Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position Y1-033

Penn Mar – Rock Wood 115 kV

July 2012

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 wind generating facility located in Elk Lick and Addison Townships in Somerset County, Pennsylvania. The installed facilities will have a total capability of 55.0 MW with 6.6 MW of this output being recognized by PJM as capacity. This means that the remaining 48.4 MW will be curtailable should a system reliability constraint occur. The proposed in-service date for this project is December 31, 2014. **This study does not imply a First Energy commitment to this in-service date.**

Point of Interconnection

Y1-033 will interconnect with the Penelec transmission system at one of two points of interconnection:

Option 1 will interconnect via a tap into the 115 kV line between Penn-Mar and Rock Wood substations at a point 4.7 miles from Penn-Mar substation and 10.1 miles from Rock Wood substation.

Option 2 will interconnect directly into the Penn-Mar substation at 115 kV.

Cost Summary

The Y1-033 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 5,479,400
Non Direct Connection Network Upgrades	$ 1,353,300
Total Costs	**$ 6,832,700**

In addition, the Y1-033 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	$ 0
Previously Identified Upgrades	$ 0
Total Costs	**$ 0**

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

Direct Connection Cost Estimate

In compliance with the Regional Transmission Expansion Planning (RTEP) protocol, the Interconnection Customer has submitted a "Form of Generation Interconnection Feasibility Study Agreement" to PJM and a proposed single line diagram that identifies its plan to construct a 55 MW Wind Generation Project with a total capability of 55 MW (6.6 MW Capacity). For purposes of this report, it has therefore been designated as the Penn Mar – Rockwood 115kV (Y1-033) Project to reflect its interconnection voltage and its proximity to the Penn Mar – Rockwood 115kV line. The IC has requested the study of both a Primary and Secondary Point of Interconnection (POI) for the Project. This report contains detailed connection requirements, direct connection costs and schedule, power flow analysis, short circuit analysis, and a cost and schedule for any associated system reinforcements for the Primary POI. For the Secondary POI, this report only provides the results of the power flow analysis and short circuit analysis. It does not contain a cost/schedule associated with direct connection or any identified system reinforcements pertaining to the analysis performed.

The interconnection of the Project at the primary POI for will be accomplished by constructing a new 115kV 3 breaker ring bus and looping the Penn Mar - Rockwood 115kV line into the new station. The new 115kV 3 breaker ring bus will be approximately 10 miles from Rockwood substation. The IC will be responsible for acquiring all easements, properties and permits that may be required to construct both the new 115kV 3 breaker ring bus interconnection substation and the associated attachment facilities. The IC will also be responsible for the rough grade of the property and an access road to the proposed 3 breaker ring bus site. A summary of the Project direct connection facilities that will be required for the Primary POI and their estimated costs are shown below. The one-line for the Primary POI is shown in Attachment 1.

The total preliminary cost estimate for Direct Connection work is given in the table below:

Description	Total Cost
Penn Mar-Rockwood 115kV, Loop to Interconnecting Substation. Install a loop, approx. 200' in length, consisting of two 3-way deadend structures.	$ 216,900
Install 115kV three position ring bus substation	$ 3,883,000
Engineering, Oversight, & Commissioning	$ 129,600
Tax	$ 1,249,900
Total	**$ 5,479,400**

Non-Direct Connection Cost Estimate

In addition to the direct connection upgrades, the Interconnection Customer will also be responsible for the following transmission upgrades to support the installation of Y1-033.

The total preliminary cost estimate for Non-Direct Connection work is given in the table below:

Description	Total Cost
Install fiber-optic cables between Y1-033 Ring Bus and Penn-Mar 115 kV SS, approximately 4.7 miles.	$ 596,500
Replace relaying at Penn Mar to accommodate new fiber connection.	$ 139,000
Upgrade Rockwood remote end	$ 309,000
Tax	**$ 308,800**
Total	**$ 1,353,300**

Interconnection Customer Requirements

Compliance Issues

The Interconnection Customer will be responsible for meeting all FE connection requirements defined in the FE Requirements for Transmission Connected Facilities document. While the voltage analysis is not performed for the feasibility study, any voltage criteria violations that would require the plant to provide reactive power, that determination of reactive power requirements will be determined in the system impact study, which will include the low voltage ride through analysis.

