

***PJM Generator Interconnection Request  
Queue #V1-011  
Haviland 138kV  
Feasibility Study***

**574579  
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## **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. 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 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.

## **V1-011 Haviland 138kV Feasibility Study**

### **General**

Northwest Ohio Wind Energy (Northwest) proposes to install PJM Project #V1-011, a 150 MW generating facility comprised of 75 Suzlon S88 2.1 MW wind turbine generators. This generation facility would connect to the American Electric Power (AEP) Haviland 138 kV Station. The proposed locations of the generating facilities are located in Paulding and Van Wert counties (See Exhibit 1). The projected in-service date is requested for February 2011.

### **Direct Connection**

The proposed generation project will be connected at Haviland Station via a new 138 kV circuit breaker (See Exhibit 2). Additional protection schemes will need to be added at the station and 138 kV metering will need to be installed.

It is understood that Northwest will be responsible for the all costs associated with construction, as well as facilities associated with connecting their 150 MW generation to Haviland Station. Note that Northwest station facilities and any facilities outside of Haviland station were not included in the cost estimates. These are assumed to be Northwest's responsibility.

The AEP construction scope for the attachment facilities:

- Construction of a new 138 kV circuit breaker and associated equipment at Haviland Station, including 138 kV metering and relaying. It is expected that substantial line and bus work will need to be completed at Haviland Station to facilitate the new 138 kV circuit breaker.

Estimated Cost (2009 Dollars): \$3,500,000

**Total Attachment Facilities Cost\*: \$3,500,000**

\*The estimates are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements. It will take approximately 12-18 months after obtaining the authorization to construct the facilities as outlined above.

### **Network Impacts**

The Queue Project #V1-011 was studied as a(n) 150.0MW(Capacity19.5MW) injection at Haviland\_138kV substation in the AEP area. Project #V1-011 was evaluated for compliance with reliability criteria for summer peak conditions in 2013. Potential network impacts were as follows:

### **Generator Deliverability**

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

No problems were identified.

### **Multiple Facility Contingency**

*(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)*

1. The T-131 Tap –North Delphos 138 kV line (from bus 924420 to bus 23181 ckt 1) loads to 132.27% (DC power flow) of its normal rating (192 MVA) for the tower line contingency outage of the Tillman-S73 and Lincoln-S73 138kV circuits. This project contributes approximately 40.35 MW to cause the thermal violation
2. (Identified by AEP) The North Delphos 138/69 kV transformer is overloaded to 116% of its 120 MVA emergency rating for a tower outage impacting both the Haviland – East Lima 138 kV line and the East Side – Sterling 138 kV line. This project contributes approximately 8.5 MVA to the thermal violation.

### **Short Circuit**

No problems identified.

### **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. The T-131 Tap-North Delphos 138 kV line (from bus 924420 to bus 23181 ckt 1) loads from 111.26% to 132.27% (DC power flow) of its normal rating (192 MVA) for the tower line contingency ('TILLMAN-S73\_LINCOLN-S73'). This project contributes approximately 40.35 MW to cause the thermal violation.
2. The Lincoln-Anthony 138 kV line (from bus 23476 to bus 23411 ckt 1) loads from 100.3% to 101.04% (DC power flow) of its normal rating (201 MVA) for the tower line contingency ('D|05ALLEN-05ROB PK-05CONVOY-345'). This project contributes approximately 9.28 MW to cause the thermal violation.
3. (Identified by AEP) The Haviland – Paulding 69 kV line is overloaded to 112% of its 50 MVA emergency rating for the Antwerp – R48 69 kV line outage. This project contributes approximately 10 MVA to cause the thermal violation.

### **New System Reinforcements**

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

1. The overload on the T131-North Delphos line can be alleviated by rebuilding approximately 25 miles (depending upon the location of the T131 interconnection) of

138kV line between T131 and North Delphos. The rebuild requires new line conductor and replacement of 16 miles of existing tower structures. The estimated cost in 2009 dollars is **\$33 million\*\***. The 138kV risers also need to be replaced at the North Delphos station. The estimated cost in 2009 dollars is **\$10,000**.

