



**Generation Interconnection
System Impact Study Report
for
Queue Project AG1-483
DICKERSON 230 KV
542.5 MW Capacity / 542.5 MW Energy**

August 2021

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1 Introduction

This System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 205, as well as the System Impact Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is PEPCO.

2 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 Interconnection Customer. As a requirement for interconnection, the Interconnection Customer 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 Interconnection Customer 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 project developer 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.

The Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

An Interconnection Customer 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.

3 General

The Interconnection Customer (IC), has proposed a Solar; Storage generating facility located in Montgomery County, Maryland. The installed facilities will have a total capability of 542.5 MW with 542.5 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is June 01, 2024. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-483
Project Name	DICKERSON 230 KV
State	Maryland
County	Montgomery
Transmission Owner	PEPCO
MFO	542.5
MWE	542.5
MWC	542.5
Fuel	Solar; Storage
Basecase Study Year	2024

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

AG1-483 will interconnect with the PEPCO transmission system at the Dickerson 230 kV substation.

5 Cost Summary

The AG1-483 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$600,000
Allocation towards System Network Upgrade Costs (PJM Identified - Summer Peak)*	\$5,000,000
Allocation towards System Network Upgrade Costs (PJM Identified - Light Load)*	\$0
Allocation towards System Network Upgrade Costs (TO Identified)*	\$0
Total Costs	\$5,600,000

*As your project progresses through the study process and other projects modify their request or withdraw, then your cost allocation could change.

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Note 1: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. The allocation of costs for a network upgrade will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.

Note 2: For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates \$0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently \$0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

6 Transmission Owner Scope of Work

The total physical interconnection costs is given in the table below:

Description	Total Cost
Add the breaker, disconnect switches and associated equipment to the Dickerson Substation	\$600,000
Total Physical Interconnection Costs	\$600,000

7 Schedule

The estimated schedule to complete the outline scope of work is 12-24 months from the execution of an Interconnection Construction Service Agreement.

The schedule for any required Network Impact Reinforcements will be more clearly identified in future study phases. The estimated time to complete each of the required reinforcements is identified in the "System Reinforcements" section of the report.

8 Transmission Owner Analysis

None

9 Interconnection Customer Requirements

None

10 Revenue Metering and SCADA Requirements

10.1 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 Section 8 of Attachment O.

10.2 Meteorological Data Reporting Requirements

None

10.3 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

<http://www.pjm.com/planning/design-engineering/to-tech-standards/>

11 Summer Peak Analysis

The Queue Project AG1-483 was evaluated as a 0 MW (Capacity 0 MW) injection (520.9 MW Load) at the Dickerson 230 kV substation in the PEPCO area, since the project is claiming CIRs from the deactivated Dickerson Units 1, 2 and 3. Project AG1-483 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-483 was studied with a commercial probability of 100.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None

11.2 Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC/D C	MW IMPACT
16542729 1	22393 8	DICKH23 0	230. 0	PEPC O	22393 7	DIC K 230	230. 0	PEPC O	2	PP7	bus	680.0	94.47	152.73	AC	398.86
17411145 2	22393 8	DICKH23 0	230. 0	PEPC O	22393 7	DIC K 230	230. 0	PEPC O	2	PEPCO_P4_PP1 6	breaker	680.0	94.48	152.74	AC	398.86

11.3 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)

None

11.4 Steady-State Voltage Requirements

None

11.5 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 developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC/D C	MW IMPAC T
167745679	223938	DICKH230	230.0	PEPCO	223937	DICK230	230.0	PEPCO	2	PEPCO_P1_P1	operation	680.0	101.64	141.04	AC	267.35
167745682	223938	DICKH230	230.0	PEPCO	223937	DICK230	230.0	PEPCO	1	PEPCO_P1_P2	operation	680.0	101.64	141.04	AC	267.35
168550189	313859	6BELMONT	230.0	DVP	314072	6PLVIEW	230.0	DVP	1	DVP_P1-2: LN558	operation	1223.9	84.59	92.98	AC	105.08

