

***Generation Interconnection
Combined Feasibility/Impact Study Report***

For

***PJM Generation Interconnection Request
Queue Position Z2-013***

Frostburg 138 kV Project

September 2014

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Introduction

This combined Feasibility/System Impact Study report provides the documentation of an assessment that has been performed by FirstEnergy (FE) in response to a request made by Big Savage, LLC to increase the capacity of an existing 200 MW wind generation project connected to the Potomac Edison transmission system. As per the PJM RTEP study process, the Frostburg 138 kV (Z2-013) Generation Project assessment was accomplished by: 1. Evaluating the reliability impact of the proposed facilities and connection on the interconnected transmission system by the performance of a power flow study; 2. Ensuring compliance with the NERC, ReliabilityFirst, PJM and FE Reliability Standards by identifying the system reinforcements that will need to be installed for an interconnection of the proposed project; 3. Coordinating and cooperating with the PJM staff and Big Savage, LLC by conducting meetings and issuing this report as a part of the Regional Transmission Expansion Plan (“RTEP”) study process; 4. Performing a Steady State, Short-Circuit and Dynamics Study as necessary; 5. Conducting all studies in accordance with the PJM Manuals and the FE “Requirements for Transmission Connected Facilities” document to assure that the assessment performed incorporates study assumptions, follows the documented system performance procedures, considers alternative connection and reinforcement plans, and jointly coordinates the study recommendations.

PJM Analysis

Network Impacts

The Queue Project Z2-013 was studied as a 7.0 MW (Capacity increase only of 7.0 MW) injection at the Big Savage 34.5 kV substation in the APS area. Project Z2-013 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project Z2-013 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Analysis - 2018

Generator Deliverability

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

None

Multiple Facility Contingency

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

None

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

1. (AP - AP) The 01SNWYCK 138/66 kV transformer (from bus 235403 to bus 237273 ckt 1) loads from 103.61% to 104.11% (**DC power flow**) of its emergency rating (32 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_1A'. This project contributes approximately 0.36 MW to the thermal violation.

CONTINGENCY 'AP_SB_1A' / ALBRIGHT-BRANDONVILLE 106
JCT. STK BKR AT ALBRIGHT
OPEN BUS 235305
OPEN BRANCH FROM BUS 235120 TO BUS 235469 CKT 1 /* ALBRIGHT-
GARRETT
OPEN BRANCH FROM BUS 235120 TO BUS 235841 CKT 1F /* ALBRIGHT-
ALTAMONT
OPEN BRANCH FROM BUS 235841 TO BUS 235492 CKT 1F /* ALTAMONT-
MTZION
OPEN BRANCH FROM BUS 235120 TO BUS 235402 CKT 1
OPEN BRANCH FROM BUS 235120 TO BUS 235320 CKT 1
OPEN BUS 235565
OPEN BUS 235564
END

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

Not Required

Delivery of Energy Portion of Interconnection Request

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.

None

Light Load Analysis - 2018

Not required for Capacity only increase.

New System Reinforcements

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

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

None

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

No change in the short circuit performance of the project is anticipated.

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

Not required because there was no change in generation equipment.

Connection Facilities

In compliance with the RTEP protocol, Big Savage, LLC has submitted a "Form of Generation Interconnection Feasibility Study Agreement" to PJM that identifies its plan to increase the capacity of its Frostburg 138 kV wind generation project by 7.0 MW. After the increase, the facility's new capacity value will be 33.0 MW. The maximum facility output will remain unchanged at 200.0 MW. The project has been designated as the Frostburg 138 kV (Z2-013) Generation Project to reflect its interconnection voltage and its point of interconnection ("POI") at Potomac Edison's Frostburg substation. This report contains detailed connection requirements, direct connection costs and schedule, power flow analysis, short circuit analysis, and a cost and schedule for any associated system reinforcements for the Project

Point of Interconnection: Frostburg 138 kV Substation.

The Project is already connected to the FE transmission system at Frostburg substation. Therefore, no new direct connection facilities are required to accommodate this request.

Power Flow Analysis

A power flow study was conducted to determine the reliability impact of the proposed Frostburg 138 kV (Z2-013) Generation Project on the FE transmission system. This study was completed using a 2018 summer peak load power flow model that contains a detailed representation of the Potomac Edison transmission network in the area of the proposed Frostburg 138 kV (Z2-013) Generation Project. The findings and the recommendations from this analysis are based on a contingency review that was performed to identify the facility loadings and/or voltage conditions that violate the ReliabilityFirst, PJM or FE Planning Criteria and are attributable to this project. Note that in accordance with PJM RTEP study procedures, this Frostburg 138 kV (Z2-013) Generation Project under study and earlier active generation queue projects are considered to be in service. Therefore, all active generation queue projects after Z2-013 are considered not in service.

The results of the FE analysis show that there are no transmission network upgrades required for the Frostburg 138 kV (Z2-013) Generation Project.

Short Circuit Analysis

Because Big Savage, LLC is only proposing an increase to the capacity output of the facility, and is not changing any installed facilities, no change in the short circuit or dynamic performance of the project is anticipated.

Metering

Big Savage, LLC will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The FirstEnergy Revenue Metering Requirements may be found in the FirstEnergy Requirements for Transmission Connected Facilities document located at the following links:

<https://www.firstenergycorp.com/content/fecorp/feconnect/potomacedison/wholesale.html>

Compliance Issues

Big Savage, LLC will be responsible for meeting all FE criteria as defined in the FE Requirements for Transmission Connected Facilities document.

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

Summary

The results of the FE power flow analysis show that the Frostburg 138 kV (Z2-013) Generation Project does not attribute to any planning criteria violations. Therefore in accordance with the RTEP procedures defined in the PJM Open Access Transmission Tariff and PJM Manuals, the Big Savage, LLC is not responsible for any network upgrades.

Appendices

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.

Appendix 1

(AP - AP) The 01SNWYCK 138/66 kV transformer (from bus 235403 to bus 237273 ckt 1) loads from 103.61% to 104.11% (**DC power flow**) of its emergency rating (32 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_1A'. This project contributes approximately 0.36 MW to the thermal violation.

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 OPEN BRANCH FROM BUS 235120 TO BUS 235402 CKT 1
 OPEN BRANCH FROM BUS 235120 TO BUS 235320 CKT 1
 OPEN BUS 235565
 OPEN BUS 235564
 END

Bus Number	Bus Name	Full Contribution
235528	01BIGSAVAGE	1.34
292400	K-028 C	0.33
292401	K-028 E	21.41
885641	T-016 C	0.1
885642	T-016 E	6.41
929522	U2-030 E	2.68
235530	U2-073 E	8.94
917091	Z2-013	0.36

Attachment 1 Single Line Diagram

