Revised Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AB2-092

Bergen 138kV

September 2019

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.

General

PSEG Fossil, LLC, the Interconnection Customer (IC), has proposed an uprate to an existing natural gas generating facility located in Bergen, New Jersey. This project requests an increase to the install capability of 51.1 MW with 51.1 MW of this output being recognized by PJM as capacity. The installed facilities will have a total capability of 736.1 MW with 690 MW of this output being recognized by PJM as capacity. The AB2-092 project is reclaiming 21 MW of CIRs from the Bergen 3 unit. The proposed in-service date for this project is November 5, 2017. **This study does not imply a PSE&G commitment to this in-service date.**

Point of Interconnection

AB2-092 will interconnect with the PSE&G transmission system at the Bergen 138 kV substation between bus sections #1 & #3.

Cost Summary

The AB2-092 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades	$ 0
Allocation for New System Upgrades	$ 0
Contribution for Previously Identified Upgrades	$ 0
Total Costs	**$ 0**

Attachment Facilities

No Attachment Facilities are required to support this interconnection request.

Direct Connection Cost Estimate

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

Non-Direct Connection Cost Estimate

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

Interconnection Customer Requirements

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

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

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

The Queue Project AB2-092 was evaluated as a 30.1 MW (Capacity 30.1 MW) injection at the Bergen 13.8 substation claiming rights from Bergen 3 in the PSEG area. Project AB2-092 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-092 was studied with a commercial probability of 100%. 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)

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
1	Non	Non	PSEG - PSEG	BERGEN_B-BERGEN_2 138 kV line	217303	216910	1	AC	97.52	102.35	NR	500	27.94	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.

Note: The BERGEN_B-BERGEN_2 138 kV line (from bus 217303 to bus 216910 ckt 1) loads from 97.52% to 102.35% (AC power flow) of its normal rating (500 MVA) for non-contingency condition. This project contributes approximately 27.94 MW to the thermal violation.

Light Load Analysis

None

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

None

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:

#	Area	Bus No.	Bus	Breaker	Rating Type	Duty Percent Without AB2-092	Duty Percent With AB2-092	Duty Percent Difference
2	PSEG	217155	BERGEN 138.kV	90P	S	170.09%	173.59%	3.50%

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.

Steady-State Voltage Requirements

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

See attachment 3

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

See attachment 3 & 4

Affected System Analysis & Mitigation

NYISO Impacts:

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	AB2-092 Allocation
#1	BERGEN_B-BERGEN_2 138 kV line	Baseline Project will reconductor this line to a summer normal rating of 555 MVA which has an ISD of 12/31/17.	B2722	**$ 0**	**$ 0**
				Total New Network Upgrades	**$ 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 will be calculated and reported for the Impact Study)

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost	AB2-092 Allocation
#2	BERGEN 138.kV CB 90P	Baseline Project will replace the Bergen 138 kV '90P' breaker with 80kA breaker. The baseline has a revised ISD of 6/1/18.	b2713	**$ 0**	**$ 0**
				Total New Network Upgrades	**$ 0**

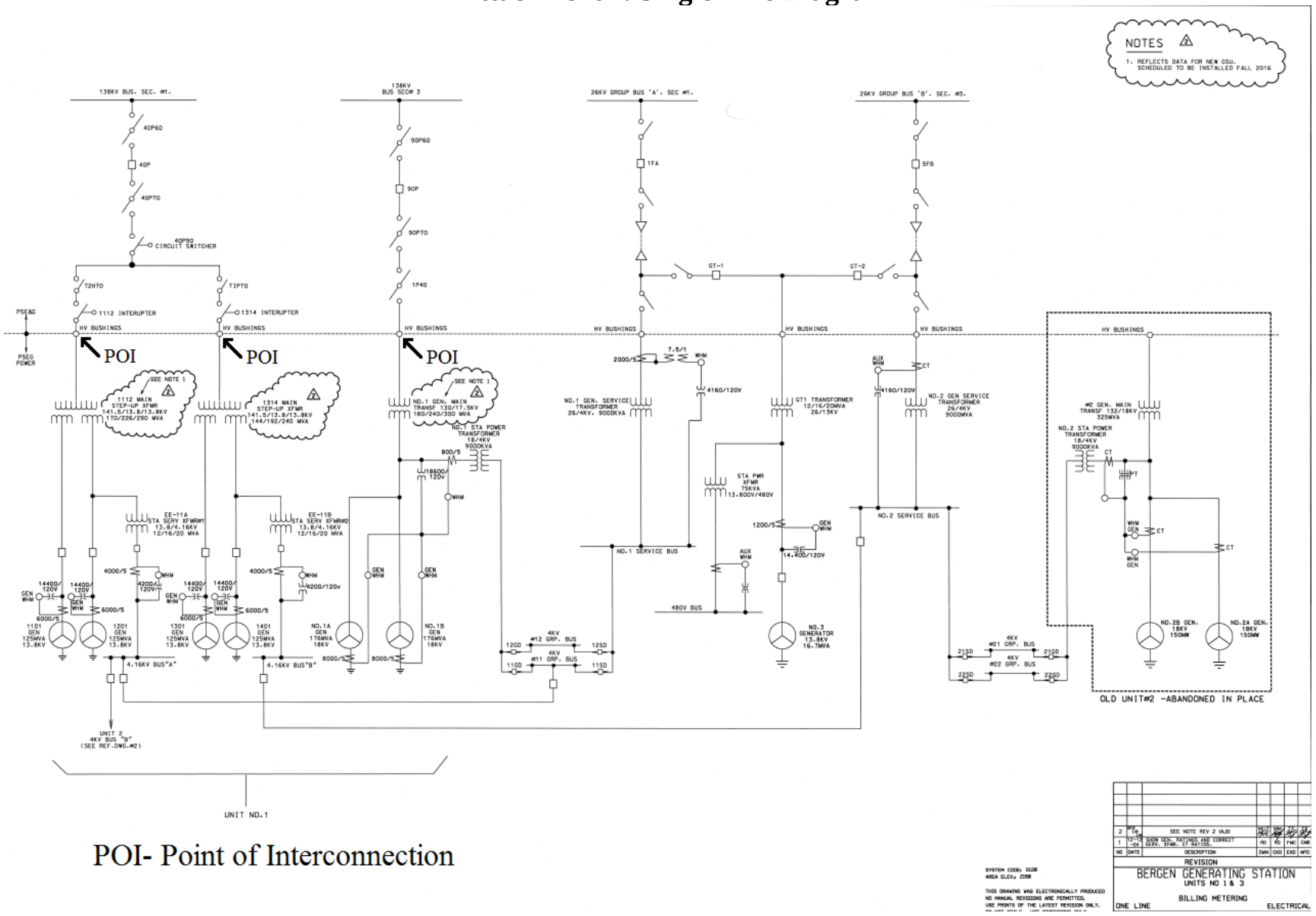
Potential Congestion due to Local Energy Deliverability

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 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.