The IC must also meet all PJM, ReliabilityFirst and NERC reliability criteria and operating procedures required for standards compliance. For example, the IC will need to properly locate and report the over and under-voltage and over and under-frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and ReliabilityFirst audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the FE system.

The IC has proposed a non-standard winding configuration for the main GSU transformer. This configuration is in violation of FE's Requirements for Transmission Facilities document and will not be accepted. As discussed in section 14.2.7 of the document, the transformer shall have a grounded wye winding on the high (utility) side and a delta winding on the low (generator) side.

Other Requirements

In addition to the FE facilities, the Interconnection Customer will also be responsible for meeting all criteria as specified in the applicable sections of the "FE Requirements for Transmission Connected Facilities" document including:

1. The purchase and installation of a fully rated circuit breaker on the high side of the Y1-033 115/34.5kV step-up transformer.

2. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.

3. The purchase and installation of an 115kV interconnection metering instrument transformer. FE will provide the ratio and accuracy specifications based on the customer load and generation levels.

4. The purchase and installation of a revenue class meter for each unit to measure the power delivered in compliance with the FE standards.

5. The purchase and installation of supervisory control and data acquisition (SCADA) equipment to provide information in a compatible format to the FE Transmission System Control Center.

6. The establishment of dedicated communication circuits for SCADA report to the FE Transmission System Control Center.

7. A compliance with the FE and PJM generator power factor and voltage control requirements.

8. The execution of a back-up service agreement to serve the customer load supplied from the Y1-033 115kV interconnection substation when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

9. The rough grade of the property for the Y1-033 115kV interconnection substation and an access road for the delivery of equipment to this site.

The above requirements are in addition to any metering required by PJM.

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.

First Energy Requirements

The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "FirstEnergy Requirements for Transmission Connected Facilities" document located at the following links:

http://www.firstenergycorp.com/feconnect
http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Summary

The Penn Mar – Rockwood 115kV (Y1-033) Project direct connection for the Primary POI will require the facility upgrades defined in the direct and non-direct cost estimates. As shown, the total estimated cost of the 115kV three breaker ring bus substation is $6,832,700 This cost includes a CIAC (Contribution in Aid of Construction) Federal Income Tax Gross Up charge of $1,558,700. The Project does not have any required network upgrades.

Based on the scope of the direct connection for the Primary POI, it is expected to take a minimum of two (2) years from the signing of a Connection Service Agreement to complete the installation required for the Project. This includes a preliminary payment that compensates FE for the first three months of the engineering design work that is related to the construction of the Y1-033 115kV interconnection substation. It also assumes that the IC will provide the property for the Y1-033 115kV interconnection substation and all right-of-way, permits, easements, etc. that will be needed. A further assumption is that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined direct connection and network upgrades, and that PJM will allow all transmission system outages when requested.

Network Impacts

Option 1

The Queue Project #Y1-033 was studied as a 55.0MW (Capacity 6.6MW) injection as a tap of the PENN-MAR – ROCKWOOD 115 kV line in the PENELEC area. Project #Y1-033 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. Potential network impacts were as follows:

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
'01BEDNGT _01BLACKO _062'	CONTINGENCY '01BEDNGT _01BLACKO _062' DISCONNECT BRANCH FROM BUS 235101 TO BUS 235103 CKT 1 /* 500/500KV, AREA 201/201. END
'APS_B_G91'	CONTINGENCY 'APS_B_G91' / 235120 01ALBRIG 138 293240 N33 C 138 0.0 1 OPEN BRANCH FROM BUS 235120 TO BUS 293240 CKT 1 END
'APS_B_G592'	CONTINGENCY 'APS_B_G592' / 235469 01GARRET 138 235470 01GARRET 115 1 OPEN BRANCH FROM BUS 235469 TO BUS 235470 CKT 1 END
'APS_B_G702'	CONTINGENCY 'APS_B_G702' / 200762 GARRETT 115 235470 01GARRET 115 1 OPEN BRANCH FROM BUS 200762 TO BUS 235470 CKT 1 END
'B_PN115-LS-#122'	CONTINGENCY 'B_PN115-LS-#122' /* HOOVERSVILLE - TOWER 51 (H1/H2) 115 KV DISCONNECT BRANCH FROM BUS 200743 TO BUS 200742 CKT 1 END
'B_PN115-LX-#198'	CONTINGENCY 'B_PN115-LX-#198' /* SOMERSET-ROCKWOOD & ROCKWOOD #1 XF DISCONNECT BRANCH FROM BUS 200744 TO BUS 290079 CKT 1 DISCONNECT BRANCH FROM BUS 290079 TO BUS 200746 CKT 1 DISCONNECT BRANCH FROM BUS 200746 TO BUS 200773 CKT 1 END
'B_PN115-XF-#95A'	CONTINGENCY 'B_PN115-XF-#95A' /* GARRETT 138-115 KV XF DISCONNECT BRANCH FROM BUS 235469 TO BUS 235470 CKT 1 DISCONNECT BRANCH FROM BUS 235470 TO BUS 200762 CKT 1 END
'B_PN115-SX-#2B'	CONTINGENCY 'B_PN115-SX-#2B' /* NEW BALTIMORE - BEDFORD NORTH DISCONNECT BRANCH FROM BUS 200884 TO BUS 200501 CKT 1 END

