



# **Generation Interconnection**

## **Feasibility Study Report**

**for**

**Queue Project AF1-052**

**MASON 230 KV**

**114.2 MW Capacity / 114.6 MW Energy**

January, 2020

## 1 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. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. 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 Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

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

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a \$10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates)

for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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.

## 2 General

The Interconnection Customer (IC) has proposed a Natural Gas, Storage and Solar generating hybrid generating facility located in Hudson County, New Jersey. The installed facilities will have a total summer capability of 114.6 MW<sup>1</sup> with 114.2 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2024. This study does not imply a TO commitment to this in-service date.

<b>Queue Number</b>	<b>AF1-052</b>
<b>Project Name</b>	MASON 230 KV
<b>State</b>	New Jersey
<b>County</b>	Hudson
<b>Transmission Owner</b>	PSEG
<b>MFO</b>	131.5 (Winter)
<b>MWE</b>	114.6 (Summer); 131.5 (Winter)
<b>MWC</b>	114.2
<b>Fuel</b>	Natural Gas; Storage; Solar
<b>Basecase Study Year</b>	2023

### 2.1 Point of Interconnection

AF1-052 will interconnect with the PSEG transmission system at the Mason 230 kV substation.

### 2.2 Cost Summary

The AF1-052 project will be responsible for the following costs for the physical interconnection:

Description	Total Cost
<b>Attachment Facilities</b>	\$10,800,000
<b>Direct Connection Network Upgrade</b>	\$0
<b>Non Direct Connection Network Upgrades</b>	\$1,200,000
<b>Total Costs</b>	\$12,000,000

In addition, the AF1-052 project may be responsible for a contribution to the following costs for the Network Upgrades identified in this report:

Description	Total Cost
<b>System Upgrades</b>	\$88,700,000

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

<sup>1</sup> The facility Maximum Facility Output is 131.5 MW. The net summer energy output is 114.6 MW. The summer value was used as the basis of this study.

### 3 Transmission Owner Scope of Work

#### 3.1 Attachment Facilities

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

Description	Total Cost
Install two (2) pothead structures at the POI and associated Gas Insulated Busbar (GIB) from the Gas Insulated Substation (GIS) hall to the POI location. Installation of revenue grade metering for two (2) connections.	\$10,800,000
<b>Total Attachment Facility Costs</b>	<b>\$10,800,000</b>

#### 3.2 Direct Connection Cost Estimate

None

#### 3.3 Non-Direct Connection Cost Estimate

Description	Total Cost
Final tie in of the attachment Facilities to the Mason 230kV Substation	\$1,200,000
<b>Total Attachment Facility Costs</b>	<b>\$1,200,000</b>

### 4 Schedule

The estimated schedule for completion of the Transmission Owner scope of work above is **24 months**.

### 5 Revenue Metering and SCADA Requirements

#### 5.1 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.

## 5.2 PSEG 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.pseg.com/business/builders/new_service/before/)

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

## 6 Behind the Meter Information

Interconnection Customer cannot use the output from a generator to net against load in a “Behind the Meter Generation” arrangement in the case that the load is connected at a different transmission bus.

## 7 Network Impacts

The Queue Project AF1-052 was evaluated as a 114.6 MW (Capacity 114.2 MW) injection at the Mason 230 kV substation in the PSEG area. Project AF1-052 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-052 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