11.6 System Reinforcements

ID	Idx	Facility	Upgrade Description	Cost	Cost Allocated to AG1-483	Upgrade Number								
165427291,174 111452	1	DICKH230 230.0 kV - DICK 230 230.0 kV Ckt 2	Project ID: PEPCO_Upgrade_AG1_001 (n7504) Description: Reconductor (bundle) circuit 23103 from Dickerson to Station H. This would raise the thermal rating to approximately 1200 MVA. To achieve this rating the 2 breakers and 4 disconnect switches connected to this circuit would also have to be upgraded along with any other associated terminal equipment Type: FAC Total Cost: \$5,000,000 Time Estimate: 36 Months Ratings: 1100/1186/1200 MVA Notes: AG1-483 is the driver and is fully cost allocated for the upgrades. <table><tr><td>Queue</td><td>MW</td><td>Cost %</td><td>Cost \$</td></tr><tr><td>AG1-483</td><td>398.86</td><td>100</td><td>\$5,000,000</td></tr></table>	Queue	MW	Cost %	Cost \$	AG1-483	398.86	100	\$5,000,000	\$5,000,000	\$5,000,000	N7504
Queue	MW	Cost %	Cost \$											
AG1-483	398.86	100	\$5,000,000											
			TOTAL COST	\$5,000,000	\$5,000,000									

Note: For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates \$0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently \$0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

11.7 Flow Gate Details

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details 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 indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. 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 are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

11.7.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
174111452	223938	DICKH230	PEPCO	223937	DICK 230	PEPCO	2	PEPCO_P4_PP16	breaker	680.0	94.48	152.74	AC	398.86

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
223967	METZ E69	-1.73	Adder	-2.04
224054	DICKHCT1	5.23	50 50	5.23
224055	DICKHCT2	5.23	50 50	5.23
224056	MCTRSH1G	1.85	50 50	1.85
224244	NIH23MW	-4.22	Adder	-4.96
226704	AOCX4-046 E	-0.9	Adder	-1.06
226895	WOAKV2-037 E	-0.32	Adder	-0.38
226896	D-009	-0.56	Adder	-0.66
901952	W1-116E	0.59	Adder	0.69
918902	AA1-109 E	0.3	Adder	0.35
923202	AB1-124 C	0.54	Adder	0.64
923203	AB1-124 E	0.88	Adder	1.04
923212	AB1-125 C OP	0.41	Adder	0.48
923213	AB1-125 E OP	0.66	Adder	0.78
924771	AB2-129 C OP (Suspended)	3.65	50 50	3.65
924772	AB2-129 E OP (Suspended)	5.96	50 50	5.96
930522	AB1-096 E	0.43	Adder	0.51
958631	AF2-154	1.08	50 50	1.08
966143	AG1-483 BAT	398.86	50 50	398.86
LTFEXP_AA2-074	LTFEXP_AA2-074->LTFIMP_AA2-074	0.319	Confirmed LTF	0.319
LTFEXP_CBM-S1	LTFEXP_CBM-S1->LTFIMP_CBM-S1	0.3382	LTF/CBM	0.3382
LTFEXP_CBM-S2	LTFEXP_CBM-S2->LTFIMP_CBM-S2	7.9694	LTF/CBM	7.9694
LTFEXP_CBM-W1	LTFEXP_CBM-W1->LTFIMP_CBM-W1	13.1037	LTF/CBM	13.1037
LTFEXP_CBM-W2	LTFEXP_CBM-W2->LTFIMP_CBM-W2	8.0761	LTF/CBM	8.0761
LTFEXP_CPLE	LTFEXP_CPLE->LTFIMP_CPLE	0.478	Confirmed LTF	0.478
LTFEXP_G-007	LTFEXP_G-007->LTFIMP_G-007	1.4115	LTF/CMTX NF	1.4115
LTFEXP_LAGN	LTFEXP_LAGN->LTFIMP_LAGN	1.542	Confirmed LTF	1.542
LTFEXP_LGEE	LTFEXP_LGEE->LTFIMP_LGEE	0.5879	Confirmed LTF	0.5879
LTFEXP_MEC	LTFEXP_MEC->LTFIMP_MEC	1.4681	Confirmed LTF	1.4681
LTFEXP_NY	LTFEXP_NY->LTFIMP_NY	0.4639	Confirmed LTF	0.4639

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
LTFEXP_O-066	LTFEXP_O-066->LTFIMP_O-066	8.785	LTF/CMTX NF	8.785
LTFEXP_SIGE	LTFEXP_SIGE->LTFIMP_SIGE	0.0977	Confirmed LTF	0.0977
LTFEXP_TVA	LTFEXP_TVA->LTFIMP_TVA	1.2319	Confirmed LTF	1.2319
LTFEXP_WEC	LTFEXP_WEC->LTFIMP_WEC	0.2948	Confirmed LTF	0.2948

