

***PJM Generator Interconnection
V3-014 Byron—Lee County 345kV, 160.2MW
Feasibility Study***

December 29, 2011

DMS #677931v1

Confidential

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Preface

The Interconnection Feasibility Study assesses the practicality and cost of accommodating interconnection of the generating unit or increased generating capacity with the Transmission System. This study was limited to load flow analysis of probable contingencies. This study included preliminary estimates of the type, scope, cost and lead-time for construction of facilities required to interconnect the project.

In some instances an interconnection customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, 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 Interconnection Feasibility Study, but the actual allocation will be deferred until the System Impact Study is performed. All facilities required for interconnection of a generation interconnection project must be designed in compliance with the technical specifications (on PJM web site) for the appropriate Transmission Owner.

The estimates do not include the feasibility, cost, or time required to obtain property rights and/or 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.

At the Interconnection Customer's request, Transmission Provider, the Interconnection Customer and the Interconnected Transmission Owner shall meet at a mutually agreeable time to discuss the results of the Interconnection Feasibility Study. Such meeting may occur in person or by telephone or videoconference.

Prior to return of the executed System Impact Study Agreement to the Transmission Provider, an Interconnection Customer may modify its project to reduce by up to 60 percent the electrical output (MW) (in the case of a Generation Interconnection Request) or by up to 60 percent of the transmission capability (in the case of a Transmission Interconnection Request) of the proposed project. For increases in generating capacity or transmission capability, the Interconnection Customer must submit a new Interconnection Request for the additional capability and shall be assigned a new Queue Position for the additional capability.

General

Queue V3-014 is a Blackhawk Wind, LLC (Interconnection Customer) 160.2 MW (20.8 MW Capacity) proposed installation of 89 Vestas V90 1.8 MW windturbine generators located NW of the Ashton, Illinois in Lee and Ogle Counties, Illinois. Queue V3-014 had proposed an in-service date of November 20, 2011.

Direct Connection Requirements

The Interconnection customer has requested two Points of Interconnection (POI) be studied.

Attachment Facilities for Primary POI

The proposed interconnection of V3-014 into the existing 345kV line between Byron (STA 6) and Lee County (TSS 937) Substations via a new 345kV three-breaker ring bus substation is depicted in **Figure #1**. This proposed interconnection would consist of looping the existing 345kV line 0627 through a new 345kV Interconnection Substation, which is to be sited adjacent to Line 0627's Right-of-Way.

Interconnection Customer shall have the right, but not the obligation ("Option to Build"), to design, procure, construct and install all or any portion of the Transmission Owner Interconnection Facilities. If the Interconnection Customer opts to build, he will build the Interconnection Facilities in accordance with ComEd's Applicable Technical Requirements and Standards and transfer ownership, including land rights, to ComEd following the successful commissioning and testing.

As shown on **Figure #1**, the Interconnection Customer is proposing to construct and own a separate plant switchyard immediately adjacent to the interconnection substation, which will serve as the 34kV collection point for the windfarm and will include a step-up transformer. The 345 kV output will then be transmitted to the Interconnection Substation.

The Interconnection Customer is responsible for constructing all of the facilities on the Interconnection Customer side of the point of interconnection. It will be the Interconnection Customer's responsibility to obtain any required right-of-way between the Interconnection Substation and existing ComEd right-of-way.

Figure 1

Interconnection Customer Scope of Direct Connection Work

Queue V3-014 Interconnection Customer is responsible for all work on the V3-014 side of the POI (Point of Interconnection).

ComEd Scope of Direct Connection work

This includes the cost of Interconnection Substation and its integration into ComEd system. The estimated cost of this upgrade is approximately \$15,000,000. The Interconnection Customer is responsible to acquire the site for the Interconnection Substation.

Interconnection Customer shall have the right, but not the obligation (“Option to Build”), to design, procure, construct and install all or any portion of the Transmission Owner Interconnection Facilities. If the Interconnection Customer opts to build, he will build the Interconnection Facilities in accordance with ComEd’s Applicable Technical Requirements and Standards and transfer ownership, including land rights, to ComEd following the successful commissioning and testing.

The Interconnected Transmission Owner shall have the exclusive right and obligation to perform the line attachments (tie-in work). This includes the structure and line upgrades necessary to integrate the Interconnection Substation into ComEd system. This is estimated to be \$2,000,000.

