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August 15, 2023

A. Shonta Dunston, Chief Clerk
North Carolina Utilities Commission
4325 Mail Service Center
Raleigh, NC 27699-4300

**Re: Application for Certificate of Public Convenience and Necessity for a 94MW Merchant Plant Located at Justice Branch Road, between Delmar Road and Beaverdam Road, North of Enfield, North Carolina in Halifax County, North Carolina
EMP-111, Sub 0
Interconnection Study Update and Response to Order Requesting Additional Information (Public)**

Dear Ms. Dunston:

On behalf of Applicant Sweetleaf Solar LLC ("Sweetleaf"), I write to provide information required by the Commission in the *Order Requesting Additional Information* issued on August 2, 2023; and to provide additional updated information relating to the proposed Sweetleaf solar facility ("the Facility"). This information relates to: (1) a minor reduction in the planned AC capacity of the Facility; (2) updated interconnection studies received for the proposed Facility, which reflect a significant reduction in the cost of Network Upgrades assigned to Sweetleaf; and (3) updated confidential LCOT calculations for the Facility, as called for in the *Order Requesting Additional Information*.

1. Change in Facility Capacity

The planned capacity of the Facility has been reduced from 94 MWac to 93 MWac. As described in testimony previously provided by Donna Robichaud on behalf of the Applicant, there are two PJM interconnection queue positions for Sweetleaf Solar: (1) AD1-056, with a capacity of 60 MWac; and (2) AD1-057, with a capacity of 34 MWac, for a total of 94 MWac. In November 2022, Applicant requested that PJM reduce the AD1-

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Ms. A. Shonta Dunston
Page Two
August 15, 2023

057 queue position by 1 MWac to 33 MWac, for a total of 93 MWac. This reduction eliminated one of the Network Upgrades allocated to Sweetleaf Solar.

2. Updated Interconnection Studies and Network Upgrade Costs

The Applicant has executed an Interconnection Service Agreement and an Interconnection Construction Service Agreement with PJM. These Agreements were filed with the Commission in this docket on May 24, 2023.

The scope and cost of work memorialized in those Agreements was determined in part by the following updated interconnection studies: (1) Generation Interconnection System Impact Study ("SIS") Report for PJM Generation Interconnection Request Queue Position AD1-056/057 (Revision 6) ("February 2023 SIS Report") (Attachment A);¹ and (2) Generation Interconnection Facility Study Report for PJM Generation Interconnection Request Queue Position AD1-056/AD1-057 ("February 2023 FS Report") (Attachment B).

PJM retooled the System Impact Study for Sweetleaf because of the downsizing of a previously queued project. As a result of that change, Sweetleaf was able to avoid triggering a significant Network Upgrade by reducing its own AC capacity by 1 MW. These changes significantly reduced the Network Upgrade costs allocated to Sweetleaf Solar.

The February 2023 SIS Report reflects this size reduction and identifies one Network Upgrade (n6618.1) for which Sweetleaf is allocated a portion of the cost. The total cost of this Network Upgrade is \$20,749. Sweetleaf Solar's allocation for this Network Upgrade is \$16,109. Compared to the Network Upgrade costs described in Ms. Robichaud's June 2022 Second Supplemental Testimony, the allocated Network Upgrade costs for Sweetleaf Solar decreased from \$82,962,766 to \$16,109. This is a result of two Network Upgrades (n6618 & n6223) being approved as reliability projects and a third Network Upgrade (n6144) being eliminated for Sweetleaf.

There are no new Affected System Studies for PJM Cluster AD1.

¹ Sweetleaf has also received a retooled SIS Report in November 2022, but this report was superseded by the February 2023 SIS Report.



Ms. A. Shonta Dunston
Page Three
August 15, 2023

3. Updated LCOT Calculations

Revised LCOT calculations based on the allocated cost of Network Upgrades provided in the February 2023 SIS Report are detailed in Confidential Attachment C filed under separate cover. The LCOT for allocated Network Upgrades is \$0.004/MWh.

The Applicant has also prepared LCOT calculations for Affected System Upgrades on DEP's system that may be triggered by Sweetleaf Solar, *i.e.*, the Everetts-Greenville Affected System Upgrade.

As detailed in testimony previously provided to the Commission, Sumac Solar LLC and Duke Energy Progress executed an Affected System Operating Agreement ("ASOA") on September 30, 2022. The ASOA was filed with the Commission in Docket No. EMP-110, Sub 0 on October 19, 2022. According to the ASOA, the estimated incremental cost of the Everetts-Greenville 115 kV Upgrade is \$150,000. The total capacity of the three projects in the AD1 cluster that contribute to the need for the upgrade (Sumac, Macadamia, and Sweetleaf Solar) is 657 MW. Based on this capacity and the estimated cost of the upgrade, the Applicant has calculated an LCOT of \$.01/MWh. If only the capacity of Sweetleaf Solar and Sumac Solar were considered, the LCOT would be \$0.02/MWh. These calculations are also detailed in Confidential Attachment C filed under separate cover.

Please contact me if you require further information.

Sincerely,

/s/ Benjamin L. Snowden

Benjamin L. Snowden
Counsel for Sweetleaf Solar, LLC

BLS:pbb

Attachments



Fox Rothschild LLP
ATTORNEYS AT LAW

Ms. A. Shonta Dunston
Page Four
August 15, 2023

Copy to: Parties and Counsel of Record (Except for Confidential Attachment C)
Erin Duffy, Commission Staff
Heather Fennell, Commission Staff
Jessica Heironimus, NC Public Staff
Robert Josey, NC Public Staff
Anne Keyworth, NC Public Staff

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

For

***PJM Generation Interconnection Request
Queue Position AD1-056/AD1-057***

***Hornertown - Hathaway 230kV
60.6 MW Capacity / 93 MW Energy***

Revision 6 / February 2023

Revision 5 / November 2022

Revision 4 / June 2022

Revision 3 / March 2022

Revision 2 / March 2022

Revision 1 / December 2021

December / 2019

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

Preface

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

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

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

Summary Revision 1 - December 2021

This revision is being issued due to a re-tool performed.

Summary Revision 2 - March 2022

This revision is being issued to account for incorrect line ratings for the 3CHESTNUT-3WITAKRS 115 kV line and 3WITAKRS-3BTLEBRO 115 kV line flowgates. Therefore, AD1-056/57 will no longer require the upgrades previously identified for those flowgates. This report also corrects for n6220/n6223. n6220 does not solve all identified overloaded flowgates in previous reports. n6223 is needed to resolve flowgates and is first to cause by this project.

Summary Revision 3 – March 2022

Adding previously missing Appendix 3. Also replaced n6052 with b3691. N6052 was a previous upgrade to re-build Lakeview-Carolina 230kV Line #2141. The PJM board approved b3691 in February 2022 which will instead drive rebuild of the Lakeview-Carolina 230kV Line #2141. Report updated to remove n6052 and replace it with b3691.

Summary Revision 4 – June 2022

The revision is being issued due to a re-tool necessitated by the withdrawal of AD1-023.

Summary Revision 5 – November 2022

The revision is being issued due to a re-tool necessitated by the reduction of Z1-039.

Summary Revision 6 – February 2023

The revision is being issued due a retool due to a 1 MW reduction and due to n6618 (Rebuild Line #55 Tarboro – Anaconda 115 kV and associated 230 kV work on towers shared with 230 kV line 229) and n6223 (Rebuild 12.8 miles of 230 kV Line 2056 from AD1-057 Tap to Hathaway with 2-636 ACSR) becoming supplemental projects s2824, s2825.1, and s2825.2.

General

The IC has proposed a solar generating facility located in Halifax County, North Carolina. The installed AD1-056/AD1-057 facilities will have a total capability of 93 MW with 60.6 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is June 1, 2020. This study does not imply an ITO commitment to this in-service date.

Point of Interconnection

AD1-056/AD1-057 will interconnect with the ITO transmission system via a new three breaker ring bus switching station that connects the Hornertown – Hathaway 230kV line.

Cost Summary

The AD1-056/AD1-057 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$ 1,800,000
Direct Connection Network Upgrades	\$ 6,300,000
Non Direct Connection Network Upgrades	\$ 1,000,000
Total Costs	\$ 9,100,000

In addition, the AD2-056/057 project may be responsible for a contribution to the following costs:

These costs are for PJM network upgrades:

Description	Total Cost
Allocation for New System Upgrades	\$ 0
Contribution for Previously Identified Upgrades	\$ 16,109
Total Costs	\$ 16,109

These costs are for Duke Energy Progress upgrades to be confirmed as part of the affected systems study and constructed via a separate agreement between the customer and Duke:

Description	Total Cost
Allocation for New System Upgrades	\$ 0
Contribution for Previously Identified Upgrades	\$ 0
Total Costs	\$ 0

Please note, although Queue Project AD1-056/AD1-057 may not have cost responsibility for Duke Energy Progress upgrades mentioned in this report, it may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-056/AD1-057 comes into service prior to completion of the upgrade, it will need an interim study. As other projects leave the queue, AD1-056/AD1-057 may receive cost allocation for Duke Energy Progress upgrades mentioned in this report.

Attachment Facilities

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

Transmission: Construct approximately one span of 230kV Attachment line between the generation substation and a new AD1-056/AD1-057 Switching Station. The estimated cost for this work is \$1,200,000.

The estimated total cost of the Attachment Facilities is \$1,800,000. It is estimated to take 18-24 months to complete this work upon execution of an Interconnection Construction Service Agreement (ICSA). 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.

Direct Connection Cost Estimate

Substation: Establish the new 230 kV AD1-056/AD1-057 Switching Substation (interconnection substation). The arrangement in the substation will be as shown in Attachment 1. The estimated cost of this work scope is \$6,300,000. It is estimated to take 24-36 months to complete this work upon execution of an Interconnection Construction Service Agreement.

Non-Direct Network Upgrades:

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 \$1,000,000 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.

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.

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>

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 AD1-056/AD1-057 was evaluated as a 93.0 MW (Capacity 60.6 MW) injection into Hornertown-Hathaway 230kV substation. Project AD1-056/AD1-057 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-056/AD1-057 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
DVP_P1-2: LN 2056-A	CONTINGENCY 'DVP_P1-2: LN 2056-A' OPEN BRANCH FROM BUS 313845 TO BUS 934330 CKT 1 /* 6HATHAWAY 230.00 - AD1-057 TAP 230.00 END
DVP_P1-2: LN 2058	CONTINGENCY 'DVP_P1-2: LN 2058' OPEN BRANCH FROM BUS 304222 TO BUS 313845 CKT 1 /* 6ROCKYMT230T230.00 - 6MORNSTR 230.00 END
DVP_P1-2: LN 2141	CONTINGENCY 'DVP_P1-2: LN 2141' OPEN BRANCH FROM BUS 314561 TO BUS 314583 CKT 1 /* 6CAROLNA 230.00 - 6LAKEVIEW 230.00 END
DVP_P1-2: LN 2181	CONTINGENCY 'DVP_P1-2: LN 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

	END
DVP_P1-2: LN 246	CONTINGENCY 'DVP_P1-2: LN 246' OPEN BRANCH FROM BUS 314537 TO BUS 314575 CKT 1 /* 6SUFFOLK 230.00 - 6NUCO TP 230.00 OPEN BRANCH FROM BUS 314569 TO BUS 314575 CKT 1 /* 6EARLEYS 230.00 - 6NUCO TP 230.00 OPEN BRANCH FROM BUS 314575 TO BUS 314590 CKT 1 /* 6NUCO TP 230.00 - 6NUCOR 230.00 OPEN BUS 314575 /* ISLAND OPEN BUS 314590 /* ISLAND END
DVP_P1-2: LN 563	CONTINGENCY 'DVP_P1-2: LN 563' OPEN BRANCH FROM BUS 314902 TO BUS 314914 CKT 1 /* 8CARSON 500.00 - 8MDLTHAN 500.00 END
DVP_P4-2: 246T247	CONTINGENCY 'DVP_P4-2: 246T247' /* SUFFOLK 230 KV OPEN BRANCH FROM BUS 314537 TO BUS 314575 CKT 1 /* 6SUFFOLK 230.00 - 6NUCO TP 230.00 OPEN BRANCH FROM BUS 314569 TO BUS 314575 CKT 1 /* 6EARLEYS 230.00 - 6NUCO TP 230.00 OPEN BRANCH FROM BUS 314575 TO BUS 314590 CKT 1 /* 6NUCO TP 230.00 - 6NUCOR 230.00 OPEN BUS 314575 /* ISLAND: 6NUCO TP 230.00 OPEN BUS 314590 /* ISLAND: 6NUCOR 230.00 OPEN BRANCH FROM BUS 314537 TO BUS 314648 CKT 1 /* 6SUFFOLK 230.00 - 6SUNBURY 230.00 OPEN BRANCH FROM BUS 314648 TO BUS 901080 CKT 1 /* 6SUNBURY