Generator Deliverability

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

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:

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.

Steady-State Voltage Requirements

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

To be determined.

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

To be determined.

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.

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.

	Contingency		Affected		Bus			Power	Loading %		Rating		MW
#	Type	Name	Area	Facility Description	From	To	Circuit	Flow	Initial	Final	Type	MVA	Contribution
1	N-1	APS_B_G91	PJM	S14_TAP-01RIDGLY 138 kV line	290219	235504	1	DC	91.81	100.79	ER	193	17.32
2	Non	Non	PJM	Y1-003 TAP-GARRETT 115 kV line	913000	200762	1	DC	96.52	114.79	NR	125	22.84
3	N-1	APS_B_G702	PJM	HOOVERSV-TOWER 51 115 kV line	200743	200742	1	DC	101.79	115.41	ER	146	19.88

#	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
4	N-1	B_PN115-XF-#95A	PJM	HOOVERSV-TOWER 51 115 kV line	200743	200742	1	DC	101.79	115.41	ER	146	19.88
5	N-1	APS_B_G592	PJM	HOOVERSV-TOWER 51 115 kV line	200743	200742	1	DC	101.79	115.41	ER	146	19.88
6	Non	Non	PJM	Y1-033 TAP-ROCKWOOD 115 kV line	913270	200746	1	DC	88.61	114.2	NR	125	32.15
7	N-1	01BEDNGT_01BLACKO _062	PJM	Y1-033 TAP-ROCKWOOD 115 kV line	913270	200746	1	DC	95.09	116.04	ER	153	32.25
8	N-1	B_PN115-LS-#122	PJM	SCALP L.-RACHEL H 115 kV line	200734	200749	1	DC	123.13	131.71	ER	119	10.22
9	N-1	B_PN115-LX-#198	PJM	01GARRET-N-033 C 138 kV line	235469	293240	1	DC	117.36	136.46	ER	201	38.37
10	N-1	B_PN115-SX-#2B	PJM	HOOVERSV-SCALP L. 115 kV line	200743	200734	1	DC	131.27	137.37	ER	119	7.26
11	Non	Non	PJM	GARRETT-01GARRET 115 kV line	200762	235470	1	DC	130.67	152.02	NR	107	22.84
12	Non	Non	PJM	GARRETT-01GARRET 115 kV line	200762	235470	1	DC	130.73	152.08	NR	107	22.84
13	N-1	B_PN115-LX-#198	PJM	N-033 C-01ALBRIG 138 kV line	293240	235120	1	DC	141.76	160.86	ER	201	38.37
14	N-1	APS_B_G702	PJM	ROCKWOOD-Q34 115 kV line	200746	290079	1	DC	139.32	172.45	ER	166	54.99
15	N-1	APS_B_G592	PJM	ROCKWOOD-Q34 115 kV line	200746	290079	1	DC	139.32	172.45	ER	166	54.99
16	N-1	B_PN115-XF-#95A	PJM	ROCKWOOD-Q34 115 kV line	200746	290079	1	DC	139.32	172.45	ER	166	54.99
17	Non	Non	PJM	ROCKWOOD-Q34 115 kV line	200746	290079	1	DC	170.35	195.93	NR	125	32.15
18	N-1	B_PN115-LX-#198	PJM	01GARRET 138/115 kV transformer	235470	235469	1	DC	170.11	198.16	ER	196	54.99