# Summer Peak Load Flow

## 8 Generation Deliverability

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

None

## 9 Multiple Facility Contingency

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

None

## 10 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)

ID	FROM BUS#	FROM BUS AREA	kV	TO BUS#	TO BUS AREA	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
46721278	218352	MDWRD_R	230.0	PSE&G	218304	BRUNSWCK	PSE&G	1	PS_P2-3_DEAN_9-10	breaker	885.0	108.54	109.36	DC	16.17
49409955	218352	MDWRD_R	230.0	PSE&G	218304	BRUNSWCK	PSE&G	1	PS_P1-2_S-2219_LT	single	885.0	115.18	116.13	DC	18.18
49409956	218352	MDWRD_R	230.0	PSE&G	218304	BRUNSWCK	PSE&G	1	Base Case	single	731.0	112.26	113.18	DC	14.41
49761984	218352	MDWRD_R	230.0	PSE&G	218304	BRUNSWCK	PSE&G	1	PS_P7-1_D2204+S2219_LT	tower	885.0	118.11	119.0	DC	17.55
49761985	218352	MDWRD_R	230.0	PSE&G	218304	BRUNSWCK	PSE&G	1	PS_P7-1_G2207+H2286_LT	tower	885.0	111.71	112.42	DC	13.51
46721225	218357	PRRNAV_R	230.0	PSE&G	218352	MDWRD_R	PSE&G	1	PS_P2-3_DEAN_9-10	breaker	885.0	111.64	112.46	DC	16.17
49409898	218357	PRRNAV_R	230.0	PSE&G	218352	MDWRD_R	PSE&G	1	PS_P1-2_S-2219	single	885.0	118.22	119.18	DC	18.19
49409899	218357	PRRNAV_R	230.0	PSE&G	218352	MDWRD_R	PSE&G	1	PS_P1-2_S-2219_LT	single	885.0	117.79	118.75	DC	18.19
49409900	218357	PRRNAV_R	230.0	PSE&G	218352	MDWRD_R	PSE&G	1	Base Case	single	731.0	116.11	117.03	DC	14.41
49761962	218357	PRRNAV_R	230.0	PSE&G	218352	MDWRD_R	PSE&G	1	PS_P7-1_D2204+S2219_LT	tower	885.0	120.48	121.37	DC	17.56
49761963	218357	PRRNAV_R	230.0	PSE&G	218352	MDWRD_R	PSE&G	1	PS_P7-1_G2207+H2286_LT	tower	885.0	114.8	115.51	DC	13.51
49409797	218469	METUCHEN	230.0	PSE&G	218357	PRRNAV_R	PSE&G	1	PS_P1-2_S-2219	single	885.0	124.79	125.74	DC	18.19
49409799	218469	METUCHEN	230.0	PSE&G	218357	PRRNAV_R	PSE&G	1	Base Case	single	731.0	120.11	121.02	DC	14.41
49761942	218469	METUCHEN	230.0	PSE&G	218357	PRRNAV_R	PSE&G	1	PS_P7-1_D2204+S2219_LT	tower	885.0	123.41	124.31	DC	17.56

## 11 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
49409958	218352	MDWRD_R	230.0	PSE&G	218304	BRUNSWCK	230.0	PSE&G	1	PS_P1-2_S-2219_LT	operation	885.0	110.69	111.63	DC	18.25
49409964	218352	MDWRD_R	230.0	PSE&G	218304	BRUNSWCK	230.0	PSE&G	1	Base Case	operation	731.0	107.76	108.67	DC	14.46
49409902	218357	PRSNVAV_R	230.0	PSE&G	218352	MDWRD_R	230.0	PSE&G	1	PS_P1-2_D-2204	operation	885.0	110.64	111.41	DC	15.29
49409907	218357	PRSNVAV_R	230.0	PSE&G	218352	MDWRD_R	230.0	PSE&G	1	Base Case	operation	731.0	111.5	112.41	DC	14.46
49409798	218469	METUCHEN	230.0	PSE&G	218357	PRSNVAV_R	230.0	PSE&G	1	PS_P1-2_S-2219	operation	885.0	120.01	120.96	DC	18.25
49409804	218469	METUCHEN	230.0	PSE&G	218357	PRSNVAV_R	230.0	PSE&G	1	Base Case	operation	731.0	115.5	116.41	DC	14.46

## 12 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
49409899, 49409898, 49761963, 49409900, 49761962, 46721225	2	PRSSNAV_R 230.0 kV - MDWRD_R 230.0 kV Ckt 1	<u>PSEG</u> r_PS_AF1_FES_PierMead1075 (41) : Reconductor Pierson Ave – Meadow Rd 230 kV line and upgrade terminal equipment to a minimum of 1075MVA SER Project Type : FAC Cost : \$3,400,000 Time Estimate : 24.0 Months	\$3,400,000
49409797, 49761942, 49409799	3	METUCHEN 230.0 kV - PRSSNAV_R 230.0 kV Ckt 1	<u>PSEG</u> r_PS_AF1_FES_MetPier1150 (40) : Reconductor the Metuchen – Pierson Ave 230 kV line Project Type : FAC Cost : \$14,300,000 Time Estimate : 24.0 Months	\$14,300,000
46721278, 49761984, 49409955, 49409956, 49761985	1	MDWRD_R 230.0 kV - BRUNSWCK 230.0 kV Ckt 1	<u>PSEG</u> r_PS_AF1_FES_MeadBrun1075 (43) : Facility upgrades addressed by PS_AF1_FES_PierMead1075 upgrade Project Type : FAC Cost : \$0 Time Estimate : 24.0 Months	\$0
Not Applicable		Roseland 230 kV Substation Breakers <sup>2</sup>	Connect the A-941 (Whippany-Roseland 230kV) line to Roseland 500kV (via a 500/230kV transformer	\$71,000,000
			<b>TOTAL COST</b>	<b>\$88,700,000</b>

<sup>2</sup> Refer to the Short Circuit section 15 of this report for details

### 13 Flow Gate Details

The following indices contain additional information about each flowgate presented in the body of the report. For each index, 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.

