Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project ID AF2-069

Crescent Ridge 138kV

December 2024

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff, as well as the Application and Studies Agreement between the Project Developer and PJM Interconnection, LLC (PJM or Transmission Provider (TP)). The Transmission Owner (TO) is ComEd.

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer has proposed an uprate to an existing Wind Generating Facility located in Bureau County, Illinois with a designated PJM Project ID of AF2-069.

This project is an increase to the existing AC1-214 Lone Tree Wind Farm and will share the same Point of Change in Ownership.

The AF2-069 project is a 9.3 MW uprate (2.2 MW Capacity uprate) to existing AC1-214. The total installed facilities will have a capability of 88.7 MW with 21.2 MW of this output being recognized by PJM as Capacity.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the ComEd transmission system via a direct connection into the TSS 981 Crescent Ridge 138kV substation.

This project will share interconnection facilities with the project noted below. The combined output of all Generating Facilities at the Point of Interconnection is 161.3 MW.

Queues	MFO
Z1-072/AF2-070	72.6
AC1-214/AF2-069	88.7
Total Output	161.3

3. POINT OF CHANGE IN OWNERSHIP

The Point in Change of Ownership is located at the first dead-end structure of L.98101 inside the TSS 981 Crescent Ridge interconnection substation fence line.

4. SCOPE OF PROJECT DEVELOPER INTERCONNECTION FACILITIES

Project Developer will design, build, own, operate and maintain the Project Developer Interconnection Facilities on Project Developer's side of the Point of Change in Ownership (PCO).

- Two (2) 3-Phase Main Power Transformers
- Three (3) 138kV circuit breaker

- Five (5) 3-pole 138kV disconnect switches
- One (1) 138kV generator lead line, 138kV L.98101, from the Generating Facility to the Point of Interconnection.
- 1200:1 CCVTs to be used for System 1 and System 2 relay protection.
- Gas circuit breaker control for loss of SF6 gas condition should be as follows (See Engineering Practice EP-5206E and relay specifications):
    - For an open circuit breaker, when SF6 gas drops to the critical level, the close circuit of breaker shall be opened and line and both CB motor operated disconnects shall be opened.
    - For a closed SF6 gas circuit breaker, when SF6 gas drops to the critical level, the circuit breaker shall be opened and both CB motor operated disconnects shall be opened.
- Project Developer to provide transformer test reports for 138kV-34.5kV step up transformers. Test reports must include %Z impedance and load loss, including type of Inverter/s used for ComEd short circuit modeling.
- In general, Project Developer relaying, etc. to follow section 6.2 (Design E) of latest version of ComEd interconnections guidelines (for Generators at Transmission Level) Rev2 Effective fate 12/16/21, with the following project specific notes:
    - New 138kV gas circuit breakers to auto trip and isolate for critical gas level.
    - New 138kV Tie Line terminal relay types to be the same as ComEd terminal relays. This includes firmware versions.
    - ComEd Protection and Control Engineering must review all Project Developer relay protection design drawings and relay settings.
    - Project Developer equipment impedance and/or test data must be provided to ComEd Protection and Control Engineering for all lines, transformers, and inverters to model in a short circuit program.
    - Project Developer to include Over/Under frequency and voltage protection at Battery Storage collector bus. Under-frequency settings are to comply with MAIN Guide 1B.
    - Dual bus protection for 34.5kV bus
    - Dual TRFM protection and site protection must be compliant with NERC & PJM requirements
    - Metering is required to be installed per ComEd & PJM standards
    - SCADA interface to ComEd is required, which will most likely require a 3rd party TelCo or wireless connection (to be determined by UCOMM during detailed Engineering phase)
- All changes to topology, including generation, must be modeled during the Phase 1 study for PRC-027 compliance. A protection system coordination study is required for new BES buses or when there is a 15% (or greater) change in fault current for an existing BES bus. Setting changes may be required per the outcome of this coordination study

