Generation Interconnection

Feasibility Study Report

for

Queue Project AE2-042

DANVILLE-MILTON 69 KV

46.8 MW Capacity / 70 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.

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 Northumberland County, Pennsylvania. The installed facilities will have a total capability of **70 MW** with **46.8 MW** of this output being recognized by PJM as Capacity. The proposed in-service date for this project is **June 30, 2022**. **This study does not imply a TO commitment to this in-service date.**

Queue Number	AE2-042
Project Name	DANVILLE-MILTON 69 KV
State	Pennsylvania
County	Northumberland
Transmission Owner	PPL
MFO	70
MWE	70
MWC	46.8
Fuel	Solar
Basecase Study Year	2022

2.1 Point of Interconnection

AE2-042 will interconnect with the PPL EU transmission system via on of the following:

Option 1: a tap of the Danville – Milton 69kV line, 0.42 miles from the Milton 69kV bus. The Point of Interconnection (POI) will be where the tap line terminates (with insulators) at the first dead-end structure inside the IC substation. The ITO will retire the line from the POI to the Danville Substation. As a result, the primary POI is modeled as a direct connection into the Milton 69 kV substation.

Option 2: A direct connection into the Milton 69kV substation

The scope of work provided in this Feasibility Study is for facilities to be constructed on the PPL EU side of the POI.

2.2 Cost Summary

The AE2-042 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$811,000
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$138,000
Total Costs	$949,000

In addition, the AE2-042 project may be responsible for a contribution to the following costs:

Description	Total Cost
System Upgrades	$120,000,000

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

3 Transmission Owner Scope of Work

3.1 Attachment Facilities

69kV Transmission Line Tap

The Attachment Facilities will connect to the Danville – Milton 69kV line approximately 0.42 miles from the Milton Substation. This scope of work is based on the IC collector sub GPS Coordinates:

lat : 40.987096° long: -76.832785°

- Extend new line west from existing Danville-Milton bay at Milton Substation.
- Rebuild the existing Milton-Millville 69kV line for double circuit with the new DANV-MILT extension to IC collector sub.
- Rebuild 0.3 miles to IC Collector Sub.
- Replace (1) wood pole with a LD pole and re-frame to tension allowing for transition from delta to vertical phase configuration on the MILT-MVIL line.
- Supply and install 556 ACSR conductor
- Supply and install dual .567" 48 count OPGW
- Extend the OPGW to the dead-end structure at IC Collector Sub

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	$811,000

3.2 Direct Connection Network Upgrades

None.

3.3 Non-Direct Connection Network Upgrades

Remote End Work – Milton 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 Milton substation:
    - Install new fiber based DTT equipment.
    - Connect fiber based DTT equipment to the new fiber installed between the Milton substation and the IC customer facilities.
    - Modify the existing Danville - Milton 69kV circuit breaker 14R protection and control schemes.
    - Modify the existing Milton 69kV bus tie 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.
    - Update all Danville line designations on equipment, panels, and drawing to reference the new IC customer.
    - Perform system checks and test equipment before placing in service.

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 – DTT Milton Substation	$138,000

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 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 the Interconnection Construction Service Agreement (ICSA) are signed and PPL EU receives Notice to Proceed from the IC

5 Transmission Owner Analysis

PPL EU identified that the contingency Milton-Sunbury 69kV line bus section breaker failure at Milton 69kV sub results in the loss of the entire 69kV substation and the two 230/69kV transformers at Milton

Mitigation Scope: Change the standard operating configuration of the Milton-Sunbury 69kV line to radial instead of network operation.

Cost: $0

6 Interconnection Customer Requirements

6.1 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

6.2 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 Milton 69 kV Substation.

PPL EU currently has OPGW on the Danville – Milton 69 kV line available for DTT to the Milton 69 kV 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.

7 Revenue Metering and SCADA Requirements

7.1 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.

7.2 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.

8 OPTION 1 - Network Impacts

The Queue Project AE2-042 was evaluated as a 70.0 MW (Capacity 46.8 MW) injection at the **Milton 69kV** substation in the PPL area. Project AE2-042 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-042 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

9 Generation Deliverability

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

None

10 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
1331233	200023	WESCOVLE	PJM	200075	BREI	PJM	1	PL:1A:P42:000923	breaker	3112.0	99.45	100.34	DC	27.59
1331234	200023	WESCOVLE	PJM	200075	BREI	PJM	1	PL:1A:P42:000922	breaker	3112.0	99.45	100.34	DC	27.59

11 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
1991540	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:1A:P42:000922	breaker	628.0	102.25	102.8	DC	7.74
1991541	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:1A:P42:000923	breaker	628.0	102.25	102.8	DC	7.74
1991542	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:10:P42:100576	breaker	628.0	101.91	102.43	DC	7.25
1991543	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:18:P42:000129	breaker	628.0	101.91	102.43	DC	7.25
1991544	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:08:P42:000130	breaker	628.0	101.91	102.43	DC	7.25

