

#S73 – Lincoln-North Delphos 138kV **Generation Interconnection**

This analysis was completed to assess the reliability impact for a new wind generator interconnecting to the PJM system as a capacity resource.

Local Impacts

Option #1 - Lincoln – North Delphos 138 kV line

The impact of the proposed generating facility on the AEP System was assessed for adherence with applicable reliability criteria. AEP planning criteria require that the transmission system meet single contingency performance criteria in accordance with the AEP FERC Form 715. Therefore, this criterion was used to assess the impact of the proposed facility on the AEP System. The AEPSC project was studied as a 200 MW net capacity consistent with the interconnection application.

Normal System (2012 Summer Conditions)

- No problems identified.

Single Contingency (2009 Summer Conditions)

- No problems identified.

Short Circuit Analysis

- No problems identified.

Stability Analysis

- Stability studies were not performed as part of this Feasibility Study and are not normally performed as part of a Facility Study effort. The stability assessments are part of the System Impact Study. Based upon the results of this future System Impact Study, the extent of system upgrades could change and the associated costs could be significantly different.

Local Upgrades

- None

Reactive Requirements

PJM requires a power factor correction to 95% lead/lag at the point of interconnection for wind generating facilities. It is expected that AEPSC will adhere to this standard.

Option #2 - connects to both North Delphos-Lincoln 138 kV line and Haviland-Milan 138 kV line via a 5-breaker ring bus substation

The impact of the proposed generating facility on the AEP System was assessed for adherence with applicable reliability criteria. AEP planning criteria require that the transmission system meet single contingency performance criteria in accordance with the AEP FERC Form 715. Therefore, this criterion was used to assess the impact of the proposed facility on the AEP System. The Heartland project was studied as a 200 MW net capacity consistent with the interconnection application. The results are summarized below.

Normal System (2012 Summer Conditions)

- No problems identified.

Single Contingency (2012 Summer Conditions)

- No problems identified.

Short Circuit Analysis

- No problems identified.

Stability Analysis

- Stability studies were not performed as part of this Feasibility Study and are not normally performed as part of a Facility Study effort. The stability assessments are part of the System Impact Study. Based upon the results of this future System Impact Study, the extent of system upgrades could change and the associated costs could be significantly different.

Network Impacts

The Queue S73 Project was studied as a 200 MW (40 MW Capacity) injection at two points of interconnection. Option#1 injects the project at the Lincoln – North Delphos 138 kV line, while option#2 connects to both North Delphos-Lincoln 138 kV line and Haviland-Milan 138 kV line via a 5-breaker ring bus substation. Project S73 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Potential network impacts were as follows:

Option#1

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 Lincoln–Anthony 138 kV line is overloaded from 91% to 111% of its emergency rating (201 MVA) for the **tower** outage of Allen–Robison Park 345 kV line and Convoy –R60 345 kV line. This project contributes approximately 40 MW to cause the thermal violation.
2. Contribution of 125 MW further overloads the S73 – Lincoln 138 kV line from 27% to 103% of its normal rating (167 MVA - conductor limited).

Short Circuit

Under Study

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)

No problems were identified.

New System Reinforcements

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

- The Lincoln–Anthony circuit overload can be mitigated by replacing the 138 kV circuit breaker "D" and associated equipment at Lincoln Station.

Estimated Cost (2007 Dollars)*: **\$500,000**

- The Lincoln-S73 overload can be mitigated by reconductoring the S73 - Lincoln 138 kV line (~17 miles).

Estimated Cost (2007 Dollars)*: **\$8,500,000**

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

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.

As a result of the aggregate energy resources in the area, the following violations were identified:

1. Contribution of 32 MW further overloads the Lincoln – Anthony 138 kV line from 101% to 117% of its emergency rating (201 MVA) for the outage of Robison Park 345/138 kV transformer ckt#5 (Cont. Id. AEP463).
 2. Contribution of 200 MW further overloads the S73–North Delphos 138 kV line from 0.11% to 104% of its emergency rating (192 MVA) for the outage of Lincoln–S73 138 kV line.
- This overload can be mitigated by replacing switches at North Delphos Station.

Estimated Cost (2007 Dollars)*: **\$100,000**

Option#2

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 Milan–Harper 138 kV line is overloaded from 70% to 101% of its emergency rating (143 MVA) for the **tower** outage of Allen–Robison Park 345 kV line and Convoy–R60 345 kV line. This project contributes approximately 44 MW to cause the thermal violation.

Short Circuit

Under Study

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)

No problems were identified.

New System Reinforcements

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

- The Milan-Harper 138kV line overload can be mitigated by replacing risers at Milan Station.

Estimated Cost (2007 Dollars)*: **\$100,000**

*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 one year after obtaining the authorization to construct the facilities as outlined above.

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)

To be determined

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.

As a result of the aggregate energy resources in the area, the following violations were identified:

1. Contribution of 69 MW overloads the Milan–Harper 138 kV line from 67% to 115% of its emergency rating (143 MVA) for the outage of Lincoln–S73 138 kV line.

This overload is mitigated by the reliability upgrade described above.