- Project Developer shall provide shunt reactive compensation as required by the PJM Interconnection studies.
- Power output from the Generating Facility shall be in accordance with the power quality standards contained in the IEEE Standard 519. The generating units and all associated equipment at the Generating Facility shall not introduce any distortion of ComEd's waveform or telephone or carrier interference that is inconsistent or conflicts with such standard.
- Relay and protective equipment, telecommunications equipment, and Supervisory Control and Data Acquisition (SCADA) to comply with the ComEd's Applicable Technical Requirements and Standards.
- For any new equipment connected to the BES (Bulk Electric System rated at 100kV or above) the associated primary/System 1 and secondary/System 2 protective schemes to have a minimum redundant:
    - Connected CTs (where available)
    - PT secondary (where available)
    - DC control circuits
    - Auxiliary trip relays
    - Circuit breaker trip coils (where available)
    - Communication circuitry.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AF2-069 project to ComEd transmission system. These facilities shall be designed according to ComEd Applicable Technical Requirements and Standards. Once built, ComEd will own, operate, and maintain these Facilities.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

This section is not applicable. This project will utilize the existing Transmission Owner Interconnection Facilities.

2. STAND ALONE NETWORK UPGRADES

This section is not applicable.

3. NETWORK UPGRADES

- TSS 981 Crescent Ridge Metering Upgrades

Upgrade the AMI & Revenue metering equipment. The Upgrade will take into consideration the new total generation output. The metering equipment will be sized to properly meter the output when the generation is in online as well as metering power supplied from the ComEd system for generator aux. power requirements when the generation is offline. All metering equipment in accordance to ComEd Standards. Revenue grade metering must meet the requirements established by the published

ComEd interconnections guidelines (for Generators at Transmission Level) Rev2 Effective fate 12/16/21

- Metering shall include registration of the generator output and auxiliary power usage. Install 138kV standard interconnection metering and telemetry to ComEd TSO including CB status, MW, MVAR, MWh and voltage values.
- Review and update relay settings for 138kV L.98101.
- Replace existing metering CTs on L.98101.

4. OTHER SCOPE OF WORK

This section is not applicable.

5. MILESTONE SCHEDULE FOR COMPLETION OF COMED WORK

Facilities outlined in this report are estimated to take 18 months to construct, from the time the Generation Interconnection Agreement is fully executed. This schedule may be impacted by the timeline for procurement and installation of long lead items, the ability to obtain outages to construct and test the proposed facilities.

Description	Start month	Finish month
Detailed Design	1	5
Permitting		
Construction	5	18

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

- Assumes dual Single Mode Fiber cables, owned and maintained by Project Developer, are already in place for Primary/System 1 and Secondary/System 2 Relays for 138kV L.98101 between TSS 981 Crescent Ridge and Lone Tree Wind Farm.
- The new metering CTs on L.98101 will need to consider the power upper and lower limit of PJM AF2-069 and AF2-070.
- ComEd estimate does not include costs of design and construction of AF2-069 Lone Tree Wind Farm substation, and transmission as described in Project Developer scope of work. ComEd estimated schedule is based on GIA contract being executed by all parties.
- This cost estimates assume that work will be performed during normal weekdays and with no overtime. Transmission line outages for construction have not been identified, but generally are available from September to May. These outages are controlled by PJM.
- Costs are based on 2024 rates and do not reflect a potential increase in Labor or Material

costs.

- Foundation design assumes typical soil conditions at locations and will be subject to change after soil boring tests.
- The Project Developer will be responsible to request and bear the cost for relocation of existing transmission or distribution lines (including structures and other facilities) that may be required for transmission line crossings, the transport of any large equipment, such as turbines, rotors, turbine structures, cranes, etc. Formal submittal of this request to ComEd's TSO for ultimate review by PJM can be made 7 months prior to back feed request date.
- All upgrades to facilities included in this document will be required to meet latest ComEd standards.
- ComEd cost estimate is valid for six (6) months after Facilities Study release by PJM.
- Upgrades are subject to change based on detailed design development.
- It is assumed that ComEd facilities included in this document will not require a sound study.
- ComEd will complete pre-design and post construction survey for the transmission and substation upgrades, as required. This includes, but is not limited to, the LIDAR survey and video imaging for transmission lines. Costs associated with this are at the expense of the Project Developer. Pre-design survey must be completed prior to detailed engineering.
- ComEd will complete geotechnical soil borings, resistivity study, and analysis for substation and transmission upgrades. Costs associated with this are at the expense of the Project Developer.
- This study assumes that there will be no additional right-of-way and/or easement work required.
- This Facilities Study is time dependent. If the project is not into construction within one year of the issuance, the study will be void and the project re-studied, requiring the completion of a new Facilities Study.
- It is assumed that all associated network upgrades, as listed in the System Impact study, are complete prior to this New Service Request Project being placed in service.
- All real property conveyed in fee to ComEd must be remediated to and all real property to which real property rights are transferred to ComEd (as determined in ComEd's discretion) must be remediated to IEPA's Tiered Approach to Corrective Action.