	230.00 - W1-029 230.00 OPEN BUS 314648 /* ISLAND: 6SUNBURY 230.00 END
DVP_P4-2: 254T2141	CONTINGENCY 'DVP_P4-2: 254T2141' /* LAKEVIEW OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141 OPEN BRANCH FROM BUS 314583 TO BUS 924510 CKT 1 /* 254 END
DVP_P4-2: 562T563	CONTINGENCY 'DVP_P4-2: 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
DVP_P7-1: LN 2058- 2181	CONTINGENCY 'DVP_P7-1: LN 2058-2181' OPEN BRANCH FROM BUS 304222 TO BUS 313845 CKT 1 /* 6ROCKYMT230T230.00 - 6HATHAWAY 230.00 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 END

DVP_P7-1: LN 81-2056	CONTINGENCY 'DVP_P7-1: LN 81-2056'	
	OPEN BRANCH FROM BUS 314559 TO BUS 314578 CKT 1 115.00 - 3HORNRTN 115.00	/* 3CAROLNA
	OPEN BRANCH FROM BUS 314578 TO BUS 314598 CKT 1 115.00 - 3ROAN DP 115.00	/* 3HORNRTN
	OPEN BRANCH FROM BUS 314598 TO BUS 314628 CKT 1 115.00 - 3DARLINGT DP115.00	/* 3ROAN DP
	OPEN BUS 314578	/* ISLAND: 3HORNRTN 115.00
	OPEN BUS 314598	/* ISLAND: 3ROAN DP 115.00
	OPEN BRANCH FROM BUS 304226 TO BUS 314591 CKT 1 RMOUNT#4230.00 - 6NASH 230.00	/* 6PA-
	OPEN BRANCH FROM BUS 313845 TO BUS 314591 CKT 1 230.00 - 6NASH 230.00	/* 6MORNSTR
	OPEN BRANCH FROM BUS 304226 TO BUS 304222 CKT 1 RMOUNT#4230.00 - 6ROCKYMT230T	/* 6PA-
	OPEN BUS 304226	/* ISLAND
	OPEN BUS 314591	/* ISLAND: 6NASH 230.00
	END	

ATTACHMENT A
EMP-111 SUB 0**Summer Peak Analysis – 2021****Generator Deliverability***(Single or N-1 contingencies for the Capacity portion only of the interconnection)*

#	Type	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Flowgate Appendix
		Name				From	To	Ckt		Initial	Final	Type	MVA		
1	N-1	DVP_P1-2: LN 2141		DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	98.44	101.96	ER	375	21.38	
2	N-1	DVP_P1-2: LN 2141		DVP - DVP	AD1-057 TAP-6MORNSTR 230 kV line	934330	313845	1	AC	91.77	100.27	ER	442	39.1	

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

#	Type	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution	Flowgate Appendix
		Name				From	To	Ckt		Initial	Final	Type	MVA		
3	LFFB	DVP_P4-2: 246T247		DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	96.5	101.76		459	24.37	3
14	DCTL	DVP_P7-1: LN 2058-2181		DVP - CPLE	6EVERETS-6GREENVILE T 230 kV line	314574	304451	1	AC	97.3	99.98	ER	478	13.36	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

ATTACHMENT A
EMP-111 SUB 0**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)

#	Type	Contingency	Affected Area	Facility Description	Bus		Ckt	Power Flow	Loading %		Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
		Name			From	To			Initial	Final				
4	N-1	DVP_P1-2: LN 2056-A	DVP - DVP	3CHESTNUT-3WITAKRS 115 kV line	313719	314623	1	AC	114.48	116.98	ER	134	3.52	4
5	DCTL	DVP_P7-1: LN 81-2056	DVP - CPLE	6MORNSTR-6ROCKYMT230T 230 kV line	313845	304222	1	AC	117.62	125.64	ER	374	30.02	5
6	LFFB	DVP_P4-2: 562T563	DVP - DVP	6CHESTF B-6BASIN 230 kV line	314287	314276	1	AC	103.47	104.47		549	6.46	6
7	DCTL	DVP_P7-1: LN 2058-2181	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	AC	224.02	234.1	ER	164	16.84	7
8	DCTL	DVP_P7-1: LN 81-2056	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	AC	111.68	114.53	ER	164	5.68	
9	N-1	DVP_P1-2: LN 2056-A	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	AC	118.31	127.37	ER	375	34.42	9
10	N-1	DVP_P1-2: LN 2056-A	DVP - DVP	3WITAKRS-3BTLEBRO 115 kV line	314623	314554	1	AC	115.37	117.87	ER	134	3.51	10
11	LFFB	DVP_P4-2: 254T2141	DVP - DVP	AD1-057 TAP-6MORNSTR 230 kV line	934330	313845	1	AC	120.37	137.1		541	92.81	11

Steady-State Voltage Requirements

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

None

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

No mitigations were found to be required.

ATTACHMENT A
EMP-111 SUB 0**New System Reinforcements**

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

Line #	Proposed Upgrade	Upgrade Description	Network Upgrade Number	Estimated Cost	(AD1-056/AD1-057) Allocation
#1, 3	AB2-100 TAP- 6CLUBHSE 230 kV line	Rebuild Clubhouse-Lakeview 230 kV Line #254 with single-circuit wood pole equivalent structures at the current 230 kV standard with a minimum rating of 1047 MVA. Rating: 1047/1047/1204 MVA Schedule: 12/31/2024 in-service date Note: Although Queue Project AD1-056/AD1-057 may not have cost responsibility for this upgrade, it may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-056/AD1-057 comes into service prior to completion of the upgrade, it will need an interim study.	b3121	-	\$0
#2	AD1-057 TAP- 6MORNSTR 230 kV line	Rebuild approximately 28.9 miles of Line #2056 Hornertown to Hathaway with current 230kV standard construction practices. The new conductor will have a minimum normal summer rating of 1573 MVA. Terminal equipment will be upgraded as needed. Rating: 1573/1573/1809 MVA Project In-Service Date: 12/31/2026 Estimate: \$49,100,000 AD1-056/057 is the driver for this upgrade	s2824	\$49,100,000	\$0
14	6EVERETS- 6GREENVILE T 230 kV line	Duke Energy/Progress Portion: Rebuild 1.87 miles of aging double circuit 230kV towers, ISD 6/1/2027 Rating: 1195/1195/1195 MVA Schedule: 30-36 months	dep0003	\$19,000,000	\$0

ATTACHMENT A
EMP-111 SUB 0

		Note: The Duke/Progress Energy portion of this line is studied under Duke's FERC tariff process. Reference the applicable affected system study for the AD1 cluster.			
		Duke Energy/Progress Portion: Reconductor 1.87 miles of one side of double circuit 230kV line plus terminal equipment Rating: 1195/1195/1195 MVA Schedule: 30-36 months Note: The Duke/Progress Energy portion of this line is studied under Duke's FERC tariff process. Reference the applicable affected system study for the AD1 cluster.	dep0003	\$350,000	\$0

ATTACHMENT A
EMP-111 SUB 0**Contribution to Previously Identified System Reinforcements**

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

Violation #	Overloaded Facility	Original Description	Network Upgrade Number	Upgrade Cost	AD1 Portfolio Allocation
#4	3CHESTNUT-3WITAKRS 115 kV line	Incorrect rating. The correct rating of the line is 176/176/202 MVA. This is not overloaded.	-	-	-
#5	6MORNSTR-6ROCKYMT230 T 230 kV line	Description: Rebuild 4.3 miles of Dominion 230 kV Line #2058 Rocky Mt. – Hathaway Rating: 1047/1047/1204 MVA Schedule: 12/31/2024 in-service date Note: Although Queue Project AD1-056/AD1-057 may not have cost responsibility for this upgrade, it may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-056/AD1-057 comes into service prior to completion of the upgrade, it will need an interim study.	b3122	\$13,000,000	\$0
#6	6CHESTF B-6BASIN 230 kV line	Chesterfield to Basin 230 kV line - Replace 0.14 miles of 1109 ACAR with a conductor which will increase the line rating to approximately 706 MVA. Note: Project is in-service as of 4/27/2018	b2990	\$350,000	\$0
#7, 8	3BTLEBRO-3ROCKYMT115 T 115 kV line	Dominion Portion: Replace Battleboro substation terminal equipment. Upgrading the breaker leads at Battleboro will bring the rating to 398 MVA for the DVP terminal. The Duke end of the line is still limiting. New Ratings of the line: 239/239/239 MVA (until Duke terminal is upgraded) Note 1: Although Queue Project AD1-056/AD1-057	n6118	\$100,000	\$0

ATTACHMENT A
EMP-111 SUB 0

		may not have cost responsibility for this upgrade, it may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-056/AD1-057 comes into service prior to completion of the upgrade, it will need an interim study.			
		Dominion Portion: Rebuild entire Line #2167 Edgecombe NUG – Hathaway (approximately 0.73 miles) to current 230kV standards with appropriate structures. The minimum normal summer conductor rating of this line will be 1573 MVA. Rebuild entire Line #229 Edgecombe NUG – Tarboro (approximately 16.9 miles) to current 230kV standards with appropriate structures. The minimum normal summer conductor rating of the line will be 1573 MVA. Rating: 1573/1573/1809 MVA Projected In-Service Date: December 31, 2023 Estimated cost: \$39,500,000	s2825.1	\$39,500,000	\$0
		Dominion Portion: Rebuild approximately 3 miles from Tarboro to Str 55/133 of Line #55 Tarboro – Harts Mill to current 115kV standards with appropriate structures. The minimum normal summer conductor rating of the line will be 393 MVA. Terminal equipment will be upgraded as necessary. Rating: 393/393/450 MVA Projected In-Service Date: December 31, 2023 Estimated cost: \$3,500,000	s2825.2	\$3,500,000	\$0
		Dominion Portion: Split the 115 kV Bus at Hathaway into two separate buses with a 115 kV Line on each bus. Rebuild Line #55 (Tarboro – Anaconda) and close the tie switch between Line 55 & 80. Line #1001 is opened at Battleboro thus making Line #1001 radial from Chestnut Substation.	n6618.1	\$20,749	\$16,109

ATTACHMENT A
EMP-111 SUB 0

		Time Estimate: 20 months <table><tr><th>Queue Project</th><th>MV Impact</th><th>Cost</th></tr><tr><td>AD1-022</td><td>4.85</td><td>\$4,640</td></tr><tr><td>AD1-056/057</td><td>16.84</td><td>\$16,109</td></tr></table>	Queue Project	MV Impact	Cost	AD1-022	4.85	\$4,640	AD1-056/057	16.84	\$16,109			
Queue Project	MV Impact	Cost												
AD1-022	4.85	\$4,640												
AD1-056/057	16.84	\$16,109												
		Duke Energy/Progress Portion: Reconductor 8.5 miles with single 795 ACSS-TW per phase, upgrade disconnect switches and CT ratios. New Ratings: 313/313/313 MVA Note 1: Although Queue Project AD1-056/AD1-057 may not have cost responsibility for this upgrade, it may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-056/AD1-057 comes into service prior to completion of the upgrade, it will need an interim study. Note 2: The Duke/Progress Energy portion of this line is studied under Duke's FERC tariff process. Reference the applicable affected system study for the AD1 cluster.	dep0001	\$31,300,000	\$0									
#9	6LAKEVEW-6CAROLNA 230 kV line	Rebuild 1.37 miles of 230 kV Line 2141 from Lakeview to Carolina with 2-636 ACSR. Rating: 1047/1047/1204 MVA Schedule: 30-36 months Note: Although Queue Project AD1-056/AD1-057 may not have cost responsibility for this upgrade, it may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-056/AD1-057 comes into service prior to completion of the upgrade, it will need an interim study.	b3691	-	\$0									

ATTACHMENT A
EMP-111 SUB 0

#10	3WITAKRS- 3BTLEBRO 115 kV line	Incorrect rating. The correct rating of the line is 176/176/202 MVA. This is not overloaded.	-	-	-
#11	AD1-057 TAP- 6MORNSTR 230 kV line	Install a second, back-to-back breaker between existing line positions #254 and #2141 at the Lakeview substation. Project Type: CON Schedule: 14-24 months Note 1: As changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AD1-056/AD1-057 could become the driver and could be responsible for the upgrade Note 2: Although Queue Project AD1-056/AD1-057 may not have cost responsibility for this upgrade, Queue Project AD1-056/AD1-057 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AD1-056/AD1-057 comes into service prior to completion of the upgrade, Queue Project AD1-056/AD1-057 will need an interim study	n6220	\$1,955,282	\$0

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.