None

Attachment 1. Single Line Diagram



POI- Point of Interconnection

Attachment 2. Flowgate Details

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 BERGEN_B-BERGEN_2 138 kV line (from bus 217303 to bus 216910 ckt 1) loads from 97.52% to 102.35% (AC power flow) of its normal rating (500 MVA) for non-contingency condition. This project contributes approximately 27.94 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
217915	BERGEN_11	21.19
217916	BERGEN_12	21.19
217917	BERGEN_13	21.19

Bus Number	Bus Name	Full Contribution
217918	BERGEN_14	21.19
924431	AB2-092	27.94

Attachment 3. Dynamic Simulation Analysis

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Executive Summary

Generator Interconnection Request AB2-092 is for the up-rating of a combined cycle generating facility with a Point of Interconnection (POI) at 138 kV substation, located in Bergen County, New Jersey, in the PSEG system. AB2-092 consists of 4 x 125 MW CT generators and 2 x 107 MW ST generators which has 704.5 MW Maximum Facility Output (MFO).

This report describes a dynamic simulation analysis of AB2-092 as part of the overall system impact study.

The load flow scenario for the analysis was based on the RTEP 2020 light load case, modified to include applicable queue projects. AB2-092 has been dispatched online at maximum power output, with approximately unity power factor at the POI.

The AB2-092 queue project was tested for compliance with NERC, PJM and other applicable criteria. The range of contingencies evaluated was limited to that necessary to assess compliance and each was limited to a 20-second simulation time period.

Simulated NERC Standard TPL-001faults include:

1. Three-phase (3ph) fault with normal clearing (Category P1)
2. Operating of a line section w/o a fault, Single-line-to-ground (slg) on Bus Section and Breaker. (Category P2)
3. Single-line-to-ground (slg) with delayed clearing as a result of breaker failure (Category P4)
4. Single-line-to-ground (slg) with delayed clearing as a result of protection failure (Category P5)
5. Single-line-to-ground (slg) with normal clearing for common structure (Category P7)

Note: For generator interconnection studies, Category P3 and P6 faults will be studied on an as needed basis. In this study, P2 contingencies are not applicable.

Other applicable criteria tested include:

1. Transmission Owner (TO) specific criteria
2. Other criteria

The system was tested for a system intact condition and the fault types listed above. Specific fault descriptions and breaker clearing times used for this study are provided in the result table.

No relevant High Speed Reclosing (HSR) contingencies were identified.

For all simulations, the queue project under study along with the rest of the PJM system were required to maintain synchronism and with all states returning to an acceptable new condition following the disturbance.

For the remaining fault contingencies tested on the 2020 Light Load case:

a) Post-contingency oscillations were positively damped with a damping margin of at least 4% for local modes and 3% for inter-area modes.

b) The AB2-092 generator was able to ride through all faults (except for faults where protective action trips a generator(s)).

c) Following fault clearing, all bus voltages recover to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).

d) No transmission element trips, other than those either directly connected or designed to trip as a consequence of that fault.

No mitigations were found to be required.

1. Introduction

Generator Interconnection Request AB2-092 is for the up-rating of a combined cycle generating facility with a Point of Interconnection (POI) at 138 kV substation, located in Bergen County, New Jersey, in the PSEG system. AB2-092 consists of 4 x 125 MW CT generators and 2 x 107 MW ST generators which has 704.5 MW Maximum Facility Output (MFO).

This analysis is effectively a screening study to determine whether the addition of AB2-092 will meet the dynamic requirements of the NERC, PJM and Transmission Owner reliability standards.

In this report the AB2-092 project and how it is proposed to be connected to the grid are first described, followed by a description of how the project is modeled in this study. The fault cases are then described and analyzed, and lastly a discussion of the results is provided.

2. Description of Project

Generator Interconnection Request AB2-092 is for the up-rating of a combined cycle generating facility with a Point of Interconnection (POI) at 138 kV substation, located in Bergen County, New Jersey, in the PSEG system. AB2-092 consists of 4 x 125 MW CT generators and 2 x 107 MW ST generators which has 704.5 MW Maximum Facility Output (MFO). The AB2-092 Point of Interconnection (POI) is the Hudson 230kV substation circuit as shown in Figure 1.

Table 1 lists the parameters given in the impact study data and the corresponding parameters of the AB2-092 loadflow models.

The dynamic model for the AB2-092 plant is based on the model data supplied by the Developer.

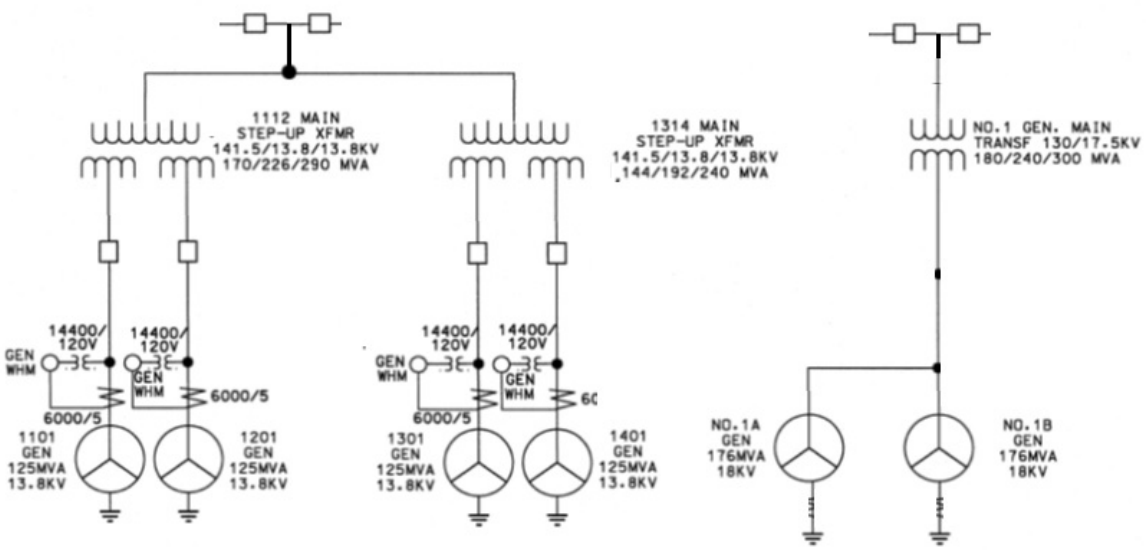


Figure 1: AB2-092 Plant Model

Table 1: AB2-092 Plant Model

	Impact Study Data	Model
Generators CT	4 x 125 MW Siemens 12-7603 Generator MVA base = 154.45 MVA Vt = 13.8 kV Unsaturated sub-transient reactance = 0.257 pu @ rated MVA	4 X 125MW generator Pgen 125 MW Pmax 125 MW Pmin 0 MW Qmax 60.54 MVAr Qmin -41.09 MVAr Mbase 154.45 MVA Zsorce j0.257 pu @ Mbase
Generators ST1	115.24 MW Westinghouse Generator MVA base = 150 MVA Vt = 18 kV Unsaturated sub-transient reactance = 0.165 pu @ rated MVA	1 X 115.24 MW generator Pgen 115.24 MW Pmax 115.24 MW Pmin 0 MW Qmax 51.8 MVAr Qmin -35.2 MVAr Mbase 150 MVA Zsorce j0.165 pu @ Mbase
Generators ST2	98.76 MW Westinghouse Generator MVA base = 150 MVA Vt = 18 kV Unsaturated sub-transient reactance = 0.165 pu @ rated MVA	1 X 98.76 MW generator Pgen 98.76 MW Pmax 98.76 MW Pmin 0 MW Qmax 51.8 MVAr Qmin -35.2 MVAr Mbase 150 MVA Zsorce j0.165 pu @ Mbase
CT 1&2 GSU transformers	1 x 138/13.8/13.8 kV three winding transformer Rating = 170/226/290 MVA Transformer base = 85 MVA Impedance: H-X = 0.0016+j0.0902 pu H-Y = 0.0017+j0.0909 pu X-Y = 0.0035+j0.1708 pu @ MVA base Number of taps = 5 Tap step size = 2.5	1 x 138/13.8/13.8 kV three winding transformer Rating = 170/226/290 MVA Transformer base = 85 MVA Impedance: H-X = 0.0016+j0.0902 pu H-Y = 0.0017+j0.0909 pu X-Y = 0.0035+j0.1708 pu @ MVA base Number of taps = 5 Tap step size = 2.5 Norminal tap = 2.5

