# Facilities Study Report

# For

# Physical Interconnection of

# PJM Generation Interconnection Request

# Project ID AG2-363 & AG2-364

# “Powerton 345 kV”

## 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.

This Facility Study was performed to satisfy the Phase 2 Facility Study requirement of the PJM Tariff. The Facility Study is intended to provide scope, cost and schedule estimates for the project as currently defined and approved for Phase 2 study. In the event project changes are made during DP2 that impact this report, updates will be provided as part of the Phase 3 report. Following execution of the project's final agreement, this report will not be updated to account for other changes made as part of the agreements modification clause and instead the scope change process will be followed.

## A. Transmission Owner Facilities Study Summary

### 1. PROJECT DESCRIPTION

The Project Developer (PD) has proposed a Solar Generating Facility located in Tazewell County, Illinois with a designated PJM Project ID of AG2-363 & AG2-364. The installed facilities will have a total Maximum Facility Output (MFO) of 500 MW with 300 MW of this output being recognized by PJM as Capacity.

| Project ID | MW Energy (MW) | Capacity Interconnection Rights (MW) |
|---|---|---|
| AG2-363 | 300 | 180 |
| AG2-364 | 200 | 120 |
| **Total** | **500** | **300** |

### 2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the ComEd transmission system via a direct connection into the STA. 3 Powerton 345kV substation.

The proposed generation interconnection is shown on the single line diagram in Attachment #1.

### 3. POINT OF CHANGE IN OWNERSHIP

The Point in Change of Ownership will be located at the first dead-end structure inside the STA. 3 Powerton 345kV 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). This includes, but is not limited to:

- Circuit breakers and associated equipment are located between the high side of the MPT(s) and the Point of Change in Ownership.
    - Project Developer to send a Transfer Trip to STA. 3 Powerton for Project Developer high-side transformer breakers Breaker Failure. Ability to isolate 87L and DTT functions is required. Example scheme/settings can be provided by ComEd.
    - New Gas Circuit breaker control for loss of SF6 gas condition should be as follows (see Engineering practice EP-5206-E):
        1. For an open circuit breaker, when SF6 gas drops to the critical level, the close circuit of breaker shall be opened, and the motor operated disconnects on both sides of CB shall be opened.
        2. For a closed SF6 gas circuit breaker, when SF6 gas drops to the critical level, the circuit breaker should be opened, and motor operated disconnects on both sides of CB should be opened.
    - Support steel structures and foundations will be designed to support associated electrical equipment.
- Generator lead line from the Generating Facility to the Point of Change in Ownership (345kV L0308) (Approx. 17 miles – Project Developer to provide final length).
    - Project Developer to install standard ComEd 345kV GIC interface relaying for the remote end station consisting of a dual SEL-411L-1 current differential scheme per GDD1940.
    - GIC interface line relaying will be the only point of interface with ComEd relaying. Current contributions from all Project Developer breakers to be combined and wired to 411L for 87L scheme. NO 3-TERMINAL DIFFERENTIAL SCHEMES WILL BE ACCEPTED OR ALLOWED FOR 345KV LINES. PROJECT DEVELOPER ENGINEERING TEAM MUST REVIEW AND APPROVE CT LENGTH INTO THEIR RELAY. THEY ALSO NEED TO BE ON THE SAME GROUND GRID. IF ABOVE CONDITIONS NOT POSSIBLE, PROJECT DEVELOPER WILL NEED TO INSTALL DEDICATED LINE BREAKER.
    - Create CD-0308 to capture changes.

- Project Developer to design, build, own, operate, and maintain two, physically diverse, single mode fiber paths between STA 3 Powerton and AG2-363/364 Mackinaw Solar .