ATTACHMENT A
EMP-111 SUB 0

#	Contingency		Affected Area	Facility Description	Bus			Power Flow	Loading %		Rating		MW Contribution
	Type	Name			From	To	Ckt		Initial	Final	Type	MVA	
12	N-1	DVP_P1-2: LN 2181	DVP - CPLE	6MORNSTR-6ROCKYMT230T 230 kV line	313845	304222	1	AC	117	125.04	ER	374	29.95
13	N-1	DVP_P1-2: LN 2058	DVP - DVP	6MORNSTR-6NASH 230 kV line	313845	314591	1	AC	104.19	110.99	ER	449	30.55
14	N-1	DVP_P1-2: LN 2056-A	DVP - DVP	3SO JUSTICE-3COX DP 115 kV line	313858	314577	1	AC	101.48	104.24	ER	165	5.4
15	N-1	DVP_P1-2: LN 563	DVP - DVP	6CHESTF B-6BASIN 230 kV line	314287	314276	1	AC	117.79	118.97	ER	449	6.2
16	N-1	DVP_P1-2: LN 2181	DVP - CPLE	3BTLEBRO-3ROCKYMT115T 115 kV line	314554	304223	1	AC	101.37	104.11	ER	164	5.44
17	N-1	DVP_P1-2: LN 2056-A	DVP - DVP	3COX DP-3CHESTNUT 115 kV line	314577	313719	1	AC	117.43	120.82	ER	134	5.4
18	N-1	DVP_P1-2: LN 2056-A	DVP - DVP	6LAKEVEW-6CAROLNA 230 kV line	314583	314561	1	AC	135.03	148.94	ER	375	52.82
19	N-1	DVP_P1-2: LN 2058	DVP - CPLE	6NASH-6PA-RMOUNT#4 230 kV line	314591	304226	1	AC	94.68	101.17	ER	470	30.55
20	N-1	DVP_P1-2: LN 246	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	113.96	120.29	ER	375	24
21	Non	Non	DVP - DVP	AB2-100 TAP-6CLUBHSE 230 kV line	924510	314563	1	AC	94.71	100.45	NR	375	21.52
22	N-1	DVP_P1-2: LN 2141	DVP - DVP	AD1-057 TAP-6MORNSTR 230 kV line	934330	313845	1	AC	104.73	117.78	ER	442	60

Light Load Analysis in 2021

Not required

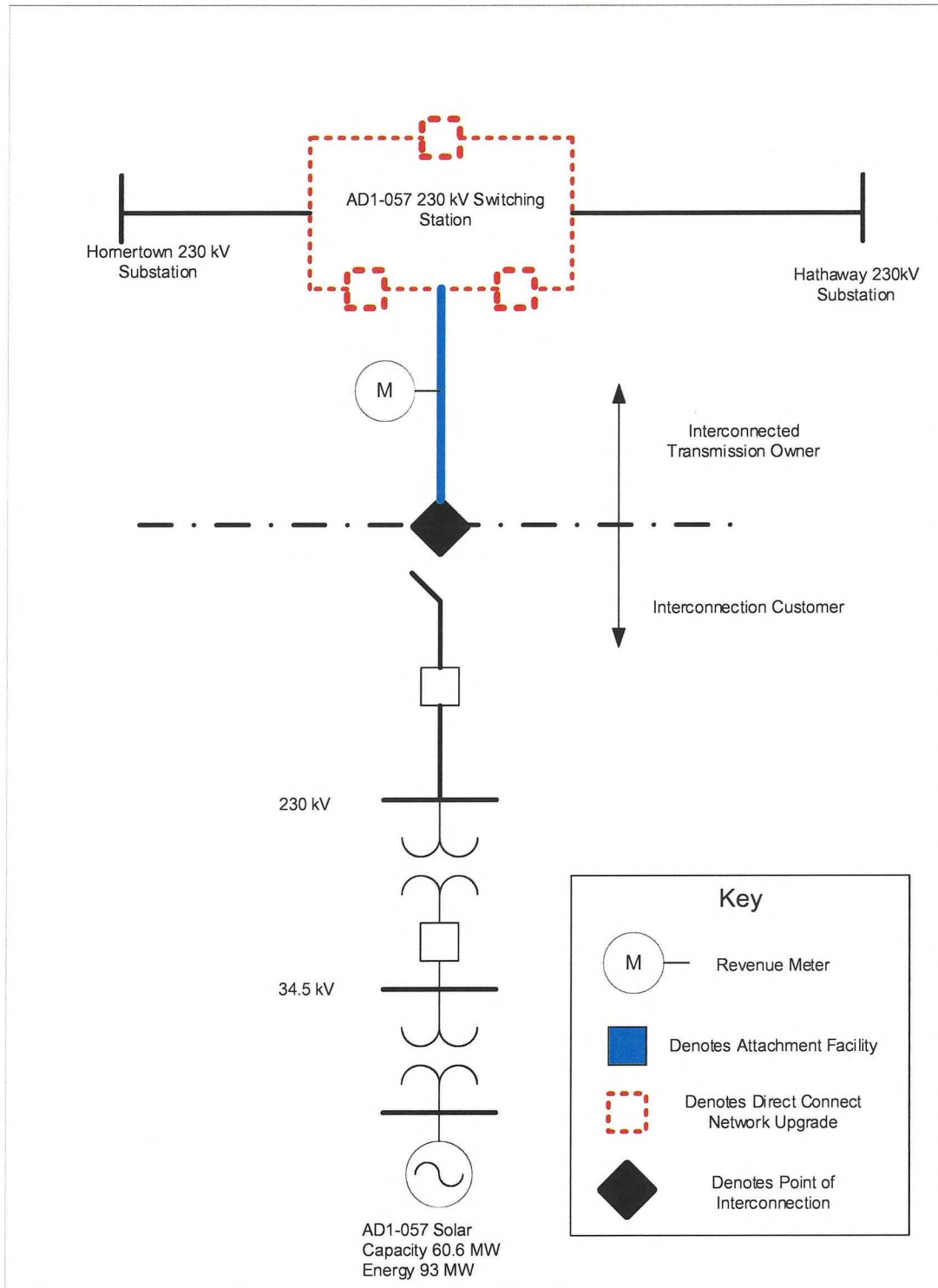
Affected System Analysis & Mitigation**Duke Energy/Progress:**

Potential constraints were identified by PJM on the following Dominion – Duke Energy/Progress (DEP) tie lines. There are no mitigations currently planned for the DEP portions of these overloads. The Queue Project AD1-056/AD1-057 may be subject to operational restriction if real-time system reliability issues occur. The following facilities were identified in this report:

- Battleboro – Rocky Mt. 115 kV line
- Everetts - Greenville 230 kV line
- Rocky Mt. – Hathaway 230 kV line

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. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the Appendices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the Appendices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators.

It should be noted the project/generator MW contributions presented in the body of the report and appendices sections are full contributions, whereas the loading percentages reported in the body of the report, take into consideration the commercial probability of each project as well as the ramping impact of "Adder" contributions.

Appendix 2

(DVP - DVP) The AD1-057 TAP-6MORNSTR 230 kV line (from bus 934330 to bus 313845 ckt 1) loads from 91.77% to 100.27% (AC power flow) of its emergency rating (442 MVA) for the single line contingency outage of 'DVP_P1-2: LN 2141'. This project contributes approximately 39.1 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 2141'

OPEN BRANCH FROM BUS 314561 TO BUS 314583 CKT 1

/* 6CAROLNA

230.00 - 6LAKEVIEW 230.00

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	9.03
315141	1GASTONB	9.03
315136	1ROSEMG1	7.13
315138	1ROSEMG2	3.34
315137	1ROSEMS1	4.42
314704	3LAWRENC	0.25
919701	AA2-057 C	-4.34
930861	AB1-132 C	37.63
931231	AB1-173 C	1.19
931241	AB1-173AC	1.19
923851	AB2-025 C	0.35
923911	AB2-031 C O1	1.18
923991	AB2-040 C O1	3.87
924151	AB2-059 C O1	-9.64
924511	AB2-100 C	17.85
925171	AB2-174 C O1	4.46
925591	AC1-034 C	-6.24
926071	AC1-086 C	55.41

934331	AD1-057 C O1	39.1
AMIL	AMIL	0.32
BLUEG	BLUEG	1.67
CALDERWOOD	CALDERWOOD	1.00
CANNELTON	CANNELTON	0.32
CATAWBA	CATAWBA	0.98
CBM-N	CBM-N	0.00
CHEOAH	CHEOAH	0.93
CLIFTY	CLIFTY	6.08
COTTONWOOD	COTTONWOOD	3.35
EDWARDS	EDWARDS	0.52
ELMERSMITH	ELMERSMITH	0.94
FARMERCITY	FARMERCITY	0.41
G-007A	G-007A	0.69
GIBSON	GIBSON	0.58
HAMLET	HAMLET	1.99
MORGAN	MORGAN	2.94
NEWTON	NEWTON	1.42
NYISO	NYISO	0.04
O-066A	O-066A	0.32
PRAIRIE	PRAIRIE	3.07
SMITHLAND	SMITHLAND	0.27
TATANKA	TATANKA	0.69
TILTON	TILTON	0.61
TRIMBLE	TRIMBLE	0.32
TVA	TVA	1.24

<i>UNIONPOWER</i>	<i>UNIONPOWER</i>	<i>1.66</i>
<i>VFT</i>	<i>VFT</i>	<i>1.83</i>
<i>Y3-032</i>	<i>Y3-032</i>	<i>0.00</i>

Appendix 3

(DVP - DVP) The AB2-100 TAP-6CLUBHSE 230 kV line (from bus 924510 to bus 314563 ckt 1) loads from 96.5% to 101.76% (AC power flow) of its load dump rating (459 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 246T247'. This project contributes approximately 24.37 MW to the thermal violation.

CONTINGENCY 'DVP_P4-2: 246T247' /* SUFFOLK 230 KV
 OPEN BRANCH FROM BUS 314537 TO BUS 314575 CKT 1 /* 6SUFFOLK
 230.00 - 6NUCO TP 230.00
 OPEN BRANCH FROM BUS 314569 TO BUS 314575 CKT 1 /* 6EARLEYS
 230.00 - 6NUCO TP 230.00
 OPEN BRANCH FROM BUS 314575 TO BUS 314590 CKT 1 /* 6NUCO TP
 230.00 - 6NUCOR 230.00
 OPEN BUS 314575 /* ISLAND: 6NUCO TP 230.00
 OPEN BUS 314590 /* ISLAND: 6NUCOR 230.00
 OPEN BRANCH FROM BUS 314537 TO BUS 314648 CKT 1 /* 6SUFFOLK
 230.00 - 6SUNBURY 230.00
 OPEN BRANCH FROM BUS 314648 TO BUS 901080 CKT 1 /* 6SUNBURY
 230.00 - W1-029 230.00
 OPEN BUS 314648 /* ISLAND: 6SUNBURY 230.00
 END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315294	1DOMTR10	1.98
315131	1EDGECEMA	9.02
315132	1EDGECEMB	9.02
315139	1GASTONA	7.4
315141	1GASTONB	7.4
315126	1ROARAP2	1.52
315128	1ROARAP4	1.46
315136	1ROSEMG1	4.97
315138	1ROSEMG2	2.33
315137	1ROSEMS1	3.08
314557	3BETHEL C	0.87
314554	3BTLEBRO	0.84

314566	3CRESWEL	1.63
314578	3HORNRTN	3.35
314603	3SCOT NK	3.54
314541	3WATKINS	0.32
314620	6CASHIE	0.83
314574	6EVERETS	2.43
314594	6PLYMOTH	0.69
932631	AC2-084 C	6.99
932632	AC2-084 E	3.44
933991	AD1-022 C	7.95
933992	AD1-022 E	4.33
934331	AD1-057 C O1	15.88
934332	AD1-057 E O1	8.49
934521	AD1-076 C O1	45.21
934522	AD1-076 E O1	23.02
LTF	CARR	0.09
LTF	CBM-S1	4.49
LTF	CBM-S2	9.26
LTF	CBM-W1	9.8
LTF	CBM-W2	24.09
LTF	CIN	2.19
LTF	CPLE	3.18
LTF	G-007	0.61
LTF	IPL	1.4
LTF	LGEE	0.47
LTF	MEC	4.97

<i>LTF</i>	<i>MECS</i>	<i>2.19</i>
<i>LTF</i>	<i>O-066</i>	<i>3.86</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>0.08</i>
<i>900672</i>	<i>V4-068 E</i>	<i>0.24</i>
<i>LTF</i>	<i>WEC</i>	<i>0.6</i>
<i>916041</i>	<i>Z1-036 C</i>	<i>2.04</i>
<i>916042</i>	<i>Z1-036 E</i>	<i>13.69</i>
<i>917331</i>	<i>Z2-043 C</i>	<i>0.47</i>
<i>917332</i>	<i>Z2-043 E</i>	<i>1.09</i>
<i>917341</i>	<i>Z2-044 C</i>	<i>0.26</i>
<i>917342</i>	<i>Z2-044 E</i>	<i>0.61</i>
<i>917511</i>	<i>Z2-088 C OP1</i>	<i>0.95</i>
<i>917512</i>	<i>Z2-088 E OP1</i>	<i>4.11</i>
<i>918411</i>	<i>AA1-050</i>	<i>0.8</i>
<i>918491</i>	<i>AA1-063AC OP</i>	<i>1.36</i>
<i>918492</i>	<i>AA1-063AE OP</i>	<i>3.51</i>
<i>918511</i>	<i>AA1-065 C OP</i>	<i>1.98</i>
<i>918512</i>	<i>AA1-065 E OP</i>	<i>5.33</i>
<i>918531</i>	<i>AA1-067 C</i>	<i>0.31</i>
<i>918532</i>	<i>AA1-067 E</i>	<i>0.73</i>
<i>918561</i>	<i>AA1-072 C</i>	<i>0.07</i>
<i>918562</i>	<i>AA1-072 E</i>	<i>0.18</i>
<i>919691</i>	<i>AA2-053 C</i>	<i>1.64</i>
<i>919692</i>	<i>AA2-053 E</i>	<i>3.86</i>
<i>919701</i>	<i>AA2-057 C</i>	<i>7.45</i>
<i>919702</i>	<i>AA2-057 E</i>	<i>3.72</i>

