Generation Interconnection

System Impact Study Report

for

Queue Project AG1-110

SILVER LAKE 69 KV

20 MW Capacity / 0 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 AEC.

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.

3 General

The Interconnection Customer (IC) has proposed an uprate to a planned Storage generating facility located in Camden, New Jersey. This project is an increase to the Interconnection Customer's AE1-062 and AF1-160 projects project, which will share the same point of interconnection. The AG1-110 queue position is a 0 MW uprate (20 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 40 MW with 40 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is November 01, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-110
Project Name	SILVER LAKE 69 KV
State	New Jersey
County	Camden
Transmission Owner	AEC
MFO	40
MWE	0
MWC	20
Fuel	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

AG1-110 will interconnect with the AEC on transmission system as an uprate to AE1-062 & AF1-160 at the 69 kV Silver Lake Substation.

5 Cost Summary

The AG1-110 project will be responsible for the following costs:

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

*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

No additional scope of work is required for the AG1-110 project. Please refer to the AE1-062 report.

7 Schedule

Please refer to the AE1-062 report for TO schedule.

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

Please refer to the AE1-062 report for customer requirements.

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 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 AG1-110 was evaluated as a 20 MW (Capacity 20 MW) injection as an uprate to AE1-062 & AF1-160 at the 69 kV Silver Lake Substation in the AEC area. Project AG1-110 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-110 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)

None

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

To be determined

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
182739453	214277	RICHMOND 35	230.0	PECO	214012	WANEETA3	230.0	PECO	1	PJM500_PS_P1-2_5015	operation	1180.0	99.22	100.61	AC	4.82

11.6 System Reinforcements

None

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".

None

11.8 Queue Dependencies

None

11.9 Contingency Descriptions

None

12 Light Load Analysis

The Queue Project AG1-110 was evaluated as a 20.0 MW injection/withdrawal as an uprate to AE1-062 & AF1-160 at the 69 kV Silver Lake Substation in the AEC area. Project AG1-110 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-110 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)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
178551048	214206	RICHRE29	230.0	PECO	214274	RICHMOND 29	230.0	PECO	1	PJM500_PS_P1-2_5015	single	1344.0	99.98	100.35	DC	4.95
178551041	219125	CAMDEN	230.0	PSE&G	214206	RICHRE29	230.0	PECO	1	PJM500_PS_P1-2_5015	single	1344.0	99.98	100.35	DC	4.95

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

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.

12.5 System Reinforcements

ID	Idx	Facility	Upgrade Description	Cost	Cost Allocated to AG1-110	Upgrade Number
178551041	2	**CAMDEN 230.0 kV - RICHRE29 230.0 kV Ckt 1**	**PECO Reinforcement:** **Project ID: pe002 (n6471)** **Description: Replace 1 piece of station cable in Richmond substation on Richmond-Camden tie line** **Type: FAC** **Total Cost: $45,000** **Time Estimate: 24 Months** **Ratings: 1181/1354/1586 MVA** **Notes: Per PJM Cost Allocation Rules, this reinforcement cost is driven by previous AE2 queue. This may change with future re-tools as projects withdraw.** **PSEG Reinforcement:** **Not a violation for PSEG portion.**	$45,000	$0	N6471
178551048	1	**RICHRE29 230.0 kV - RICHMOND29 230.0 kV Ckt 1**				
			TOTAL COST	**$45,000**	$0	

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.

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".

12.6.1 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
178551048	214206	RICHRE29	PECO	214274	RICHMOND29	PECO	1	PJM500_PS_P1-2_5015	single	1344.0	99.98	100.35	DC	4.95