CT 3&4 GSU transformers	1 x 138/13.8/13.8 kV three winding transformer Rating = 144/192/240 MVA Transformer base = 72 MVA Impedance: H-X = 0.0015+j0.0890 pu H-Y = 0.0015+j0.0910 pu X-Y = 0.0033+j0.1710 pu @ MVA base Number of taps = 5 Tap step size = 2.5	1 x 138/13.8/13.8 kV three winding transformer Rating = 144/192/240 MVA Transformer base = 72 MVA Impedance: H-X = 0.0015+j0.0890 pu H-Y = 0.0015+j0.0910 pu X-Y = 0.0033+j0.1710 pu @ MVA base Number of taps = 5 Tap step size = 2.5 Norminal tap = 2.5
ST 1&2 GSU transformers	1 x 138/18 kV two winding transformer Rating = 180/240/300 MVA Transformer base = 180 MVA Impedance: H-X = 0.0015+j0.074 pu @ MVA base Number of taps = 5 Tap step size = 2.5	1 x 138/18 kV two winding transformer Rating = 180/240/300 MVA Transformer base = 180 MVA Impedance: H-X = 0.0015+j0.074 pu @ MVA base Number of taps = 5 Tap step size = 2.5 Norminal tap = 0
Auxiliary load	9.5 MW + 4.6 MVAR	0.75 MW + 0.36 MVAR at low voltage side of each CT GSU winding 6.5 MW + 3.14 MVAR at low voltage side of ST GSU
Station load	N/A	N/A
Transmission line	Not Provided	ZBR

3. Loadflow and Dynamics Case Setup

The dynamics simulation analysis was carried out using PSS/E Version 33.7.

The load flow scenario and fault cases for this study are based on PJM's Regional Transmission Planning Process[1].

The selected load flow scenario is the RTEP 2020 Light Load case with the following modifications:

a) Addition of all applicable queue projects prior to AB2-092.

b) Addition of AB2-092 queue project.

c) Removal of withdrawn and subsequent queue projects in the vicinity of AB2-092.

d) Dispatch of units in the PJM system to maintain slack generators within limits.

The AB2-092 initial conditions are listed in Table 2, indicating maximum power output, with AB2-092 regulating to unity power factor at the generator bus.

Table 2: AB2-092 machine initial conditions

Bus	Name	Unit	PGEN (MW)	QGEN (MVAR)	ETERM (p.u.)	POI Voltage (p.u.)
217118	BERGEN 1 ST 18.000	1	115.2390	-35.1985	0.9962	1.0128
217118	BERGEN 1 ST 18.000	2	98.7610	-35.1985	0.9962	1.0128
217915	BERGEN 1 _313.800	1	125.0000	-9.4109	0.9607	1.0128
217916	BERGEN 1 _213.800	1	125.0000	-9.4109	0.9599	1.0128
217917	BERGEN 1 _113.800	1	125.0000	-9.4108	0.9662	1.0128
217918	BERGEN 1 13.800	1	125.0000	-9.4109	0.9663	1.0128

Generation within the vicinity of AB2-092 has been dispatched online at maximum output (PMAX). The dispatch of generation in the vicinity of AB2-092 is given in Attachment 3.

[1] Manual 14B: PJM Region Transmission Planning Process, Rev 33, May 5 2016, Attachment G : PJM Stability, Short Circuit, and Special RTEP Practices and Procedures.

4. Fault Cases

Tables 3 listed the contingencies and results that were studied, with representative worst case total clearing times provided by PJM. Each contingency was studied over a 20 second simulation time interval.

Simulated NERC Standard TPL-001faults include:

1. Three-phase (3ph) fault with normal clearing (Category P1)
2. Operating of a line section w/o a fault, Single-line-to-ground (slg) on Bus Section and Breaker. (Category P2)
3. Single-line-to-ground (slg) with delayed clearing as a result of breaker failure (Category P4)
4. Single-line-to-ground (slg) with delayed clearing as a result of protection failure (Category P5)
5. Single-line-to-ground (slg) with normal clearing for common structure (Category P7)

Note: For generator interconnection studies, Category P3 and P6 faults will be studied on an as needed basis. In this study, P2 contingencies are not applicable.

Other applicable criteria tested include:

1. Transmission Owner (TO) specific criteria
2. Other criteria

The system was tested for a system intact condition and the fault types listed above. No relevant High Speed Reclosing (HSR) contingencies were studied.

5. Evaluation Criteria

This study is focused on AB2-092, along with the rest of the PJM system, maintaining synchronism and having all states return to an acceptable new condition following the disturbance. The recovery criteria applicable to this study are as per PJM's Regional Transmission Planning Process and Transmission Owner criteria:

a) The system with AB2-092 included is transiently stable and post-contingency oscillations should be positively damped with a damping margin of at least 4% for local modes and 3% for inter-area modes.

b) The AB2-092 is able to ride through faults (except for faults where protective action trips AB2-092).

c) Following fault clearing, all bus voltages recover to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).

d) No transmission element trips, other than those either directly connected or designed to trip as a consequence of that fault.

6. Summary of Results

Plots from the dynamic simulations are provided in Attachment 4, with results summarized in Table 3.

Due to the frequency protection was disabled due to the PSSE deficiency in calculating frequencies.

For the fault contingencies tested in this study:

a) Post-contingency oscillations were positively damped with a damping margin of at least 4% for local modes and 3% for inter-area modes.

b) The AB2-092 generator was able to withstand all contingencies.

c) Following fault clearing, all bus voltages recover to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).

d) No transmission element trips, other than those either directly connected or designed to trip as a consequence of that fault.

7. Mitigations

No Mitigations were found to be required.