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## 13.1 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
49761984	218352	MDWRD_R	PSE&G	218304	BRUNSWCK	PSE&G	1	PS_P7- 1_D2204+S2219_LT	tower	885.0	118.11	119.0	DC	17.55

Bus #	Bus	MW Impact
217082	WEATEXAS E	0.1419
217104	FAIRLAWN_AB	8.8392
217203	FBANKSOLAR E	0.0842
217205	WCALDSOLAR E	0.1952
217207	PARK ELE E	0.0352
217210	CAMDEN ST E	0.0388
217212	AMBOY SO E	0.5495
217213	AMBOY SO C	0.0485
217214	CENTRL HS E	0.0497
217216	BARNGR HS E	0.0443
217218	BAYON2SP2_E	0.0074
217249	HACKENSOLA E	0.0818
217254	BAYON2SP4_E	0.0054
217255	BAYON2SP3_E	0.0092
217256	COOKPTSP1_E	0.0049
217270	COOKPTSP2_E	0.0052
217272	COOKPTSP3_E	0.0049
217274	COOKPTSP4_E (Deactivation : 06/01/15)	0.0041
217276	DOREMUSP1_E	0.0060
217280	DOREMUSP2_E	0.0063
217282	DOREMUSP3_E	0.0063
217284	DOREMUSP4_E	0.0060
217289	HOBEK1SP1_E	0.0118
217291	HOBEK1SP2_E	0.0118
217295	HOBEK1SP3_E	0.0118
217297	HOBEK1SP4_E	0.0118
217305	HILLDASP1_E	0.0020
217318	HILLDASP2_E	0.0020
217335	HILLDASP3_E	0.0020
217337	HILLDASP4_E	0.0020
217341	HOBEK2SP1_E	0.0012
217343	HOBEK2SP2_E	0.0012
217345	HOBEK2SP3_E	0.0012
217350	HOBEK2SP4_E	0.0012
217360	JACKPSSP1_E	0.0059
217364	JACKPSSP2_E	0.0059
217387	JACKPSSP3_E	0.0059
217389	JACKPSSP4_E	0.0059
217393	LEONIASP1_E	0.0150
217397	LEONIASP2_E	0.0150
217399	LEONIASP3_E	0.0150
217406	LEONIASP4_E	0.0150

Bus #	Bus	MW Impact
217410	MAYWOOSP1_E	0.0100
217418	MAYWOOSP2_E	0.0100
217420	MAYWOOSP3_E	0.0075
217425	MAYWOOSP4_E	0.0100
217449	NEWMILSP1_E	0.0078
217457	NEWMILSP2_E	0.0078
217460	NEWMILSP3_E	0.0078
217480	NEWMILSP4_E	0.0078
217487	SADDLESP1_E	0.0069
217489	SADDLESP2_E	0.0069
217517	SADDLESP3_E	0.0069
217519	SADDLESP4_E	0.0069
217530	WALDWKSP1_E	0.0019
217541	WALDWKSP2_E	0.0020
217543	WALDWKSP3_E	0.0004
217545	WALDWKSP4_E	0.0004
217547	WCALDWSP1_E	0.0029
217550	WCALDWSP2_E	0.0029
217560	WCALDWSP3_E	0.0029
217563	WCALDWSP4_E	0.0029
217565	ATHENISP1_E	0.0206
217567	ATHENISP2_E	0.0206
217569	ATHENISP3_E	0.0206
217572	MARIONSP1_E	0.0249
217576	MARIONSP2_E	0.0249
217583	MARIONSP3_E	0.0249
217585	WORNGESP1_E	0.0117
217600	WORNGESP2_E	0.0117
217610	WORNGESP3_E	0.0117
217612	CEDARGSP1_E	0.0098
217614	CEDARGSP2_E	0.0098
217618	ERUTHSP1_E	0.0207
217630	ERUTHSP2_E	0.0207
217640	FAIRLASP1_E	0.0368
217642	FAIRLASP2_E	0.0368
217660	HINCHMSP1_E	0.0088
217670	HINCHMSP2_E	0.0088
217680	NORTHASP1_E	0.0300
217689	NORTHASP2_E	0.0300
217691	SPRINGSP1_E	0.0176
217710	SPRINGSP2_E	0.0176
217721	BELLEVSP1_E	0.0352
218344	TOSCO_G6	0.6092
218418	LINDEN_G5	2.0281
218419	LINDEN_G6	2.0281
218423	LINDEN_G21	5.2838
218424	LINDEN_G22	5.2838
218425	LINDEN_G12	5.7642
218426	LINDEN_2ST	9.1266
218428	ETC SOLAR C	0.0118
218429	ETC SOLAR E	0.1997
218439	SUMMTASSOC E	0.6595

