



Generation Interconnection

Queue Project AE1-101

McConnellsburg – Texas Eastern 138 kV

Feasibility Study Report

Capacity : 100.5 MW / Energy : 150 MW

February, 2019

General

Interconnection Customer has proposed a new solar-plus-battery generating facility located in Franklin County, Pennsylvania. The installed facilities will have a total capability of 150 MW with 100.5 MW of this output being recognized by PJM as Capacity Interconnection Rights. The proposed in-service date for this project is May 31, 2021. **This study does not imply a West Penn Power Company (Transmission Owner or WPP) commitment to this in-service date.**

Point of Interconnection

The AE1-101 facility will interconnect with the WPP transmission system at either one of the following Point of Interconnections (POI):

- Option 1 POI: Tapping the McConnellsburg – Texas Eastern 6 138 kV Line at a point located approximately 7.30 miles from McConnellsburg and 9.31 miles from Texas Eastern 6 substations. A three-breaker ring bus substation is required to tap the line, which will be located one to two spans adjacent to the 138 kV line.
- Option 2 POI: Tapping the same McConnellsburg – Texas Eastern 6 Line but at a different point located approximately 6.25 miles from McConnellsburg substation. A three-breaker ring bus substation is required to tap the line, which will be located one to two spans adjacent to the 138 kV line.

The following table provides a breakdown of MW contributions to the Maximum Facility Output (MFO) and Capacity Interconnection Rights (CIR) by fuel type:

Fuel Type	Energy	Capacity
Solar	150	100.5
Battery Storage	50	0.0
	MFO = 150 ^[1]	CIR = 100.5

[1] Please note that the MFO of the AE1-101 Customer Facility is limited to 150 MW.

Network Impacts

The Queue Project AE1-101 was evaluated as a 150 MW (Capacity 100.5 MW) injection tapping the McConnellsburg – Texas Eastern 6 138 kV line in the APS zone (West Penn Power, FirstEnergy). Project AE1-101 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-101 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Primary POI: Summer Peak Analysis – 2022

Generator Deliverability

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

None

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
628483	200532	26ROXBURY	PENELEC	200520	26ROXBURY	PENELEC	2	AP-P7-1-WPP-138-57	tower	150.0	75.85	97.48	DC	32.44
627306	235189	01GUILFD	AP	235136	01ANTRIM	AP	1	AP-P2-3-WP-138-272T	breaker	306.0	46.33	76.37	DC	91.95
628584	235189	01GUILFD	AP	235187	01GRANDP	AP	1	AP-P7-1-WPP-138-57	tower	228.0	46.55	80.18	DC	76.69

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
626975	200532	26ROXBURY	PENELEC	200520	26ROXBURY	PENELEC	2	ME_P4-500-002H	breaker	150.0	104.5	117.97	DC	20.21

Short Circuit

None. (No overdutied circuit breakers identified)

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.

Only the most severely overloaded conditions are listed. 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 will 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
627901	200532	26ROXBURY	PENELEC	200520	26ROXBURY	PENELEC	2	Base Case	operation	124.0	87.77	103.64	DC	19.68
627902	200532	26ROXBURY	PENELEC	200520	26ROXBURY	PENELEC	2	AP-P2-2-PE-138-074	operation	150.0	73.12	94.75	DC	32.44
628162	235189	01GUILFD	AP	235187	01GRANDP	AP	1	AP-P2-2-PE-138-071	operation	228.0	42.82	76.41	DC	76.6

System Reinforcements:

Short Circuit

None.

Stability and Reactive Power Requirement

Will be determined at a later study stages.

Summer Peak Load Flow Analysis Reinforcements

New System Reinforcements

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

ID	Index	Facility	Upgrade Description	Cost
627306	2	01GUILFD 138.0 kV - 01ANTRIM 138.0 kV Ckt 1	Description : No Violation. Facility loading does not exceed 100%.	\$0
628584	3	01GUILFD 138.0 kV - 01GRANDP 138.0 kV Ckt 1	Description : No Violation. Facility loading does not exceed 100%.	\$0
628483,626975	1	26ROXBURY 138.0 kV - 26ROXBURY 138.0 kV Ckt 2	Description : Supplemental upgrade s1643: Replace the existing Roxbury 100 MVA 138/115 kV transformer with a 224 MVA unit. Convert Roxbury 115 kV substation into a four (4) breaker ring bus. The supplemental project has an projected in-service date of 12/31/2019.	\$0
		TOTAL COST	\$0	

Flow Gate Detail, ID #626975

PJM Queue Position: AE1-101

This appendix contains additional information about the flowgate presented in the body of the report. 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.