Table 3: Fault list

P0: Steady State

Fault ID	Duration
P0.00	Steady State 20 sec run

P1: Three Phase Faults with normal clearing

Fault ID	Fault description	Clearing Time Normal (Cycles)	Results
P1.01	3ph @ Bergen 138/345kV Tx, normal clear	6	Stable
P1.02	3ph @ Bergen – East Rutherford 138kV line, normal clear	6	Stable
P1.03	3ph @ Bergen 138/230kV Tx, normal clear	6	Stable
P1.04	3ph @ Bergen – Fairlawn 138kV, normal clear	6	Stable
P1.05	3ph @ Fairlawn – Kuller Rd 138kV, normal clear	6	Stable
P1.06	3ph @ Fairlawn 138/230kV Tx, normal clear loss of Fairlawn 230kV bus, Waldwick PAR, V1-030	6	Stable
P1.07	3ph @ Fairlawn – Athenia 138kV, normal clear	6	Stable
P1.08	3ph @ Bergen – Saddlebrook 230kV line, normal clear	5	Stable
P1.09	3ph @ Bergen – Athenia 230kV line, normal clear	5	Stable
P1.10	3ph @ Bergen – Leonia_3 230kV line T-2272, normal clear	5	Stable
P1.11	3ph @ Bergen – Leonia_1 230kV line K-2289, normal clear	5	Stable
P1.12	3ph @ Bergen – North Bergen – 49th ST – Hoboken 230kV line, normal clear	5	Stable
P1.13	3ph @ Bergen – North Bergen 230kV line circuit U-2326, normal clear	5	Stable
P1.14	3ph @ Bergen – Bergen Gen2 collector bus 230kV line, normal clear loss of Bergen Gen2 units	5	Stable
P1.15	3ph @ Bergen 230/345kV Tx, normal clear	5	Stable
P1.16	3ph @ Bergen – Hudson HVDC 230kV line, normal clear	5	Stable
P1.17	3ph @ Bergen 230/69kV Tx, normal clear	6	Stable

Fault ID	Fault description	Clearing Time Normal (Cycles)	Results
P1.18	3ph @ Bergen – Marion 345kV line F-3406 (#2), normal clear	4	Stable
P1.19	3ph @ Bergen – Marion 345kV line E-3405 (#1), normal clear	4	Stable

P4: SLG Stuck Breaker (SB) Faults at Backup Clearing

Fault ID	Fault description	Clearing Time Normal/Delayed (Cycles)	Results
P4.01	SLG @ Bergen – East Rutherford 138kV line, SB @ Bergen 138kV, delayed clear loss of AB2-092 ST	6/19	Stable
P4.02	SLG @ Bergen – East Rutherford 138kV line, SB @ Bergen 138kV, delayed clear loss of Bergen 138/340kV Tx	6/19	Stable
P4.03	SLG @ Bergen 138/345kV Tx, SB @ Bergen 138kV, delayed clear loss of AB2-092	6/19	Stable
P4.04	SLG @ Bergen 138/230kV Tx, SB @ Bergen 138kV, delayed clear loss of AB2-092 ST	6/19	Stable
P4.05	SLG @ Bergen 138/230kV Tx, SB @ Bergen 138kV, delayed clear loss of Bergen – Fairlawn 138kV	6/19	Stable
P4.06	SLG @ Bergen – Fairlawn 138kV, SB @ Bergen 138kV, delayed clear loss of AB2-092	6/19	Stable
P4.07	SLG @ Bergen 345/138kV Tx, SB @ Bergen 345kV, delayed clear loss of Bergen – Marion 345kV line F3406 (#2)	6/19	Stable
P4.08	SLG @ Bergen – Marion 345kV line F3406 (#2), SB @ Bergen 345kV, delayed clear loss of Bergen 345/138kV Tx	4/19	Stable
P4.09	SLG @ Bergen 345/230kV Tx, SB @ Bergen 345kV, delayed clear loss of Bergen – Marion 345kV line E3405 (#1)	5/19	Stable
P4.10	SLG @ Bergen – Marion 345kV line E3405 (#1), SB @ Bergen 345, delayed clear loss of Bergen 345/230kV Tx	4/19	Stable
P4.11	SLG @ Bergen – Saddlebrook 230kV line, SB @ Bergen 230kV, delayed clear loss of Bergen 230/138kV Tx	5/19	Stable
P4.12	SLG @ Bergen 230/26kV Tx 220-1, SB @ Bergen 230kV, delayed clear loss of Bergen Gen 2	6/19	Stable
P4.13	SLG @ Bergen 230/69kV Tx, SB @ Bergen 230kV, delayed clear loss of Bergen – Athenia 230kV line	6/19	Stable

Fault ID	Fault description	Clearing Time Normal/Delayed (Cycles)	Results
P4.14	SLG @ Bergen 230/26kV Tx 220-2, SB @ Bergen 230kV, delayed clear loss of Bergen – Leonia_3 230kV line T-2272	6/19	Stable
P4.15	SLG @ Bergen 230/13kV Tx 40, SB @ Bergen 230kV, delayed clear loss of Bergen – North Bergen – Hoboken 230kV line	6/19	Stable
P4.16	SLG @ Bergen 230/13kV Tx 20, SB @ Bergen 230kV, delayed clear loss of Bergen – North Bergen 230kV line	6/19	Stable
P4.17	SLG @ Bergen 230/26kV Tx 220-3, SB @ Bergen 230kV, delayed clear loss of Bergen – Leonia_1 230kV line K-2289	6/19	Stable
P4.18	SLG @ Bergen 230/13kV Tx 10, SB @ Bergen 230kV, delayed clear loss of Bergen 230/345kV Tx	6/19	Stable
P4.19	SLG @ Bergen 230/13kV Tx 30, SB @ Bergen 230kV, delayed clear loss of Bergen - Hudson HVDC 230kV line	6/19	Stable

P5: SLG Fault with Delayed (Zone 2) Clearing

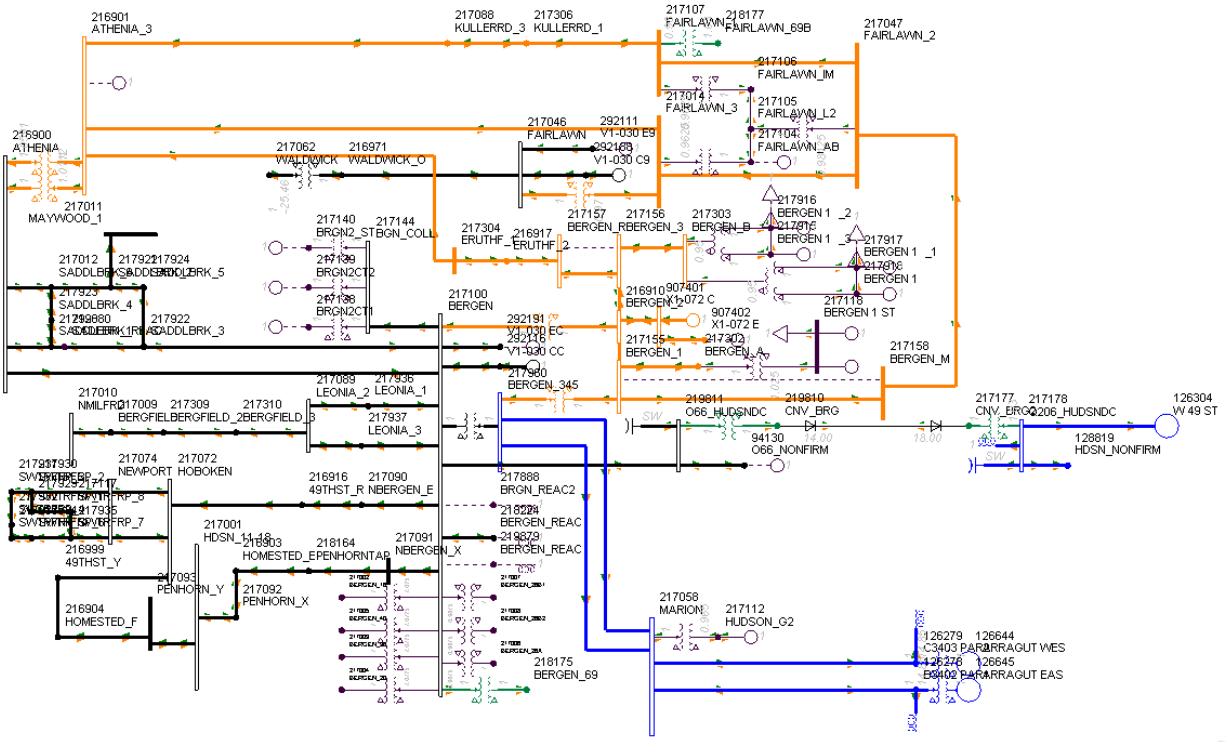
Fault ID	Fault description	Clearing Time Normal/Delayed (Cycles)	Results
P5.01	SLG @ Bergen 138/345kV Tx, relay failure, delayed clear	/34	Stable
P5.02	SLG @ Bergen 345/138kV Tx, relay failure, delayed clear	/34	Stable
P5.03	SLG @ Bergen – East Rutherford 138kV line, East Rutherford relay failure, delayed clear	6/34	Stable
P5.04	SLG @ East Rutherford – Bergen 138kV line, Bergen relay failure, delayed clear	6/34	Stable
P5.05	SLG @ Bergen 138/230kV Tx, relay failure, delayed clear	/34	Stable
P5.06	SLG @ Bergen 230/138kV Tx, relay failure, delayed clear	/34	Stable
P5.07	SLG @ Bergen – Fairlawn 138kV, Fairlawn relay failure, delayed clear	6/34	Stable
P5.08	SLG @ Fairlawn – Bergen 138kV, Bergen relay failure, delayed clear	6/34	Stable
P5.09	SLG @ Athenia – Fairlawn 138kV, Fairlawn relay failure, delayed clear	6/34	Stable
P5.10	SLG @ Bergen – Saddlebrook 230kV line, Saddlebrook relay failure, delayed clear	5/34	Stable
P5.11	SLG @ Saddlebrook – Bergen 230kV line, Bergen relay failure, delayed clear	5/34	Stable