Bus #	Bus	MW Impact
218440	SUMMTASSOC C	0.0564
218450	ALDENES1_E	0.0230
218513	ALDENES2_E	0.0231
218545	WOODBRS1_C	0.0086
218549	WOODBRS1_E	0.1004
218554	WOODBRS2_C	0.0072
218555	WOODBRS2_E	0.0836
218558	WOODBRS3_C	0.0072
218559	WOODBRS3_E	0.0838
218636	METUCHSP1_C	0.0127
218640	METUCHSP1_E	0.1483
218655	METUCHSP2_C	0.0127
218659	METUCHSP2_E	0.1483
218662	MINUESP1_C	0.0020
218663	MINUESP1_E	0.0241
218664	MINUESP2_C	0.0014
218665	MINUESP2_E	0.0165
218667	NWKS WTSP1_E	0.0420
218672	KENILWRTH E	1.1315
218675	WARINASP1_E	0.0481
218677	WARINASP2_E	0.0479
218727	LINSOLAR E	0.2512
218728	CNTRALGAS1 C	0.0874
218729	CNTRALGAS1 E	0.7563
218730	CNTRALGAS2 C	0.0873
218731	CNTRALGAS2 E	0.7551
219001	SEWAREN7GT	10.4693
219002	SEWAREN7ST	15.7040
219679	NRGCENTER E	-0.2931
219881	V2-009 E2	-0.6615
219883	V2-009 E1	-0.3301
913101	Y1-026	4.8660
917001	Z2-000 C O1	271.8758
917002	Z2-000 E O1	1.6207
917011	Z2-002 C	1.7292
917521	SEWARENG7E1	4.7891
917522	SEWARENG7E2	4.7891
919802	AA2-066 E	-0.2931
920031	AA2-099 C	1.6455
924431	AB2-092	7.0099
930092	AB1-021 E	0.1953
930901	AB1-139 C	0.1414
930902	AB1-139 E	1.6612
934302	AD1-054 E	0.1981
936193	AD2-025 BAT	0.3256
938281	AE1-041 C	0.0810
938282	AE1-041 E	0.3647
940301	AE2-014 FTIR (Withdrawn : 01/24/2020)	442.0680
943841	AF1-052 C	7.8807
943842	AF1-052 E	0.0276
945723	AF1-237 BAT	29.2780
945801	AF1-245 C O1	5.5375

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
945802	AF1-245 E O1	8.3063
DUCKCREEK	DUCKCREEK	0.4813
NEWTON	NEWTON	0.4556
FARMERCITY	FARMERCITY	0.0240
G-007A	G-007A	0.3740
VFT	VFT	137.9913
PRAIRIE	PRAIRIE	1.1107
COFFEEN	COFFEEN	0.2236
EDWARDS	EDWARDS	0.1460
CHEOAH	CHEOAH	0.2342
TILTON	TILTON	0.2633
GIBSON	GIBSON	0.2304
CALDERWOOD	CALDERWOOD	0.2321
BLUEG	BLUEG	0.7326
TRIMBLE	TRIMBLE	0.2343
CATAWBA	CATAWBA	0.1767

## 13.2 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
49761962	218357	PRSNVAV_R	PSE&G	218352	MDWRD_R	PSE&G	1	PS_P7-1_D2204+S2219_LT	tower	885.0	120.48	121.37	DC	17.56

Bus #	Bus	MW Impact
217082	WEATEXAS E	0.1419
217104	FAIRLAWN_AB	8.8403
217203	FBANKSOLAR E	0.0842
217205	WCALDSOLAR E	0.1952
217207	PARK ELE E	0.0352
217210	CAMDEN ST E	0.0389
217212	AMBOY SO E	0.5495
217213	AMBOY SO C	0.0485
217214	CENTRL HS E	0.0497
217216	BARNGR HS E	0.0443
217218	BAYON2SP2_E	0.0074
217249	HACKENSOLA E	0.0818
217254	BAYON2SP4_E	0.0054
217255	BAYON2SP3_E	0.0092
217256	COOKPTSP1_E	0.0049
217270	COOKPTSP2_E	0.0052
217272	COOKPTSP3_E	0.0049
217274	COOKPTSP4_E (Deactivation : 06/01/15)	0.0041
217276	DOREMUSP1_E	0.0060
217280	DOREMUSP2_E	0.0063
217282	DOREMUSP3_E	0.0063
217284	DOREMUSP4_E	0.0060
217289	HOBEK1SP1_E	0.0118
217291	HOBEK1SP2_E	0.0118
217295	HOBEK1SP3_E	0.0118
217297	HOBEK1SP4_E	0.0118
217305	HILLDASP1_E	0.0020
217318	HILLDASP2_E	0.0020
217335	HILLDASP3_E	0.0020
217337	HILLDASP4_E	0.0020
217341	HOBEK2SP1_E	0.0012
217343	HOBEK2SP2_E	0.0012
217345	HOBEK2SP3_E	0.0012
217350	HOBEK2SP4_E	0.0012
217360	JACKPSSP1_E	0.0059
217364	JACKPSSP2_E	0.0059
217387	JACKPSSP3_E	0.0059
217389	JACKPSSP4_E	0.0059
217393	LEONIASP1_E	0.0150
217397	LEONIASP2_E	0.0150
217399	LEONIASP3_E	0.0150
217406	LEONIASP4_E	0.0150

