



**Generation Interconnection
Feasibility Study Report
for
Queue Project AE2-242
BOWMANN'S MILL-SCOTT 69 KV
42 MW Capacity / 100 MW Energy**

July, 2019

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 Solar generating facility located in Columbia County, Pennsylvania. The installed facilities will have a total capability of 100 MW with 42 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is March, 5, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AE2-242
Project Name	BOWMANN'S MILL-SCOTT 69 KV
State	Pennsylvania
County	Columbia
Transmission Owner	PPL
MFO	100
MWE	100
MWC	42
Fuel	Solar
Basecase Study Year	2022

2.1 Point of Interconnection

AE2-242 will interconnect with the PPL transmission system Millville Tap 69 kV line, approximately 4.8 miles from the Bowman's Mill Tap and 1.25 miles from the Scott 69 kV Substation. The Point of Interconnection (POI) will be where the PPL EU tap line terminates (with insulators) at the first dead-end structure inside the IC substation.

2.2 Cost Summary

The AE2-242 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$ 550,000
Direct Connection Network Upgrade	\$ 0
Non Direct Connection Network Upgrades	\$ 115,000
Total Costs	\$ 665,000

In addition, the AE2-242 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$ 153,000,000

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

3 Transmission Owner Scope of Work

3.1 Attachment Facilities

69 kV Transmission Line Tap

The Attachment Facilities will connect to the Millville Tap 69 kV line approximately 4.8 miles from the Bowman’s Mill Tap and 1.25 miles from the Scott 69 kV Substation. This scope of work is based on the IC collector substation GPS Coordinates: 41° 2'18.47"N 76°24'37.94"W.

- Install 69kV tap off the existing Millville tap 69kV line to IPP AE2-242.
- Intersperse a DCT style tap pole between poles 36932N32017 and 36919N32064.
- Tap the Millville tap off the DCT style tap pole.
- Install MOLBAB on tap to IPP dead-end.
- Extend 250’ tap to the IPP dead-end utilizing 556 ASCR and single OPGW.
- Break OPGW by completing a fiber throw and install splice box at 36932N32017.
- Install one span of fiber between 32/17 and new tap pole. Install splice box on new tap pole.

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
69kV Transmission Tap	\$ 550,000
Total Attachment Facility Costs	\$ 550,000

3.2 Direct Connection Cost Estimate

None

3.3 Non-Direct Connection Cost Estimate

Remote End Work – Columbia 69kV Substation

- Model IC in CAPE and conduct a wide area short-circuit study two busses away from the IC facilities. Identify affected relays and revise settings as needed.
- Conduct a review of the IC relay settings and engineering package (submitted by IC to PPL EU)
- The following upgrades are required at the Columbia substation:
 - Install DTT equipment.
 - Connect DTT equipment to new communication path installed between the Columbia substation and the IC customer facilities.
 - Modify the existing Columbia-Scott 69kV circuit breaker protection and control schemes.
 - Modify the existing protective relay settings.
 - Modify the existing SCADA for new alarms.

- Modify the existing Alarm Management System (AMS).
- Install new cables and modify control wiring for the above.
- Perform system checks and test equipment before placing in service
- Update all Columbia line designations on equipment, panels, and drawing to reference the new IC customer.

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

Description	Total Cost
Remote End Work- Columbia 69kV Substation	\$ 115,000
	\$
Total Non-Direct Connection Facility Costs	\$115,000

3.4 Study Assumptions

- Availability of optimal transmission line route
- Outage feasibility not assessed until Facilities Study
- No major environmental, real estate, or permitting issues
- IC is responsible for acquisition of easements and right of way for the Attachment Facilities

4 Schedule

The estimated time to complete the scope of work is 12-18 months after the PJM three-party Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (ICSA) are signed and PPL EU receives Notice to Proceed from the IC.

5 Interconnection Customer Requirements

5.1 PPL EU Interconnection Requirements

PPL EU applicable technical standards that address requirements for interconnection of generation, transmission, and end user facilities can be found at the following link:

<https://pjm.com/planning/design-engineering/to-tech-standards/private-ppl.aspx>

5.2 IC Direct Transfer Trip (DTT) Requirements

PPL EU will require an independent communication path, for Direct Transfer Trip (DTT) of the IC Intertie Protective Relaying (IPR) Fault Interrupting Devices (FIDs), consisting of one communication circuit with the Columbia Substation.