Fault ID	Fault description	Clearing Time Normal/Delayed (Cycles)	Results
P5.12	SLG @ Bergen – Leonia_3 230kV line T-2272, Leonia_3 relay failure, delayed clear	5/34	Stable
P5.13	SLG @ Leonia – Bergen _3 230kV line T-2272, Bergen relay failure, delayed clear	5/34	Stable
P5.14	SLG @ Bergen – Athenia 230kV line, Athenia relay failure, delayed clear	5/34	Stable
P5.15	SLG @ Athenia – Bergen 230kV line, Bergen relay failure, delayed clear	5/34	Stable
P5.16	SLG @ Bergen 230/345kV Tx, Bergen relay failure, delayed clear	/34	Stable
P5.17	SLG @ Bergen 345/230kV Tx, Bergen relay failure, delayed clear	/34	Stable
P5.18	SLG @ Bergen – North Bergen – 49th ST – Hoboken 230kV line, Hoboken relay failure, delayed clear	5/34	Stable
P5.19	SLG @ Hoboken – 49th ST – North Bergen – Bergen 230kV line, Bergen relay failure, delayed clear	5/34	Stable
P5.20	SLG @ Bergen – North Bergen 230kV line circuit U-2326, North Bergen relay failure, delayed clear	5/34	Stable
P5.21	SLG @ North Bergen –Bergen 230kV line circuit U-2326, Bergen relay failure, delayed clear	5/34	Stable

P7: Common Structure

Fault ID	Fault description	Clearing Time (Cycles)	Results
P7.01	CONTINGENCY 'E1305+F1306' SLG @ Bergen – Marion 345kV line #1, tower failure normal clear loss of Bergen – Marion 345kV line #2	4	Stable
P7.02	CONTINGENCY 'HMSD-PNHT+HMSD-HOBK' SLG @ North Bergen – Homestead – Penhorn_X – Hudson 230kV, tower failure normal clear loss of Penhorn_Y – Homestead – 49th ST – Hoboken 230kV	5	Stable
P7.03	CONTINGENCY 'R2270+HMSD-PNHT' SLG @ Bergen – North Bergen – 49th ST – Hoboken 230kV line, tower failure normal clear loss of North Bergen – Homestead – Penhorn X – Hudson 230kV line	5	Stable

Attachment 1. PSS/E Model One Line Diagram



Attachment 2. AB2-092 PSS/E Dynamic Model

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    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     WED, JAN 04 2017  15:22
2014 SERIES, ERAG/MMWG BASE CASE LIBRARY (CEII)
2020 SPRING LIGHT LOAD CASE, FINAL; FOR DYN

PLANT MODELS

REPORT FOR PLANT MODELS                 BUS 217915 [BERGEN 1  _313.800] MODELS


Model GENROU Bus 217915 [BERGEN 1  _313.800] Machine "1 " :

                C O N S     S T A T E S
               80640-80653   35109-35114

            MBASE     Z S O R C E         X T R A N       GENTAP
            154.4  0.00000+J 0.25700  0.00000+J 0.00000  1.00000

 T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
 7.64 0.052  0.85 0.083   3.71  0.00 2.4890 2.4350 0.3720 0.5820 0.2570 0.2120

                             S(1.0)  S(1.2)
                             0.1330  0.3830


Model PSS2A Bus 217915 [BERGEN 1  _313.800] Machine "1 " :

  I C O N S      C O N S     S T A T E S     V A R S
  8968-8973   124348-124364  61521-61536   22404-22407

                  IC1 REMBUS1     IC2 REMBUS2       M       N
                    1       0       3       0       5       1

      TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
     5.000    5.000    0.000    5.000    0.000    5.000    0.543    1.000

      T8       T9      KS1       T1       T2       T3       T4      VSTMAX   VSTMIN
     0.000    0.100   15.000    0.110    0.006    0.110    0.006    0.050   -0.050


Model ESST4B Bus 217915 [BERGEN 1  _313.800] Machine "1 " :

                C O N S     S T A T E S
               225279-225295  93204-93207

    TR    KPR     KIR     VRMAX    VRMIN    TA     KPM     KIM    VMMAX   VMMIN
  0.050   6.000   3.000   1.000  -0.866   0.002  10.620   0.000  10.620  -9.200

            KG      KP      KI   VBMAX     KC      XL    THETAP
          0.000********   0.000   1.000   0.000  0.0000   0.000


Model TGOV1 Bus 217915 [BERGEN 1  _313.800] Machine "1 " :

                C O N S     S T A T E S      V A R
               317488-317494 122244-122245     49714

       R         T1       VMAX      VMIN       T2        T3        DT
     0.050     0.490     1.120     0.000     2.100     7.000     0.000

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    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     WED, JAN 04 2017  15:22
2014 SERIES, ERAG/MMWG BASE CASE LIBRARY (CEII)
2020 SPRING LIGHT LOAD CASE, FINAL; FOR DYN
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PLANT MODELS

REPORT FOR PLANT MODELS BUS 217916 [BERGEN 1 _213.800] MODELS

Model GENROU Bus 217916 [BERGEN 1 _213.800] Machine "1 " :