#	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
19	N-1	B_PN115-LX-#198	PJM	Y1-033 TAP-PENN-MAR 115 kV line	913270	200747	1	DC	165.13	201.08	ER	153	54.99
20	N-1	B_PN115-LX-#198	PJM	PENN-MAR-Y1-003 TAP 115 kV line	200747	913000	1	DC	167.11	203.29	ER	152	54.99
21	N-1	B_PN115-XF-#95A	PJM	Q34-SOMERST 115 kV line	290079	200744	1	DC	199.48	232.61	ER	166	54.99
22	N-1	APS_B_G592	PJM	Q34-SOMERST 115 kV line	290079	200744	1	DC	199.48	232.61	ER	166	54.99
23	N-1	APS_B_G702'	PJM	Q34-SOMERST 115 kV line	290079	200744	1	DC	199.48	232.61	ER	166	54.99
24	N-1	B_PN115-LX-#198	PJM	Y1-003 TAP-GARRETT 115 kV line	913000	200762	1	DC	206.5	242.68	ER	152	54.99
25	Non	Non	PJM	Q34-SOMERST 115 kV line	290079	200744	1	DC	226.6	252.18	NR	125	32.15
26	N-1	'B_PN115-LX-#198'	PJM	GARRETT-01GARRET 115 kV line	200762	235470	1	DC	258.53	301.15	ER	129	54.99

Option 2

The Queue Project #Y1-033 was studied as a 55.0MW (Capacity 6.6MW) injection at the PENN-MAR 115 kV substation in the PENELEC area. Project #Y1-033 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. Potential network impacts were as follows:

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The following contingencies resulted in overloads:

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01HATFLD _01BLACKO _058	CONTINGENCY '01HATFLD _01BLACKO _058' DISCONNECT BRANCH FROM BUS 235108 TO BUS 235103 CKT 1 /* 500/500KV, AREA 201/201. END
APS_B_G592	CONTINGENCY 'APS_B_G592' / 235469 01GARRET 138 235470 01GARRET 115 1 OPEN BRANCH FROM BUS 235469 TO BUS 235470 CKT 1 END
APS_B_G702	CONTINGENCY 'APS_B_G702' / 200762 GARRETT 115 235470 01GARRET 115 1 OPEN BRANCH FROM BUS 200762 TO BUS 235470 CKT 1 END
B_PN115-LX-#120	CONTINGENCY 'B_PN115-LX-#120' /* HOOVERSVILLE-SCALP LEVEL-RACHEL HILL 115 KV DISCONNECT BRANCH FROM BUS 200743 TO BUS 200734 CKT 1 DISCONNECT BRANCH FROM BUS 200734 TO BUS 200749 CKT 1 DISCONNECT BRANCH FROM BUS 200734 TO BUS 200777 CKT 1 DISCONNECT BUS 200734 END
B_PN115-LX-#198	CONTINGENCY 'B_PN115-LX-#198' /* SOMERSET-ROCKWOOD & ROCKWOOD #1 XF DISCONNECT BRANCH FROM BUS 200744 TO BUS 290079 CKT 1 DISCONNECT BRANCH FROM BUS 290079 TO BUS 200746 CKT 1 DISCONNECT BRANCH FROM BUS 200746 TO BUS 200773 CKT 1 END
B_PN115-SX-#2B	CONTINGENCY 'B_PN115-SX-#2B' /* NEW BALTIMORE - BEDFORD NORTH DISCONNECT BRANCH FROM BUS 200884 TO BUS 200501 CKT 1 END
B_PN115-XF-#95A	CONTINGENCY 'B_PN115-XF-#95A' /* GARRETT 138-115 KV XF DISCONNECT BRANCH FROM BUS 235469 TO BUS 235470 CKT 1 DISCONNECT BRANCH FROM BUS 235470 TO BUS 200762 CKT 1 END

Generator Deliverability

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

None.