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
99211	G07 REV_FTWR	0.2694	80/20	0.2694
919662	AA2-048 E	0.7706	80/20	0.7706
937563	AD2-077 BAT	11.2000	80/20	11.2000
938421	AE1-061 C	0.6745	80/20	0.6745
938422	AE1-061 E	0.6745	80/20	0.6745
938431	AE1-062 C	2.4728	80/20	2.4728
938781	AE1-104 C O1	24.4095	80/20	24.4095
938782	AE1-104 E O1	62.4421	80/20	62.4421
938871	AE1-115 C	2.6395	80/20	2.6395
938872	AE1-115 E	2.6395	80/20	2.6395
939301	AE1-161 C	5.0602	80/20	5.0602
939302	AE1-161 E	7.5903	80/20	7.5903
940161	AE2-000 C O1	24.8690	80/20	24.8690
940162	AE2-000 E O1	63.6311	80/20	63.6311
940361	AE2-020 C	17.8904	80/20	17.8904
940362	AE2-020 E	83.7643	80/20	83.7643
940371	AE2-021 C	17.8904	80/20	17.8904
940372	AE2-021 E	83.7643	80/20	83.7643
940381	AE2-022 C	10.4361	80/20	10.4361
940382	AE2-022 E	48.8625	80/20	48.8625
940401	AE2-024 C O1	13.5944	80/20	13.5944
940402	AE2-024 E O1	63.6476	80/20	63.6476
940411	AE2-025 C	6.8625	80/20	6.8625
940412	AE2-025 E	32.1264	80/20	32.1264
942101	AE2-222 C	14.5225	80/20	14.5225
942102	AE2-222 E	37.1591	80/20	37.1591
942381	AE2-251 C	56.6766	80/20	56.6766
942382	AE2-251 E	145.0194	80/20	145.0194
943561	AF1-027	0.2930	80/20	0.2930
944331	AF1-101 C O1	24.3809	80/20	24.3809
944332	AF1-101 E O1	62.3839	80/20	62.3839
944951	AF1-160 C	2.4728	80/20	2.4728
945431	AF1-208 C O1	0.0003	80/20	0.0003
945432	AF1-208 E O1	2.5098	80/20	2.5098
945571	AF1-222 C	10.7746	80/20	10.7746
945572	AF1-222 E	28.4057	80/20	28.4057
945721	AF1-237 C	8.0208	80/20	8.0208
945722	AF1-237 E	12.0312	80/20	12.0312
945731	AF1-238 C O1	11.9957	80/20	11.9957
945732	AF1-238 E O1	17.9936	80/20	17.9936
945741	AF1-239 C	2.8225	80/20	2.8225
945742	AF1-239 E	4.2338	80/20	4.2338
957221	AF2-016 C	25.9908	80/20	25.9908
957222	AF2-016 E	38.9862	80/20	38.9862

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
957251	AF2-019 C	1.7667	80/20	1.7667
957252	AF2-019 E	2.6501	80/20	2.6501
957261	AF2-020 C	1.9613	80/20	1.9613
957262	AF2-020 E	2.9419	80/20	2.9419
957271	AF2-021 C	1.3007	80/20	1.3007
957272	AF2-021 E	1.9511	80/20	1.9511
957291	AF2-023 C	4.4880	80/20	4.4880
957292	AF2-023 E	6.7320	80/20	6.7320
957301	AF2-024 C	2.8345	80/20	2.8345
957302	AF2-024 E	4.2517	80/20	4.2517
957311	AF2-025 C	1.7227	80/20	1.7227
957312	AF2-025 E	2.5841	80/20	2.5841
957443	**AF2-038 BAT (Withdrawn : 04/20/2021)**	**1.6824**	**80/20**	**1.6824**
957771	AF2-071	8.7300	80/20	8.7300
957781	AF2-072 C	2.7368	80/20	2.7368
957782	AF2-072 E	2.7368	80/20	2.7368
961221	AF2-413	16.8400	80/20	16.8400
962392	AG1-088 E	3.5655	80/20	3.5655
962542	AG1-103 E	3.8847	80/20	3.8847
962591	AG1-108	2.7368	80/20	2.7368
962611	AG1-110	4.9456	80/20	4.9456
962662	AG1-115 BAT	5.6000	80/20	5.6000
962672	AG1-116 E	4.7534	80/20	4.7534
962682	AG1-117 E	12.6925	80/20	12.6925
962811	AG1-130 C	0.3820	80/20	0.3820
962812	AG1-130 E	0.5729	80/20	0.5729
964002	AG1-254 E	5.0135	80/20	5.0135
964012	AG1-255 E	7.1522	80/20	7.1522
964081	AG1-263 C	3.2084	80/20	3.2084
964082	AG1-263 E	4.8126	80/20	4.8126

12.6.2 Index 2

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
178551041	219125	CAMDEN	PSE&G	214206	RICHRE29	PECO	1	PJM500_PS_P1-2_5015	single	1344.0	99.98	100.35	DC	4.95

