

# *Generation Interconnection Feasibility Study Report*

## *Queue Position AD1-125 Baker 138 kV*

### **General**

“Interconnection Customer” has proposed a new wind generation facility located approximately 1.5 miles north of Baker substation located in Hardy County, West Virginia. The installed facilities will have capability of 80 MW with 11.76 MW of this output being recognized by PJM as capacity. The proposed in-service date is December 31, 2020. This study does not imply a **Potomac Edison (“Transmission Owner”) commitment to this in-service date.**

### **Point of Interconnection (POI)**

This project will interconnect with the Potomac Edison transmission system by direct injection into Baker substation which will be reconfigured to a three breaker ring bus substation. The POI is located on the exist side of Baker substation to wind facility. The generation site is 1.5 miles from the POI. There is no Secondary POI requested for this project. Please refer to Appendix 2 for one-line diagram of system configuration.

## Network Impacts

The Queue Project AD1-125 was evaluated as a 80.0 MW (Capacity 11.8 MW) injection at the Baker 138kV substation in the APS area. Project AD1-125 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-125 was studied with a commercial probability of 53%. Potential network impacts were as follows:

## Summer Peak Analysis - 2021

### 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)*

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 01PARSNS-01LOUGHL 138 kV line (from bus 235385 to bus 235362 ckt 1) loads from 105.6% to 116.42% (**DC power flow**) of its emergency rating (179 MVA) for the line fault with failed breaker contingency outage of 'AP-P2-4-MP-138-200'. This project contributes approximately 19.38 MW to the thermal violation.

CONTINGENCY 'AP-P2-4-MP-138-200'	/* ALBRIGHT BREAKER FAILURE - TIE BREAKER
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235304 CKT 1	/* 01ALBRIG 138 01BRANDN 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235305 CKT 1	/* 01ALBRIG 138 01 106 J 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235320 CKT 1	/* 01ALBRIG 138 01DENVER 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235356 CKT 1	/* 01ALBRIG 138 01KINGWD 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235398 CKT 1	/* 01ALBRIG 138 01RUTHBL 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235402 CKT 1	/* 01ALBRIG 138 01SNOW T 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 934440 CKT 1	/* 01ALBRIG 138 AD1-068 TAP 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235485 CKT 1	/* 01ALBRIG 138 01METTIK 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235492 CKT 1	/* 01ALBRIG 138 01MTZION 138
END	

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

2. (AP - AP) The 01PARSNS-01LOUGHL 138 kV line (from bus 235385 to bus 235362 ckt 1) loads from 103.74% to 114.03% (**DC power flow**) of its emergency rating (179 MVA) for the line fault with failed breaker contingency outage of 'AP-P2-3-MP-138-153'. This project contributes approximately 18.43 MW to the thermal violation.

CONTINGENCY 'AP-P2-3-MP-138-153'	/* OAK PARK-KELSO GAP STK BKR AT ALBRIGHT
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235485 CKT 1	/* 01ALBRIG 138 01METTIK 138

DISCONNECT BRANCH FROM BUS 235120 TO BUS 235492 CKT 1	/* 01ALBRIG 138 01MTZION 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235305 CKT 1	/* 01ALBRIG 138 01 106 J 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235320 CKT 1	/* 01ALBRIG 138 01DENVER 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 934440 CKT 1	/* 01ALBRIG 138 AD1-068 TAP 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235402 CKT 1	/* 01ALBRIG 138 01SNOW T 138
DISCONNECT BRANCH FROM BUS 235402 TO BUS 235403 CKT 1	/* 01SNOW T 138 01SNWYCK 138
DISCONNECT BRANCH FROM BUS 235402 TO BUS 235497 CKT 1	/* 01SNOW T 138 01OAKPRK 138
DISCONNECT BRANCH FROM BUS 235403 TO BUS 237273 CKT 1	/* 01SNWYCK 138 01SNOW C 66
DISCONNECT BRANCH FROM BUS 235497 TO BUS 237313 CKT 1	/* 01OAKPRK 138 01KELSOG 138
END	

3. (AP - AP) The 01PARSNS-01LOUGHL 138 kV line (from bus 235385 to bus 235362 ckt 1) loads from 103.25% to 113.82% (**DC power flow**) of its emergency rating (179 MVA) for the bus fault outage of 'AP-P2-2-MP-138-101'. This project contributes approximately 18.93 MW to the thermal violation.

CONTINGENCY 'AP-P2-2-MP-138-101'	/* ALBRIGHT-138-SOUTH
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235320 CKT 1	/* 01ALBRIG 138 01DENVER 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235402 CKT 1	/* 01ALBRIG 138 01SNOW T 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 934440 CKT 1	/* 01ALBRIG 138 AD1-068 TAP 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235485 CKT 1	/* 01ALBRIG 138 01METTIK 138
DISCONNECT BRANCH FROM BUS 235120 TO BUS 235305 CKT 1	/* 01ALBRIG 138 01 106 J 138
END	

4. (AP - AP) The 01WILLIM-01PARSNS 138 kV line (from bus 235427 to bus 235385 ckt 1) loads from 109.29% to 120.11% (**DC power flow**) of its emergency rating (179 MVA) for the line fault with failed breaker contingency outage of 'AP-P2-4-MP-138-200'. This project contributes approximately 19.38 MW to the thermal violation.

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Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

5. (AP - AP) The 01WILLIM-01PARSNS 138 kV line (from bus 235427 to bus 235385 ckt 1) loads from 107.43% to 117.72% (**DC power flow**) of its emergency rating (179 MVA) for the line fault with failed breaker contingency outage of 'AP-P2-3-MP-138-153'. This project contributes approximately 18.43 MW to the thermal violation.