PPL EU currently has OPGW on the Millville Tap 69 kV line available for DTT to the Columbia Substation. PPL EU assumes strands of this fiber will be used for the independent communication pathway. However, the IC may choose to procure a third-party communication circuit at its own discretion in lieu of the OPGW. 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 PPL Requirements

Installation of revenue grade Bi-directional Metering Equipment will be required in the vicinity of the POI to measure kWh and kVARh. PPL EU will design and supply the required metering equipment; all installation costs would be borne by the IC including CTs/PTs. All metering equipment must meet applicable PPL EU tariff requirements as well as being compliant with all applicable requirements of the PJM agreements. The equipment must provide bidirectional revenue metering (kWh and kVARh) and real-time data (kW, kVAR, circuit breaker status, and generator bus voltages) for the IC's generating resource. The metering equipment should be housed in a control cabinet or similar enclosure and must be accessible to PPL EU metering personnel.

6 Network Impacts

The Queue Project AE2-242 was evaluated as a 100.0 MW (Capacity 42.0 MW) injection tapping the Bowmans Mill to Scott 69kV line in the PPL area. Project AE2-242 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-242 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

7 Generation Deliverability

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

None

8 Multiple Facility Contingency

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

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
8475355	208040	MONT	PPL	208034	MILT	PPL	1	PL:08:P71:001414	tower	739.0	98.95	100.96	DC	14.83

9 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	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
7258221	200022	SUSQHANA	PJM	200023	WESCOVLE	PJM	1	PL:1A:P42:000923	breaker	3112.0	106.54	107.07	DC	36.02
7258222	200022	SUSQHANA	PJM	200023	WESCOVLE	PJM	1	PL:1A:P42:000922	breaker	3112.0	106.54	107.07	DC	36.02
7258216	200023	WESCOVLE	PJM	200075	BREI	PJM	1	PL:1A:P42:000923	breaker	3112.0	106.56	107.13	DC	38.9
7258217	200023	WESCOVLE	PJM	200075	BREI	PJM	1	PL:1A:P42:000922	breaker	3112.0	106.56	107.13	DC	38.9
8475354	208040	MONT	PPL	208034	MILT	PPL	1	PL:08:P71:101343	tower	739.0	103.77	105.78	DC	14.83
8474713	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:1A:P42:000922	breaker	628.0	103.94	104.75	DC	11.34
8474714	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:1A:P42:000923	breaker	628.0	103.94	104.75	DC	11.34
8474715	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:18:P42:000129	breaker	628.0	103.5	104.29	DC	10.99
8474716	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:08:P42:000130	breaker	628.0	103.5	104.29	DC	10.99
8474717	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:10:P42:100576	breaker	628.0	103.5	104.29	DC	10.99

10 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	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
7258931	200021	SUNBURY	PJM	200009	JUNIATA	PJM	1	PL:28:P12:000080	operation	3112.0	116.51	117.22	DC	48.67
7258936	200021	SUNBURY	PJM	200009	JUNIATA	PJM	1	Base Case	operation	2707.0	104.16	104.85	DC	40.99
7259123	200022	SUSQHANA	PJM	200023	WESCOVLE	PJM	1	PL:08:P12:000083	operation	3112.0	106.42	106.96	DC	36.42
7259117	200023	WESCOVLE	PJM	200075	BREI	PJM	1	PL:08:P12:000083	operation	3112.0	106.48	107.05	DC	39.2
8475119	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:08:P12:000083	operation	628.0	103.45	104.24	DC	10.99

