Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AB2-091

Hudson 345kV

September 2016

Preface

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

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

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The 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.

General

The Interconnection Customer (IC), has proposed a natural gas generating facility located in Middlesex, New Jersey. The installed facilities will have a total capability of 105 MW with 100 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is June 1, 2019. **This study does not imply a PSE&G commitment to this in-service date.**

Point of Interconnection

AB2-091 will interconnect with the PSE&G transmission system at one of the two following points of interconnection:

Option 1 will connect via a new breaker position at Marion 345 kV substation.

Option 2 will connect via a new breaker position at Hudson 230 kV substation

Cost Summary- Option 1

The AB2-091 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 38,200,000
Non Direct Connection Network Upgrades	$ 0
Total Costs	**$ 38,200,000**

In addition, the AB2-091 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	$ 1,439,072
Previously Identified Upgrades	$ 2,921,885
Total Costs	**$ 4,360,957**

Cost allocations for these upgrades will be provided in the System Impact Study Report.

Attachment Facilities

No Attachment Facilities are required to support this interconnection request.

Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Expand the existing Marion 345kV GIS substation building to accommodate the AB2-091 interconnection	$38,200,000
Total Direct Connection Facility Costs	**$38,200,000**

Non-Direct Connection Cost Estimate

No Non-Direct Connection Facilities are required to support this interconnection request.

Schedule

Based on the extent of the Direct Connection and system upgrades required to support the AB2-091 generation project, it is expected to take a minimum of 60 months from the date of a fully executed Interconnection Construction Service Agreement to complete the installation.

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.

Public Service Electric and Gas Requirements

The Interconnection Customer will be required to comply with all PSE&G Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Information and Requirements for Electric Service" document located at the following links:

http://www.pseg.com/business/builders/new_service/before/
http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Network Impacts

Option 1

The Queue Project AB2-091 was evaluated as a 105.0 MW (Capacity 100.0 MW) injection at the Marion 345kV substation in the PSEG area. Project AB2-091 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-091 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
L_H-2286	CONTINGENCY 'L_H-2286' /* FANWOOD TO METUCHEN DISCONNECT BUS 218355 /* NEW DOVER REMOVE H DISCONNECT BUS 218320 /* REMOVE FANWOOD SECTION 1 END
T_BRG3_230-1	CONTINGENCY 'T_BRG3_230-1' /*BERGEN 230/345 TX DISCONNECT BRANCH FROM BUS 217100 TO BUS 217960 CKT 1 /*REMOVE BERGEN 230/345 TX END

Generator Deliverability

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

Contingency					Bus				Loading %		Rating			
#	Type	Name	Affected Area	Facility Description	From	To	Circuit	Power Flow	Initial	Final	Type	MVA	MW Contribution	Ref
1	N-1	T_BRG3_230-1	PSEG	TOSCO_2-VFT 2 230 kV line	218343	218441	1	DC	98.47	100.41	ER	1081	22.07	1

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Multiple Facility Contingency

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

None.

Contribution to Previously Identified Overloads

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

Contingency			Affected		Bus			Power	Loading %		Rating		MW	
#	Type	Name	Area	Facility Description	From	To	Circuit	Flow	Initial	Final	Type	MVA	Contribution	Ref
2	N-1	L_H-2286	PSEG	LINDEN-TOSCO_3 230 kV line	218300	219046	1	DC	103.17	103.83	ER	1081	16.44	2

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Short Circuit

(Summary of impacted circuit breakers)

None.

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.

New System Reinforcements

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

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
#1	TOSCO_2-VFT 2 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: • Reconductor Tosco-VFT (S-2271) 230kV line The estimated schedule duration is 36 months.		**$ 1,439,072**
			Total New Network Upgrades	**$ 1,439,072**

Contribution to Previously Identified System Reinforcements

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

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
#2	LINDEN-TOSCO_3 230 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: • Reconductor Linden-Tosco (B-2254) 230kV line The estimated schedule duration is 36 months.		**$ 2,921,885**
			Total New Network Upgrades	**$ 2,921,885**

Network Impacts

Option 2

The Queue Project AB2-091 was evaluated as a 105.0 MW (Capacity 100.0 MW) injection at the Marion 345kV substation in the PSEG area. Project AB2-091 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-091 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Generator Deliverability

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

None.