<i>LTF</i>	<i>AA2-074</i>	<i>2.16</i>
<i>920042</i>	<i>AA2-088 E</i>	<i>6.93</i>
<i>920591</i>	<i>AA2-165 C</i>	<i>0.19</i>
<i>920592</i>	<i>AA2-165 E</i>	<i>0.49</i>
<i>920671</i>	<i>AA2-174 C</i>	<i>0.08</i>
<i>920672</i>	<i>AA2-174 E</i>	<i>0.45</i>
<i>920692</i>	<i>AA2-178 E</i>	<i>2.8</i>
<i>930401</i>	<i>AB1-081 C</i>	<i>1.74</i>
<i>930402</i>	<i>AB1-081 E</i>	<i>4.08</i>
<i>930861</i>	<i>AB1-132 C</i>	<i>30.87</i>
<i>930862</i>	<i>AB1-132 E</i>	<i>13.23</i>
<i>924151</i>	<i>AB2-059 C OI</i>	<i>11.21</i>
<i>924152</i>	<i>AB2-059 E OI</i>	<i>5.78</i>
<i>924501</i>	<i>AB2-099 C</i>	<i>0.61</i>
<i>924502</i>	<i>AB2-099 E</i>	<i>0.26</i>
<i>924511</i>	<i>AB2-100 C</i>	<i>42.66</i>
<i>924512</i>	<i>AB2-100 E</i>	<i>21.01</i>
<i>925121</i>	<i>AB2-169 C</i>	<i>5.87</i>
<i>925122</i>	<i>AB2-169 E</i>	<i>5.26</i>
<i>925591</i>	<i>AC1-034 C</i>	<i>7.26</i>
<i>925592</i>	<i>AC1-034 E</i>	<i>5.48</i>
<i>925781</i>	<i>AC1-054 C</i>	<i>3.7</i>
<i>925782</i>	<i>AC1-054 E</i>	<i>1.7</i>
<i>926071</i>	<i>AC1-086 C</i>	<i>45.46</i>
<i>926072</i>	<i>AC1-086 E</i>	<i>20.69</i>
<i>926201</i>	<i>AC1-098 C</i>	<i>6.54</i>

<i>926202</i>	<i>AC1-098 E</i>	<i>3.89</i>
<i>926211</i>	<i>AC1-099 C</i>	<i>2.19</i>
<i>926212</i>	<i>AC1-099 E</i>	<i>1.29</i>
<i>927021</i>	<i>AC1-189 C</i>	<i>8.99</i>
<i>927022</i>	<i>AC1-189 E</i>	<i>4.48</i>
<i>927141</i>	<i>AC1-208 C</i>	<i>9.4</i>
<i>927142</i>	<i>AC1-208 E</i>	<i>4.17</i>

Appendix 4

(DVP - DVP) The 3CHESTNUT-3WITAKRS 115 kV line (from bus 313719 to bus 314623 ckt 1) loads from 114.48% to 116.98% (AC power flow) of its emergency rating (134 MVA) for the single line contingency outage of 'DVP_P1-2: LN 2056-A'. This project contributes approximately 3.52 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 2056-A'

OPEN BRANCH FROM BUS 313845 TO BUS 934330 CKT 1
230.00 - AD1-057 TAP 230.00

/* 6HATHAWAY

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	1.17
315141	1GASTONB	1.17
315126	1ROARAP2	1.01
315128	1ROARAP4	0.97
315136	1ROSEMG1	0.84
315138	1ROSEMG2	0.39
315137	1ROSEMS1	0.52
315115	1S HAMPT1	0.58
932631	AC2-084 C	15.09
934331	AD1-057 C O1	3.52
LTF	AMIL	0.14
LTF	BLUEG	0.74
LTF	CALDERWOOD	0.45
LTF	CANNELTON	0.14
LTF	CATAWBA	0.44
LTF	CBM-N	< 0.01
LTF	CHEOAH	0.42
LTF	CLIFTY	2.7

<i>LTF</i>	<i>COTTONWOOD</i>	<i>1.51</i>
<i>LTF</i>	<i>EDWARDS</i>	<i>0.23</i>
<i>LTF</i>	<i>ELMERSMITH</i>	<i>0.42</i>
<i>LTF</i>	<i>FARMERCITY</i>	<i>0.18</i>
<i>LTF</i>	<i>G-007A</i>	<i>0.29</i>
<i>LTF</i>	<i>GIBSON</i>	<i>0.26</i>
<i>LTF</i>	<i>HAMLET</i>	<i>0.91</i>
<i>LTF</i>	<i>MORGAN</i>	<i>1.32</i>
<i>LTF</i>	<i>NEWTON</i>	<i>0.63</i>
<i>LTF</i>	<i>NYISO</i>	<i>< 0.01</i>
<i>LTF</i>	<i>O-066A</i>	<i>0.14</i>
<i>LTF</i>	<i>PRAIRIE</i>	<i>1.37</i>
<i>LTF</i>	<i>SMITHLAND</i>	<i>0.12</i>
<i>LTF</i>	<i>TATANKA</i>	<i>0.31</i>
<i>LTF</i>	<i>TILTON</i>	<i>0.27</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>0.14</i>
<i>LTF</i>	<i>TVA</i>	<i>0.56</i>
<i>LTF</i>	<i>UNIONPOWER</i>	<i>0.75</i>
<i>900671</i>	<i>V4-068 C</i>	<i>0.05</i>
<i>LTF</i>	<i>VFT</i>	<i>0.79</i>
<i>917331</i>	<i>Z2-043 C</i>	<i>0.49</i>
<i>918491</i>	<i>AA1-063AC OP</i>	<i>0.89</i>
<i>918561</i>	<i>AA1-072 C</i>	<i>0.07</i>
<i>919691</i>	<i>AA2-053 C</i>	<i>1.</i>
<i>919701</i>	<i>AA2-057 C</i>	<i>26.37</i>
<i>920041</i>	<i>AA2-088 C</i>	<i>0.5</i>

920591	AA2-165 C	0.66
920671	AA2-174 C	0.05
930861	AB1-132 C	4.88
931231	AB1-173 C	1.09
931241	AB1-173AC	1.09
923911	AB2-031 C O1	1.08
923991	AB2-040 C O1	3.55
924151	AB2-059 C O1	-10.62
924501	AB2-099 C	0.28
925171	AB2-174 C O1	3.12
925591	AC1-034 C	-6.88
925781	AC1-054 C	2.48
926071	AC1-086 C	7.18
926201	AC1-098 C	14.12
926211	AC1-099 C	4.73
927141	AC1-208 C	19.61

Appendix 5

(DVP - CPLE) The 6MORNSTR-6ROCKYMT230T 230 kV line (from bus 313845 to bus 304222 ckt 1) loads from 117.62% to 125.64% (AC power flow) of its emergency rating (374 MVA) for the tower line contingency outage of 'DVP_P7-1: LN 81-2056'. This project contributes approximately 30.02 MW to the thermal violation.

CONTINGENCY 'DVP_P7-1: LN 81-2056'

OPEN BRANCH FROM BUS 314559 TO BUS 314578 CKT 1 /* 3CAROLNA
115.00 - 3HORNRTN 115.00
OPEN BRANCH FROM BUS 314578 TO BUS 314598 CKT 1 /* 3HORNRTN
115.00 - 3ROAN DP 115.00
OPEN BRANCH FROM BUS 314598 TO BUS 314628 CKT 1 /* 3ROAN DP
115.00 - 3DARLINGT DP115.00
OPEN BUS 314578 /* ISLAND: 3HORNRTN 115.00
OPEN BUS 314598 /* ISLAND: 3ROAN DP 115.00
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 /* 6MORNSTR
230.00 - 6NASH 230.00
OPEN BRANCH FROM BUS 304226 TO BUS 304222 CKT 1 /* 6PA-
RMOUNT#4230.00 - 6ROCKYMT230T
OPEN BUS 304226 /* ISLAND
OPEN BUS 314591 /* ISLAND: 6NASH 230.00
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315131	1EDGECEMA	21.38
315132	1EDGECEMB	21.38
315139	1GASTONA	3.75
315141	1GASTONB	3.75
315126	1ROARAP2	1.14
315128	1ROARAP4	1.1
315136	1ROSEMG1	3.14
315138	1ROSEMG2	1.47
315137	1ROSEMS1	1.95

314557	3BETHEL C	1.61
314554	3BTLEBRO	1.08
314566	3CRESWEL	1.09
314572	3EMPORIA	0.27
314603	3SCOT NK	3.23
314541	3WATKINS	0.33
314620	6CASHIE	0.49
314574	6EVERETS	1.81
314594	6PLYMOTH	0.44
932631	AC2-084 C	7.04
932632	AC2-084 E	3.47
933991	AD1-022 C	4.84
933992	AD1-022 E	2.63
934331	AD1-057 C O1	19.56
934332	AD1-057 E O1	10.46
934521	AD1-076 C O1	28.52
934522	AD1-076 E O1	14.52
LTF	AMIL	0.38
LTF	BLUEG	1.99
LTF	CALDERWOOD	1.17
LTF	CANNELTON	0.38
LTF	CARR	< 0.01
LTF	CATAWBA	1.14
LTF	CELEVELAND /* 35% REVERSE 4479079 4642907	< 0.01
LTF	CHEOAH	1.09
LTF	CLIFTY	7.31

<i>LTF</i>	<i>COTTONWOOD</i>	<i>3.91</i>
<i>LTF</i>	<i>EDWARDS</i>	<i>0.61</i>
<i>LTF</i>	<i>ELMERSMITH</i>	<i>1.11</i>
<i>LTF</i>	<i>FARMERCITY</i>	<i>0.48</i>
<i>LTF</i>	<i>G-007A</i>	<i>0.76</i>
<i>LTF</i>	<i>GIBSON</i>	<i>0.69</i>
<i>LTF</i>	<i>HAMLET</i>	<i>2.25</i>
<i>LTF</i>	<i>MORGAN</i>	<i>3.43</i>
<i>LTF</i>	<i>NEWTON</i>	<i>1.68</i>
<i>LTF</i>	<i>O-066A</i>	<i>0.35</i>
<i>LTF</i>	<i>PRAIRIE</i>	<i>3.62</i>
<i>LTF</i>	<i>SMITHLAND</i>	<i>0.32</i>
<i>LTF</i>	<i>TATANKA</i>	<i>0.82</i>
<i>LTF</i>	<i>TILTON</i>	<i>0.72</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>0.38</i>
<i>LTF</i>	<i>TVA</i>	<i>1.45</i>
<i>LTF</i>	<i>UNIONPOWER</i>	<i>1.94</i>
<i>900671</i>	<i>V4-068 C</i>	<i>0.06</i>
<i>900672</i>	<i>V4-068 E</i>	<i>0.18</i>
<i>LTF</i>	<i>VFT</i>	<i>2.03</i>
<i>907092</i>	<i>X1-038 E</i>	<i>2.6</i>
<i>LTF</i>	<i>Y3-032</i>	<i>< 0.01</i>
<i>917331</i>	<i>Z2-043 C</i>	<i>0.36</i>
<i>917332</i>	<i>Z2-043 E</i>	<i>0.84</i>
<i>917341</i>	<i>Z2-044 C</i>	<i>0.32</i>
<i>917342</i>	<i>Z2-044 E</i>	<i>0.75</i>

917511	Z2-088 C OP1	1.56
917512	Z2-088 E OP1	6.74
918411	AA1-050	1.32
918491	AA1-063AC OP	1.07
918492	AA1-063AE OP	2.74
918511	AA1-065 C OP	1.09
918512	AA1-065 E OP	2.92
918531	AA1-067 C	0.23
918532	AA1-067 E	0.54
918561	AA1-072 C	0.05
918562	AA1-072 E	0.14
919691	AA2-053 C	1.19
919692	AA2-053 E	2.79
919701	AA2-057 C	8.78
919702	AA2-057 E	4.39
920042	AA2-088 E	5.93
920591	AA2-165 C	0.22
920592	AA2-165 E	0.58
920671	AA2-174 C	0.05
920672	AA2-174 E	0.32
920692	AA2-178 E	1.86
930401	AB1-081 C	2.67
930402	AB1-081 E	6.24
930861	AB1-132 C	15.62
930862	AB1-132 E	6.7
931231	AB1-173 C	1.56

931232	AB1-173 E	0.73
931241	AB1-173AC	1.56
931242	AB1-173AE	0.73
923852	AB2-025 E	0.45
923911	AB2-031 C O1	1.55
923912	AB2-031 E O1	0.76
923991	AB2-040 C O1	5.07
923992	AB2-040 E O1	4.15
924151	AB2-059 C O1	17.15
924152	AB2-059 E O1	8.84
924501	AB2-099 C	0.4
924502	AB2-099 E	0.17
924511	AB2-100 C	8.3
924512	AB2-100 E	4.09
925121	AB2-169 C	4.03
925122	AB2-169 E	3.62
925171	AB2-174 C O1	4.75
925172	AB2-174 E O1	4.3
925591	AC1-034 C	11.11
925592	AC1-034 E	8.38
926071	AC1-086 C	23.01
926072	AC1-086 E	10.47
926201	AC1-098 C	6.58
926202	AC1-098 E	3.92
926211	AC1-099 C	2.21
926212	AC1-099 E	1.3

ATTACHMENT A
EMP-111 SUB 0

927021	AC1-189 C	12.21
927022	AC1-189 E	6.08
927141	AC1-208 C	10.44
927142	AC1-208 E	4.64

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Appendix 6

(DVP - DVP) The 6CHESTF B-6BASIN 230 kV line (from bus 314287 to bus 314276 ckt 1) loads from 103.47% to 104.47% (AC power flow) of its load dump rating (549 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 562T563'. This project contributes approximately 6.46 MW to the thermal violation.

