# Facilities Study Report

# For

# Physical Interconnection of

# PJM Generation Interconnection Request

# Project ID AG2-675

# 345kV Gipper Battery Storage - 80MW TSS 940

# Cordova E.C.

## 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 storage uprate to a planned/existing solar Generating Facility located in, Rock Island, IL with a designated PJM Project ID of AG2-675.

This project is an increase to the AG1-462 project, and will share the same Point of Change in Ownership.

The AG2-675 project is a 80 MW uprate (32 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 335 MW with 185 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 940 Cordova Energy Center 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 TSS 940 Cordova Energy Center 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:

4.1. The PD is responsible for construction of the additional 80MW of storage as well as 345kV/34kV transformer (210 MVA, Z%=9.5%, X/R = 39.6) and two (2) 345kV breakers. An additional metering CT will also be required. This CT will be owned by ComEd.

4.2. At AG2-675 collector station, in general, IPP relaying, etc. to follow section 6.1 (Design F) of latest version of EED interconnection guidelines (for Generator Greater than 20MW) Rev 0: Effective 07/22/2013, 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 relay 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 to model in a short circuit program. Examples include lines, transformers (include percent impedance and load loss), wind turbines, and inverters.
- Project Developer to include over/under frequency and voltage protection at solar farm collector bus. Suggested settings will be provided by ComEd. Under-frequency settings are to comply with MAIN Guide 1B.
- Dual bus protection for secondary 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.
- Witness testing by ComEd or a DA will be required and must be pre-scheduled at least 90 days in advance.

4.3. New Gas Circuit breaker control for loss of SF6 gas condition should be as follows (see Engineering practice EP-5206-E):

- For an open circuit breaker, when SF6 gas drops to the critical level, the close circuit of breaker shall be opened, and motor operated disconnects on both sides of CB 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 motor operated disconnects on both sides of CB shall be opened and the close of the circuit breaker shall be opened.

4.4. 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

4.5 The PD will be responsible to purchase real estate or obtain the necessary right-of-way easement to install the 345kV transmission line to TSS 940 Cordova Energy Center substation.

4.6 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 the fault current for an existing BES bus. Settings changes may be required per the outcome of this coordination study.

- The PD is to provide two, physically diverse, Single Mode Fiber paths between TSS 940 Cordova Energy Center Substation and Gipper Solar.
- The PD will be responsible to request and bear the cost of any outages required on existing transmission or distribution lines that may be required for the transport of any large equipment, i.e. turbines, rotors, turbine structures, etc.
- PD 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.

4.7 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

## B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AG2-675 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

The ComEd Interconnection Facilities will include, but not be limited to, the following which are existing at TSS 940 Cordova Energy Center for L.94005 and shall be verified for the addition of the AG2-675:

- A 345kV dead-end structure and foundation within the fence of the Project Developer's facility, 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 Project Developer's facility.
- One (1) Motor Operated Disconnect (MOD) switch.
- CT/PT, meters, and associated equipment to meter L.94005
- Foundation and structures

## 2. STAND ALONE NETWORK UPGRADES

Not applicable.

## 3. NETWORK UPGRADES

*The Network Upgrades will include, but not be limited to, the following.*

Review of L.94005 CT/PTs at TSS 940 Cordova Energy Center. Design, procurement and construction to upgrade (if necessary) to the Point of Interconnection metering CT/PTs within ComEd's TSS 940 Cordova Energy Center.

Relay Upgrades

345kV L94005:

a. Relaying should be existing and should consist of standard GIC interface relaying package of either SEL-411L/SEL311L or dual SEL-411L for 87L line differential which were installed for AG1-462.

b. Relay settings to be reviewed and reset as required. All engineering protection models to be review, verified, and updated as required per PRC-027 requirements.

Existing GIC interface relaying to be continued to be utilized for two terminal line differential scheme. Line relay settings to be reviewed and reset as required.

a. GIC relaying to be utilized as the only point of interface with ComEd relaying. Current contributions from all Project Developer breakers to be combined and wired to 87L scheme for 2 a terminal differential. No three terminal differential schemes will be accepted or allowed.

| 345kV L94005 | Function | TSS940 | Gipper Storage (GIC) |
|---|---|---|---|
| 87L-1<br>SEL-411L-1<br>Direct Fiber | Current Diff, LTT, BFTT | T R | T R |
| 87L-2<br>SEL-411L-1/311L<br>J-MUX | Current Diff, LTT, BFTT | T R | T R |

***Upgrades to neighboring facilities:***

Not applicable

## 4. OTHER SCOPE OF WORK

Metering will be required to be installed at the interconnection substation. Metering to be provided for revenue and AMI purposes.

