Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project ID AG1-462

CORDOVA 345KV

Rev. 0: December 2024

Rev. 1 August 2025

Revision History

- Rev. 0 – Initial version
- Rev. 1 – Administrative updates to capture project reduction and clarify scope

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 a Solar Generating Facility located in Whiteside County, Illinois with a designated PJM Project ID of AG1-462. The installed facilities will have a total Maximum Facility Output (MFO) of 255 MW with 153 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 existing TSS 940 Cordova 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 TSS 940 Cordova 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:

- One (1) 3-Phase Main Power Transformer (TR.1) - 200/265/335 MVA (OA/FA/FA). 345kV Y-grounded, 34.5kV Y-grounded with a 13.8kV Delta tertiary. The Z% = 8.5% on a 200 MVA base with X/R=38.0 (High side to low side).
- One (1) 345KV circuit breaker.
- One (1) 345kV disconnect switch.
- One (1) 345kV generator lead line, 345kV L.94005, from the Generating Facility to the Point of Interconnection.
- Relaying at project developer facility to send a Transfer Trip to TSS 940 Cordova for 345kV CB Breaker Failure. Ability to isolate 87L and DTT functions is required. Example scheme/settings can be provided by ComEd.
- Install three (3) 3000:1 CCVTs on 345kV side of power transformer to be used for System 1 and System 2 relay protection.
- For new dead tank 345kV gas circuit breaker, install CB motor operated disconnects on both sides. All new 345kV current transformers are to be rated 3000 overall ratio with at least 1.5

RF for a minimum 3000A continuous thermal rating. New dead tank breakers to have 2 sets of 3000:5 overall ratio bushing CTs on each side. CTs to be multi-ratio with standard taps and C800 class. All new CBs will have CB monitoring and Breaker Failure scheme. New 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 345-kV-34.5kV-13.8kV step up transformers. Test reports must include %Z impedance and load loss for ComEd short circuit modeling.
- Project Developer to provide limiting Transmission Facility ratings for their portion of 345kV L94005, in accordance with NERC FAC-008, FERC Order 881 and PJM Operational requirements for normal and emergency ratings from -55F to 130F in 5F increments.
- 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.
- In general, Project Developer relaying, etc. to follow per section 6.1 (Design F) of latest version of EED interconnection guidelines (for Generator Greater than 10MW) Rev 2: Effective 12/16/21, with the following project specific notes:
  - New 345kV gas circuit breakers to auto trip and isolate for critical gas level.
  - New 345kV Tie Line terminal relay types to be the same as ComEd terminal relays. This includes firmware versions.
  - Project Developer to ensure proper current contributions from the new Transformer high side breaker CTs to the 345kV line relaying. New 345kV Tie Line relays to account for tripping the new transformer high side breaker.
  - 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 to model in a short circuit program.
  - Project Developer to include Over/Under frequency and voltage protection at solar farm 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 will be required, which will most likely require a 3rd party

TelCo or wireless connection (to be determined by UCOMM during detailed Engineering phase).

  - Witness testing by ComEd or a DA will be required and must be pre-scheduled at least 90 days in advance.

- Project Developer to provide final lead length of 345kV L.94005, electrical characteristics, construction configuration, size of conductors, and impedance characteristics.
- Project Developer shall provide shunt reactive compensation as required by the PJM Interconnection studies.
- Power output from the Project Developer site shall be in accordance with the power quality standards contained in the IEEE Standard 519. The generating units and all associated equipment at the Project Developer site 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. 345KV L.94005 will require two Single Mode Fiber paths from TSS 940 Cordova to the developer substation control building (Gipper Solar Farm), approximately 0.1 miles. One fiber path will be dedicated for System 1 Relay/schemes, and the other will be dedicated for System 2 Relays/schemes. These Fiber paths will need to be physically diverse from each other, and each should contain a minimum of 48 Single Mode Fibers. Both of these Fiber cables will be owned and maintained by the Project Developer, and the demarcation of ownership will be in an FDP within the TSS 940 Cordova control building.
- Fiber installation requirements will be specified by the P&CE Communication Engineering. Refer to GDD 2302 modified for direct fiber connection to SEL-311L-1. In addition, install load rejection logic such that transfer trip is initiated on both System 1 and System 2 relaying to Project Developer site if BT1-4 & 3-4 CB's at TSS940 Cordova are opened.
- Redundancy of protection is required per ComEd standards, NERC Planning Standards, PJM Standards, and/or RFC Standards which specify that no single protection system component failure can cause a fault to remain on the system. 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 AG1-462 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. TSS940 Cordova will be expanded to accommodate both AG1-553 and AG1-462.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

The ComEd Interconnection Facilities will include, but not be limited to, the following:

- A 345kV 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) Motor Operated Disconnect (MOD) switch. Disconnect switch shall have a minimum nameplate capability of 3282/3534/4224/5046 A (1961/2112/2524/3015 MVA) SN/SLTE/SSTE/SLD continuous.
- Three (3) metering CTs, three metering PTs, or a combination unit, meters, and associated equipment to meter L.94005.
    - Install equipment necessary to provide bi-directional revenue metering (kWH, kVARH) and real time data (kW, kVAR, and circuit breaker status and 138kV voltage) for 345kV L.94005, on the ComEd side of the POI per ComEd applicable standards.
- Three (3) surge arrestors
- Foundations and structures

2. STAND ALONE NETWORK UPGRADES

This section is not applicable.