CONTINGENCY 'DVP_P4-2: 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	32.84
315131	1EDGECEMA	3.05
315132	1EDGECEMB	3.05
315074	1HOPCGN1	5.66
315075	1HOPCGN2	5.66
315077	1HOPHCF1	1.74
315078	1HOPHCF2	1.74
315079	1HOPHCF3	1.74
315080	1HOPHCF4	2.64
315076	1HOPPOLC	1.24
315073	1STONECA	4.88
314557	3BETHEL	0.3
314554	3BTLEBRO	0.3
314572	3EMPORIA	0.22
314578	3HORNRTN	1.43
314314	3LOCKS	0.06
314315	3LOCKS E	0.83

314603	3SCOT NK	1.31
314541	3WATKINS	0.27
314620	6CASHIE	0.31
314594	6PLYMOTH	0.3
932591	AC2-079 C	2.7
932592	AC2-079 E	4.41
932631	AC2-084 C	2.64
932632	AC2-084 E	1.3
933991	AD1-022 C	3.17
933992	AD1-022 E	1.72
934011	AD1-025 C O1	9.49
934012	AD1-025 E O1	5.62
934331	AD1-057 C O1	4.21
934332	AD1-057 E O1	2.25
934521	AD1-076 C O1	19.37
934522	AD1-076 E O1	9.86
934571	AD1-082 C O1	5.2
934572	AD1-082 E O1	2.97
935161	AD1-151 C O1	9.07
935162	AD1-151 E O1	6.05
LTF	CARR	0.23
LTF	CBM-S1	3.99
LTF	CBM-S2	8.63
LTF	CBM-W1	7.45
LTF	CBM-W2	20.89
LTF	CIN	1.7

<i>LTF</i>	<i>CPLE</i>	<i>2.76</i>
<i>LTF</i>	<i>G-007</i>	<i>1.04</i>
<i>LTF</i>	<i>IPL</i>	<i>1.08</i>
<i>LTF</i>	<i>LGEE</i>	<i>0.37</i>
<i>LTF</i>	<i>MEC</i>	<i>4.07</i>
<i>LTF</i>	<i>MECS</i>	<i>1.38</i>
<i>LTF</i>	<i>O-066</i>	<i>6.63</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>0.18</i>
<i>900672</i>	<i>V4-068 E</i>	<i>0.12</i>
<i>LTF</i>	<i>WEC</i>	<i>0.47</i>
<i>907092</i>	<i>X1-038 E</i>	<i>2.34</i>
<i>914231</i>	<i>Y2-077</i>	<i>0.7</i>
<i>916302</i>	<i>Z1-086 E</i>	<i>3.71</i>
<i>917332</i>	<i>Z2-043 E</i>	<i>0.39</i>
<i>917342</i>	<i>Z2-044 E</i>	<i>0.22</i>
<i>917512</i>	<i>Z2-088 E OP1</i>	<i>1.45</i>
<i>918492</i>	<i>AA1-063AE OP</i>	<i>1.7</i>
<i>918512</i>	<i>AA1-065 E OP</i>	<i>1.69</i>
<i>918562</i>	<i>AA1-072 E</i>	<i>0.07</i>
<i>919692</i>	<i>AA2-053 E</i>	<i>1.6</i>
<i>919701</i>	<i>AA2-057 C</i>	<i>2.8</i>
<i>919702</i>	<i>AA2-057 E</i>	<i>1.4</i>
<i>LTF</i>	<i>AA2-074</i>	<i>1.88</i>
<i>920042</i>	<i>AA2-088 E</i>	<i>4.24</i>
<i>920592</i>	<i>AA2-165 E</i>	<i>0.18</i>
<i>920672</i>	<i>AA2-174 E</i>	<i>0.18</i>

930402	AB1-081 E	1.46
930861	AB1-132 C	6.74
930862	AB1-132 E	2.89
931231	AB1-173 C	1.1
931232	AB1-173 E	0.52
931241	AB1-173AC	1.1
931242	AB1-173AE	0.52
923851	AB2-025 C	0.32
923852	AB2-025 E	0.78
923911	AB2-031 C OI	1.1
923912	AB2-031 E OI	0.54
923991	AB2-040 C OI	3.6
923992	AB2-040 E OI	2.94
924151	AB2-059 C OI	4.01
924152	AB2-059 E OI	2.06
924501	AB2-099 C	0.23
924502	AB2-099 E	0.1
924511	AB2-100 C	6.79
924512	AB2-100 E	3.35
924811	AB2-134 C OI	7.23
924812	AB2-134 E OI	7.11
925051	AB2-160 C OI	3.59
925052	AB2-160 E OI	5.86
925061	AB2-161 C OI	2.28
925062	AB2-161 E OI	3.72
925121	AB2-169 C	2.34

925122	AB2-169 E	2.1
925171	AB2-174 C OI	3.52
925172	AB2-174 E OI	3.18
925331	AB2-190 C	11.28
925332	AB2-190 E	4.84
925591	AC1-034 C	2.6
925592	AC1-034 E	1.96
925821	AC1-061	< 0.01
926071	AC1-086 C	9.93
926072	AC1-086 E	4.52
926201	AC1-098 C	2.46
926202	AC1-098 E	1.47
926211	AC1-099 C	0.83
926212	AC1-099 E	0.49
927021	AC1-189 C	3.2
927022	AC1-189 E	1.59
927141	AC1-208 C	3.74
927142	AC1-208 E	1.66
927221	AC1-216 C OI	5.52
927222	AC1-216 E OI	4.34

Appendix 7

(DVP - CPLE) The 3BTLEBRO-3ROCKYMT115T 115 kV line (from bus 314554 to bus 304223 ckt 1) loads from 224.02% to 234.1% (AC power flow) of its emergency rating (164 MVA) for the tower line contingency outage of 'DVP_P7-1: LN 2058-2181'. This project contributes approximately 16.84 MW to the thermal violation.

CONTINGENCY 'DVP_P7-1: LN 2058-2181'

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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315131	1EDGECEMA	11.56
315132	1EDGECEMB	11.56
315139	1GASTONA	2.33
315141	1GASTONB	2.33
315126	1ROARAP2	0.97
315128	1ROARAP4	0.93
315136	1ROSEMG1	1.89
315138	1ROSEMG2	0.88
315137	1ROSEMS1	1.17
314557	3BETHEL C	0.88
314554	3BTLEBRO	1.95
314572	3EMPORIA	0.2
314578	3HORNRTN	2.51
314603	3SCOT NK	3.67

314541	3WATKINS	0.26
314620	6CASHIE	0.32
314574	6EVERETS	1.04
932631	AC2-084 C	8.5
932632	AC2-084 E	4.19
933991	AD1-022 C	3.14
933992	AD1-022 E	1.71
934331	AD1-057 C O1	10.97
934332	AD1-057 E O1	5.87
LTF	AMIL	0.26
LTF	BLUEG	1.35
LTF	CALDERWOOD	0.8
LTF	CANNELTON	0.26
LTF	CARR	< 0.01
LTF	CATAWBA	0.78
LTF	CHEOAH	0.74
LTF	CLIFTY	4.95
LTF	COTTONWOOD	2.67
LTF	EDWARDS	0.42
LTF	ELMERSMITH	0.75
LTF	FARMERCITY	0.33
LTF	G-007A	0.49
LTF	GIBSON	0.47
LTF	HAMLET	1.56
LTF	MORGAN	2.34
LTF	NEWTON	1.14

<i>LTF</i>	<i>O-066A</i>	<i>0.23</i>
<i>LTF</i>	<i>PRAIRIE</i>	<i>2.46</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>< 0.01</i>
<i>LTF</i>	<i>SMITHLAND</i>	<i>0.22</i>
<i>LTF</i>	<i>TATANKA</i>	<i>0.55</i>
<i>LTF</i>	<i>TILTON</i>	<i>0.49</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>0.26</i>
<i>LTF</i>	<i>TVA</i>	<i>0.99</i>
<i>LTF</i>	<i>UNIONPOWER</i>	<i>1.32</i>
<i>900672</i>	<i>V4-068 E</i>	<i>0.15</i>
<i>LTF</i>	<i>VFT</i>	<i>1.3</i>
<i>917331</i>	<i>Z2-043 C</i>	<i>0.35</i>
<i>917332</i>	<i>Z2-043 E</i>	<i>0.82</i>
<i>917341</i>	<i>Z2-044 C</i>	<i>0.53</i>
<i>917342</i>	<i>Z2-044 E</i>	<i>1.25</i>
<i>917511</i>	<i>Z2-088 C OP1</i>	<i>0.86</i>
<i>917512</i>	<i>Z2-088 E OP1</i>	<i>3.69</i>
<i>918411</i>	<i>AA1-050</i>	<i>0.72</i>
<i>918492</i>	<i>AA1-063AE OP</i>	<i>2.28</i>
<i>918512</i>	<i>AA1-065 E OP</i>	<i>1.94</i>
<i>918532</i>	<i>AA1-067 E</i>	<i>0.31</i>
<i>918561</i>	<i>AA1-072 C</i>	<i>0.05</i>
<i>918562</i>	<i>AA1-072 E</i>	<i>0.14</i>
<i>919691</i>	<i>AA2-053 C</i>	<i>0.99</i>
<i>919692</i>	<i>AA2-053 E</i>	<i>2.32</i>
<i>919701</i>	<i>AA2-057 C</i>	<i>13.27</i>

919702	AA2-057 E	6.64
920042	AA2-088 E	4.77
920591	AA2-165 C	0.33
920592	AA2-165 E	0.87
920671	AA2-174 C	0.05
920672	AA2-174 E	0.27
930401	AB1-081 C	3.67
930402	AB1-081 E	8.59
930861	AB1-132 C	9.71
930862	AB1-132 E	4.16
931231	AB1-173 C	1.21
931232	AB1-173 E	0.56
931241	AB1-173AC	1.21
931242	AB1-173AE	0.56
923911	AB2-031 C O1	1.2
923912	AB2-031 E O1	0.59
923991	AB2-040 C O1	3.93
923992	AB2-040 E O1	3.22
924151	AB2-059 C O1	23.61
924152	AB2-059 E O1	12.16
924501	AB2-099 C	0.31
924502	AB2-099 E	0.13
924511	AB2-100 C	5.32
924512	AB2-100 E	2.62
925121	AB2-169 C	2.45
925122	AB2-169 E	2.2

925171	AB2-174 C OI	3.6
925172	AB2-174 E OI	3.26
925591	AC1-034 C	15.3
925592	AC1-034 E	11.54
926071	AC1-086 C	14.3
926072	AC1-086 E	6.51
926201	AC1-098 C	7.95
926202	AC1-098 E	4.74
926211	AC1-099 C	2.66
926212	AC1-099 E	1.56
927021	AC1-189 C	6.74
927022	AC1-189 E	3.36
927141	AC1-208 C	11.27
927142	AC1-208 E	5.

