Generation Interconnection

Feasibility Study Report

Queue Position AB1-014

(Revised)

Interconnection Customer (IC) has proposed a solar photovoltaic generating facility located in Brown County, Ohio. The installed facilities will have a total capability of 125 MW with 47.5 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is October 30, 2018. **This study does not imply a Duke Energy commitment to this in-service date.**

Point of Interconnection

AB1-014 will interconnect with the Duke Energy transmission system at one of the following points of interconnection: Option 1 will tap onto the Hillcrest-Eastwood 138kV line; and Option 2 will interconnect to existing 138kV bus at Hillcrest substation.

Network Impacts - First Point of Interconnection

The following Network Impacts Analysis pertains to the first option point of interconnection (Option 1) which is considered to be the main or primary point of interconnection for the project. Please refer to the next section title "Alternate or Secondary Point of Interconnection" for Network Impacts regarding the secondary or alternate point of interconnection.

The Queue Project AB1-014 was evaluated as a 125.0 MW (Capacity 47.5 MW) injection tapping the Hillcrest-Eastwood 138kV line in the DEOK area. Project AB1-014 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB1-014 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2019

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)

None

Steady-State Voltage Requirements
(Results of the steady-state voltage studies should be inserted here)

To be determined

Short Circuit
(Summary of impacted circuit breakers)

AB1-014 did not cause any breakers to become newly over duty and did not have a > 3% contribution to any existing over duty breakers.

Affected System Analysis & Mitigation

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.

1. (OVEC - AEP) The 06KYGER-05SPORN 345 kV line (from bus 248005 to bus 242528 ckt 1) loads from 105.44% to 106.06% (**DC power flow**) of its normal rating (1017 MVA) for the single line contingency outage of '8468_B2'. This project contributes approximately 13.96 MW to the thermal violation.

CONTINGENCY '8468_B2'
OPEN BRANCH FROM BUS 242528 TO BUS 248005 CKT 2 / 242528 05SPORN 345 248005 06KYGER 345 2
END

2. (OVEC - AEP) The 06KYGER-05SPORN 345 kV line (from bus 248005 to bus 242528 ckt 2) loads from 115.49% to 116.14% (**DC power flow**) of its normal rating (971 MVA) for the

single line contingency outage of '349_B2_TOR21'. This project contributes approximately 13.96 MW to the thermal violation.

CONTINGENCY '349_B2_TOR21'
OPEN BRANCH FROM BUS 242528 TO BUS 248005 CKT 1 / 242528 05SPORN 345 248005 06KYGER 345 1
END

Light Load Analysis - 2019

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

System Reinforcements

None identified

Network Impacts – Alternate or Secondary Point of Interconnection

The following Network Impacts Analysis pertains to the second point of interconnection (Option 2) which is considered to be the alternative option point of interconnection for AB1-014 project. Please refer to the previous section title “Network Impacts - First Point of Interconnection” for Network Impacts regarding the main or primary point of interconnection.

The Queue Project AB1-014 was evaluated as a 125.0 MW (Capacity 47.5 MW) injection at the Hillcrest 138kV substation in the DEOK area. Project AB1-014 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). The Study is based on Summer Peak Analysis – 2019. Project AB1-014 was studied with a commercial probability of 53%. Potential network impacts were as follows:

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)

None

Steady-State Voltage Requirements
(Results of the steady-state voltage studies should be inserted here)

To be determined

Short Circuit
(Summary of impacted circuit breakers)

To be determined

Affected System Analysis & Mitigation

LGEE Impacts:

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

MISO Impacts:

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

OVEC Impacts:

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

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.

1. (OVEC - AEP) The 06KYGER-05SPORN 345 kV line (from bus 248005 to bus 242528 ckt 1) loads from 105.56% to 106.18% (**DC power flow**) of its normal rating (1017 MVA) for the single line contingency outage of '8468_B2'. This project contributes approximately 13.96 MW to the thermal violation.

CONTINGENCY '8468_B2'
OPEN BRANCH FROM BUS 242528 TO BUS 248005 CKT 2 / 242528 05SPORN 345 248005 06KYGER 345 2
END

2. (OVEC - AEP) The 06KYGER-05SPORN 345 kV line (from bus 248005 to bus 242528 ckt 2) loads from 115.62% to 116.27% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of '349_B2_TOR21'. This project contributes approximately 13.96 MW to the thermal violation.

CONTINGENCY '349_B2_TOR21'
OPEN BRANCH FROM BUS 242528 TO BUS 248005 CKT 1 / 242528 05SPORN 345 248005 06KYGER 345 1
END

Light Load Analysis - 2019

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

System Reinforcements

None identified

Additional Interconnection Customer Responsibilities:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 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.

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

3. The Interconnection Customer seeking to interconnect a wind generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per item 5.iv. of Schedule H to the Interconnection Service Agreement.