11 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
7258216,7258217	3	WESCOVLE 500.0 kV - BREI 500.0 kV Ckt 1	No Reinforcement Needed. Not a valid violation	\$0
8474714,8474715,8474716,8474717,8474713	4	AE1-058 TAP 230.0 kV - SIEG 230.0 kV Ckt 1	R-PL-0003 (336) : Rebuild the FRACKVILLE-SIEGFRIED 230kV line Cost : \$120,000,000 Time Estimate : 36-60 Months	\$120,000,000
7258222,7258221	2	SUSQHANA 500.0 kV - WESCOVLE 500.0 kV Ckt 1	No Reinforcement Needed. Not a valid violation	\$0
8475355,8475354	1	MONT 230.0 kV - MILT 230.0 kV Ckt 1	R-PL-0002 (335) : Build a second circuit from MONTOUR-MILTON 230kV and MILTON-SUNBURY 230kV Project Type : CON Cost : \$33,000,000 Time Estimate : 36.0 Months	\$33,000,000
			TOTAL COST	\$153,000,000

Note:

If “No Reinforcement Needed. Not a valid violation” was provided as the Upgrade Description for a facility in the System Reinforcements table then that facility met one of the following conditions:

The loading on the facility at your queue position was less than 100%; therefore, the facility is not yet overloaded, but may be overloaded by end of the AE2 queue.

The TO reviewed their ratings on the facility and determined that the current rating was greater than the rating in PJM’s model. This new rating was greater than the loading at your queue position making the violation invalid.

The TO reviewed the contingency and determined that contingency was not valid; therefore the violation is invalid. Any contingency corrections will be assessed and corrected in the AE2 System Impact Study phase.

12 Flow Gate Details

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.

12.1 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
8475354	208040	MONT	PPL	208034	MILT	PPL	1	PL:08:P71:101343	tower	739.0	103.77	105.78	DC	14.83

Bus #	Bus	MW Impact
208911	MONT G1	24.6
208912	MONT G2	27.59
209006	NEPC IPP	3.63
211375	BEAC	1.4
212369	PATRIOT 1	12.39
212370	PATRIOT 2	12.39
292935	U2-015 E	6.39
919512	AA2-008 E	15.17
926681	AC1-151 C	0.53
926682	AC1-151 E	0.86
931942	AB1-182 E	1.29
938401	AE1-059 C O1	13.05
938402	AE1-059 E O1	13.05
939521	AE1-181 C	1.88
939522	AE1-181 E	1.26
940592	AE2-046 E	1.82
941161	AE2-110 C	1.25
941162	AE2-110 E	1.72
942281	AE2-241 C	1.25
942282	AE2-241 E	1.72
942291	AE2-242 C	6.23
942292	AE2-242 E	8.6
942561	AE2-271 C	16.24
942562	AE2-271 E	10.81
BLUEG	BLUEG	3.62
CALDERWOOD	CALDERWOOD	0.39
CANNELTON	CANNELTON	0.22
CATAWBA	CATAWBA	0.24
CBM-N	CBM-N	0.66
CHEOAH	CHEOAH	0.35
CHILHOWEE	CHILHOWEE	0.13
COFFEEN	COFFEEN	0.38
COTTONWOOD	COTTONWOOD	1.5
DUCKCREEK	DUCKCREEK	0.83
EDWARDS	EDWARDS	0.38
ELMERSMITH	ELMERSMITH	0.38
FARMERCITY	FARMERCITY	0.25
G-007A	G-007A	1.64
GIBSON	GIBSON	0.15
HAMLET	HAMLET	0.4

Bus #	Bus	MW Impact
NEWTON	NEWTON	1.0
NYISO	NYISO	2.85
PRAIRIE	PRAIRIE	1.86
SANTEETLA	SANTEETLA	0.1
SMITHLAND	SMITHLAND	0.15
TATANKA	TATANKA	0.45
TILTON	TILTON	0.46
TRIMBLE	TRIMBLE	0.4
TVA	TVA	1.25
UNIONPOWER	UNIONPOWER	0.55
VFT	VFT	5.37

12.2 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
7258222	200022	SUSQHANA	PJM	200023	WESCOVLE	PJM	1	PL:1A:P42:000922	breaker	3112.0	106.54	107.07	DC	36.02