Appendix 9

(DVP - DVP) The 6LAKEVEW-6CAROLNA 230 kV line (from bus 314583 to bus 314561 ckt 1) loads from 118.31% to 127.37% (AC power flow) of its emergency rating (375 MVA) for the single line contingency outage of 'DVP_P1-2: LN 2056-A'. This project contributes approximately 34.42 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 2056-A'

OPEN BRANCH FROM BUS 313845 TO BUS 934330 CKT 1
230.00 - AD1-057 TAP 230.00

/* 6HATHAWAY

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	11.44
315141	1GASTONB	11.44
315136	1ROSEMG1	8.22
315138	1ROSEMG2	3.85
315137	1ROSEMS1	5.1
314704	3LAWRENC	0.19
934331	AD1-057 C O1	34.42
LTF	AMIL	0.18
LTF	BLUEG	0.92
LTF	CALDERWOOD	0.54
LTF	CANNELTON	0.18
LTF	CATAWBA	0.53
LTF	CBM-N	< 0.01
LTF	CHEOAH	0.51
LTF	CLIFTY	3.38
LTF	COTTONWOOD	1.83
LTF	EDWARDS	0.28
LTF	ELMERSMITH	0.52

<i>LTF</i>	<i>FARMERCITY</i>	<i>0.22</i>
<i>LTF</i>	<i>G-007A</i>	<i>0.38</i>
<i>LTF</i>	<i>GIBSON</i>	<i>0.32</i>
<i>LTF</i>	<i>HAMLET</i>	<i>1.07</i>
<i>LTF</i>	<i>MORGAN</i>	<i>1.61</i>
<i>LTF</i>	<i>NEWTON</i>	<i>0.78</i>
<i>LTF</i>	<i>NYISO</i>	<i>0.02</i>
<i>LTF</i>	<i>O-066A</i>	<i>0.17</i>
<i>LTF</i>	<i>PRAIRIE</i>	<i>1.69</i>
<i>LTF</i>	<i>SMITHLAND</i>	<i>0.15</i>
<i>LTF</i>	<i>TATANKA</i>	<i>0.38</i>
<i>LTF</i>	<i>TILTON</i>	<i>0.34</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>0.18</i>
<i>LTF</i>	<i>TVA</i>	<i>0.68</i>
<i>LTF</i>	<i>UNIONPOWER</i>	<i>0.9</i>
<i>LTF</i>	<i>VFT</i>	<i>1.01</i>
<i>919701</i>	<i>AA2-057 C</i>	<i>-4.57</i>
<i>930861</i>	<i>AB1-132 C</i>	<i>47.71</i>
<i>923851</i>	<i>AB2-025 C</i>	<i>0.41</i>
<i>924511</i>	<i>AB2-100 C</i>	<i>21.45</i>
<i>925121</i>	<i>AB2-169 C</i>	<i>-3.86</i>
<i>925781</i>	<i>AC1-054 C</i>	<i>-3.97</i>
<i>926071</i>	<i>AC1-086 C</i>	<i>70.26</i>

Appendix 10

(DVP - DVP) The 3WITAKRS-3BTLEBRO 115 kV line (from bus 314623 to bus 314554 ckt 1) loads from 115.37% to 117.87% (AC power flow) of its emergency rating (134 MVA) for the single line contingency outage of 'DVP_P1-2: LN 2056-A'. This project contributes approximately 3.51 MW to the thermal violation.

CONTINGENCY 'DVP_P1-2: LN 2056-A'

OPEN BRANCH FROM BUS 313845 TO BUS 934330 CKT 1

/* 6HATHAWAY

230.00 - AD1-057 TAP 230.00

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	1.17
315141	1GASTONB	1.17
315126	1ROARAP2	1.01
315128	1ROARAP4	0.97
315136	1ROSEMG1	0.84
315138	1ROSEMG2	0.39
315137	1ROSEMS1	0.52
315115	1S HAMPT1	0.58
932631	AC2-084 C	15.09
934331	AD1-057 C O1	3.51
LTF	AMIL	0.14
LTF	BLUEG	0.75
LTF	CALDERWOOD	0.45
LTF	CANNELTON	0.14
LTF	CATAWBA	0.44
LTF	CHEOAH	0.42
LTF	CLIFTY	2.73
LTF	COTTONWOOD	1.52

<i>LTF</i>	<i>EDWARDS</i>	<i>0.23</i>
<i>LTF</i>	<i>ELMERSMITH</i>	<i>0.42</i>
<i>LTF</i>	<i>FARMERCITY</i>	<i>0.18</i>
<i>LTF</i>	<i>G-007A</i>	<i>0.29</i>
<i>LTF</i>	<i>GIBSON</i>	<i>0.26</i>
<i>LTF</i>	<i>HAMLET</i>	<i>0.91</i>
<i>LTF</i>	<i>MORGAN</i>	<i>1.33</i>
<i>LTF</i>	<i>NEWTON</i>	<i>0.64</i>
<i>LTF</i>	<i>O-066A</i>	<i>0.13</i>
<i>LTF</i>	<i>PRAIRIE</i>	<i>1.38</i>
<i>LTF</i>	<i>SMITHLAND</i>	<i>0.12</i>
<i>LTF</i>	<i>TATANKA</i>	<i>0.31</i>
<i>LTF</i>	<i>TILTON</i>	<i>0.27</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>0.14</i>
<i>LTF</i>	<i>TVA</i>	<i>0.56</i>
<i>LTF</i>	<i>UNIONPOWER</i>	<i>0.75</i>
<i>900671</i>	<i>V4-068 C</i>	<i>0.05</i>
<i>LTF</i>	<i>VFT</i>	<i>0.76</i>
<i>917331</i>	<i>Z2-043 C</i>	<i>0.49</i>
<i>917341</i>	<i>Z2-044 C</i>	<i>1.09</i>
<i>918491</i>	<i>AA1-063AC OP</i>	<i>0.89</i>
<i>918561</i>	<i>AA1-072 C</i>	<i>0.07</i>
<i>919691</i>	<i>AA2-053 C</i>	<i>1.</i>
<i>919701</i>	<i>AA2-057 C</i>	<i>26.37</i>
<i>920041</i>	<i>AA2-088 C</i>	<i>0.5</i>
<i>920591</i>	<i>AA2-165 C</i>	<i>0.66</i>

920671	AA2-174 C	0.05
930861	AB1-132 C	4.87
931231	AB1-173 C	1.09
931241	AB1-173AC	1.09
923911	AB2-031 C O1	1.08
923991	AB2-040 C O1	3.55
924151	AB2-059 C O1	-10.62
924501	AB2-099 C	0.28
925171	AB2-174 C O1	3.12
925591	AC1-034 C	-6.88
925781	AC1-054 C	2.48
926071	AC1-086 C	7.18
926201	AC1-098 C	14.11
926211	AC1-099 C	4.73
927141	AC1-208 C	19.61

Appendix 11

(DVP - DVP) The AD1-057 TAP-6MORNSTR 230 kV line (from bus 934330 to bus 313845 ckt 1) loads from 120.37% to 137.1% (AC power flow) of its load dump rating (541 MVA) for the line fault with failed breaker contingency outage of 'DVP_P4-2: 254T2141'. This project contributes approximately 92.81 MW to the thermal violation.

CONTINGENCY 'DVP_P4-2: 254T2141' /* LAKEVIEW
OPEN BRANCH FROM BUS 314583 TO BUS 314561 CKT 1 /* 2141
OPEN BRANCH FROM BUS 314583 TO BUS 924510 CKT 1 /* 254
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
315139	1GASTONA	20.11
315141	1GASTONB	20.11
315136	1ROSEMG1	14.44
315138	1ROSEMG2	6.76
315137	1ROSEMS1	8.96
934331	AD1-057 C O1	60.48
934332	AD1-057 E O1	32.34
LTF	AMIL	0.06
LTF	BLUEG	0.35
LTF	CALDERWOOD	0.11
LTF	CANNELTON	0.06
LTF	CARR	0.07
LTF	CATAWBA	0.07
LTF	CHEOAH	0.1
LTF	CLIFTY	1.43
LTF	COTTONWOOD	0.42
LTF	EDWARDS	0.1
LTF	ELMERSMITH	0.17

<i>LTF</i>	<i>FARMERCITY</i>	<i>0.07</i>
<i>LTF</i>	<i>G-007</i>	<i>0.21</i>
<i>LTF</i>	<i>GIBSON</i>	<i>0.12</i>
<i>LTF</i>	<i>HAMLET</i>	<i>0.11</i>
<i>LTF</i>	<i>MORGAN</i>	<i>0.35</i>
<i>LTF</i>	<i>NEWTON</i>	<i>0.27</i>
<i>LTF</i>	<i>O-066</i>	<i>1.34</i>
<i>LTF</i>	<i>PRAIRIE</i>	<i>0.51</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>0.06</i>
<i>LTF</i>	<i>SMITHLAND</i>	<i>0.04</i>
<i>LTF</i>	<i>TATANKA</i>	<i>0.13</i>
<i>LTF</i>	<i>TILTON</i>	<i>0.13</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>0.07</i>
<i>LTF</i>	<i>TVA</i>	<i>0.15</i>
<i>LTF</i>	<i>UNIONPOWER</i>	<i>0.16</i>
<i>930861</i>	<i>AB1-132 C</i>	<i>83.83</i>
<i>930862</i>	<i>AB1-132 E</i>	<i>35.93</i>
<i>926071</i>	<i>AC1-086 C</i>	<i>123.45</i>
<i>926072</i>	<i>AC1-086 E</i>	<i>56.19</i>

Appendix 14

(DVP - CPLE) The 6EVERETS-6GREENVILE T 230 kV line (from bus 314574 to bus 304451 ckt 1) loads from 97.30% to 99.98% (AC power flow) of its emergency rating (478 MVA) for the tower line contingency outage of 'DVP_P7-1: LN 2058-2181'. This project contributes approximately 13.36 MW to the thermal violation.

CONTINGENCY 'DVP_P7-1: LN 2058-2181'

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

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
314541	3WATKINS	0.36
314554	3BTLEBRO	0.43
314557	3BETHELC	1.15
314566	3CRESWEL	2.04
314572	3EMPORIA	0.21
314574	6EVERETS	5.39
314578	3HORNRTN	2.04
314594	6PLYMOTH	0.83
314603	3SCOT NK	2.51
314620	6CASHIE	0.88
314648	6SUNBURY	0.40
314651	6WINFALL	0.97
315131	1EDGECEMA	8.00
315132	1EDGECEMB	8.00
315136	1ROSEMG1	1.85
315137	1ROSEMS1	1.15
315138	1ROSEMG2	0.87
315292	1DOMTR78	1.97
315293	1DOMTR9	1.61
315294	1DOMTR10	2.92
900672	V4-068 E	0.21
901082	W1-029E	16.22

907092	X1-038 E	2.96
913392	Y1-086 E	1.05
916041	Z1-036 C	2.73
916042	Z1-036 E	18.34
917122	Z2-027 E	0.51
917331	Z2-043 C	0.37
917332	Z2-043 E	0.86
917342	Z2-044 E	0.33
917511	Z2-088 C OP1	1.42
917512	Z2-088 E OP1	6.13
918411	AA1-050	1.20
918492	AA1-063AE OP	2.44
918511	AA1-065 C OP	1.80
918512	AA1-065 E OP	4.84
918531	AA1-067 C	0.69
918532	AA1-067 E	1.62
918561	AA1-072 C	0.06
918562	AA1-072 E	0.14
919692	AA2-053 E	2.58
919701	AA2-057 C	4.25
919702	AA2-057 E	2.12
920042	AA2-088 E	6.25
920592	AA2-165 E	0.28
920672	AA2-174 E	0.30
920691	AA2-178 C	1.50
920692	AA2-178 E	3.50
923831	AB2-022 C	1.02
923832	AB2-022 E	0.55
923911	AB2-031 C O1	1.20
923912	AB2-031 E O1	0.59
923991	AB2-040 C O1	3.93
923992	AB2-040 E O1	3.22
924151	AB2-059 C O1	6.65
924152	AB2-059 E O1	3.42
924501	AB2-099 C	0.53
924502	AB2-099 E	0.23
924511	AB2-100 C	5.86
924512	AB2-100 E	2.88
925121	AB2-169 C	10.02

925122	AB2-169 E	8.99
925171	AB2-174 C O1	3.64
925172	AB2-174 E O1	3.30
925591	AC1-034 C	4.30
925592	AC1-034 E	3.25
926071	AC1-086 C	15.26
926072	AC1-086 E	6.95
926201	AC1-098 C	4.33
926202	AC1-098 E	2.58
926211	AC1-099 C	1.45
926212	AC1-099 E	0.85
927021	AC1-189 C	15.46
927022	AC1-189 E	7.70
927141	AC1-208 C	5.75
927142	AC1-208 E	2.55
930402	AB1-081 E	2.42
930861	AB1-132 C	10.36
930862	AB1-132 E	4.44
931231	AB1-173 C	1.21
931232	AB1-173 E	0.56
931241	AB1-173AC	1.21
931242	AB1-173AE	0.56
932631	AC2-084 C	4.63
932632	AC2-084 E	2.28
933991	AD1-022 C	8.98
933992	AD1-022 E	4.89
934331	AD1-057 C O1	8.71
934332	AD1-057 E O1	4.65
934521	AD1-076 C O1	54.77
934522	AD1-076 E O1	27.89
AC1-131	AC1-131	5.64
AMIL	AMIL	0.48
BLUEG	BLUEG	2.50
CALDERWOOD	CALDERWOOD	1.54
CANNELTON	CANNELTON	0.48
CATAWBA	CATAWBA	1.50
CBM-N	CBM-N	0.01
CELEVELAND /* 35% REVERSE	CELEVELAND /* 35% REVERSE	0.00