Multiple Facility Contingency

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

None.

Contribution to Previously Identified Overloads

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

None.

Short Circuit

(Summary of impacted circuit breakers)

None.

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.

New System Reinforcements

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

None.

Contribution to Previously Identified System Reinforcements

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

None.

Attachment 1. System Configuration

Option 1

Attachment 2. System Configuration

Option 2

Attachment 3. Flowgate Details
Option 1

Appendices

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

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

Appendix 1

(PSEG - PSEG) The TOSCO_2-VFT 2 230 kV line (from bus 218343 to bus 218441 ckt 1) loads from 98.47% to 100.41% (**DC power flow**) of its emergency rating (1081 MVA) for the single line contingency outage of 'T_BRG3_230-1'. This project contributes approximately 22.07 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
217136	BAYONNE_CTG1	8.29
217183	BAYONNE_CTG2	8.29
217184	BAYONNE_CTG3	8.29
217185	BAYONNE_STG4	12.57
219030	CIR_AB2-008A	5.34
219031	CIR_AB2-008B	5.34
219032	CIR_AB2-009A	5.9
219033	CIR_AB2-009B	5.9
217112	HUDSON_G2	27.33
218435	LINDEN_1GT	9.12
218426	LINDEN_2ST	17.27
218318	LINDEN_AB	1.94
218436	LINDEN_G11	24.96
218425	LINDEN_G12	5.8
218423	LINDEN_G21	5.8
218424	LINDEN_G22	5.8
218418	LINDEN_G5	6.33

Bus Number	Bus Name	Full Contribution
219035	LINDEN_G8	4.99
290745	S-061	1.63
219060	SEWAREN_1LD5	20.1
219064	SEWAREN_2LD2	22.8
219068	SEWAREN_3LD2	20.68
219071	SEWAREN_4LD1	24.74
218364	SEWAREN_G6	21.43
292094	V1-030 C1	0.06
901801	W1-101C	0.02
913101	Y1-026	13.07
920612	Z1-116 C	104.97
920613	Z1-116 E	8.69
917521	Z2-089 C	98.36
923302	AB1-139 C	0.36
924111	AB2-055 OP	232.12
924171	AB2-061 C	0.11
924341	AB2-082 C	97.15

Bus Number	Bus Name	Full Contribution
218419	LINDEN_G6	6.33
219036	LINDEN_G7	4.99

Bus Number	Bus Name	Full Contribution
924421	AB2-091 C OP	22.07

Appendix 2

(PSEG - PSEG) The LINDEN-TOSCO_3 230 kV line (from bus 218300 to bus 219046 ckt 1) loads from 103.17% to 103.83% (**DC power flow**) of its emergency rating (1081 MVA) for the single line contingency outage of 'L_H-2286'. This project contributes approximately 16.44 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
217136	BAYONNE_CTG1	6.32
217183	BAYONNE_CTG2	6.32
217184	BAYONNE_CTG3	6.32
217185	BAYONNE_STG4	9.58
219030	CIR_AB2-008A	8.36
219031	CIR_AB2-008B	8.36
219032	CIR_AB2-009A	9.23
219033	CIR_AB2-009B	9.23
218426	LINDEN_2ST	17.69
218318	LINDEN_AB	1.72
218436	LINDEN_G11	23.72
218425	LINDEN_G12	5.94
218423	LINDEN_G21	5.94
218424	LINDEN_G22	5.94
218418	LINDEN_G5	6.48
218419	LINDEN_G6	6.48
219036	LINDEN_G7	4.75
219035	LINDEN_G8	4.74

Bus Number	Bus Name	Full Contribution
219060	SEWAREN_1LD5	26.95
219064	SEWAREN_2LD2	30.58
219068	SEWAREN_3LD2	27.73
219071	SEWAREN_4LD1	33.17
218364	SEWAREN_G6	28.74
292094	V1-030 C1	0.06
292680	V3-069 C	0.04
902651	W2-052C	< 0.01
909461	X2-089 C	0.03
920612	Z1-116 C	164.56
920613	Z1-116 E	13.62
917521	Z2-089 C	131.9
918571	AA1-073 C	0.17
923302	AB1-139 C	0.57
924111	AB2-055 OP	176.95
924171	AB2-061 C	0.17
924341	AB2-082 C	152.3
924421	AB2-091 C OP	16.44