Multiple Facility Contingency

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(Summary of impacted circuit breakers)

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Contributions to previously identified circuit breakers found to be over-duty:

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

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New System Reinforcements

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

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	Contingency		Affected		Bus			Power	Loading %		Rating		MW
#	Type	Name	Area	Facility Description	From	To	Circuit	Flow	Initial	Final	Type	MVA	Contribution
1	N-1	01HATFLD _01BLACKO _058	PJM	01SHORTG-01BLACKO 138 kV line	235558	235446	1	DC	98.74	100.65	ER	297	5.68
2	N-1	B_PN115-LX-#120	PJM	HOOVERSV-TOWER 51 115 kV line	200743	200742	1	DC	93.59	101.69	ER	146	11.83

#	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
3	Non	Non	PJM	01RIDGLY-01CUMBRL 138 kV line	235504	235454	1	DC	107.63	110.08	NR	242	5.93
4	N-1	01HATFLD _01BLACK O _058	PJM	01CUMBRL-01SHORTG 138 kV line	235454	235558	1	DC	109.35	111.26	ER	297	5.68
5	N-1	B_PN115-LX-#198	PJM	01GARRET-N-033 C 138 kV line	235469	293240	1	DC	96.57	115.66	ER	201	38.37
6	Non	Non	PJM	GARRETT-01GARRET 115 kV line	200762	235470	1	DC	94.51	121.38	NR	107	28.76
7	Non	Non	PJM	GARRETT-01GARRET 115 kV line	200762	235470	1	DC	94.59	121.47	NR	107	28.76
8	N-1	B_PN115-SX-#2B	PJM	SCALP L.-RACHEL H 115 kV line	200734	200749	1	DC	120.09	125.07	ER	119	5.93
9	N-1	01HATFLD _01BLACK O _058	PJM	01RIDGLY-01CUMBRL 138 kV line	235504	235454	1	DC	124.85	126.76	ER	297	5.68
10	N-1	B_PN115-SX-#2B	PJM	HOOVERSV-SCALP L. 115 kV line	200743	200743	1	DC	130.63	135.61	ER	119	5.93
11	N-1	B_PN115-LX-#198	PJM	N-033 C-01ALBRIG 138 kV line	293240	235120	1	DC	120.94	140.03	ER	201	38.37
12	N-1	01BEDNGT _01BLACK O _062	PJM	ROCKWOOD-Q34 115 kV line	200746	290079	1	DC	136.05	151.84	ER	166	26.34
13	N-1	B_PN115-LX-#198	PJM	01GARRET 138/115 kV transformer	235470	235469	1	DC	139.5	167.56	ER	196	54.99
14	Non	Non	PJM	01GARRET 138/115 kV transformer	200746	290079	1	DC	153.37	174.26	NR	125	26.23
15	N-1	APS_B_G592	PJM	Q34-SOMERST 115 kV line	290079	200744	1	DC	163.35	196.47	ER	166	54.99

#	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
16	N-1	APS_B_G702	PJM	Q34-SOMERST 115 kV line	290079	200744	1	DC	163.35	196.47	ER	166	54.99
17	N-1	B_PN115-XF-#95A	PJM	Q34-SOMERST 115 kV line	290079	200744	1	DC	163.35	196.47	ER	166	54.99
13	N-1	B_PN115-LX-#198	PJM	N-033 C-01ALBRIG 138 kV line	293240	235120	1	DC	141.76	160.86	ER	201	38.37
14	N-1	APS_B_G702	PJM	ROCKWOOD-Q34 115 kV line	200746	290079	1	DC	139.32	172.45	ER	166	54.99
15	N-1	APS_B_G592	PJM	ROCKWOOD-Q34 115 kV line	200746	290079	1	DC	139.32	172.45	ER	166	54.99
16	N-1	B_PN115-XF-#95A	PJM	ROCKWOOD-Q34 115 kV line	200746	290079	1	DC	139.32	172.45	ER	166	54.99
17	Non	B_PN115-XF-#95A	PJM	Q34-SOMERST 115 kV line	290079	200744	1	DC	163.35	196.47	ER	166	54.99
18	N-1	B_PN115-LX-#198	PJM	PENN-MAR-GARRETT 115 kV line	200747	200762	1	DC	167.11	203.29	ER	152	54.99
19	Non	Non	PJM	Q34-SOMERST 115 kV line	290079	200744	1	DC	209.62	230.51	NR	125	26.23
20	N-1	B_PN115-LX-#198	PJM	GARRETT-01GARRET 115 kV line	200762	235470	1	DC	212.02	254.65	ER	129	54.99

Attachment 1

System Configuration