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
217410	MAYWOOSP1_E	0.0100
217418	MAYWOOSP2_E	0.0100
217420	MAYWOOSP3_E	0.0075
217425	MAYWOOSP4_E	0.0100
217449	NEWMILSP1_E	0.0078
217457	NEWMILSP2_E	0.0078
217460	NEWMILSP3_E	0.0078
217480	NEWMILSP4_E	0.0078
217487	SADDLESP1_E	0.0069
217489	SADDLESP2_E	0.0069
217517	SADDLESP3_E	0.0069
217519	SADDLESP4_E	0.0069
217530	WALDWKSP1_E	0.0019
217541	WALDWKSP2_E	0.0020
217543	WALDWKSP3_E	0.0004
217545	WALDWKSP4_E	0.0004
217547	WCALDWSP1_E	0.0029
217550	WCALDWSP2_E	0.0029
217560	WCALDWSP3_E	0.0029
217563	WCALDWSP4_E	0.0029
217565	ATHENISP1_E	0.0206
217567	ATHENISP2_E	0.0206
217569	ATHENISP3_E	0.0206
217572	MARIONSP1_E	0.0249
217576	MARIONSP2_E	0.0249
217583	MARIONSP3_E	0.0249
217585	WORNGESP1_E	0.0117
217600	WORNGESP2_E	0.0117
217610	WORNGESP3_E	0.0117
217612	CEDARGSP1_E	0.0098
217614	CEDARGSP2_E	0.0098
217618	ERUTHSP1_E	0.0207
217630	ERUTHSP2_E	0.0207
217640	FAIRLASP1_E	0.0368
217642	FAIRLASP2_E	0.0368
217660	HINCHMSP1_E	0.0088
217670	HINCHMSP2_E	0.0088
217680	NORTHASP1_E	0.0300
217689	NORTHASP2_E	0.0300
217691	SPRINGSP1_E	0.0176
217710	SPRINGSP2_E	0.0176
217721	BELLEVSP1_E	0.0352
218344	TOSCO_G6	0.6093
218418	LINDEN_G5	2.0283
218419	LINDEN_G6	2.0283
218423	LINDEN_G21	5.2843
218424	LINDEN_G22	5.2843
218425	LINDEN_G12	5.7647
218426	LINDEN_2ST	9.1274
218428	ETC SOLAR C	0.0118
218429	ETC SOLAR E	0.1997
218450	ALDENESP1_E	0.0230

Bus #	Bus	MW Impact
218513	ALDENESP2_E	0.0231
218545	WOODBRS1_C	0.0086
218549	WOODBRS1_E	0.1004
218554	WOODBRS2_C	0.0072
218555	WOODBRS2_E	0.0836
218558	WOODBRS3_C	0.0072
218559	WOODBRS3_E	0.0838
218636	METUCHSP1_C	0.0127
218640	METUCHSP1_E	0.1483
218655	METUCHSP2_C	0.0127
218659	METUCHSP2_E	0.1483
218662	MINUESP1_C	0.0020
218663	MINUESP1_E	0.0241
218664	MINUESP2_C	0.0014
218665	MINUESP2_E	0.0165
218667	NWKSWTSP1_E	0.0420
218672	KENILWRTH E	1.1317
218675	WARINASP1_E	0.0481
218677	WARINASP2_E	0.0479
218727	LINSOLAR E	0.2512
219001	SEWAREN7GT	10.4699
219002	SEWAREN7ST	15.7048
219679	NRGCENTER E	-0.2931
219881	V2-009 E2	-0.6615
219883	V2-009 E1	-0.3301
913101	Y1-026	4.8664
917001	Z2-000 C O1	271.8892
917002	Z2-000 E O1	1.6208
917011	Z2-002 C	1.7294
917521	SEWARENG7E1	4.7893
917522	SEWARENG7E2	4.7893
919712	AA2-058 E	-0.0698
919802	AA2-066 E	-0.2931
920031	AA2-099 C	1.6456
924431	AB2-092	7.0108
930092	AB1-021 E	0.1953
930901	AB1-139 C	0.1414
930902	AB1-139 E	1.6613
934302	AD1-054 E	0.1981
936193	AD2-025 BAT	0.3256
938281	AE1-041 C	0.0810
938282	AE1-041 E	0.3647
940301	AE2-014 FTIR (Withdrawn : 01/24/2020)	442.0920
943841	AF1-052 C	7.8817
943842	AF1-052 E	0.0276
945723	AF1-237 BAT	29.2760
945801	AF1-245 C O1	5.5383
945802	AF1-245 E O1	8.3074
DUCKCREEK	DUCKCREEK	0.4790
NEWTON	NEWTON	0.4534
FARMERCITY	FARMERCITY	0.0239
G-007A	G-007A	0.3788