12 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
1991540	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:1A:P42:000922	breaker	628.0	102.25	102.8	DC	7.74
1991541	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:1A:P42:000923	breaker	628.0	102.25	102.8	DC	7.74
1991542	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:10:P42:100576	breaker	628.0	101.91	102.43	DC	7.25
1991543	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:18:P42:000129	breaker	628.0	101.91	102.43	DC	7.25
1991544	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:08:P42:000130	breaker	628.0	101.91	102.43	DC	7.25

13 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
1331233,1331234	1	WESCOVLE 500.0 kV - BREI 500.0 kV Ckt 1	No Reinforcement Needed. Not a valid violation	$0
1991542,1991543,1991540,1991541,1991544	2	AE1-058 TAP 230.0 kV - SIEG 230.0 kV Ckt 1	Rebuild the FRACVILL-SIEGFIED 230kV line Cost : $120,000,000 Time Estimate : 36-60 Months	$120,000,000
			TOTAL COST	**$120,000,000**

14 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.

14.1 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
1331234	200023	WESCOVLE	PJM	200075	BREI	PJM	1	PL:1A:P42:000922	breaker	3112.0	99.45	100.34	DC	27.59

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
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
935102	AD1-143 E4	1.35

Bus #	Bus	MW Impact
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
CHILHOWEE	CHILHOWEE	0.5

Bus #	Bus	MW Impact
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

14.2 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
1991544	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:08:P42:000130	breaker	628.0	101.91	102.43	DC	7.25

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
941372	AE2-133 E	1.25
942281	AE2-241 C	0.92

Bus #	Bus	MW Impact
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

15 Affected Systems

15.1 LG&E

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

15.2 MISO

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

15.3 TVA

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

15.4 Duke Energy Progress

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

15.5 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: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

Short Circuit

16 Short Circuit

The following Breakers are over duty:

None.

17 OPTION 2: Network Impacts

The Queue Project AE2-042 was evaluated as a 70.0 MW (Capacity 46.8 MW) injection at the **Milton 69kV** substation in the PPL area. Project AE2-042 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-042 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

1 Generation Deliverability

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

None

2 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
1331233	200023	WESCOVLE	PJM	200075	BREI	PJM	1	PL:1A:P42:000923	breaker	3112.0	99.45	100.34	DC	27.59
1331234	200023	WESCOVLE	PJM	200075	BREI	PJM	1	PL:1A:P42:000922	breaker	3112.0	99.45	100.34	DC	27.59

3 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
1991540	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:1A:P42:000922	breaker	628.0	102.25	102.8	DC	7.74
1991541	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:1A:P42:000923	breaker	628.0	102.25	102.8	DC	7.74
1991542	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:10:P42:100576	breaker	628.0	101.91	102.43	DC	7.25
1991543	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:18:P42:000129	breaker	628.0	101.91	102.43	DC	7.25
1991544	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:08:P42:000130	breaker	628.0	101.91	102.43	DC	7.25

4 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
1331834	200021	SUNBURY	PJM	200009	JUNIATA	PJM	1	PL:28:P12:000080	operation	3112.0	108.64	109.83	DC	37.13
1331839	200021	SUNBURY	PJM	200009	JUNIATA	PJM	1	Base Case	operation	2707.0	96.87	98.05	DC	32.08
1332013	200022	SUSQHANA	PJM	200023	WESCOVLE	PJM	1	PL:08:P12:000083	operation	3112.0	99.86	100.71	DC	26.26
1332003	200023	WESCOVLE	PJM	200075	BREI	PJM	1	PL:08:P12:000083	operation	3112.0	99.33	100.24	DC	28.01
1991845	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:08:P12:000083	operation	628.0	101.86	102.38	DC	7.25

5 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.

5.1 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
1331234	200023	WESCOVLE	PJM	200075	BREI	PJM	1	PL:1A:P42:000922	breaker	3112.0	99.45	100.34	DC	27.59

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
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
935102	AD1-143 E4	1.35

Bus #	Bus	MW Impact
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 O2	18.44
940562	AE2-042 E O2	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 O2	11.0
941752	AE2-175 E O2	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 O2	23.44
942562	AE2-271 E O2	15.6
942581	AE2-274	0.23
942721	AE2-288	88.55
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
CHILHOWEE	CHILHOWEE	0.5
COFFEEN	COFFEEN	1.44
COTTONWOOD	COTTONWOOD	5.82

Bus #	Bus	MW Impact
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

5.2 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
1991544	938390	AE1-058 TAP	PPL	208072	SIEG	PPL	1	PL:08:P42:000130	breaker	628.0	101.91	102.43	DC	7.25

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 O2	4.85
940562	AE2-042 E O2	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 O2	5.58
942562	AE2-271 E O2	3.71
942581	AE2-274	0.06
942721	AE2-288	17.87
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

17 Affected Systems

17.1 LG&E

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

17.2 MISO

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

17.3 TVA

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

17.4 Duke Energy Progress

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

17.5 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: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

Short Circuit

18 Short Circuit

The following Breakers are over-duty:

None.