3. NETWORK UPGRADES

Reconfigure 345 kV line terminations within existing TSS 940 Cordova substation to accommodate substation expansion

- The L15503 345kV line will be cut and rerouted at TSS 940 Cordova.
    - ComEd will be performing the design, procurement, and construction of the new structure(s) required to reroute L15503.
    - The new conductor type will be 2-1277.2 kcmil ACAR (54/7) Bundled. The new shield wire will be 7#6 Alumoweld.
    - Approximately 0.04 new circuit miles of conductor and shield wire will be installed.
    - Only the substation A-frame takeoff structure will be required to be replaced for the cutover work. The new structure will be a 70' A-frame similar to EM60013(1T).
- Relocate existing 345kV L0403 from existing bus ring to new Bus 1 position.

- The existing 345kV line 0403 will be rerouted to accommodate the expansion of TSS 940 Cordova. The new conductor will be 2-1277 kcmil ACAR and the new shield wire will be 7#6 Alumoweld. Approximately 0.06 circuit miles of new conductor and shield wire will be installed.
- Install one (1) 345kV transmission line dead-end structure for L0403 with testing to check proper phase and identification is correct.
- The following structure replacements and installations are required:

Structure Number	Line Number	Existing Structure Type	Comments
13D, 14	0403	N/A	Install new single-circuit deadend structure

- Relocate existing 345 kV L94001 generator lead line for Cordova Energy Center developer.

TSS 940 Cordova Upgrade

The existing substation, TSS 940 Cordova 345kV, will be expanded to interconnect the project with the ComEd transmission system.

- Expand TSS 940 Cordova 345kV bus ring switchyard to the ultimate breaker and a half configuration bus configuration
- Three (3) 345kV station class surge arrestors.
- Install six (6) 345kV circuit breaker with a minimum nameplate capability 3282/3534/4224/5046 A (1961/2112/2524/3015MVA) SN/SLTE/SSTE/SLD continuous, and interrupting capability of 63kA at -40°F. Circuit breakers to be equipped with a motor operated disconnect switch (MOD) on both sides of the breakers. All equipment associated with the breaker termination should meet or exceed the thermal capability of the breaker including CB disconnects, leads, CTs, metering, relays, etc. Nameplates to reflect actual maximum capability of equipment (NOT minimum requirements specified).
- Install new breaker failure relaying per GDD2303 and CB monitoring for all new BT circuit breakers. Install SEL-351A for second reclose mode for all middle BTs.
- All 345kV circuit breakers are required to have a SEL-2411 relay pre-installed inside of the breaker control cabinet for monitoring. Multimode fiber from the yard to the control building is required.
- Install fifteen (15) 345kV motor operated breaker disconnect switches: one (1) on each side of each 345kV circuit breaker, three (3) for each 345kV transmission line (L.0403, L.15503, L.94001). These disconnect switches shall have the same minimum thermal capability as the circuit breakers above.
- Install 3 phase, 3000:1 CCVTs on all new buses to be used for System 1 and System 2 relay protection.
  - Re-wire CCVT connections to breaker failure and line relays as required.
- Re-wire CT contributions from new and existing BTs to existing line relays.

    - Review and modify existing settings as needed.
- Foundations and structures for all new equipment.
- For 345kV line L94005, install standard ComEd 345kV GIC interface relaying consisting of a Primary 87L-1/SEL-411L (with standard 1300nm 87L port) current differential scheme and a Secondary 87L-2/SEL-311L-1 current differential scheme. Utilize full 2000:5 CT ratio for both systems of line relaying.
- Install 50BF/79 SEL-451-5 relay and associated LOR per GDD 2303 on new 345kV Bus tie 1-4 CB. New CB must have sync check thru the relay for Manual close, SCADA close, and automatic reclosing for L0403. Add SEL-351S/79 for L94005 auto-reclosing.
- Re-configure BT3-4(former BT1-3) SEL-279H relay for L0403 to L94005.
- New CB will have two sets of 2000:5 or 3000:5 CTs on each side, C800 accuracy class, and at least a 1.5 times rating factor. CB will have MOD on each side that will be tripped/opened on critical gas.
- For 345kV L0403, replace system 1 LFCB/87L relay with SEL411L per GDD 2302. Reconfigure line source breakers from 345kV BT1-2 & 1-3 to BT 1-2F & 1-4.
- Replace 2156kcmil conductors used on BT 1-2 and BT 3-4 (formerly BT 1-3) between the corresponding switches. (This increases the SN ratings from 1334 MVA to 1529 MVA).
- For L0403, replace BT 1-2 A,B,C phase CTs with a CT with a higher RF value.
- For L15503, replace BT 3-4 (formerly BT 1-3) A,B,C phase CTs with a CT with a higher RF value.
- Upgrade existing BT1-2 and 3-4 breaker failure relaying to SEL-451 per GDD2303. Incorporate live tank CB and free-standing CT flashover protection in the new SEL-451s.
    - Remove existing BT1-2 and 3-4 50G flashover SEL-501s.
    - Remove existing BT1-2 and 3-4 SEL-279 reclosing relays.
- Modify tripping for existing line relaying and BT breaker failure per the new station layout.
- For the 2 end buses, install dual SEL-487B bus differential per GDD1920.
- Reset relay settings for the remote ends of the following 345kV lines, L0403, L94001, L15503 and L94005.
- Review and reset relay settings on 345kV line L94001, L15503 and L0403, including remote terminals.
- Install SEL-3350 RTAC
    - Serial Port 15 used for Remote Access
    - Serial Port 16 used for SCADA Data
- Install RST-2228 dual aux switch architecture for new relays
- Install SEL-3350 RTAC for Project Developer data. Install one pair of serial fiber connections for each Project Developer RTU data exchange.
- Connect ComEd-owned revenue meter to new IP switch architecture.