- System 1 Relays will use the "System 1" Fiber cable for a Current Differential Relay Scheme, which will also provide Direct Transfer Trip (DTT). This fiber cable will be owned and maintained by the Project Developer and should have minimum of 48 Fibers. The demarcation for the Fibers in this cable will be in a Fiber Distribution Panel (FDP) inside of STA 3 Powerton. ComEd will own and maintain the FDP.
- System 2 Relays will use the "System 2" Fiber cable for a Current Differential Relay Scheme, which will also provide Direct Transfer Trip (DTT). This fiber cable will be owned and maintained by the Project Developer and should have minimum of 48 Fibers. The demarcation for the Fibers in this cable will be in a Fiber Distribution Panel (FDP) inside of STA 3 Powerton. ComEd will own and maintain the FDP.
- Project Developer will own and maintain both Fiber cables from ComEd's STA 3 FDP all of the way to their AG2-363/AG2-364.

| System<br>345kV L0308 | Function | STA. 3 Powerton | Mackinaw Solar (IPP) |
|---|---|---|---|
| | | | |
| 1 – Direct Fiber | SEL 411L (87L-1, LTT, BFTT) | T R | T R |
| | | | |
| 2 – Direct Fiber | SEL 411L (87L-2, LTT, BFTT) | T R | T R |
| | | | |

- Load rejection transfer trip if at STA3, any of the below conditions occur (logic via 52b breaker aux contacts): BT 5-15 and BT 8-15 CB is open.

In general, GIC to follow section 6.2 (Design F) of the latest version of ComEd Interconnection Guidelines for Generators at Transmission Level (Rev 2: Effective 12/16/2021).

1. New gas circuit breakers to auto trip and isolate for critical gas level.
2. New Tie Line terminal relay types to be the same as ComEd terminal relays. This includes relay firmware versions.
3. ComEd Protection and Control Engineering must review all Project Developer relay protection design drawings and relay settings.
4. Project Developer equipment impedance and/or test data must be provided to ComEd Protection and Control Engineering to model in a short circuit program. Examples include lines, transformers (include percent impedance and load loss), wind turbines, and inverters.
5. Project Developer to include over/under frequency and voltage protection at wind/solar farm collector bus. Suggested settings will be provided by ComEd. Under-frequency settings are to comply with MAIN Guide 1B.

6. Dual bus protection for secondary buses.
7. Dual TRFM protection and site protection must be compliant with NERC & PJM requirements.
8. Metering is required to be installed per ComEd & PJM standards.
9. SCADA interface to ComEd will be required.
10. Witness testing by ComEd or a DA will be required and must be pre-scheduled at least 90 days in advance.

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:

1. Connected CTs (where available).
2. PT secondary (where available).
3. DC control circuits.
4. Auxiliary trip relays.
5. Circuit breaker trip coils (where available).
6. Communication circuitry.

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.

## B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AG2-363 & AG2-364 projects to the 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:

- One (1) 345 kV dead-end structure and foundation within the fence of the Interconnection Substation, to terminate the Project Developer's generator lead line.
- Line conductor from the dead-end structure to the bus position in the switchyard of the interconnection substation.
- One (1) 345 kV line motor operated disconnect (MOD) rated 4000A, ACCC D06.
- Three (3) 345kV station class surge arresters.

- Support steel structures and foundations will be designed to support line motor operated disconnect (MOD) and the 345kV station class surge arresters
- AMI Metering and Revenue Metering.

## 2. STAND ALONE NETWORK UPGRADES

N/A.

## 3. NETWORK UPGRADES

STA. 3 Powerton 345kV Upgrade (AG2-363 & AG2-364)

The existing substation, STA. 3 Powerton 345kV, will be expanded/upgraded to interconnect the project with the ComEd transmission system.

- Split 345kV Bus 5 into Bus 5 and Bus 15 sections and install new 345kV BT 5-15 GCB.
    - New Bus 15 will have 3-phase 3000:1 (345kV) CCVT's with two winding outputs to be used for Primary and Secondary relay protection.
    - For new 345kV BT 5-15 CB:
        1. Install new 345kV 4000A continuous SF6 Gas Circuit Breaker.
        2. Install 50BF/79 SEL-451-5 relay and LOR per GDD 2303 for new BT 5-15 CB. New CBs must have sync check thru the relay for Manual close, SCADA close, and automatic reclosing.
        3. New CB will have SEL-2411 installed for CB Monitoring per GDD2411.
        4. New CB will have two sets of MR 2000:5 tapped at full ratio (or 3000:5 CTs tapped at 2000) CTs on each side, C800 accuracy class, RF=2.0, and at least a 1.5 times thermal rating factor.
        5. CB will have one set of three-phase 345kV MODs on each side (rated 4000A, ACCC D06) that will be tripped/opened on critical gas.
        6. Rewire 86BF LOR relay for BT 8-15 CB (old BT 5-8) to BT5-15 CB and rewire 86BF LOR relay for BT 5-6 CB to BT 5-15 CB. Rewire the DTT BF initiates as well.
        7. Wire the new BT 5-15 CB for Bus 5 differential protection. Since now BT 8-15 CB (old BT 5-8) will not be doing bus diff for Bus 5.
        8. Connect new CB SEL-2411 device with serial fiber to the station RTU RTAC
- For new 345kV line L0308:
    - Install standard ComEd 345kV GIC interface relaying consisting of a Primary 87L-1/SEL-411L-1 (with standard 1300nm 87L port) current differential scheme and a Secondary 87L-2/SEL-411L-1 current differential scheme per GDD1940. Use full tap