C O N S	S T A T E S
80654-80667	35115-35120

MBASE	Z S O R C E	X T R A N	GENTAP
154.4	0.00000+J 0.25700	0.00000+J 0.00000	1.00000

T'D0	T''D0	T'Q0	T''Q0	H	DAMP	XD	XQ	X'D	X'Q	X''D	XL
7.64	0.052	0.85	0.083	3.71	0.00	2.4890	2.4350	0.3720	0.5820	0.2570	0.2120

S(1.0)	S(1.2)
0.1330	0.3830

Model PSS2A Bus 217916 [BERGEN 1 _213.800] Machine "1 " :

I C O N S	C O N S	S T A T E S	V A R S
8974-8979	124365-124381	61537-61552	22408-22411

IC1	REMBUS1	IC2	REMBUS2	M	N
1	0	3	0	5	1

TW1	TW2	T6	TW3	TW4	T7	KS2	KS3
5.000	5.000	0.000	5.000	0.000	5.000	0.543	1.000

T8	T9	KS1	T1	T2	T3	T4	VSTMAX	VSTMIN
0.000	0.100	15.000	0.110	0.006	0.110	0.006	0.050	-0.050

Model ESST4B Bus 217916 [BERGEN 1 _213.800] Machine "1 " :

C O N S	S T A T E S
225296-225312	93208-93211

TR	KPR	KIR	VRMAX	VRMIN	TA	KPM	KIM	VMMAX	VMMIN
0.050	6.000	3.000	1.000	-0.866	0.002	10.620	0.000	10.620	-9.200

KG	KP	KI	VBMAX	KC	XL	THETAP
0.000********	0.000	1.000	0.000	0.0000	0.000	

Model TGOV1 Bus 217916 [BERGEN 1 _213.800] Machine "1 " :

C O N S	S T A T E S	V A R
317495-317501	122246-122247	49715

R	T1	VMAX	VMIN	T2	T3	DT
0.050	0.490	1.120	0.000	2.100	7.000	0.000

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E WED, JAN 04 2017 15:22
2014 SERIES, ERAG/MMWG BASE CASE LIBRARY (CEII)
2020 SPRING LIGHT LOAD CASE, FINAL; FOR DYN

PLANT MODELS

REPORT FOR PLANT MODELS BUS 217917 [BERGEN 1 _113.800] MODELS

Model GENROU Bus 217917 [BERGEN 1 _113.800] Machine "1 " :

```
                C O N S     S T A T E S
               80668-80681   35121-35126

            MBASE     Z S O R C E         X T R A N       GENTAP
            154.4  0.00000+J 0.25700  0.00000+J 0.00000  1.00000

 T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
 7.64 0.052  0.85 0.083   3.71  0.00 2.4890 2.4350 0.3720 0.5820 0.2570 0.2120

                            S(1.0)  S(1.2)
                            0.1330  0.3830


Model PSS2A Bus 217917 [BERGEN 1  _113.800] Machine "1 " :

  I C O N S      C O N S     S T A T E S     V A R S
  8980-8985   124382-124398  61553-61568   22412-22415

                  IC1 REMBUS1     IC2 REMBUS2       M       N
                    1       0       3       0       5       1

      TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
     5.000    5.000    0.000    5.000    0.000    5.000    0.543    1.000

      T8       T9      KS1       T1       T2       T3       T4      VSTMAX   VSTMIN
     0.000    0.100   15.000    0.110    0.006    0.110    0.006    0.050   -0.050


Model ESST4B Bus 217917 [BERGEN 1  _113.800] Machine "1 " :

                C O N S     S T A T E S
              225313-225329  93212-93215

    TR    KPR     KIR     VRMAX    VRMIN    TA     KPM     KIM    VMMAX   VMMIN
  0.050   6.000   3.000   1.000  -0.866   0.002  10.620   0.000  10.620  -9.200

            KG      KP      KI   VBMAX     KC      XL    THETAP
          0.000********   0.000   1.000   0.000  0.0000   0.000


Model TGOV1 Bus 217917 [BERGEN 1  _113.800] Machine "1 " :

                C O N S     S T A T E S      V A R
              317502-317508 122248-122249     49716

       R         T1       VMAX      VMIN       T2        T3        DT
     0.050     0.490     1.120     0.000     2.100     7.000     0.000

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    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     WED, JAN 04 2017  15:22
2014 SERIES, ERAG/MMWG BASE CASE LIBRARY (CEII)
2020 SPRING LIGHT LOAD CASE, FINAL; FOR DYN

PLANT MODELS

REPORT FOR PLANT MODELS                 BUS 217918 [BERGEN 1    13.800] MODELS


Model GENROU Bus 217918 [BERGEN 1    13.800] Machine "1 " :

                C O N S     S T A T E S
               80682-80695   35127-35132

            MBASE     Z S O R C E         X T R A N       GENTAP
            154.4  0.00000+J 0.25700  0.00000+J 0.00000  1.00000
```

```
 T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
 7.64 0.052  0.85 0.083   3.71  0.00 2.4890 2.4350 0.3720 0.5820 0.2570 0.2120

                            S(1.0)  S(1.2)
                            0.1330  0.3830


Model PSS2A Bus 217918 [BERGEN 1    13.800] Machine "1 " :

  I C O N S      C O N S     S T A T E S     V A R S
  8986-8991   124399-124415  61569-61584   22416-22419

                 IC1 REMBUS1     IC2 REMBUS2       M       N
                   1       0       3       0       5       1

      TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
     5.000    5.000    0.000    5.000    0.000    5.000    0.543    1.000

      T8       T9      KS1       T1       T2       T3       T4      VSTMAX   VSTMIN
     0.000    0.100   15.000    0.110    0.006    0.110    0.006    0.050   -0.050


Model ESST4B Bus 217918 [BERGEN 1    13.800] Machine "1 " :

               C O N S     S T A T E S
              225330-225346  93216-93219

    TR    KPR     KIR     VRMAX    VRMIN    TA     KPM     KIM    VMMAX   VMMIN
  0.050   6.000   3.000   1.000  -0.866   0.002  10.620   0.000  10.620  -9.200

           KG      KP      KI   VBMAX     KC      XL    THETAP
         0.000********   0.000   1.000   0.000  0.0000   0.000


Model TGOV1 Bus 217918 [BERGEN 1    13.800] Machine "1 " :

               C O N S     S T A T E S      V A R
              317509-317515 122250-122251     49717

       R         T1       VMAX      VMIN       T2        T3        DT
     0.050     0.490     1.120     0.000     2.100     7.000     0.000
```

```
    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     WED, JAN 04 2017  15:23
2014 SERIES, ERAG/MMWG BASE CASE LIBRARY (CEII)
2020 SPRING LIGHT LOAD CASE, FINAL; FOR DYN

PLANT MODELS

REPORT FOR PLANT MODELS                 BUS 217118 [BERGEN 1 ST 18.000] MODELS


Model GENROU Bus 217118 [BERGEN 1 ST 18.000] Machine "1 " :

               C O N S     S T A T E S
              80374-80387   34995-35000

            MBASE     Z S O R C E         X T R A N       GENTAP
            150.0  0.00000+J 0.16500  0.00000+J 0.00000  1.00000

 T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
 4.82 0.046  1.00 0.040   4.03  0.00 1.2400 1.2200 0.2160 0.3820 0.1650 0.1480

                            S(1.0)  S(1.2)
                            0.1110  0.3560
```

Model IEEEVC Bus 217118 [BERGEN 1 ST 18.000] Machine "1 " :