<i>4479079</i>	<i>4479079</i>	
<i>4642907</i>	<i>4642907</i>	
<i>CHEOAH</i>	<i>CHEOAH</i>	<i>1.44</i>
<i>CLIFTY</i>	<i>CLIFTY</i>	<i>9.03</i>
<i>COTTONWOOD</i>	<i>COTTONWOOD</i>	<i>5.20</i>
<i>EDWARDS</i>	<i>EDWARDS</i>	<i>0.78</i>
<i>ELMERSMITH</i>	<i>ELMERSMITH</i>	<i>1.41</i>
<i>FARMERCITY</i>	<i>FARMERCITY</i>	<i>0.62</i>
<i>G-007A</i>	<i>G-007A</i>	<i>1.04</i>
<i>GIBSON</i>	<i>GIBSON</i>	<i>0.88</i>
<i>HAMLET</i>	<i>HAMLET</i>	<i>3.22</i>
<i>MORGAN</i>	<i>MORGAN</i>	<i>4.56</i>
<i>NEWTON</i>	<i>NEWTON</i>	<i>2.15</i>
<i>NYISO</i>	<i>NYISO</i>	<i>0.09</i>
<i>O-066A</i>	<i>O-066A</i>	<i>0.48</i>
<i>PRAIRIE</i>	<i>PRAIRIE</i>	<i>4.68</i>
<i>SMITHLAND</i>	<i>SMITHLAND</i>	<i>0.42</i>
<i>TATANKA</i>	<i>TATANKA</i>	<i>1.05</i>
<i>TILTON</i>	<i>TILTON</i>	<i>0.92</i>
<i>TRIMBLE</i>	<i>TRIMBLE</i>	<i>0.47</i>
<i>TVA</i>	<i>TVA</i>	<i>1.91</i>
<i>UNIONPOWER</i>	<i>UNIONPOWER</i>	<i>2.56</i>
<i>VFT</i>	<i>VFT</i>	<i>2.76</i>
<i>Y3-032</i>	<i>Y3-032</i>	<i>0.00</i>

***Generation Interconnection
Facility Study Report***

For

***PJM Generation Interconnection Request
Queue Position AD1-056/AD1-057***

***Hornertown-Hathaway 230 kV
60.6 MW Capacity / 93 MW Energy***

February 2023

General

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff §207, as well as the Facilities Study Agreement between Sweetleaf Solar, LLC, the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company (VEPCO).

Point of Interconnection

AD1-056/AD1-057 will interconnect with the ITO transmission system via a new three breaker ring bus switching station that connects the Hornertown-Hathaway 230kV line.

Cost Summary

The AD1-056/AD1-057 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$751,903
Direct Connection Network Upgrades	\$7,336,809
Non Direct Connection Network Upgrades	\$1,774,853
Allocation for New System Upgrades	\$0
Contribution for Previously Identified Upgrades	\$16,109
Total Costs	\$9,879,674

A. Transmission Owner Facilities Study Summary

1. Description of Project

Queue AD1-056/AD1-057 is a request to interconnect a 94MW new solar generating facility to be located in Halifax County, North Carolina. AD1-056/AD1-057 will interconnect with the ITO transmission system via a new three breaker ring bus switching station that connects on the Hornertown-Hathaway 230kV line. Attachment Facility and Network Upgrade construction is estimated to be 18-26 months.

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

None

3. Interconnection Customer's Milestone Schedule

- Plan to break ground September 1, 2025
- Permits – state level Permit By Rule and county level final site plan approval complete December 31, 2025
- Substantial site work completed January 1, 2026
- Delivery of major electrical equipment September 1, 2026
- Back Feed Power June 1, 2026
- Commercial Operation December 31, 2026

4. Scope of Customer's Work

Generator Interconnection Request AD1-056/AD1-057 is for a 94MW Maximum Facility Output (MFO) solar generation plant.

5. Description of Facilities Included in the Facilities Study

Project AD1-056/AD1-057 provides for the initial construction of a new 230kV three breaker ring substation at transmission structure 2056/214. The objective of this project is to build a 230kV, 3-breaker ring bus to support the new 94MW Solar Farm built by Sweetleaf Solar, LLC. The site is located along Dominion Energy's existing 230kV, Line 2056 from Hathaway Substation to Hornertown Substation. The cut line will consume two of the positions in the ring bus. The third position will be for the 230kV feed from Sweetleaf Solar, LLC Collector Station for the new 94MW Solar Farm.

The new 230kV three breaker ring substation will share a common footprint and fence line with Sweetleaf Solar, LLC Collector Station. The demarcation point between the two stations will be the 230kV breaker disconnect switch 4-hole pad in the Sweetleaf Solar, LLC Collector Station by the common fence. Dominion Energy will bring its bus to the demarcation point. The bus, structures, disconnect switch, metering accuracy CCVT's, metering accuracy CT's, protection and metering equipment will be Attachment Facilities. The grounding systems for each station will be tied together. All substation permitting, site preparation and grading activity will be performed by Sweetleaf Solar, LLC. Sweetleaf Solar, LLC is also responsible for maintaining accessibility to the adjacent gas pipeline facilities that are adjacent to the project site.

The existing line segment between the new three breaker ring and Hathaway substation will be renumbered. The existing line segment between the new three breaker ring substation and Hornertown Substation shall remain Line 2056.

Additional work to be required at Hathaway and Hornertown substations.

Site plan (Attachment 2) was developed by the ITO during PJM's generation queue process. The single line is shown in Attachment 1.

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

Work Description	Direct		Indirect		Total Cost
	Labor	Material	Labor	Material	
Attachment	\$412,480	\$242,867	\$68,810	\$27,746	\$751,903
Total Attachment Facilities Cost	\$412,480	\$242,867	\$68,810	\$27,746	\$751,903
Generator Interconnect (n8167.2)	\$3,408,635	\$3,041,119	\$522,731	\$364,324	\$7,336,809
Transmission Line (n8167.1)	\$885,099	\$632,976	\$135,251	\$54,976	\$1,708,302
Total Remote Changes	\$37,812	\$17,354	\$8,718	\$2,667	\$66,551
Total Network Upgrades	\$4,331,546	\$3,691,449	\$666,700	\$421,967	\$9,111,662
Total Project Costs	\$4,744,026	\$3,934,316	\$735,510	\$449,713	\$9,863,565

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

Facilities are estimated to take 18-26 months from ISA execution and is based on the ability to obtain outages to construct and test the proposed facilities.

Proposed Schedule

- Detailed design: 6-8 months
- Permitting: 8-12 months (timeline runs concurrent with design)
- Construction: 12-18 months

ITO requires the site to be fully graded and permitted site so they can start construction by July 2025.

B. Transmission Owner Facilities Study Results

1. Attachment Facilities

The Attachment Facilities include the portion of the interconnecting switching station which is associated solely with the single feed to the generating facilities collector station. The equipment associated with the Attachment Facilities include the metering accuracy CCVT's, metering accuracy CT's, disconnect switch, conductors and connectors.

Purchase and install substation material:

1. One (1), 230kV, 3000A, 3-phase center break gang operated switch
2. Three (3), 230kV, Metering accuracy CCVT's
3. Three (3), 230kV, 500:5 Metering accuracy CT's
4. Conductor, connectors, conduits, control cables, foundations, steel structures and grounding material as per engineering standards

Purchase and install relay material:

1. One (1), 1109 – 28" Dual SEL-587Z transmission bus panel
2. One (1), 4200 – Bus differential C.T. make-up (M.U.) box
3. One (1), 1425 – 28" Dual SEL-735 transmission & generator interconnect metering panel
4. One (1), 4524 – Revenue metering C.T. make-up (M.U.) box
5. One (1), 4506 – CCVT potential make-up (M.U.) box
6. One (1), 1323 – 28" SEL-487E/735 PMU & PQ monitoring panel
7. Two (2), 4541 - Control cable make-up (M.U.) box
8. Two (2), 4528A – Generation fiber make-up (M.U.) box

2. Transmission Line – Upgrades

PJM Network Upgrade #n8167.1 - Re-arrange line #2056 to loop into and out of the new three breaker AD1-056/AD1-057 230 kV switching station

This existing 230kV transmission line was originally built in the 1960s. This corridor is comprised primarily of single circuit H-Frame wood structures. There is an End-of-Life project to wreck and rebuild the line in its entirety under project number 99-2901. This project is anticipated to be completed by the end of 2025. This estimate assumes that project AD1-056/AD1-057 will be executed prior to rebuild project 99-2901.

This project will serve to build a new substation under the existing 2056 line, replacing existing wood pole H-Frame structure 214 with a new 230kV backbone offset approximately 50' from the existing alignment. This proposed station will split the 2056 line into two separate lines, the 2056 from Hornertown to the new AD1-056/AD1-057 station, and the 2XXX line from the new station to Hathaway.

The transmission work will include installation of:

- Two (2) 70' single circuit DDE engineered steel H-Frame structures with foundations
- One (1) 75' single circuit 230kV heavy duty steel backbone structure with foundations
- Two (2) 75' static poles with foundations

The project work summary is described below:

Estimated Permanent Facilities to be Installed:

1. Install two (2) 70' single circuit DDE weathering steel engineered H-Frame structures with foundations (Structures 2056/213 and 2XXX/215). See note 7 under miscellaneous notes.
2. Install one (1) 75' single circuit DDE standard heavy duty galvanized steel backbone structure with foundations (Structure 2056/214 & 2XXX/214).
3. Install two (2) 75' standard galvanized steel static poles with foundations (Structures 2056/214A and 2XXX/214A).
4. Transfer the existing 1033.5 ACSR conductor to proposed DDE H-Frame structures 2056/213 and 2XXX/215.
5. Install two (2) spans of 3-Phase 2-768.2 ACSS/TW/HS "Maumee" between new DDE H-frames (2056/213 and 2XXX/215) and the new Backbone (2056/214 & 2XXX/214), approximately 0.21 miles.
6. Install four (4) spans of (1) new DNO-10585 static wire from new Backbone (2056/214 & 2XXX/214) to existing structure 2056/218 (to be renumbered as 2XXX/218), approx. 0.47 miles.
7. Install three (3) spans of new 7#7 Alumoweld static wire inside of the proposed AD1-056/AD1-057 Substation between structures 2056/214, 2056/214A, and 2XXX/214A.
8. Install one (1) span of new 7#7 Alumoweld static wire from proposed DDE H-Frame (2056/213) to new Backbone (2056/214 & 2XXX/214), approximately 0.12 miles.

Estimated Permanent Facilities to be Removed:

1. Remove two (2) spans of 1033.5 ACSR conductor between structures 2056/213 and 2XXX/215, approximately 0.21 miles.
2. Remove three (3) existing single circuit suspension H-frame wood structures, existing structures 2056/213, 2056/214, & 2056/215.
3. Remove five (5) spans of (1) existing 3#6 Alumoweld static wire between structures 2056/213 and 2056/218, approximately 0.59 miles.

Miscellaneous Notes:

1. The new DNO-10585 static wire will be tied with the existing OPGW at an existing splice at structure 2056/218 and will replace the 3#6 Alumoweld between structures 2056/218 and 2056/214. See note 8 below for more details regarding this scope.
2. There will be a new splice at the termination of the new DNO-10585 OPGW at the new backbone, structure 2056/214 (2XXX/214).
3. Line switches, switch structures and wave traps have not been included in the transmission scope of this work but can be added should they be deemed necessary by Dominion SOC.
4. The existing OPGW on the west side of the structures on the existing 2056 line is not to be cut. Due to the three proposed dead-end structures and the 50' horizontal offset to proposed backbone structure 2056/214 (2XXX/214), it will be necessary to feed more wire into the span from the existing coil located on structure 2056/218.
5. Rev 1 of this estimate has utilized LIDAR flown in April of 2021. This is the same LIDAR data that is being utilized for EOL rebuild project 99-2901.
6. The 2056 line will be split at the new substation. The portion of the line between structure 215 and Hornertown Sub will be renumbered as the 2XXX circuit.
7. New DDE H-Frames 2056/213 and 2XXX/215 shall be designed using ahead/back conductor and OPGW tensions from rebuild project 99-2901. The line will be rebuilt

- using 2-768.2 ACSS/TW/HS conductor and dual DNO-11410 fiber. Both structures shall be designed for construction dead-end loading.
8. As an alternative to running DNO-10585 back to structure 2056/218, a single span of DNO-11410 can be run from the backbone to adjacent structure 81/147 (1024/23). This can only be done if projects 992739, 992741, 992742, & 992899 have been completed and there is fiber connectivity between Hornertown and Hathaway Substations.
 - a. OPGW cannot be used for system protection relays until there is fiber connectivity between Hornertown and Hathaway Substations.
 9. If Line 2056 is rebuilt under project 99-2901 prior to the AD1-056/AD1-057 substation being built, the scope of this project will change as follows (not included in this cost estimate):
 - a. New DNO-10585 will no longer be needed between 2056/218 and 2056/214 (Proposed Backbone).
 - b. Cut and transfer 2-768.2 ACSS/TW/HS conductor (installed under project 99-2901) to the proposed DDE H-Frames.
 - c. Pull new 2-768.2 ACSS/TW/HS conductor between the new DDE H-Frames and the proposed backbone.
 - d. Cut and transfer dual DNO-11410 fiber (installed under project 99-2901) to the new DDE H-Frames. Coil and splice fiber at both H-Frames.
 - e. Pull new dual DNO-11410 between new H-Frames and new Backbone. Coil and splice fiber at the backbone.
 - f. Remove three (3) single circuit suspension H-frame DOM Pole structures, 2056/213, 2056/214, & 2056/215 (installed under project 99-2901).