CT ratio for both systems of line relaying. In addition, install load rejection logic such that transfer trip is initiated on both Primary and Secondary relaying to GIC site if Line CB/CBs at STA. 3 Powerton is/are opened (refer to GDD 4003 for load rejection design).

  - Create new SB diagram for new 345kV L0308.

- Check if Anti-Islanding is present or required. Transmission Planning to provide guidelines ahead of the Engineering design.
- Substation Engineer of Choice (EOC) to perform the battery calculations.
- Modify all mimic boards as required.
- Add new relays to existing dual IP switch architecture.
- For each Project Developer RTU, install one pair of serial fiber connections for each Project Developer RTU data exchange to be coordinated with ComEd SCADA Engineering:
  - Breaker statuses
  - MW, MVAR, MWh and voltage values

## 4. OTHER SCOPE OF WORK

N/A.

## 5. MILESTONE SCHEDULE FOR COMPLETION OF COMED WORK

Facilities outlined in this report are estimated to take 50 months to be constructed, 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 | 6 |
| Procurement | 1 | 44 |
| Construction | 44 | 50 |

## 6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

- This study is based on the PJM AG2-363 and AG2-364 Phase I Study Reports.
- 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.
- This cost estimates assume that work will be performed during normal weekdays and with no overtime.
- All upgrades to facilities included in this document will be required to meet latest ComEd standards.
- Costs are based on 2026 rates and do not reflect a potential increase in Labor or Material costs after 2026.
- 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 PD. 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 PD.
- All upgrades to facilities included in this document will be required to meet latest ComEd standards.
- 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 or flood mitigation.
- The Project Developer has agreed to pay for the work necessary in preparing a cost estimate, impact study review, and review of relay requirements.
- This 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 Facility Study.
- ComEd cost estimate is valid for six (6) months after the Facilities Study release by PJM.
- Transmission line outages for construction have not been identified but generally are available from September to May. These outages are controlled by PJM.
- It is assumed that all associated network upgrades, as listed in the Phase 1 study, are complete prior to this New Service Request Project being placed in service.
- Foundation design assumes typical soil conditions at locations and will be subject to change

after soil boring tests.

## 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 AG2-363 & AG2-364 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 and AMI metering will be installed on the ComEd side of the Point of Change in Ownership and will be installed, 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 Change in Ownership.
    - ComEd shall own, operate, maintain, inspect, and test all the metering equipment as set forth in 'Testing of Metering Equipment' section of the PJM Tariff, 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, at the Project Developer's expense.
- 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 the 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

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.

Land requirements for the Interconnection Substation needed for this interconnection project must meet the requirements in the 'ComEd Interconnection Guidelines' and 'Guidelines on Land Requirements for Interconnection Substation' posted on PJM website.