\*\*This estimate is preliminary in nature, as it was determined without the benefit of detailed engineering studies. It is possible that detailed engineering studies would show that a larger conductor can be used on the existing towers. Final estimates will require an on-site review and coordination to determine final construction requirements. It will take approximately 18-24 months after obtaining a signed agreement to construct the facilities as outlined above.

2. The overload on the North Delphos transformer can be alleviated by replacing the transformer and associated equipment with that of a higher rating. The estimated cost in 2009 dollars is **\$2 million**.

### **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. The overload on the T131-North Delphos line can be alleviated by rebuilding approximately 25 miles (depending upon the location of the T131 interconnection) of 138kV line between T131 and North Delphos. The rebuild requires new line conductor and replacement of 16 miles of existing tower structures. The estimated cost in 2009 dollars is **\$33 million\*\***. The 138kV risers also need to be replaced at the North Delphos station. The estimated cost in 2009 dollars is **\$10,000**.

\*\*This estimate is preliminary in nature, as it was determined without the benefit of detailed engineering studies. It is possible that detailed engineering studies would show that a larger conductor can be used on the existing towers. Final estimates will require an on-site review and coordination to determine final construction requirements. It will take approximately 18-24 months after obtaining a signed agreement to construct the facilities as outlined above.

1. The overload on the Lincoln-Anthony 138kV circuit can be alleviated by replacing 138 kV circuit breaker “D” and associated equipment at Lincoln Station. The existing circuit breaker is only rated for 201 MVA and needs to be upgraded to accommodate PJM Project #R03 and #S73. The control relay for the circuit breaker as well as the control cables will also need to be upgraded as part of this project. (Network Upgrade # n1028)

Estimated Cost (2009 Dollars)\*: **\$269,000**

1. The overload on the Haviland-Paulding 69kV circuit can be alleviated by rebuilding 10.72 miles of 69 kV line between Haviland and Paulding Stations. (Network Upgrade #n1469)

Estimated Cost (2009 Dollars)\*: **\$3,870,000**

### **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. The S73A -Lincoln 138 kV line (from bus 90794 to bus 23476 ckt 1) loads from 137.79% to 165.41% (DC power flow) of its rating (192 MVA) for the single line contingency ('5205\_B2\_TOR769\_S73A'). This project contributes approximately 53.03 MW to cause the thermal violation.
2. The S73A -Lincoln 138 kV line (from bus 90794 to bus 23476 ckt 1) loads from 126.63% to 152.78% (DC power flow) of its normal rating (156 MVA) for non-contingency condition. This project contributes approximately 40.8 MW to cause the thermal violation.
3. The Milan-Harper 138 kV line (from bus 23487 to bus 23457 ckt 1) loads from 125.07% to 151.93% (DC power flow) of its normal rating (143 MVA) for the single line contingency ('5206\_B2\_TOR770\_WOMOAB\_S73B'). This project contributes approximately 38.41 MW to cause the thermal violation.
4. The Milan-Harper 138 kV line (from bus 23487 to bus 23457 ckt 1) loads from 125.07% to 151.93% (DC power flow) of its normal rating (143 MVA) for the single line contingency ('5209\_B2\_TOR770C\_MOAB'). This project contributes approximately 38.41 MW to cause the thermal violation.
5. The Milan-Harper 138 kV line (from bus 23487 to bus 23457 ckt 1) loads from 89.46% to 109.28% (DC power flow) of its normal rating (111 MVA) for non-contingency condition. This project contributes approximately 22 MW to cause the thermal violation.
6. The Tillman-Milan 138 kV line (from bus 23519 to bus 23487 ckt 1) loads from 106.77% to 127.65% (DC power flow) of its normal rating (184 MVA) for the single line contingency ('5209\_B2\_TOR770C\_MOAB'). This project contributes approximately 38.41 MW to cause the thermal violation.
7. The Tillman-Milan 138 kV line (from bus 23519 to bus 23487 ckt 1) loads from 106.77% to 127.65% (DC power flow) of its normal rating (184 MVA) for the single line contingency ('5206\_B2\_TOR770\_WOMOAB\_S73B'). This project contributes approximately 38.41 MW to cause the thermal violation.

## Exhibit 1: Interconnection location of the proposed facilities

**Exhibit 2: Simplified diagram of proposed 138 kV connection to Haviland Station**