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
VFT	VFT	138.0042
PRAIRIE	PRAIRIE	1.1055
COFFEEN	COFFEEN	0.2225
EDWARDS	EDWARDS	0.1452
CHEOAH	CHEOAH	0.2332
TILTON	TILTON	0.2621
GIBSON	GIBSON	0.2293
CALDERWOOD	CALDERWOOD	0.2311
BLUEG	BLUEG	0.7291
TRIMBLE	TRIMBLE	0.2332
CATAWBA	CATAWBA	0.1761

### 13.3 Index 3

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
49409797	218469	METUCHEN	PSE&G	218357	PRSNVAV_R	PSE&G	1	PS_P1-2_S-2219	single	885.0	124.79	125.74	DC	18.19

Bus #	Bus	MW Impact
217065	ECRRF_1	0.7328
217081	WEATEXAS C	0.0146
217104	FAIRLAWN_AB	10.7991
217118	BERGEN 1 ST	4.6398
217138	BERGEN_2CT1	3.9434
217139	BERGEN_2CT2	3.9457
217140	BERGEN_2ST	5.8330
217176	GREATFALLS	0.1321
217193	NEC_ST	7.8690
217201	HACKENSOLA C	0.0085
217209	CENTRL HS C	0.0072
217211	CAMDEN ST C	0.0040
217213	AMBOY SO C	0.0545
217217	BAYON2SP2_C	0.0007
217250	BAYON2SP4_C	0.0006
217285	HOBEK1SP1_C	0.0012
217290	HOBEK1SP2_C	0.0012
217294	HOBEK1SP3_C	0.0012
217296	HOBEK1SP4_C	0.0012
217323	ECRRF_2	0.7326
217339	HOBEK2SP1_C	0.0001
217342	HOBEK2SP2_C	0.0001
217344	HOBEK2SP3_C	0.0001
217346	HOBEK2SP4_C	0.0001
217392	LEONIASP1_C	0.0016
217394	LEONIASP2_C	0.0016
217398	LEONIASP3_C	0.0016
217400	LEONIASP4_C	0.0016
217564	ATHENISP1_C	0.0022
217566	ATHENISP2_C	0.0022
217568	ATHENISP3_C	0.0022
217571	MARIONSP1_C	0.0026
217575	MARIONSP2_C	0.0026
217580	MARIONSP3_C	0.0026
217617	ERUTHSP1_C	0.0022
217619	ERUTHSP2_C	0.0022
217637	FAIRLASP1_C	0.0038
217641	FAIRLASP2_C	0.0038
217675	NORTHASP1_C	0.0031
217688	NORTHASP2_C	0.0031
217915	BERGEN_11	2.6347

Bus #	Bus	MW Impact
217916	BERGEN_12	2.6347
217917	BERGEN_13	2.6347
217918	BERGEN_14	2.6347
218092	PRIMEENG_G	1.5816
218318	LINDEN_26	1.1021
218344	TOSCO_G6	0.6129
218418	LINDEN_G5	2.0554
218419	LINDEN_G6	2.0554
218423	LINDEN_G21	5.3548
218424	LINDEN_G22	5.3548
218425	LINDEN_G12	5.8416
218426	LINDEN_2ST	9.2491
218435	LINDEN_1GT	5.3044
218436	LINDEN_G11	9.1058
218545	WOODBRS1_C	0.0097
218554	WOODBRS2_C	0.0080
218558	WOODBRS3_C	0.0081
218636	METUCHSP1_C	0.0144
218655	METUCHSP2_C	0.0144
218662	MINUESP1_C	0.0022
218664	MINUESP2_C	0.0013
218666	NWKSWTSP1_C	0.0043
218674	WARINASP1_C	0.0048
218676	WARINASP2_C	0.0048
218726	LINSOLAR C	0.0258
219001	SEWAREN7GT	11.6814
219002	SEWAREN7ST	17.5221
219035	LINDEN_G8	1.8251
219036	LINDEN_G7	1.8251
913101	Y1-026	4.8946
917001	Z2-000 C O1	307.5193
917011	Z2-002 C	1.7525
920031	AA2-099 C	1.8360
924431	AB2-092	8.5270
930901	AB1-139 C	0.1599
938281	AE1-041 C	0.0917
940301	AE2-014 FTIR (Withdrawn : 01/24/2020)	493.2480
943841	AF1-052 C	8.1930
945801	AF1-245 C O1	5.7556
DUCKCREEK	DUCKCREEK	0.5608
NEWTON	NEWTON	0.5287
FARMERCITY	FARMERCITY	0.0278
G-007A	G-007A	2.4478
VFT	VFT	138.4170
PRAIRIE	PRAIRIE	1.2889
COFFEEN	COFFEEN	0.2600
EDWARDS	EDWARDS	0.1698
CHEOAH	CHEOAH	0.2693
TILTON	TILTON	0.3062
GIBSON	GIBSON	0.2675
CALDERWOOD	CALDERWOOD	0.2664
BLUEG	BLUEG	0.8506

<b>Bus #</b>	<b>Bus</b>	<b>MW Impact</b>
TRIMBLE	TRIMBLE	0.2727
CATAWBA	CATAWBA	0.2013

# Affected Systems

## **14 Affected Systems**

### **14.1 LG&E**

LG&E Impacts to be determined during later study phases (as applicable).