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
626975	200532	26ROXBURY	PENELEC	200520	26ROXBURY	PENELEC	2	ME_P4-500-002H	breaker	150.0	104.5	117.97	DC	20.21

Bus #	Bus	MW Impact
235723	01GUILF1	1.04
235724	01GUILF2	1.04
237329	01CHBRG_I12	0.97
905554	W4-102 E	0.64
918661	AA1-080 C	0.13
918662	AA1-080 E	0.07
918731	AA1-092 C	0.52
918732	AA1-092 E	0.26
918761	AA1-095 C	0.36
918762	AA1-095 E	0.18
918771	AA1-096 C	0.13
918772	AA1-096 E	0.07
923871	AB2-027 C	0.17
923872	AB2-027 E	0.29
924482	AB2-097 E	0.61
930781	AB1-123 C O1	0.38
930782	AB1-123 E O1	0.62
930821	AB1-127 C	1.02
930822	AB1-127 E	1.66
930831	AB1-128 C	1.02
930832	AB1-128 E	1.66
933251	AC2-136 C	0.32
933252	AC2-136 E	0.36
933973	AD1-020 BAT	1.13
934362	AD1-060 E	0.85
934371	AD1-061 C	0.85
934372	AD1-061 E	1.39
936061	AD2-009 C	5.79
936062	AD2-009 E	2.64
936471	AD2-062 C O1	20.79

Bus #	Bus	MW Impact
936472	AD2-062 E O1	10.42
936871	AD2-110	1.85
938751	AE1-101 C	13.54
938752	AE1-101 E	6.67
939031	AE1-132 C O1	6.14
939032	AE1-132 E O1	4.09
939081	AE1-136 C	4.44
939082	AE1-136 E	2.94
939111	AE1-140 C O1	2.34
939112	AE1-140 E O1	1.56
939591	AE1-188 C	1.55
939592	AE1-188 E	0.91
CARR	CARR	0.44
CBM-S1	CBM-S1	1.75
CBM-S2	CBM-S2	1.08
CBM-W1	CBM-W1	2.69
CBM-W2	CBM-W2	12.43
CIN	CIN	1.2
CPL	CPL	0.46
G-007	G-007	1.26
IPL	IPL	0.77
LGEE	LGEE	0.35
MEC	MEC	2.31
MECS	MECS	1.44
O-066	O-066	4.32
RENSSELAER	RENSSELAER	0.35
WEC	WEC	0.32

Flow Gate Detail, ID #627306

PJM Queue Position: AE1-101

This appendix contains additional information about the flowgate presented in the body of the report. 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.

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
627306	235189	01GUILFD	AP	235136	01ANTRIM	AP	1	AP-P2-3-WP-138-272T	breaker	306.0	46.33	76.37	DC	91.95

Bus #	Bus	MW Impact
235723	01GUILF1	5.0
235724	01GUILF2	5.0
237577	01ROUTE 16	0.48
925851	AC1-064	0.04
930821	AB1-127 C	3.85
930822	AB1-127 E	6.29
930831	AB1-128 C	3.85
930832	AB1-128 E	6.29
934361	AD1-060 C	0.2
934362	AD1-060 E	2.09
934371	AD1-061 C	3.14
934372	AD1-061 E	5.13
936061	AD2-009 C	25.03
936062	AD2-009 E	11.4
936471	AD2-062 C O1	39.62
936472	AD2-062 E O1	19.84
936871	AD2-110	8.89
938751	AE1-101 C	61.6
938752	AE1-101 E	30.34
939031	AE1-132 C O1	26.54
939032	AE1-132 E O1	17.69
939081	AE1-136 C	20.47
939082	AE1-136 E	13.56
939591	AE1-188 C	4.57
939592	AE1-188 E	2.68
CARR	CARR	0.05
CBM-S1	CBM-S1	0.08
CBM-S2	CBM-S2	0.05
CBM-W1	CBM-W1	0.12
CBM-W2	CBM-W2	0.54

Bus #	Bus	MW Impact
CIN	CIN	0.05
CPLE	CPLE	0.02
G-007	G-007	0.16
IPL	IPL	0.03
LGEE	LGEE	0.02
MEC	MEC	0.1
MECS	MECS	0.06
O-066	O-066	0.52
RENSSELAER	RENSSELAER	0.04
WEC	WEC	0.01

Flow Gate Detail, ID #628584

PJM Queue Position: AE1-101

This appendix contains additional information about the flowgate presented in the body of the report. 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.

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
628584	235189	01GUILFD	AP	235187	01GRANDP	AP	1	AP-P7-1-WPP-138-57	tower	228.0	46.55	80.18	DC	76.69

Bus #	Bus	MW Impact
235723	01GUILF1	4.14
235724	01GUILF2	4.14
237577	01ROUTE 16	0.43
918731	AA1-092 C	0.61
918732	AA1-092 E	0.31
925851	AC1-064	0.03
930821	AB1-127 C	3.11
930822	AB1-127 E	5.08
930831	AB1-128 C	3.11
930832	AB1-128 E	5.08
934361	AD1-060 C	0.18
934362	AD1-060 E	1.88
934371	AD1-061 C	2.66
934372	AD1-061 E	4.34
936061	AD2-009 C	21.0
936062	AD2-009 E	9.56
936871	AD2-110	7.37
938751	AE1-101 C	51.38
938752	AE1-101 E	25.31
939031	AE1-132 C O1	22.26
939032	AE1-132 E O1	14.84
939081	AE1-136 C	17.05
939082	AE1-136 E	11.3
939591	AE1-188 C	3.52
939592	AE1-188 E	2.07
CARR	CARR	0.15
CBM-S1	CBM-S1	0.56
CBM-S2	CBM-S2	0.35
CBM-W1	CBM-W1	0.85
CBM-W2	CBM-W2	3.98

Bus #	Bus	MW Impact
CIN	CIN	0.38
CPLE	CPLE	0.15
G-007	G-007	0.43
IPL	IPL	0.25
LGEE	LGEE	0.11
MEC	MEC	0.73
MECS	MECS	0.45
O-066	O-066	1.47
RENSSELAER	RENSSELAER	0.12
WEC	WEC	0.1