Bus #	Bus	MW Impact
200038	SUSQ 2	42.91
200083	FRPO 1	26.73
200084	FRPO 2	26.73
200823	26MHP_X3-003	10.24
208930	SNBY 6	11.26
208931	SNBY 7	12.22
208932	SNBY 5	11.26
208933	SNBY 8	20.0
208945	LOHA CT	0.62
209006	NEPC IPP	14.66
209018	SUNBIPCT	1.63
210706	HOLD	5.61
211064	PSPA	2.08
211375	BEAC	5.64
292935	U2-015 E	25.64
294573	P-028 E	20.72
916351	Z1-091	2.75
917661	WAYM E	15.68
918431	AA1-057	5.91
918602	AA1-077 E	22.28
918682	AA1-082 E	7.65
919201	AA1-144 O1	21.2
919512	AA2-008 E	20.48
919532	PEFO 1 E	6.05
919542	PEFO 2 E	6.05
920711	AA2-182 C	404.99
920712	AA2-182 E	21.97
924291	AB2-074 C	20.73
924292	AB2-074 E	26.11
925951	AC1-071 C	2.32
925952	AC1-071 E	15.54
926081	AC1-087 C	0.79
926082	AC1-087 E	1.29
926681	AC1-151 C	2.14
926682	AC1-151 E	3.5
930641	AB1-108	147.2
931942	AB1-182 E	6.16
932691	AC2-092	29.1
935071	AD1-143 C1	1.21
935072	AD1-143 E1	7.25
935081	AD1-143 C2	0.04
935082	AD1-143 E2	1.01
935091	AD1-143 C3	1.19

Bus #	Bus	MW Impact
935092	AD1-143 E3	7.11
935101	AD1-143 C4	0.04
935102	AD1-143 E4	1.0
938331	AE1-051	1.5
938391	AE1-058 C	72.61
938392	AE1-058 E	72.61
938401	AE1-059 C O1	73.83
938402	AE1-059 E O1	73.83
938981	AE1-127 C	6.67
938982	AE1-127 E	8.33
939521	AE1-181 C	7.61
939522	AE1-181 E	5.07
939891	AE1-225 C O1	3.49
939892	AE1-225 E O1	3.86
940561	AE2-042 C O1	17.17
940562	AE2-042 E O1	8.51
940592	AE2-046 E	7.36
940711	AE2-058 C	3.08
940712	AE2-058 E	4.26
940721	AE2-059 C	3.08
940722	AE2-059 E	4.26
940801	AE2-067 C	3.46
940802	AE2-067 E	0.02
940941	AE2-084 C	3.08
940942	AE2-084 E	4.26
941161	AE2-110 C	3.03
941162	AE2-110 E	4.18
941171	AE2-111 C	3.1
941172	AE2-111 E	4.28
941371	AE2-133 C	3.12
941372	AE2-133 E	4.31
942281	AE2-241 C	3.03
942282	AE2-241 E	4.18
942291	AE2-242 C	15.13
942292	AE2-242 E	20.89
942301	AE2-243 C	0.65
942302	AE2-243 E	4.01
942311	AE2-244 C	0.65
942312	AE2-244 E	4.01
942561	AE2-271 C	21.74
942562	AE2-271 E	14.47
942581	AE2-274	0.17
942721	AE2-288	85.39
942771	AE2-295 C O1	8.57
942772	AE2-295 E O1	49.73
BLUEG	BLUEG	11.76
CALDERWOOD	CALDERWOOD	1.33
CANNELTON	CANNELTON	0.72
CATAWBA	CATAWBA	0.87
CBM-N	CBM-N	4.81
CHEOAH	CHEOAH	1.22
CHILHOWEE	CHILHOWEE	0.43

Bus #	Bus	MW Impact
COFFEEN	COFFEEN	1.24
COTTONWOOD	COTTONWOOD	5.03
DUCKCREEK	DUCKCREEK	2.69
EDWARDS	EDWARDS	1.22
ELMERSMITH	ELMERSMITH	1.24
FARMERCITY	FARMERCITY	0.82
G-007A	G-007A	2.78
GIBSON	GIBSON	0.49
HAMLET	HAMLET	1.45
NEWTON	NEWTON	3.24
NYISO	NYISO	20.72
PRAIRIE	PRAIRIE	6.09
SANTEETLA	SANTEETLA	0.36
SMITHLAND	SMITHLAND	0.49
TATANKA	TATANKA	1.48
TILTON	TILTON	1.47
TRIMBLE	TRIMBLE	1.31
TVA	TVA	4.21
UNIONPOWER	UNIONPOWER	1.88
VFT	VFT	17.14