### **14.2 MISO**

MISO Impacts to be determined during later study phases (as applicable).

### **14.3 TVA**

TVA Impacts to be determined during later study phases (as applicable).

### **14.4 Duke Energy Progress**

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

### **14.5 NYISO**

NYISO Impacts to be determined during later study phases (as applicable).

Contingency Name	Contingency Definition
PS_P2-3_DEAN_9-10	CONTINGENCY 'PS_P2-3_DEAN_9-10' TRIP LINE FROM BUS 218304 TO BUS 218306 CKT 1 /* DEANS TO BRUNSWICK DISCONNECT BRANCH FROM BUS 200006 TO BUS 218306 CKT 3 END
PS_P1-2_D-2204	CONTINGENCY 'PS_P1-2_D-2204' /* BRUNSWICK DEANS TRIP LINE FROM BUS 218304 TO BUS 218306 CKT 1 END
PS_P7-1_D2204+S2219_LT	CONTINGENCY 'PS_P7-1_D2204+S2219_LT' /* DEANS - BRUNSWICK & DEANS - METUCHEN TRIP LINE FROM BUS 218304 TO BUS 218306 CKT 1 DISCONNECT BUS 218358 /* PIERSON AVE S CLOSE LINE FROM BUS 218401 TO BUS 218402 CKT Z/* PIERSON AVE DISCONNECT BUS 218351 /* MDWRD_S CLOSE LINE FROM BUS 218392 TO BUS 218393 CKT Z/* MDWRD_L1_L2 MOVE 8 MW LOAD FROM BUS 218401 TO BUS 218384 /* INTERSTATION TIE TRANSFER LOAD FROM PRSNAVS TO KILMER T2 MOVE 8 MW LOAD FROM BUS 218393 TO BUS 218385 /* INTERSTATION TIE TRANSFER LOAD FROM MDWRD TO KILMER T4 MOVE 8 MW LOAD FROM BUS 218401 TO BUS 218399 /* INTERSTATION TIE TRANSFER LOAD FROM PRSNAVS TO NEWDOVR T2 MOVE 8 MW LOAD FROM BUS 218402 TO BUS 218399 /* INTERSTATION TIE TRANSFER LOAD FROM PRSNAVS TO NEWDOVR T2 MOVE 8 MW LOAD FROM BUS 218402 TO BUS 218390 /* INTERSTATION TIE TRANSFER LOAD FROM PRSNAVS TO LAFAYET T2 MOVE 8 MW LOAD FROM BUS 218392 TO BUS 219616 /* INTERSTATION TIE TRANSFER LOAD FROM MDWRD TO HARTS LANE MOVE 8 MW LOAD FROM BUS 218392 TO BUS 219616 /* INTERSTATION TIE TRANSFER LOAD FROM MDWRD TO HARTS LANE MOVE 8 MW LOAD FROM BUS 218393 TO BUS 218390 /* INTERSTATION TIE TRANSFER LOAD FROM MDWRD TO LAFAYET T2 END