CONTINGENCY 'AP-P2-3-MP-138-153'	/* OAK PARK-KELSO GAP STK BKR AT ALBRIGHT
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DISCONNECT BRANCH FROM BUS 235497 TO BUS 237313 CKT 1  
END

/\* 01OAKPRK 138 01KELSOG 138

6. (AP - AP) The 01WILLIM-01PARSNS 138 kV line (from bus 235427 to bus 235385 ckt 1) loads from 106.99% to 117.56% (**DC power flow**) of its emergency rating (179 MVA) for the bus fault outage of 'AP-P2-2-MP-138-101'. This project contributes approximately 18.93 MW to the thermal violation.

CONTINGENCY 'AP-P2-2-MP-138-101'

/\* ALBRIGHT-138-SOUTH

DISCONNECT BRANCH FROM BUS 235120 TO BUS 235320 CKT 1

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/\* 01ALBRIG 138 01METTIK 138

DISCONNECT BRANCH FROM BUS 235120 TO BUS 235305 CKT 1

/\* 01ALBRIG 138 01 106 J 138

END

### **Steady-State Voltage Requirements**

To be determined during later study phases

### **Short Circuit**

None

### **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 - 2021**

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

### **System Reinforcements**

#### **Short Circuit**

None

#### **Stability and Reactive Power Requirement**

To be determined during later study phases

## 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)*

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)*

1. (AP - AP) The 01PARSNS-01LOUGHHL 138 kV line (from bus 235385 to bus 235362 ckt 1) loads from 105.6% to 116.42% (**DC power flow**) of its emergency rating (179 MVA) for the line fault with failed breaker contingency outage of 'AP-P2-4-MP-138-200'. This project contributes approximately 19.38 MW to the thermal violation.

#### **APS:**

**In conjunction with AD1-068 generation project, the reconfiguration of the Albright substation eliminates the P2 contingency at Albright. The estimated cost of the reconfiguration is less than the combined estimated cost of the reconductors and line upgrades for both projects. This fixes the contingencies identified. Cost estimate and timeframe will be provided in the System Impact Study report, and PJM will be responsible for allocating costs.**

Please refer to Appendix 6 for FirstEnergy's analysis for Network Facility Reinforcement.

2. (AP - AP) The 01PARSNS-01LOUGHHL 138 kV line (from bus 235385 to bus 235362 ckt 1) loads from 103.74% to 114.03% (**DC power flow**) of its emergency rating (179 MVA) for the line fault with failed breaker contingency outage of 'AP-P2-3-MP-138-153'. This project contributes approximately 18.43 MW to the thermal violation.

#### **Same as Contribution to Previously Identified #1**

3. (AP - AP) The 01PARSNS-01LOUGHHL 138 kV line (from bus 235385 to bus 235362 ckt 1) loads from 103.25% to 113.82% (**DC power flow**) of its emergency rating (179 MVA) for the bus fault outage of 'AP-P2-2-MP-138-101'. This project contributes approximately 18.93 MW to the thermal violation.

#### **Same as Contribution to Previously Identified #1**

4. (AP - AP) The 01WILLIM-01PARSNS 138 kV line (from bus 235427 to bus 235385 ckt 1) loads from 109.29% to 120.11% (**DC power flow**) of its emergency rating (179 MVA) for the line fault with failed breaker contingency outage of 'AP-P2-4-MP-138-200'. This project contributes approximately 19.38 MW to the thermal violation.

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**Same as Contribution to Previously Identified #1**

## **Light Load 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)*

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

## Appendix 3

### Flowgate Information: Contingency - Albright Breaker Failure - Tie Breaker PJM Queue Position: AD1-125

This appendix contains additional information about the flowgate presented in the body of the report. The intent of this 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 gauge 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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DISCONNECT BRANCH FROM BUS 235120 TO  
BUS 235492 CKT 1 /\* 01ALBRIG 138  
01MTZION 138

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
235625	01BACKB	31.66
235091	U2-061_E	26.08
235854	01KL_K28_T16	0.93
237312	01DANS_S-014	0.85
237512	01ROTHROCK	0.76
290229	S-014 E	3.42
292310	K-019	1.55
292401	K-028 E	14.67
885642	T-016 E	4.39
917231	Z2-038 C	0.46
917232	Z2-038 E	0.75
918461	AA1-062 C	3.41
918462	AA1-062 E	116.91
918812	AA1-100 E	0.71
933951	AD1-018 C	0.57
933952	AD1-018 E	0.93
934931	AD1-125 C	2.85
934932	AD1-125 E	16.53
920072	AA2-103 E	11.99

## Appendix 4

### Flowgate Information: Contingency - Albright Breaker Failure - Tie Breaker PJM Queue Position: AD1-125

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DISCONNECT BRANCH FROM BUS 235120 TO  
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TAP 138

DISCONNECT BRANCH FROM BUS 235120 TO  
BUS 235485 CKT 1 /\* 01ALBRIG 138  
01METTIK 138

DISCONNECT BRANCH FROM BUS 235120 TO  
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01MTZION 138

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
235625	01BACKB	31.66
235091	U2-061_E	26.08
235854	01KL_K28_T16	0.93
237312	01DANS_S-014	0.85
237512	01ROTHROCK	0.76
290229	S-014 E	3.42
292310	K-019	1.55
292401	K-028 E	14.67
885642	T-016 E	4.39
917231	Z2-038 C	0.46
917232	Z2-038 E	0.75
918461	AA1-062 C	3.41
918462	AA1-062 E	116.91
918812	AA1-100 E	0.71
920072	AA2-103 E	11.99
933951	AD1-018 C	0.57
933952	AD1-018 E	0.93
<b>934931</b>	<b>AD1-125 C</b>	<b>2.85</b>
<b>934932</b>	<b>AD1-125 E</b>	<b>16.53</b>