3. New Substation/Switchyard Facilities

PJM Network Upgrade #n8167.2 - Build a three breaker AD1-056/AD1-057 230 kV switching station.

Project AD1-056/AD1-057 provides for the initial construction of a new 230kV three breaker ring substation at transmission structure 2056/214.

The objective of this project is to build a 230kV, 3-breaker ring bus to support the new 94MW solar farm built by Sweetleaf Solar, LLC. The site is located along Dominion Energy's existing 230kV, 2056 Line from Hathaway Substation to Hornertown Substation. The cut line will consume two of the positions in the ring bus. The third position will be for the 230kV feed from Sweetleaf Solar, LLC Collector Station for the new 94MW Solar Farm.

The new 230kV three breaker ring substation will share a common footprint and fence line with Sweetleaf Solar, LLC Collector Station. The demarcation point between the two stations will be the 230kV breaker disconnect switch 4-hole pad in the Sweetleaf Solar, LLC Collector Station by the common fence. Dominion Energy will bring its bus to the demarcation point. The bus, structures, disconnect switch, metering accuracy CCVT's, metering accuracy CT's, protection and metering equipment will be Attachment Facilities. The grounding systems for each station will be tied together. All substation permitting, site preparation and grading activity will be

performed by Sweetleaf Solar, LLC. Sweetleaf Solar, LLC is also responsible for maintaining accessibility to the adjacent gas pipeline facilities that are adjacent to the project site.

The existing line segment between the new three breaker ring substation and Hathaway substation will be renumbered. The existing line segment between the new three breaker ring substation and Hornertown substation shall remain Line 2056.

Additional work to be required at Hathaway and Hornertown substations.

Security and Fence Type – Design Level 4.

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

The work required is as follows:

Purchase and install substation material – Direct Network Upgrade:

1. Approximately 325' x 291' site preparation and grading as required for installation of the switching station (by the developer).
2. Approximately 1,232 linear FT of 5/8" chain link, 12 ft tall, perimeter fence around the station along with the security cameras and integrators as per Design 4 fence standards.
3. Three (3), 230 kV, 3000A, 50kAIC, SF-6 circuit breakers.
4. Six (6), 230 kV, 3000A, 3-phase center break gang operated switches.
5. Six (6), 230kV, Relay accuracy CCVTs.
6. Nine (9), 180 kV, 144 kV MCOV surge arresters.
7. Two (2), 230 kV, 3000 A wave traps (frequency TBD during detail design).
8. Two (2), Line tuners.
9. Two (2), 230kV, 3000A, 2-phase switches (for PVT's).
10. Two (2), 230kV, 100KVA power PT's for station service.
11. One (1), 24' x 40' control enclosure.
12. One (1), 125 VDC, 400 Ah station battery and 75-amp charger (size to be verified during detail engineering).
13. Approximately 170 feet of cable trough, with a 20 foot road crossing section.
14. Station stone as required.
15. Station lighting as required.
16. Steel structures as required including switch stands, bus supports, station service transformers, CCVT and wave trap supports.
17. Foundations as required including control house, equipment, and bus support stands.
18. Conductors, connectors, conduits, control cables, cable trough, and grounding materials as per engineering standards.

Purchase and install relay material – Direct Network Upgrade:

1. Three (3), 1510 – 28" Dual SEL-351-7 transmission breaker with reclosing panel

2. Three (3), 4510 – SEL-2411 breaker annunciator
3. Two (2), 1340 – 28” Dual SEL-411L DCB line panel
4. Two (2), 4506 – 3 Phase CCVT potential make-up (M.U.) box
5. One (1), 1603 – 28” SEL-451 islanding control scheme panel
6. Two (2), 4000 – Station service potential make-up (M.U.) box
7. Two (2), 4018 – 500A station service AC distribution panel
8. Two (2), 4007 – 225A outdoor transmission yard AC NQOD
9. Two (2), 4019 – 225A three phase throw over switch
10. Two (2), 4016 – 600A PVT disconnect switch
11. One (1), 4153 – Wall mount station battery monitor
12. One (1), 5618 - SEL-3555 communications panel
13. One (1), 1255 – Station annunciator panel
14. One (1), 5021 – SEL-2411 RTU panel
15. One (1), 5609 – Fiber optic management panel
16. Three (3), 4526_A – Circuit breaker fiber optic make-up (M.U.) box
17. One (1), 5202 – 26” APP 601 digital fault recorder
18. One (1), 5603 – Station network panel No. 1
19. One (1), 5603 – Station network panel No. 2
20. One (1), 4523 – Security camera interface box
21. One (1), 5616 – Station security panel
22. One (1), High voltage protection (HVP) box (Provided by IT)
23. One (1), Telephone interface box
24. One (1), 5616 - Security fence panel
25. Two (2), 4018 – 225A station service AC distribution panel branch breaker

4. Upgrades to Substation / Switchyard Facilities

PJM Network Upgrade #n8167.3 - Remote protection and communication work.

Additional work to be required at Hathaway and Hornertown 230 kV Substations.

Hathaway 230 kV Substation

Project AD1-056/AD1-057 provides for the drawing work, relay resets, and field support necessary to change the Line 2056 destination at Hathaway Substation from Hornertown to AD1-056/AD1-057 generator interconnect. The line number may or may not be changed. Consult the construction one line.

The existing islanding transfer trip signal to Hornertown will now pass through AD1-056/AD1-057 generator interconnect to Hornertown. This project is the Non-Direct Connect for the AD1-056/AD1-057 generator interconnect project.

Purchase and install relay material:

1. No Relay Material

Hornertown 230 kV Substation

Project AD1-056/AD1-057 provides for the drawing work, relay resets, and field support necessary to change the Line 2056 destination at Hornertown Substation from Hathaway to AD1-056/AD1-057 generator interconnect. The line number may or may not be changed. Consult the construction one line.

Replace the Line 2056 islanding transfer trip receiver with a UPLC II Transceiver in order to continue receiving islanding transfer trip from Hathaway (via AD1-056/AD1-057) and to send islanding transfer trip to AD1-056/AD1-057. The existing islanding transfer trip signal from Lakeview will now pass through Hornertown to AD1-056/AD1-057 generator interconnect.

This project is the Non-Direct Connect for the AD1-056/AD1-057 generator interconnect project.

Purchase and install relay material:

1. One (1), UPLC II transfer trip transceiver

Work Description	Direct		Indirect		Total Cost
	Labor	Material	Labor	Material	
Hathaway 230kV (n8167.3)	\$13,829	\$0	\$3,259	\$0	\$17,088
Hornertown 230kV (n8167.3)	\$23,983	\$17,354	\$5,459	\$2,667	\$49,463
Total Remote Relay Upgrades	\$37,812	\$17,354	\$8,718	\$2,667	\$66,551

5. Metering & Communications

PJM Requirements

The IC will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 8 of Attachment O Appendix 2.

ITO Requirements

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

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

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

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

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

6. Environmental, Real Estate and Permitting Issues

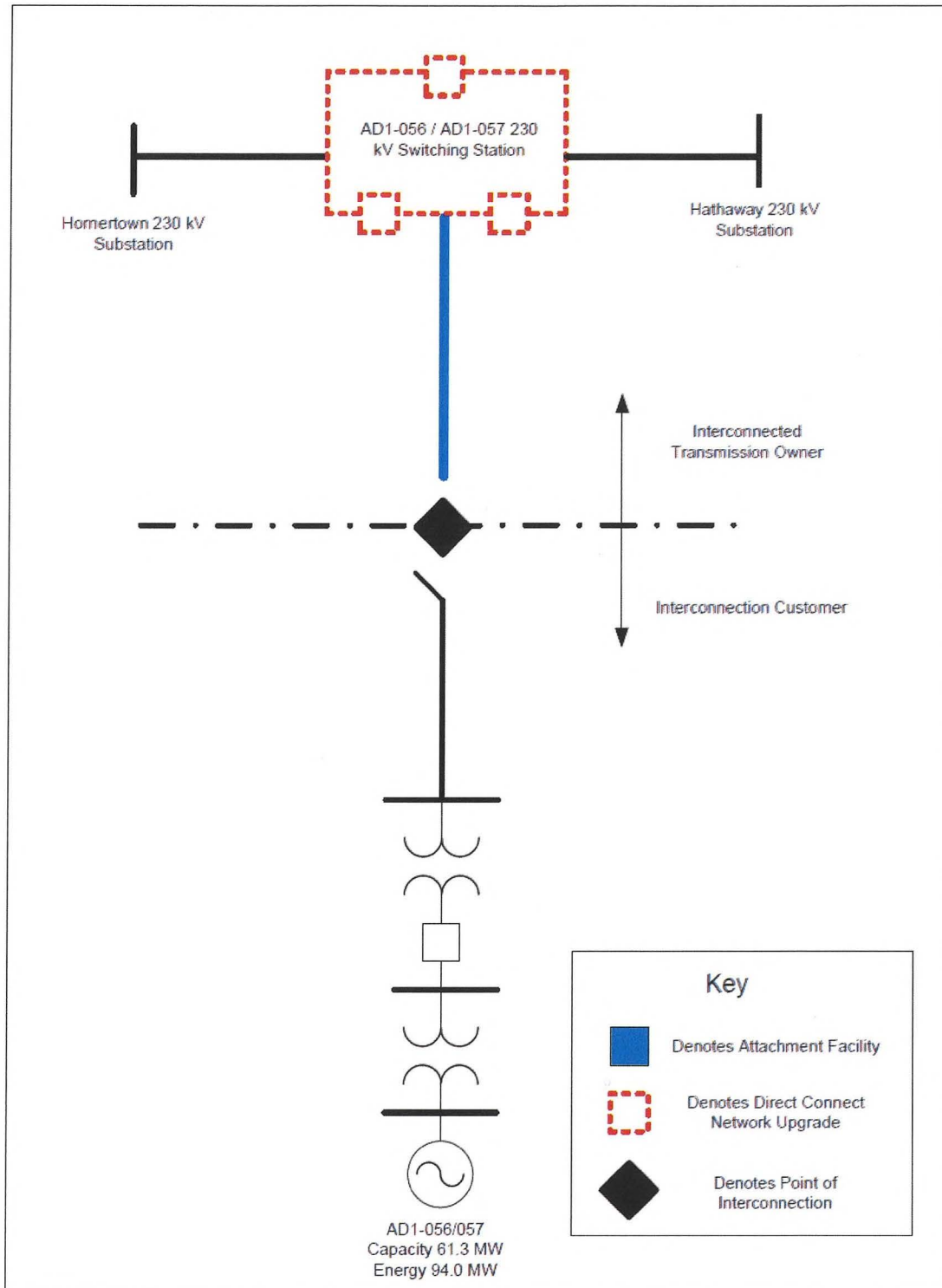
The IC would be responsible for the following expectations in the area of Environmental, Real Estate and Permitting:

- Suitable Access Road from Substation to a North Carolina State Maintained Roadway.
- Any additional land needed for Storm Water Management, Landscaping, and Wetlands/Wetlands Mitigation.
- Conditional Use Permit for Substation.
- Any other Land/Permitting requirements required by the Substation.

ITO Real Estate Needs:

- The substation layout is complete and ITO requires a 325' x 291' piece of property (title in fee) to build the substation. The property includes the piece of property between the substation and collector station for the strain bus.
 - ITO requires ownership transfer of the substation site before they start construction. Target for the deed by July 2025.
 - The size of the station assumes ITO will not need a separate storm water management system for the substation. If the county rules differently than the ITO will need to revisit the land requirements.
- ITO will need a letter similar to the zoning letter from the county stating that if the solar farm is retired and / or decommissioned the substation will remain.

*Attachment 1.
Single Line*



Attachment 2.
AD1-056/AD1-057 Switching Station General Arrangement

