSVL 500.00 - 8SPOTSYL 500.00
END

Bus Number	*Bus Name*	*Full Contribution*
315053	*1BELMED1*	*2.87*
315054	*1BELMED2*	*2.87*
315055	*1BELMED3*	*2.38*
315060	*1CHESTF5*	*10.15*
315061	*1CHESTG7*	*3.98*
315063	*1CHESTG8*	*3.95*
315062	*1CHESTS7*	*1.81*
315064	*1CHESTS8*	*2.02*
315067	*1DARBY 1*	*2.6*
315068	*1DARBY 2*	*2.61*
315069	*1DARBY 3*	*2.64*
315070	*1DARBY 4*	*2.64*
315225	*1N ANNA1*	*39.21*
315226	*1N ANNA2*	*38.6*
315083	*1SPRUNCA*	*1.76*
315084	*1SPRUNCB*	*1.76*
315085	*1SPRUNCC*	*1.3*
315086	*1SPRUNCD*	*1.3*

315091	*1YORKTN2*	*27.23*
314309	*6IRON208*	*0.39*
314236	*6NRTHEST*	*0.19*
314251	*6S PUMP*	*0.9*
315074	*CIR_AB2-152*	*8.99*
297087	*V2-040*	*0.12*
921162	*AA1-063AC*	*7.07*
921622	*AA1-145*	*10.22*
921752	*AA2-053 C*	*7.3*
921982	*AA2-088 C*	*5.31*
922512	*AA2-174 C*	*0.33*
922532	*AA2-178 C*	*8.44*
922682	*AB1-027 C*	*2.39*
923262	*AB1-132 C OP*	*11.86*
923572	*AB1-173 C OP*	*1.91*
923582	*AB1-173AC OP*	*1.91*
923801	*AB2-015 C OP*	*8.09*
923831	*AB2-022 C*	*2.08*
923841	*AB2-024 C*	*2.25*
923851	*AB2-025 C*	*2.16*
923861	*AB2-026 C*	*2.09*
923911	*AB2-031 C OP*	*1.89*
923991	*AB2-040 C OP*	*6.22*
924061	*AB2-050*	*3.36*
924241	*AB2-068 OP*	*186.57*
924501	*AB2-099 C*	*0.5*

924511	*AB2-100 C*	*9.92*
924811	*AB2-134 C OP*	*11.88*
925021	*AB2-158 C*	*8.99*
925051	*AB2-160 C OP*	*5.02*
925061	*AB2-161 C OP*	*3.09*
925171	*AB2-174 C O1*	*5.96*
925281	*AB2-186 C*	*0.54*
925331	*AB2-190 C*	*18.52*
926261	*AC1-027 C*	*1.83*
926591	*AC1-060*	*0.07*
926601	*AC1-061*	*0.03*
926621	*AC1-063*	*0.35*
926641	*AC1-065 C*	*3.03*
926751	*AC1-076 C*	*3.24*
926851	*AC1-086 C*	*17.46*
926981	*AC1-099 C*	*6.81*
927061	*AC1-107 OP*	*281.62*
927181	*AC1-112 C*	*1.86*
927411	*AC1-134*	*8.39*
927561	*AC1-147 C*	*2.06*
927681	*AC1-158 C*	*74.26*
927711	*AC1-161 C OP*	*27.77*
927741	*AC1-164 C OP*	*37.23*
928011	*AC1-191 C OP*	*8.61*
928271	*AC1-216 C OP*	*9.07*