### 9. APPLICABLE TECHNICAL REQUIREMENTS AND STANDARDS

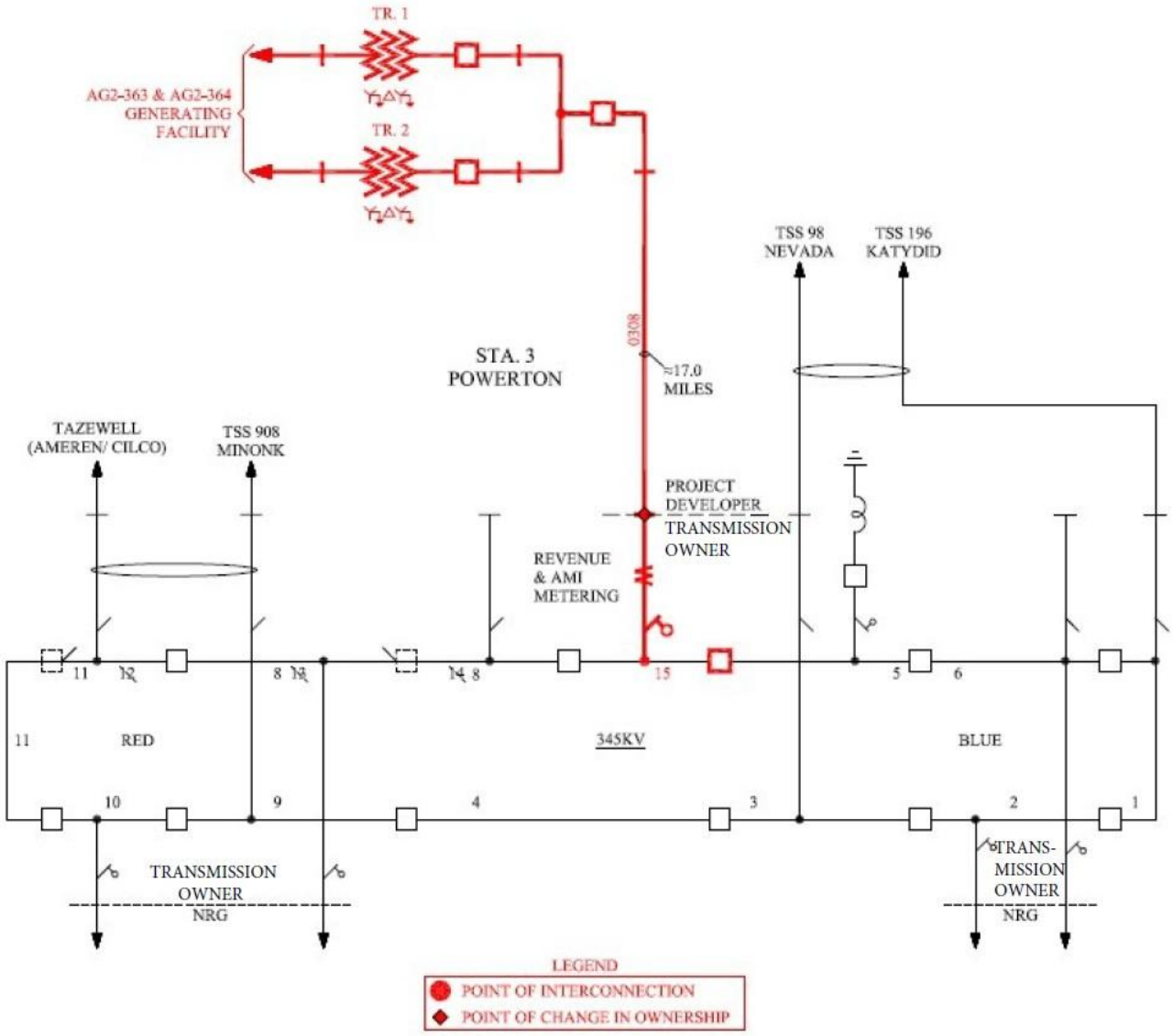
- ComEd Interconnection Guidelines (For Generators at Transmission Level), Rev. 2, Dated 12/16/2021
- ComEd Guidelines on Land Requirements for Interconnection Substations, Rev. 2, Dated January 2026

### 10. ENVIRONMENTAL AND PERMITING

- Project Developer will be responsible for 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.
- 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.
- 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
- Project Developer will be responsible for remediation costs for locations found to have environmental contamination 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


TR. 1
AG2-363 & AG2-364
GENERATING
FACILITY
TR. 2
TSS 98
NEVADA
TSS 196
KATYDID
0308
STA. 3
POWERTON
≈17.0
MILES
TAZEWELL
(AMEREN/ CILCO)
TSS 908
MINONK
PROJECT
DEVELOPER
TRANSMISSION
OWNER
REVENUE
& AMI
METERING
11
8
8
15
5
6
11
RED
345KV
BLUE
10
9
4
3
2
1
TRANSMISSION
OWNER
NRG
TRANS-
MISSION
OWNER
NRG
LEGEND
POINT OF INTERCONNECTION
POINT OF CHANGE IN OWNERSHIP