If the Interconnection Customer does not elect to exercise the Option to Build, ComEd estimates to build the Interconnection Substation in approximately 18-24 months from execution of the Interconnection Service Agreement and Interconnection Construction Service Agreement.

Network Impacts

The Queue Project V3-014 was studied as a(n) 160.2MW(Capacity20.8MW) injection into ComEd's system. Project V3-014 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. Potential network impacts were as follows:

Generator Deliverability

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

No violations identified.

Multiple Facility Contingency

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

No violations identified.

Short Circuit

To be determined in the System Impact Study

Steady-State Voltage Requirements

To be determined in the System Impact Study

Stability and Reactive Power Requirement

To be determined in the System Impact Study.

Potential Issues

Impacts on the MISO member transmission systems are not included in this analysis, but they will be included in the Impact Study, which may reveal upgrades needed in the MISO system not identified in this Feasibility Study.

New System Reinforcements

None required

Contribution to Previously Identified System Reinforcements

Prior projects in the PJM Queue demonstrated the need to construct new 765 kV lines from Collins Station 23 to the AEP system. It is expected that the 765 kV “backbone” will also address the overloads identified above in Contribution to Previously Identified Overloads section. This project may have a cost allocation for the following previously identified system reinforcements:

- Expansion of the 765 kV bus at Station 23 Collins to accommodate the additional circuits
- Construction of a new 765 kV circuit from Station 23 Collins east to Meadowlake substation in AEP
- Construction of a new 765 kV circuit from Station 23 Collins east to Sullivan substation in AEP
- Construction of a new 765/345 kV autotransformer at Station 23 Collins
- Relocation of existing 765kV line 2315
- Construction of a new 345 kV red/blue bus tie circuit breaker at TSS 935 Kendall County Energy Center
- Construction of two new 345 kV lines between Station 6 Byron and TSS144 Wayne

Additional studies will be performed during the System Impact and Facilities Studies to determine the optimum plan to address these issues. Studies will also be performed regarding cost allocation among the various projects.

Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of the surrounding generation. Any potential 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 Transmission Interconnection request.

Note: 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 analyzes all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.

1. The V3-014 TAP-BYRON; B 345 kV line (from bus 894570 to bus 270678 ckt 1) loads from 102.39% to 108.81% (**DC power flow**) of its rating (1726 MVA) for the single line contingency ('345-L15502_B-R_B'). This project contributes approximately 110.84 MW to the thermal violation.

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CONTINGENCY '345-L15502_B-R_B' / CONTINGENCY # 487 / P20
TRIP BRANCH FROM BUS 294490 TO BUS 270730 CKT 1 / P20(NELSO; B) 345 ELECT; B 345
END
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2. The W DEK;3T-WATER;3B 138 kV line (from bus 272756 to bus 272730 ckt 1) loads from 109.3% to 109.6% (**DC power flow**) of its rating (449 MVA) for the single line contingency ('345-L0627__B-R_V3-014B'). This project contributes approximately 8.23 MW to the thermal violation.

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CONTINGENCY '345-L0627__B-R_V3-014B' / CONTINGENCY # 373
TRIP BRANCH FROM BUS 894570 TO BUS 270678 CKT 1 / LEECO;BP 345 BYRON; B 345
END
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3. The HAUME; B-W DEK;3T 138 kV line (from bus 271680 to bus 272756 ckt 1) loads from 117.6% to 117.89% (**DC power flow**) of its rating (449 MVA) for the single line contingency ('345-L0627__B-R_V3-014B'). This project contributes approximately 8.23 MW to the thermal violation.

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CONTINGENCY '345-L0627__B-R_V3-014B' / CONTINGENCY # 373
TRIP BRANCH FROM BUS 894570 TO BUS 270678 CKT 1 / LEECO;BP 345 BYRON; B 345
END
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Attachment Facilities for Alternate POI

The alternate proposed interconnection of V3-014 is into the existing 345kV line between Electric Junction (TSS 111) and Nelson (TSS 155) Substations by expanding a yet to be constructed 345kV three-breaker ring bus substation as shown in Figure 2. This proposed interconnection would consist of looping the existing 345kV line 15502 through a new 345kV Interconnection Substation proposed to be built as part of the P20 project, which is to be sited adjacent to Line 15502's Right-of-Way.

Interconnection Customer Scope of Direct Connection Work

Queue V3-014 Interconnection Customer is responsible for all work on the V3-014 side of the POI (Point of Interconnection).