12.3 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
7258217	200023	WESCOVLE	PJM	200075	BREI	PJM	1	PL:1A:P42:000922	breaker	3112.0	106.56	107.13	DC	38.9

Bus #	Bus	MW Impact
200038	SUSQ 2	43.38
200083	FRPO 1	27.05
200084	FRPO 2	27.05
200823	26MHP_X3-003	10.85
208930	SNBY 6	11.68
208931	SNBY 7	12.67
208932	SNBY 5	11.68
208933	SNBY 8	20.74
208945	LOHA CT	0.67
209006	NEPC IPP	17.38
209018	SUNBIPCT	1.75
210706	HOLD	5.98
211064	PSPA	2.82
211375	BEAC	6.68
292935	U2-015 E	29.75
294573	P-028 E	21.96
916351	Z1-091	2.91
917661	WAYM E	16.7
918431	AA1-057	6.33
918602	AA1-077 E	23.72
919512	AA2-008 E	22.1
919532	PEFO 1 E	9.59
919542	PEFO 2 E	9.59
920711	AA2-182 C	419.94
920712	AA2-182 E	22.78
924291	AB2-074 C	21.49
924292	AB2-074 E	27.08
925951	AC1-071 C	2.52
925952	AC1-071 E	16.88
926081	AC1-087 C	1.07
926082	AC1-087 E	1.75
926681	AC1-151 C	2.54
926682	AC1-151 E	4.14
930641	AB1-108	152.01
931942	AB1-182 E	6.69
932691	AC2-092	29.44
935071	AD1-143 C1	1.63
935072	AD1-143 E1	9.77
935081	AD1-143 C2	0.06
935082	AD1-143 E2	1.37
935091	AD1-143 C3	1.61
935092	AD1-143 E3	9.67
935101	AD1-143 C4	0.06

Bus #	Bus	MW Impact
935102	AD1-143 E4	1.35
938331	AE1-051	1.59
938391	AE1-058 C	86.22
938392	AE1-058 E	86.22
938401	AE1-059 C O1	79.38
938402	AE1-059 E O1	79.38
938981	AE1-127 C	7.46
938982	AE1-127 E	9.32
939521	AE1-181 C	9.02
939522	AE1-181 E	6.01
939712	AE1-202 E	1.15
939891	AE1-225 C O1	3.74
939892	AE1-225 E O1	4.13
940561	AE2-042 C O1	18.44
940562	AE2-042 E O1	9.14
940592	AE2-046 E	8.72
940711	AE2-058 C	3.31
940712	AE2-058 E	4.57
940721	AE2-059 C	3.31
940722	AE2-059 E	4.57
940801	AE2-067 C	3.66
940802	AE2-067 E	0.02
940941	AE2-084 C	3.31
940942	AE2-084 E	4.57
941161	AE2-110 C	3.27
941162	AE2-110 E	4.51
941171	AE2-111 C	3.33
941172	AE2-111 E	4.59
941371	AE2-133 C	3.34
941372	AE2-133 E	4.62
941751	AE2-175 C O1	11.0
941752	AE2-175 E O1	7.33
942281	AE2-241 C	3.27
942282	AE2-241 E	4.51
942291	AE2-242 C	16.34
942292	AE2-242 E	22.56
942301	AE2-243 C	0.69
942302	AE2-243 E	4.26
942311	AE2-244 C	0.69
942312	AE2-244 E	4.26
942561	AE2-271 C	23.51
942562	AE2-271 E	15.64
942581	AE2-274	0.23
942721	AE2-288	88.55
942771	AE2-295 C O1	9.59
942772	AE2-295 E O1	55.61
BLUEG	BLUEG	13.65
CALDERWOOD	CALDERWOOD	1.53
CANNELTON	CANNELTON	0.83
CATAWBA	CATAWBA	1.0
CBM-N	CBM-N	5.27
CHEOAH	CHEOAH	1.4