C O N S
101204-101205

RC	XC
0.00000	0.05000

Model PSS2A Bus 217118 [BERGEN 1 ST 18.000] Machine "1 " :

I C O N S	C O N S	S T A T E S	V A R S
8920-8925	124194-124210	61390-61405	22372-22375

IC1	REMBUS1	IC2	REMBUS2	M	N
1	0	3	0	5	1

TW1	TW2	T6	TW3	TW4	T7	KS2	KS3
5.000	5.000	0.009	5.000	0.000	5.000	0.620	1.000

T8	T9	KS1	T1	T2	T3	T4	VSTMAX	VSTMIN
0.500	0.100	12.000	0.090	0.040	0.090	0.040	0.050	-0.050

Model ST6B Bus 217118 [BERGEN 1 ST 18.000] Machine "1 " :

I C O N	C O N S	S T A T E S	V A R S
13946	224963-224978	93125-93128	28171-28173

OEL	OPTION
	0

TR	KPA	KIA	KDA	TDA	VAMAX	VAMIN
0.0000	120.0000	12.0000	0.0000	1.0000	3.3060	-2.8040

KFF	KM	KCI	KLR	ILR	VRMAX	VRMIN
1.0000	1.0000	1.0000	20.0000	3.4400	3.3060	-2.8040

KG	TG
1.0000	0.0200

Model WSIEG1 Bus 217118 [BERGEN 1 ST 18.000] Machine "1 " and Bus 217118 [BERGEN 1 ST 18.000] Machine "2 " :

C O N S	S T A T E S	V A R S
317004-317037	122102-122107	49448-49455

K	T1	T2	T3	UO	UC	PMAX	PMIN	T4	K1
30.32	0.500	0.000	0.100	0.400	-0.400	1.5000	0.0000	0.250	0.307

K2	T5	K3	K4	T6	K5	K6	T7	K7	K8
0.000	10.000	0.000	0.230	0.588	0.231	0.231	0.000	0.000	0.000

DB1	ERR	DB2	GV1	PGV1	GV2	PGV2
0.001	0.000	0.000	0.000	0.000	0.250	0.250

GV3	PGV3	GV4	PGV4	GV5	PGV5	IBLOCK
0.500	0.500	0.750	0.750	2.000	2.000	0.000

Model GENROU Bus 217118 [BERGEN 1 ST 18.000] Machine "2 " :

C O N S	S T A T E S
80388-80401	35001-35006

```
            MBASE     Z S O R C E         X T R A N       GENTAP
            150.0  0.00000+J 0.16500  0.00000+J 0.00000  1.00000

 T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
 4.82 0.046  1.00 0.040   4.39  0.00 1.2400 1.2200 0.2160 0.3820 0.1650 0.1480

                             S(1.0)  S(1.2)
                             0.1110  0.3560

Model IEEEVC Bus 217118 [BERGEN 1 ST 18.000] Machine "2 " :

               C O N S
             101206-101207

   RC         XC
  0.00000    0.05000

Model PSS2A Bus 217118 [BERGEN 1 ST 18.000] Machine "2 " :

  I C O N S      C O N S     S T A T E S     V A R S
  8926-8931   124211-124227  61406-61421   22376-22379

                  IC1 REMBUS1     IC2 REMBUS2       M       N
                    1       0       3       0       5       1

      TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
     5.000    5.000    0.009    5.000    0.000    5.000    0.570    1.000

      T8       T9      KS1       T1       T2       T3       T4      VSTMAX   VSTMIN
     0.500    0.100   12.000    0.090    0.040    0.090    0.040    0.050   -0.050


Model ST6B Bus 217118 [BERGEN 1 ST 18.000] Machine "2 " :

   I C O N       C O N S     S T A T E S     V A R S
    13947     224979-224994  93129-93132   28174-28176

  OEL OPTION
        0

       TR           KPA           KIA           KDA        TDA          VAMAX         VAMIN
      0.0000     120.0000      12.0000       0.0000       1.0000       3.3060      -2.8040

      KFF           KM            KCI         KLR         ILR         VRMAX         VRMIN
      1.0000       1.0000       1.0000      20.0000       3.4400       3.3060      -2.8040

      KG            TG
      1.0000       0.0200

Model WSIEG1 Bus 217118 [BERGEN 1 ST 18.000] Machine "2 " and Bus 217118 [BERGEN 1 ST
18.000] Machine "1 " :

               C O N S     S T A T E S     V A R S
             317004-317037 122102-122107  49448-49455

     K      T1      T2      T3     UO      UC    PMAX   PMIN     T4      K1
  30.32   0.500   0.000   0.100  0.400  -0.400 1.5000 0.0000   0.250   0.307

    K2      T5      K3      K4      T6      K5      K6      T7      K7      K8
 0.000  10.000   0.000   0.230   0.588   0.231   0.231   0.000   0.000   0.000

       DB1       ERR       DB2       GV1      PGV1       GV2      PGV2
     0.001     0.000     0.000     0.000     0.000     0.250     0.250

       GV3      PGV3       GV4      PGV4       GV5      PGV5    IBLOCK
     0.500     0.500     0.750     0.750     2.000     2.000     0.000
```

Attachment 3. AB2-092 PSS/E Case Dispatch

Bus Number	Bus Name	Id	In Service	PGen (MW)	PMax (MW)	PMin (MW)	QGen (Mvar)	QMax (Mvar)	QMin (Mvar)
94130	O66_NONFIRM 230.00	1	1	5	5	0	0	0	0
216901	ATHENIA_3 138.00	1	1	6.6	6.6	0	-2	2	-2
217083	KRNY_1334 13.800	3	1	49.5	49.5	30	-15	22	-15
217083	KRNY_1334 13.800	4	1	49.5	49.5	30	-15	22	-15
217086	KRNY_1312 13.800	1	1	49.5	49.5	30	-15.1	21.93	-15.1
217086	KRNY_1312 13.800	2	1	49.5	49.5	30	-15.1	21.93	-15.1
217087	KRNY_1412 13.800	1	1	49.5	49.5	30	-15	22	-15
217087	KRNY_1412 13.800	2	1	49.5	49.5	30	-15	22	-15
217104	FAIRLAWN_AB 26.000	1	1	73	73	10	-5	5	-5
217112	HUDSON_G2 20.000	1	1	667.5	667.5	215	-127	250.9	-127
217118	BERGEN 1 ST 18.000	1	1	115.2	115.2	23.5	-35.2	51.8	-35.2
217118	BERGEN 1 ST 18.000	2	1	98.76	98.76	23.5	-35.2	51.8	-35.2
217136	BAYONNE_CTG113.800	1	1	37.2	37.2	0	-4	10	-4
217138	BRGN2CT1 18.000	1	1	188	188	87	-62	92	-62
217139	BRGN2CT2 18.000	1	1	188	188	87	-62	92	-62
217140	BRGN2_ST 18.000	1	1	273	273	60	-90	133	-90
217146	KRNY_1234 13.800	1	1	46	46	28	-15	22.15	-15
217146	KRNY_1234 13.800	2	1	46	46	28	-15	22.15	-15
217147	KRNY_1212 13.800	1	1	46	46	28	-15	22.15	-15
217147	KRNY_1212 13.800	2	1	46	46	28	-15	22.15	-15
217183	BAYONNE_CTG213.800	2	1	37.2	37.2	5	-4	10	-4
217184	BAYONNE_CTG313.800	3	1	37.2	37.2	5	-4	10	-4
217185	BAYONNE_STG413.800	4	1	56.4	56.4	5	-5	15	-5
217915	BERGEN 1 _313.800	1	1	125	125	101	-9.41	60.54	-41.1
217916	BERGEN 1 _213.800	1	1	125	125	0	-9.41	60.54	-41.1
217917	BERGEN 1 _113.800	1	1	125	125	0	-9.41	60.54	-41.1
217918	BERGEN 1 13.800	1	1	125	125	0	-9.41	60.54	-41.1
292111	V1-030 E9 230.00	1	1	0.93	0.93	0	-0.31	0.446	-0.31
292116	V1-030 CC 230.00	1	1	2.812	2.812	0	-0.93	1.35	-0.93
292188	V1-030 C9 230.00	1	1	0.57	0.57	0	-0.19	0.274	-0.19
292191	V1-030 EC 230.00	1	1	4.588	4.588	0	-1.51	2.202	-1.51
293439	V3-066 C 230.00	1	1	0.16	0.16	0	0	0	0
293440	V3-066 E 230.00	1	1	0.272	0.272	0	0	0	0
901801	W1-101C 13.000	1	1	0.532	0.532	0	0	0	0
905491	W4-059 C 13.000	1	1	0.323	0.323	0	0	0	0
907401	X1-072 C 138.00	1	1	0.38	0.38	0	0	0	0
907402	X1-072 E 138.00	1	1	0.669	0.669	0	0	0	0
924112	AB2-055 CT1 26.000	1	1	359.8	359.8	0	-8.62	174.2	-118
924113	AB2-055 CT2 26.000	1	1	359.8	359.8	0	-8.62	174.2	-118
924114	AB2-055 ST 26.000	1	1	343.2	343.2	0	-8.62	166.2	-113