Contingency Name	Contingency Definition
<p>PS_P7-1_G2207+H2286_LT</p>	<pre> CONTINGENCY 'PS_P7-1_G2207+H2286_LT'          /*FANWOOD-METUCHEN &amp; LINDEN-DEANS DISCONNECT BUS 218354                          /* MINUE STREET G DISCONNECT BUS 218355                          /* NEW DOVERH DISCONNECT BUS 218320                          /* FANWOOD 1 CLOSE LINE FROM BUS 218398 TO BUS 218399 CKT Z /* NEW DOVER MOVE 8 MW LOAD FROM BUS 218398 TO BUS 218412 /* INTERSTATION TIE TRANSFER LOAD FROM NEWDOVR TO WDBRDG T2 MOVE 8 MW LOAD FROM BUS 218398 TO BUS 218391 /* INTERSTATION TIE TRANSFER LOAD FROM NEWDOVR TO LAFAYET T1 MOVE 8 MW LOAD FROM BUS 218399 TO BUS 218401 /* INTERSTATION TIE TRANSFER LOAD FROM NEWDOVR TO PRSNAVS T1 MOVE 8 MW LOAD FROM BUS 218399 TO BUS 218402 /* INTERSTATION TIE TRANSFER LOAD FROM NEWDOVR TO PRSNAVS T2 CLOSE LINE FROM BUS 218380 TO BUS 218381 CKT Z /* FANWOOD MOVE 8 MW LOAD FROM BUS 218381 TO BUS 218415 /* INTERSTATION TIE TRANSFER LOAD FROM FANWOOD TO WESTFIELD T1 MOVE 8 MW LOAD FROM BUS 218380 TO BUS 218374 /* INTERSTATION TIE TRANSFER LOAD FROM FANWOOD TO ALDENE T10 MOVE 8 MW LOAD FROM BUS 218381 TO BUS 216926 /* INTERSTATION TIE TRANSFER LOAD FROM FANWOOD TO SPRINGRD T1 MOVE 8 MW LOAD FROM BUS 218380 TO BUS 216927 /* INTERSTATION TIE TRANSFER LOAD FROM FANWOOD TO SPRINGRD T2 CLOSE LINE FROM BUS 218396 TO BUS 218397 CKT Z /* MINUE STREET MOVE 8 MW LOAD FROM BUS 218397 TO BUS 218413 /* INTERSTATION TIE TRANSFER LOAD FROM MINUEST TO WDBRDG T3 MOVE 8 MW LOAD FROM BUS 218396 TO BUS 218414 /* INTERSTATION TIE TRANSFER LOAD FROM MINUEST TO WDBRDG T1 MOVE 8 MW LOAD FROM BUS 218397 TO BUS 218410 /* INTERSTATION TIE TRANSFER LOAD FROM MINUEST TO WARINICO T1 MOVE 8 MW LOAD FROM BUS 218396 TO BUS 218414 /* INTERSTATION TIE TRANSFER LOAD FROM MINUEST TO WDBRDG T1 END </pre>
<p>PS_P1-2_S-2219</p>	<pre> CONTINGENCY 'PS_P1-2_S-2219'                  /* METUCHEN TO DEANS DISCONNECT BUS 218358                          /* PIERSON AVE S CLOSE LINE FROM BUS 218401 TO BUS 218402 CKT Z /* PIERSON AVE DISCONNECT BUS 218351                          /* MDWRD_S CLOSE LINE FROM BUS 218392 TO BUS 218393 CKT Z /* MDWRD_L1_L2 END </pre>

Contingency Name	Contingency Definition
PS_P1-2_S-2219_LT	CONTINGENCY 'PS_P1-2_S-2219_LT' /* METUCHEN TO DEANS DISCONNECT BUS 218358 /* PIERSON AVE S CLOSE LINE FROM BUS 218401 TO BUS 218402 CKT Z/* PIERSON AVE DISCONNECT BUS 218351 /* MDWRD_S CLOSE LINE FROM BUS 218392 TO BUS 218393 CKT Z/* MDWRD_L1_L2 MOVE 8 MW LOAD FROM BUS 218401 TO BUS 218384 /* INTERSTATION TIE TRANSFER LOAD FROM PRSNAVS TO KILMER T2 MOVE 8 MW LOAD FROM BUS 218393 TO BUS 218385 /* INTERSTATION TIE TRANSFER LOAD FROM MDWRD TO KILMER T4 MOVE 8 MW LOAD FROM BUS 218401 TO BUS 218399 /* INTERSTATION TIE TRANSFER LOAD FROM PRSNAVS TO NEWDOVR T2 MOVE 8 MW LOAD FROM BUS 218402 TO BUS 218399 /* INTERSTATION TIE TRANSFER LOAD FROM PRSNAVS TO NEWDOVR T2 MOVE 8 MW LOAD FROM BUS 218402 TO BUS 218390 /* INTERSTATION TIE TRANSFER LOAD FROM PRSNAVS TO LAFAYET T2 MOVE 8 MW LOAD FROM BUS 218392 TO BUS 219616 /* INTERSTATION TIE TRANSFER LOAD FROM MDWRD TO HARTS LANE MOVE 8 MW LOAD FROM BUS 218392 TO BUS 219616 /* INTERSTATION TIE TRANSFER LOAD FROM MDWRD TO HARTS LANE MOVE 8 MW LOAD FROM BUS 218393 TO BUS 218390 /* INTERSTATION TIE TRANSFER LOAD FROM MDWRD TO LAFAYET T2 END
Base Case	

# Short Circuit

## 15 Short Circuit

The following Breakers are over duty:

Bus Number	Bus Name	BREAKER	Rating Type	Breaker Capacity (Amps)	Initial Duty (%)	Final Duty (%)	Duty Difference (%)	Initial Duty (Amps )	Final Duty (Amps )
216950	ROSELAND 230.kV	11H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	12H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	21H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	22H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	31H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	32H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	51H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	52H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	61H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	62H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	71H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	72H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	81H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	82H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	91H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	92H	S	80000	99.97	100.45	0.48	79979.3	80361.4
216950	ROSELAND 230.kV	13H	S	80000	99.95	100.42	0.48	79956.2	80337.9
216950	ROSELAND 230.kV	41H	S	80000	99.95	100.42	0.48	79956.2	80337.9