Bus #	Bus	MW Impact
CHILHOWEE	CHILHOWEE	0.5
COFFEEN	COFFEEN	1.44
COTTONWOOD	COTTONWOOD	5.82
DUCKCREEK	DUCKCREEK	3.12
EDWARDS	EDWARDS	1.42
ELMERSMITH	ELMERSMITH	1.44
FARMERCITY	FARMERCITY	0.96
G-007A	G-007A	3.92
GIBSON	GIBSON	0.56
HAMLET	HAMLET	1.66
NEWTON	NEWTON	3.77
NYISO	NYISO	22.68
PRAIRIE	PRAIRIE	7.07
SANTEETLA	SANTEETLA	0.41
SMITHLAND	SMITHLAND	0.57
TATANKA	TATANKA	1.72
TILTON	TILTON	1.71
TRIMBLE	TRIMBLE	1.52
TVA	TVA	4.87
UNIONPOWER	UNIONPOWER	2.18
VFT	VFT	22.72

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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
8474717	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:10:P42:100576	breaker	628.0	103.5	104.29	DC	10.99

Bus #	Bus	MW Impact
208941	FISH CT	0.81
208981	FOWH IPP	1.11
208982	GLBT IPP	2.14
209013	SCEN IPP	2.48
209022	WHFR IPP	1.24
211064	PSPA	0.75
918431	AA1-057	1.69
919512	AA2-008 E	5.49
920711	AA2-182 C	84.75
920712	AA2-182 E	4.6
924291	AB2-074 C	4.34
924292	AB2-074 E	5.47
926081	AC1-087 C	0.28
926082	AC1-087 E	0.46
935071	AD1-143 C1	0.46
935072	AD1-143 E1	2.78
935081	AD1-143 C2	0.02
935082	AD1-143 E2	0.39
935091	AD1-143 C3	0.42
935092	AD1-143 E3	2.53
935101	AD1-143 C4	0.01
935102	AD1-143 E4	0.35
938391	AE1-058 C	86.81
938392	AE1-058 E	86.81
938981	AE1-127 C	4.27
938982	AE1-127 E	5.34
939712	AE1-202 E	0.28
939891	AE1-225 C O1	1.01
939892	AE1-225 E O1	1.12
940561	AE2-042 C O1	4.85
940562	AE2-042 E O1	2.4
940711	AE2-058 C	0.87
940712	AE2-058 E	1.2
940721	AE2-059 C	0.87
940722	AE2-059 E	1.2
940941	AE2-084 C	0.87
940942	AE2-084 E	1.2
941161	AE2-110 C	0.92
941162	AE2-110 E	1.28
941171	AE2-111 C	0.89
941172	AE2-111 E	1.23
941371	AE2-133 C	0.91

Bus #	Bus	MW Impact
941372	AE2-133 E	1.25
942281	AE2-241 C	0.92
942282	AE2-241 E	1.28
942291	AE2-242 C	4.62
942292	AE2-242 E	6.38
942561	AE2-271 C	5.71
942562	AE2-271 E	3.8
942581	AE2-274	0.06
942721	AE2-288	17.87
942771	AE2-295 C O1	5.47
942772	AE2-295 E O1	31.73
BLUEG	BLUEG	1.04
CALDERWOOD	CALDERWOOD	0.12
CANNELTON	CANNELTON	0.06
CATAWBA	CATAWBA	0.08
CBM-N	CBM-N	0.12
CHEOAH	CHEOAH	0.11
CHILHOWEE	CHILHOWEE	0.04
COFFEEN	COFFEEN	0.11
COTTONWOOD	COTTONWOOD	0.45
DUCKCREEK	DUCKCREEK	0.24
EDWARDS	EDWARDS	0.11
ELMERSMITH	ELMERSMITH	0.11
FARMERCITY	FARMERCITY	0.07
G-007	G-007	0.63
GIBSON	GIBSON	0.04
HAMLET	HAMLET	0.14
NEWTON	NEWTON	0.29
NYISO	NYISO	0.49
O-066	O-066	5.21
PRAIRIE	PRAIRIE	0.54
SANTEETLA	SANTEETLA	0.03
SMITHLAND	SMITHLAND	0.04
TATANKA	TATANKA	0.13
TILTON	TILTON	0.13
TRIMBLE	TRIMBLE	0.12
TVA	TVA	0.38
UNIONPOWER	UNIONPOWER	0.17