11.8 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AA1-109	Cotoctin-Troutville Junction 34.5kV	In Service
AA2-074	CPL-PJM	Confirmed
AB1-096	Carroll-Mt. Airy 34.5kV	Engineering and Procurement
AB1-124	Carroll-Monocacy 34.5kV	Engineering and Procurement
AB1-125	Carroll-Monocacy 34.5kV	Engineering and Procurement
AB2-129	Doubs 230kV	Suspended
AE2-019	New Road 230 kV	Active
AF1-066	New Road 230 kV	Active
AF2-154	Dickerson H2 CT 230 kV	Active
AG1-143	Gainesville-Loudoun 230 kV	Active
AG1-221	Poland Rd-Runway DP 230 kV	Active
AG1-483	Dickerson 230 kV	Active
AG1-534	Evergreen Mills 230 kV	Active
V2-037	White Oak	In Service
W1-116	Emmitsburg 34kV	In Service
X4-039	Pleasant View-Brambleton 230kV	In Service
X4-046	E Street (Sub 18) 13kV	In Service

11.9 Contingency Descriptions

Contingency Name	Contingency Definition
DVP_P1-2: LN 558	CONTINGENCY 'DVP_P1-2: LN 558' OPEN BRANCH FROM BUS 314933 TO BUS 314939 CKT 1 /* 8BRAMBLETON 500.00 - 8GOOSE CREEK500.00 /* SET PRECONTRATING 3533 BRANCH FROM BUS 314930 TO BUS 314933 CKT 2/* RATE A OF LN 546 IS DE-RATED! /* SET POSTCONTRATING 3811 BRANCH FROM BUS 314930 TO BUS 314933 CKT 2/* RATE B OF LN 546 IS DE-RATED! END
PP7	CONTINGENCY 'PP7' /* DICKERSON DISCONNECT BRANCH FROM BUS 223937 TO BUS 314290 CKT 1 /* DICKERSN 8EDFERRY 230 230 DISCONNECT BRANCH FROM BUS 223937 TO BUS 223938 CKT 1 /* DICKERSN STATIONH 230 230 END
DVP_P4-2: 227T2180	CONTINGENCY 'DVP_P4-2: 227T2180' /* BELMONT 230 KV OPEN BRANCH FROM BUS 313859 TO BUS 314170 CKT 1 /* 6BELMONT 230.00 - 6COHMIL 230.00 OPEN BRANCH FROM BUS 314006 TO BUS 314010 CKT 1 /* 6ASHBURA 230.00 - 6BEAMEAD 230.00 OPEN BRANCH FROM BUS 314006 TO BUS 314170 CKT 1 /* 6ASHBURA 230.00 - 6COHMIL 230.00 OPEN BUS 314006 /* ISLAND: 6ASHBURA 230.00 OPEN BUS 314170 /* ISLAND: 6COHMIL 230.00 OPEN BRANCH FROM BUS 313859 TO BUS 314072 CKT 1 /* 6BELMONT 230.00 - 6PL VIEW 230.00 END
PEPCO_P1_PP1	CONTINGENCY 'PEPCO_P1_PP1' OPEN BRANCH FROM BUS 223937 TO BUS 223938 CKT 1 / 223937 DICK 230 230 223938 DICKH230 230 1 END
PEPCO_P1_PP2	CONTINGENCY 'PEPCO_P1_PP2' OPEN BRANCH FROM BUS 223937 TO BUS 223938 CKT 2 / 223937 DICK 230 230 223938 DICKH230 230 2 END
PEPCO_P4_PP16	CONTINGENCY 'PEPCO_P4_PP16' /*DICKERSON BREAKER 23104 DISCONNECT BRANCH FROM BUS 223937 TO BUS 314290 CKT 1 /*DICKERSN 8EDFERRY 230230 DISCONNECT BRANCH FROM BUS 223937 TO BUS 223938 CKT 1 /*DICKERSN STATIONH 230230 END

12 Light Load Analysis

The Queue Project AG1-483 was evaluated as a 0MW injection (520.9 MW Load as Withdrawal) at the Dickerson 230 kV substation in the PEPCO area. Project AG1-483 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-483 was studied with a commercial probability of 100.0 %. Potential network impacts were as follows:

12.1 Light Load Deliverability

(Single or N-1 contingencies)

None

12.2 Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies)

None

12.3 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)

None

12.4 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 developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

None

12.5 System Reinforcements

None

12.6 Flow Gate Details

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details 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 indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. 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 are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

None

12.7 Contingency Descriptions

None

13 Short Circuit Analysis

The following Breakers are overdutied:

None

13.1 System Reinforcements - Short Circuit

None

14 Stability and Reactive Power

To be determined in the Facilities Study Phase.

15 Affected Systems

None

16 Attachment 1: One Line Diagram

Dickerson "D" 230kV AG1-483 INTERCONNECTION