7. REVENUE METERING REQUIREMENTS

All revenue metering needed for this interconnection project must meet the metering requirements stated in Appendix 2, section 8 of the AF2-069 GIA, and in PJM Manuals M01 and M14D. The details of applicable revenue metering requirements are given in the 'ComEd Interconnection Guidelines' posted on PJM website.

The revenue metering will be installed on the ComEd side of the Point of Change in Ownership, owned and maintained by ComEd.

- REVENUE METERING FOR PJM AND COMED

- The revenue meter measures the wholesale energy output (Hourly compensated net MWH and Hourly compensated net MVARH) of the Generating Facility.
- The metering equipment, including revenue meter and CT/PT shall be installed, at Project Developer's expense, at the interconnection substation on ComEd side of the Point of Interconnection.
- ComEd shall own, operate, maintain, inspect, and test all the metering equipment as set forth in 'Testing of Metering Equipment' section of this Interconnection Service Agreement, at the Project Developer's expense.

- REAL-TIME METERING FOR PJM
  - The Project Developer shall install, own, operate, maintain, inspect, and test real-time metering equipment to measure and transmit directly to PJM the real time MW, MVAR, voltage and status of electrical equipment such as circuit breakers and Motor Operated Disconnect switches, in conformance with the requirements listed in PJM Manuals M-01 and M-14D.
- RETAIL METERING FOR COMED
  - The AMI Meter measures the energy consumption by the Project Developer at transmission level and hence shall be designed to measure low MW flow.
  - The metering equipment including AMI Meter and CT/PT shall be installed at the interconnection substation on ComEd side of POI, at the Project Developer 's expense.
  - ComEd shall own, operate, maintain, inspect, and test all the metering equipment as set forth in the 'ComEd Interconnection Guidelines'.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

No additional easements, access rights, or temporary or permanent real property rights or acquisitions were identified as required for network upgrades to the ComEd system or for the project to interconnect at this location within this study. However, as further needs are assessed in detailed engineering, design and/or construction activities, if it is determined that there is a need for easements, access rights, or temporary or permanent real property rights or acquisitions, the developer is fully responsible for the costs to acquire these required land rights. Also, as necessary, the schedule will be adjusted accordingly to account for the necessary time to obtain these required land rights. All easements, access rights, or temporary or permanent real property rights or acquisitions shall comply with all ComEd requirements as detailed in "Land requirements for Interconnection Substations".

9. ENVIRONMENTAL AND PERMITING

- ComEd will be responsible to obtain all environmental approvals and permitting required. This includes any endangered species studies and monitoring, as required. Costs associated with this permitting are at the expense of the Project Developer.
- The Project Developer will be responsible for site restoration required for substation and transmission upgrades. This includes, but is not limited to road restoration/improvements, wetland restoration, and farm field restoration/crop damage. Costs associated with this are at the expense of the Project Developer.

- The Project Developer will be responsible for the cost to purchase real estate or obtain the necessary right-of-way easement for all upgrades associated with this project. These associated upgrades are not included in the costs listed in this study.
- The Project Developer will be responsible for remediation costs for locations found to have environmental contaminations and remediation. This may require contaminated soil disposal as well as lead paint removal for existing structure work.
- It is assumed that all necessary permits will be obtained in a timely manner to allow engineering and construction to proceed according to the Milestone Schedule.
- It is assumed that conveyance of property and rights will be obtained to support the PJM Transmission Outage Schedule.
- It is assumed that the required Environmental Study will yield no impediments to the development of the site.

C. APPENDICES

Attachment #1: Single line Diagram for the Physical Interconnection

Single line Diagram for the Physical Interconnection