Affected Systems

13 Affected Systems

13.1 LG&E

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

13.2 MISO

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

13.3 TVA

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

13.4 Duke Energy Progress

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

13.5 NYISO

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

Contingency Name	Contingency Definition
PL:10:P42:100576	CONTINGENCY 'PL:10:P42:100576' /* AT JUNIATA 500SUB SUNBURY 500KV S.CB FAILED DISCONNECT BRANCH FROM BUS 200009 TO BUS 200183 CKT 1 /* /* JUNIATA CAP 500 KV DISCONNECT BRANCH FROM BUS 200009 TO BUS 208004 CKT 1 /* /* JUNIATA 500-230 KV BK1 DISCONNECT BRANCH FROM BUS 200009 TO BUS 200021 CKT 1 /* /* JUNIATA-SUNBURY 500 KV (SHOULD BE FAULTED) END
PL:08:P71:101343	CONTINGENCY 'PL:08:P71:101343' /* SAEGERS-CLINTON & SAEGERS-ELIMSPORT 230 KV TOWER DISCONNECT BRANCH FROM BUS 212397 TO BUS 207968 CKT 1 /* /* SAEG-ELIM DISCONNECT BRANCH FROM BUS 207937 TO BUS 212397 CKT 1 /* /* SAEG-CLIN END
PL:18:P42:000129	CONTINGENCY 'PL:18:P42:000129' /* JUNI-SUNB 500KV STUCK BREAKER CONNECTED TO TR2 DISCONNECT BRANCH FROM BUS 200009 TO BUS 208005 CKT 2 /* JUNIATA-JUNI BU2 500-230 DISCONNECT BRANCH FROM BUS 200009 TO BUS 200021 CKT 1 /* JUNIATA-SUNBURY 500 END
Base Case	
PL:08:P12:000083	CONTINGENCY 'PL:08:P12:000083' /* JUNI-SUNB 500KV LINE DISCONNECT BRANCH FROM BUS 200009 TO BUS 200021 CKT 1 /* JUNIATA-SUNBURY 500 END
PL:28:P12:000080	CONTINGENCY 'PL:28:P12:000080' /* SUSQ-WESC 500KV LINE DISCONNECT BRANCH FROM BUS 200022 TO BUS 200023 CKT 1 /* SUSQHANA-WESCOVLE 500 END
PL:08:P42:000130	CONTINGENCY 'PL:08:P42:000130' /* JUNI-SUNB 500KV STUCK BREAKER CONNECTED TO TR1 DISCONNECT BRANCH FROM BUS 200009 TO BUS 208004 CKT 1 /* JUNIATA-JUNI BU1 500-230 DISCONNECT BRANCH FROM BUS 200009 TO BUS 200021 CKT 1 /* JUNIATA-SUNBURY 500 END
PL:1A:P42:000923	CONTINGENCY 'PL:1A:P42:000923' /* SUNBURY 500KV YARD 3T BF DISCONNECT BRANCH FROM BUS 200021 TO BUS 200009 CKT 1 /* /* JUNIATA-SUNBURY 500KV LINE DISCONNECT BRANCH FROM BUS 200021 TO BUS 208109 CKT 25 /* /* T25 END
PL:1A:P42:000922	CONTINGENCY 'PL:1A:P42:000922' /* SUNBURY 500KV YARD 3N BF DISCONNECT BRANCH FROM BUS 200021 TO BUS 200009 CKT 1 /* /* JUNIATA-SUNBURY 500KV LINE DISCONNECT BRANCH FROM BUS 200021 TO BUS 208109 CKT 24 /* /* T24 END

Contingency Name	Contingency Definition
PL:08:P71:001414	CONTINGENCY 'PL:08:P71:001414' /* SAEG-ELIM 230KV LINE & CLIN-ELIM 230KV LINE DISCONNECT BRANCH FROM BUS 212397 TO BUS 207968 CKT 1 /* /* SAEG-ELIM 230KV LINE DISCONNECT BRANCH FROM BUS 207937 TO BUS 207968 CKT 1 /* /* CLIN-ELIM 230KV LINE END

Short Circuit

14 Short Circuit

The following Breakers are over duty

None