PJM Generator Interconnection Request
Queue #U2-041
East Lima-Marysville (Hardin County) 345kV
Feasibility Study

509347

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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,

U2-041 East Lima-Marysville (Hardin County) 345kV Feasibility Study Report

General

The Interconnection Customer (IC) proposes to install PJM Project #U2-041, a 300 MW generating facility comprised of 200 - 1.5 MW General Electric wind turbine generators with option #1 connecting to the American Electric Power (AEP) East Lima-Marysville 345kV circuit via a new 3-breaker ring bus and option #2 connecting to the Southwest Lima-Marysville 345kV circuit via a expansion of the new 3-breaker ring bus proposed for interconnection of project T142. The proposed project will be located in Hardin County, Ohio. The projected in-service date is scheduled for December 1, 2011.

Attachment Facilities

Option #1

The attachment facilities will consist of a new in-line switching station located between AEP's East Lima and Marysville Stations or the Southwest Lima and Marysville Stations in Ohio. The new station would consist of three 345 kV circuit breakers configured in a ring-bus arrangement with 345 kV metering. AEP will retain ownership of the proposed in-line station facilities. A preliminary one-line diagram of these facilities is shown in Exhibit 2. It is understood that IC will be responsible for all costs associated with this construction, as well as facilities associated with connecting the 300 MW of generation to the in-line facilities.

It is expected that a 400' x 400' (minimum) station site will be provided to AEP by IC. Note that the IC station facilities and any facilities outside the new station were not included in the cost estimate; these are assumed to be IC's responsibility.

The AEP construction scope for the attachment facilities:

- Construction of a new switching station, including three 345 kV circuit breakers, relays, 345 kV metering, SCADA, and associated equipment.

  Estimated Cost (2008 dollars): **$8,000,000**

- Modify line relaying with AEP standard package at East Lima and Marysville stations.

  Estimated Cost (2008 dollars): **$200,000**

Primary Attachment Facilities Cost[1]: **$8,200,000**

[1] 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

Option #2

- Expand station to be built for attachment facilities for PJM Project #T142 by adding a circuit breaker to create a new terminal position to accommodate U2-041.

  Estimated Cost (2008 dollars): **$1,800,000**

- Modify line relaying with AEP standard package at Southwest Lima and Marysville stations.

  Estimated Cost (2008 dollars): **$200,000**

Secondary Attachment Facilities Cost[1]: **$2,000,000**

If the T142 project withdraws, IC will be responsible for supplying property for and construction of a 3-breaker ring bus as described in Option #1

Local AEP Impacts

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 performance criteria in accordance with the AEP FERC Form 715. Therefore, this set of criteria was used to assess the impact of the proposed facility on the AEP System. The IC project was studied as a 300 MW net energy injection consistent with the interconnection application. This project was studied with PJM projects #P55, R48, R49, S072, S073, T130, T131, T142, U1-059, U1-060, and U2-026 already in service at 100% output in the vicinity of U2-041. The interconnection project was studied at full capacity. The results are summarized below.

Option #1

(East Lima – Marysville 345 kV)

Normal System (2012 Summer Conditions)

- No problems identified

Single Contingency (2012 Summer Conditions)

- No problems identified

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requirements. It will take approximately one year after obtaining the authorization to construct the facilities as outlined above.

Multiple 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.

Option #2

(Southwest Lima – Marysville 345 kV)

Normal System (2012 Summer Conditions)

- No problems identified.

Single Contingency (2012 Summer Conditions)

- No problems identified.

Multiple Contingency (2012 Summer Conditions)

- AEP Eastown Road – Rockhill[2] 138 kV line gets overloaded to 103% (190 MVA) of its emergency rating for an outage of the AEP East Lima – Marysville 345 kV line and AEP East Lima – Southwest Lima 345 kV line. Without the addition of U2-041 Project, the same facilities are loaded to 96% (177 MVA) of emergency rating under the same contingency.

Short Circuit Analysis

- No problems identified.

Stability Analysis

- Stability analysis was not performed as part of this Feasibility Study. The stability assessments are part of the System Impact Study. Based upon the results of this future

[2] The affected facility may appear in additional contingencies that are not mentioned.

System Impact Study, the extent of system upgrades could change and the associated costs could be significantly different.

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 Great Lakes will adhere to this standard.

Network Impacts

Option #1

(East Lima – Marysville 345 kV)

The Queue Project U2-041 was studied as a(n) 300MW (Capacity = 39MW) injection at the East Lima – Marysville 345 kV lines in the AEP area. Project U2-041 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Potential network impacts were as follows:

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

No problems identified

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

No problems identified

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

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)

None

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)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

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. **These are not required reliability upgrades.**

Note: Only the most severely overloaded conditions are listed below. 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 the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

As a result of the aggregate energy resources in the area, the following potential congestion was identified

1. **(AEP/AEP)** The R60C-Robison Park 345kV line (from bus 96546 to bus 22670 ckt 1) loads from 135.4% to 137.7% (DC power flow) of its normal rating (897MVA) for non-contingency condition. This project contributes approximately 20.5MW to the thermal congestion.

2. **(AEP/AEP)** The R60C-Robison Park 345kV line (from bus 96546 to bus 22670 ckt 1) loads from 100.1% to 101.7% (DC power flow) of its emergency rating (1301MVA) for the single line contingency outage (AEP21). This project contributes approximately 20.2MW to the thermal congestion.

MISO Impacts

Any impacts on the MISO transmission system will be identified in the Impact Study.

Option #2

(Southwest Lima – Marysville 345 kV)

The Queue Project U2-041 was studied as a(n) 300MW(Capacity = 39MW) injection at the SW Lima- Marysville 345 kV lines in the AEP area. Project U2-041 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. 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, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

1. **(AEP/AEP)** The Eastown Road-Rock Hill 138kV line (from bus 23137 to bus 23202 ckt 1) loads from 99.50% to 104.84% (DC power flow) of its emergency rating (184MVA) for the tower line outage (AEP_TOWER42). This project contributes approximately 9.8MW to cause this 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)

None

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 Eastown Rd-Rock Hill 138kV circuit can be alleviated by replacing the 138 kV risers at Rockhill station terminal.

   Estimated Cost (2008 dollars): **$75,000**

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)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

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. **These are not required reliability upgrades.**

Note: Only the most severely overloaded conditions are listed below. 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 the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

As a result of the aggregate energy resources in the area, the following potential congestion was identified

2. (**AEP/AEP)** The R60C-Robison Park 345kV line (from bus 96546 to bus 22670 ckt 1) loads from 135.4% to 136.9% (DC power flow) of its normal rating (897MVA) for non-contingency condition. This project contributes approximately 14.0MW to the thermal congestion.

3. (**AEP/AEP)** The R60C-Robison Park 345kV line (from bus 96546 to bus 22670 ckt 1) loads from 100.1% to 101.2% (DC power flow) of its emergency rating (1301MVA) for the single line contingency outage (AEP21). This project contributes approximately 13.8MW to the thermal congestion.

MISO Impacts

Any impacts on the MISO transmission system will be identified in the Impact Study.

Exhibit 1: Approximate interconnection location of the proposed facilities

Exhibit 2: Simplified diagram of proposed 345 kV interconnection

IC