- For L0403 retire existing System 1 DTT and System 2 schemes and remove DTT cards replacing them with blanks. The current System 2 SEL-311L with an Nx64 card must be reconfigured to handle direct transfer tripping.
- Install SEL-3350 RTAC.
- Install RST-2228 Master Switch.
- Install RST-2228 dual aux switch architecture for new relays.
- Install SEL-2440 DPAC for new I/O.
- Install additional SEL-3350 RTAC for Project Developer data. Install one pair of serial fiber connections for each data exchange/Project Developer RTU.
- Connect ComEd-owned revenue meter to IP architecture.
- Relocate existing distribution/transmission circuits North of TSS 940 Cordova EC.

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- For 345kV L.0403, replace System 1 LFCB/87L relay with SEL-411L per GDD 2302.
- Install SEL-3350 RTAC
  - Serial Port 15 used for Remote Access
  - Serial Port 16 used for SCADA Data
- Install RST-2228 dual aux switch architecture for new relays
- For L0403 retire existing System 1 and System 2 DTT schemes and remove DTT cards replacing them with blanks. The current System 2 SEL-311L with an Nx64 card must be reconfigured to handle direct transfer tripping.

4. OTHER SCOPE OF WORK

None

5. MILESTONE SCHEDULE FOR COMPLETION OF [TO] WORK

Facilities outlined in this report are estimated to take 36 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	12
Permitting	12	24
Construction	24	36

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

- Assumes existing TSS 940 Cordova EC can be expanded to the North and West.
- Assumes there are sufficient DC circuits and AC circuits for the additional equipment.
- Assumes existing distribution infrastructure can be relocated.
- L15503 and 94001 ratings will be 1334 MVA SN, limited by existing equipment.
- 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 after 2024.
- ComEd cost estimate is valid for six (6) months after Facilities Study release by PJM.
- 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.
- Foundation design assumes typical soil conditions at locations and will be subject to change after soil boring tests.
- 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.
- 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.
- This study assumes that there will be any additional right-of-way and/or easement work will be acquired at the expense of the Project Developer.
- 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 Facility Study.
- It is assumed that all associated network upgrades, as listed in the Phase 1 study, are complete prior to this queue being placed in service.

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 AG1-462 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 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 Interconnection.
    - 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'.

Commented [TS1]: Not applicable to the scope of this project

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

- The site should be accessible from at least two sides to bring in future transmission lines. This means that there should be no river, another transmission line, hills, forest, or wetland on at least two sides of the site.
- There should be no legal agreements or other impediment to interconnect additional generator lead lines to this site from other generators in the future.
- The site should not encroach into ComEd transmission or distribution corridors.
- If the Project Developer owns the land surrounding the substation site, the Project Developer must provide open easement to ComEd to bring in future transmission lines into the substation.
- The Project Developer is responsible to build an access road meeting ComEd requirements to the substation site from the nearest public road.
- The Project Developer is responsible to acquire land to install tie-lines integrating the substation with the ComEd transmission system.
- The Project Developer is responsible to acquire land for the stormwater detention facility

meeting all applicable ComEd Environmental requirements and all applicable municipal, county, and state requirements for stormwater management.

Upon completion of the construction and installation of the interconnection substation, the tie-line, access road, stormwater detention facility and related improvements and facilities, and the satisfactory completion of testing of the interconnection substation acceptable to ComEd, the Project Developer shall transfer all the Property Rights and Permits to ComEd, at no cost or expense to ComEd, pursuant to documentation that is acceptable to ComEd, including (without limitation) the Property Transfer Documents in fee simple.

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 Objectives (TACO) Tier 1 residential remediation standards.

9. ENVIRONMENTAL AND PERMITING

- The Project Developer will be responsible to obtain all environmental approvals and permitting required for the expansion of TSS 940 Cordova, Gipper Solar Farm Solar substation, and 345kV L94005.
- ComEd will be responsible to obtain all environmental approvals and permitting required for L.0403 work. 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.
- 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.

C. APPENDICES

Attachment #1: Single line Diagram for the Physical Interconnection

Attachment #1