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
99211	G07 REV_FTWR	0.2694	80/20	0.2694
919662	AA2-048 E	0.7706	80/20	0.7706
937563	AD2-077 BAT	11.2000	80/20	11.2000
938421	AE1-061 C	0.6745	80/20	0.6745
938422	AE1-061 E	0.6745	80/20	0.6745
938431	AE1-062 C	2.4728	80/20	2.4728
938781	AE1-104 C O1	24.4095	80/20	24.4095
938782	AE1-104 E O1	62.4421	80/20	62.4421
938871	AE1-115 C	2.6395	80/20	2.6395
938872	AE1-115 E	2.6395	80/20	2.6395
939301	AE1-161 C	5.0602	80/20	5.0602
939302	AE1-161 E	7.5903	80/20	7.5903
940161	AE2-000 C O1	24.8690	80/20	24.8690
940162	AE2-000 E O1	63.6311	80/20	63.6311
940361	AE2-020 C	17.8904	80/20	17.8904
940362	AE2-020 E	83.7643	80/20	83.7643
940371	AE2-021 C	17.8904	80/20	17.8904
940372	AE2-021 E	83.7643	80/20	83.7643
940381	AE2-022 C	10.4361	80/20	10.4361
940382	AE2-022 E	48.8625	80/20	48.8625
940401	AE2-024 C O1	13.5944	80/20	13.5944
940402	AE2-024 E O1	63.6476	80/20	63.6476
940411	AE2-025 C	6.8625	80/20	6.8625
940412	AE2-025 E	32.1264	80/20	32.1264
942101	AE2-222 C	14.5225	80/20	14.5225
942102	AE2-222 E	37.1591	80/20	37.1591
942381	AE2-251 C	56.6766	80/20	56.6766
942382	AE2-251 E	145.0194	80/20	145.0194
943561	AF1-027	0.2930	80/20	0.2930
944331	AF1-101 C O1	24.3809	80/20	24.3809
944332	AF1-101 E O1	62.3839	80/20	62.3839
944951	AF1-160 C	2.4728	80/20	2.4728
945431	AF1-208 C O1	0.0003	80/20	0.0003
945432	AF1-208 E O1	2.5098	80/20	2.5098
945571	AF1-222 C	10.7746	80/20	10.7746
945572	AF1-222 E	28.4057	80/20	28.4057
945721	AF1-237 C	8.0208	80/20	8.0208
945722	AF1-237 E	12.0312	80/20	12.0312
945731	AF1-238 C O1	11.9957	80/20	11.9957
945732	AF1-238 E O1	17.9936	80/20	17.9936
945741	AF1-239 C	2.8225	80/20	2.8225
945742	AF1-239 E	4.2338	80/20	4.2338

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
957221	AF2-016 C	25.9908	80/20	25.9908
957222	AF2-016 E	38.9862	80/20	38.9862
957251	AF2-019 C	1.7667	80/20	1.7667
957252	AF2-019 E	2.6501	80/20	2.6501
957261	AF2-020 C	1.9613	80/20	1.9613
957262	AF2-020 E	2.9419	80/20	2.9419
957271	AF2-021 C	1.3007	80/20	1.3007
957272	AF2-021 E	1.9511	80/20	1.9511
957291	AF2-023 C	4.4880	80/20	4.4880
957292	AF2-023 E	6.7320	80/20	6.7320
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957302	AF2-024 E	4.2517	80/20	4.2517
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957781	AF2-072 C	2.7368	80/20	2.7368
957782	AF2-072 E	2.7368	80/20	2.7368
961221	AF2-413	16.8400	80/20	16.8400
962392	AG1-088 E	3.5655	80/20	3.5655
962542	AG1-103 E	3.8847	80/20	3.8847
962591	AG1-108	2.7368	80/20	2.7368
962611	AG1-110	4.9456	80/20	4.9456
962662	AG1-115 BAT	5.6000	80/20	5.6000
962672	AG1-116 E	4.7534	80/20	4.7534
962682	AG1-117 E	12.6925	80/20	12.6925
962811	AG1-130 C	0.3820	80/20	0.3820
962812	AG1-130 E	0.5729	80/20	0.5729
964002	AG1-254 E	5.0135	80/20	5.0135
964012	AG1-255 E	7.1522	80/20	7.1522
964081	AG1-263 C	3.2084	80/20	3.2084
964082	AG1-263 E	4.8126	80/20	4.8126

12.7 Contingency Descriptions

Contingency Name	Contingency Definition
PJM500_PS_P1-2_5015	CONTINGENCY 'PJM500_PS_P1-2_5015' /* HOPE CREEK TO RED LION TRIP LINE FROM BUS 200027 TO BUS 200029 CKT 1 /* HOPE CREEK TO RED LION END

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