ComEd Scope of Direct Connection work

Should P20 build the interconnection substation, the additional bay would be approximately \$3,500,000. If P20 does not proceed to build TSS 184 Walton Road, then the ComEd Scope of Direct Connection work is effectively identical to Primary POI section above.

Figure 2

Network Impacts

The Queue Project V3-014 was studied as a(n) 160.2MW(Capacity20.8MW) injection into ComEd's system. Project V3-014 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. Potential network impacts were as follows:

Generator Deliverability

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

No violations identified.

Multiple Facility Contingency

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

No violations identified.

Short Circuit

To be determined in the System Impact Study

Steady-State Voltage Requirements

To be determined in the System Impact Study

Stability and Reactive Power Requirement

To be determined in the System Impact Study.

Potential Issues

Impacts on the MISO member transmission systems are not included in this analysis, but they will be included in the Impact Study, which may reveal upgrades needed in the MISO system not identified in this Feasibility Study.

New System Reinforcements

None required

Contribution to Previously Identified System Reinforcements

Prior projects in the PJM Queue demonstrated the need to construct new 765 kV lines from Collins Station 23 to the AEP system. It is expected that the 765 kV “backbone”

will also address the overloads identified above in Contribution to Previously Identified Overloads section. This project may have a cost allocation for the following previously identified system reinforcements:

- Expansion of the 765 kV bus at Station 23 Collins to accommodate the additional circuits
- Construction of a new 765 kV circuit from Station 23 Collins east to Meadowlake substation in AEP
- Construction of a new 765 kV circuit from Station 23 Collins east to Sullivan substation in AEP
- Construction of a new 765/345 kV autotransformer at Station 23 Collins
- Relocation of existing 765kV line 2315
- Construction of a new 345 kV red/blue bus tie circuit breaker at TSS 935 Kendall County Energy Center
- Construction of two new 345 kV lines between Station 6 Byron and TSS144 Wayne

Additional studies will be performed during the System Impact and Facilities Studies to determine the optimum plan to address these issues. Studies will also be performed regarding cost allocation among the various projects.

Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of the surrounding generation. Any potential 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 Transmission Interconnection request.

Note: 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 analyzes all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.

1. (CE) The Lee County Energy Center-Byron (Blue) 345 kV line (from bus 274768 to bus 270678 ckt 1) loads from 102.50% to 106.8% (DC power flow) of its emergency rating (1726 MVA) for the operational contingency '345-L15502_B-R_B'. This project contributes approximately 74.21 MW to the thermal violation.

CONTINGENCY '345-L15502_B-R_B' / CONTINGENCY # 487 / P20
TRIP BRANCH FROM BUS 294490 TO BUS 270730 CKT 1 / P20(NELSO; B) 345 ELECT; B 345
END

2. (CE) The Lee County Energy Center-Byron (Blue) 345 kV line (from bus 274768 to bus 270678 ckt 1) loads from 91.71% to 95.22% (DC power flow) of its normal rating (1334 MVA) for non contingency condition. This project contributes approximately 46.92 MW to the thermal violation.

3. (CE) The Nelson (Blue)-Lee County Energy Center 345 kV line (from bus 270828 to bus 274768 ckt 1) loads from 73.82% to 78.87% (DC power flow) of its emergency rating (1479 MVA) for the operational contingency '345-L15502_B-R_B'. This project contributes approximately 74.79 MW to the thermal violation.

CONTINGENCY '345-L15502_B-R_B' / CONTINGENCY # 487 / P20
TRIP BRANCH FROM BUS 294490 TO BUS 270730 CKT 1 / P20(NELSO; B) 345 ELECT; B 345
END

4. (CE/ALTW) The Quad Cities –Rock Creek 345 kV line (from bus 270864 to bus 631141 ckt 1) loads from 102.20% to 102.44% (DC power flow) of its emergency rating (890 MVA) for the operational contingency '345-L0401___-R'. This project contributes approximately 12.92 MW to the thermal violation.

CONTINGENCY '345-L0401___-R' / CONTINGENCY # 365
TRIP BRANCH FROM BUS 270866 TO BUS 636610 CKT 1 / QUAD 6-7 345 SUB 91 3 345
TRIP BRANCH FROM BUS 636610 TO BUS 636611 CKT 1 / SUB 91 3 345 SB 91 5 161
TRIP BRANCH FROM BUS 636615 TO BUS 636610 CKT 1 / SB 56 3 345 SUB 91 3 345
END