Attachment 4. Reactive Assessment

PJM has determined that the aggregate output of the Bergen Unit #1 generating facility may be considered for determining the power factor capabilities (in lieu of each individual generating unit/module) for the increase of 51.1 MW to the Customer Facility associated with the AB2-092 queue position.

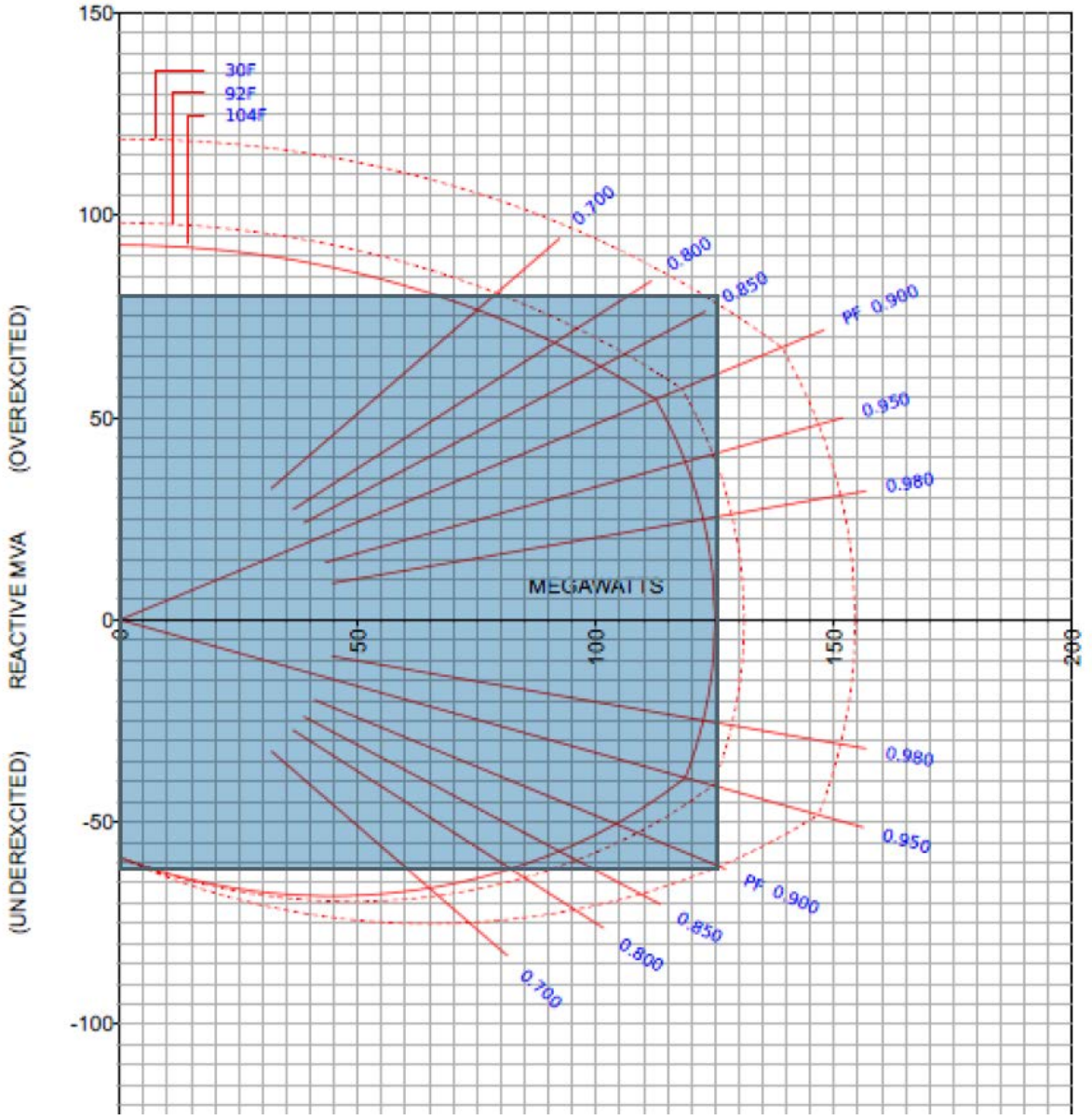
Per PJM Manual 14A Attachment H, for generation increases that result in insufficient reactive capability, the interconnection customer has the option to install power factor correction or other equipment at the generation plant to mitigate the reactive deficiency or to pay a reactive deficiency charge. Since Bergen Unit #1 already has the additional reactive capability with the extra reactive head room on the Bergen 1 steam turbine, the increased MW output of the Bergen Unit #1 meets the intent of the PJM reactive capability process without any additional equipment or payments.

Information provided by the Interconnection Customer:

PJM has determined that the entire Bergen 1 generating facility may be considered for determining the reactive power capability.

1. The total Facility Power Factor requirement (Ref case 0.90 Lagging) @ Max Summer Gross Output (92º F) is achieved with each of 4 CTGs operating at 121.75 MW, PF=0.93, and STGs operating at 106.25 MW (x 2 machines), PF=0.84. - all machine operations are within capabilities published by OEMs.
2. The total Facility Power Factor requirement (Ref case 0.90 Lagging) @ Max Winter Gross Output (30º F) is achieved with each of the 4 CTGs operating at 125 MW, PF=0.90, and STGs operating at 107 MW (x 2 machines), PF=0.90. - all machine operations are within capabilities published by OEMs.

CT:



ST:

C1 Calculated Capability & Coordination Curves – HP & LP