Review and update, if required, the ComEd-owned AMI metering and revenue grade metering for generator outputs and auxiliary power requirements. Revenue grade metering must meet the requirements established by the published EED interconnection guidelines. The metering equipment will be verified to properly meter the output when the generation is online as well as metering power supplied from the ComEd system for generator auxiliary power requirements when the generation is offline. Metering shall include registration of the generator output and auxiliary power usage. Telemetry to ComEd TSO (including CB status, MW, MVAR, MWh, and voltage values) will be verified and configured as required using existing infrastructure; no new hardware installation is anticipated as part of this scope.

A battery charge meter will be needed on the 345kV bus at Gipper Solar. This will be installed on the Project Developer 345kV bus but will be owned by ComEd.

FERC Order 841 designates inflow to charge battery storage facility as wholesale power. To separately measure the power inflow to charge the battery and bill it at wholesale rate, the Project Developer needs to install the following equipment.

- Battery Charge Meter including Current Transformer/Potential Transformer (CT/PT) at the output terminal of the battery storage facility to measure power inflow from transmission system to charge the battery storage facility.
- Fiber cable to provide communication link to transmit Battery Charge Meter data to the ComEd SCADA system.

## 5. MILESTONE SCHEDULE FOR COMPLETION OF COMED WORK

Facilities outlined in this report are estimated to take 12 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 | 6 |
| Permitting | - | - |
| Construction | 7 | 12 |

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

6.1 This study is based on the Phase 2 System Impact Report for PJM Generation Interconnection New Service Request Project AG2-675. The steady-state voltage study for stability analysis will be performed by PJM during the Facility Phase. The PJM study could identify upgrades to the ComEd system that would become part of this project's scope of work. It is assumed that all associated network upgrades, as listed in the above System Impact study, are complete prior to this Queue Position being placed in service.

6.2 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.

6.3 Costs are based on 2026 rates and do not reflect a potential increase in Labor or Material costs after 2026.

6.4 ComEd cost estimate is valid for six (6) months after Facilities Study release by PJM.

6.5 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.

6.6 Foundation design assumes typical soil conditions at locations and will be subject to change after soil boring tests.

6.7 All upgrades to facilities included in this document will be required to meet latest ComEd standards.

6.8 Upgrades are subject to change based on detailed design development.

6.9 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.

6.10 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.

6.11 Both (1) all real property conveyed in fee to ComEd must be remediated to and (2) 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.

6.12 This facilities study report (FSR) assumes that generator output and plant auxiliary power consumption can both be metered with revenue accuracy as described. The final revenue metering configuration and equipment will be confirmed, and may be revised, during detailed engineering following execution of the Generator Interconnection Agreement (GIA).

6.13 It is assumed that dual Single Mode Fiber cables, owned and maintained by Project Developer, are already in place for System 1 and System 2 Relays between TSS 940 Cordova Energy Center and Gipper Solar for L.94005.

6.14 Assumes completion of PD PSAG1462 "PJM Project AG1-462 Gipper Solar Farm 300MW - 345kV Expansion of TSS 940 Cordova".

6.15 Assumes completion of PD PSAG1553 "PJM Project AG1-553 Fowl Solar Farm - 284MW - 345kV Expansion of TSS 940 Cordova".

## 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 AG2-675 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.

7.1 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's and PT's shall be installed, at PD'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 PD's expense.

7.2 REAL-TIME METERING FOR PJM:

The PD 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 Disconnects, in conformance with the requirements listed in PJM Manuals M-01 and M-14D.

7.3 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'.

7.4 BATTERY CHARGE METER FOR COMED

- FERC Order 841 designates inflow to charge battery storage facility as wholesale power. To separately measure the power inflow to charge the battery and bill it at wholesale rate, the Project Developer needs to install the following equipment.
- Battery Charge Meter including Current Transformer/Potential Transformer (CT/PT) at the output terminal of the battery storage facility to measure power inflow from transmission system to charge the battery storage facility.
- Fiber cable to provide communication link to transmit Battery Charge Meter data to the ComEd SCADA system.

## 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

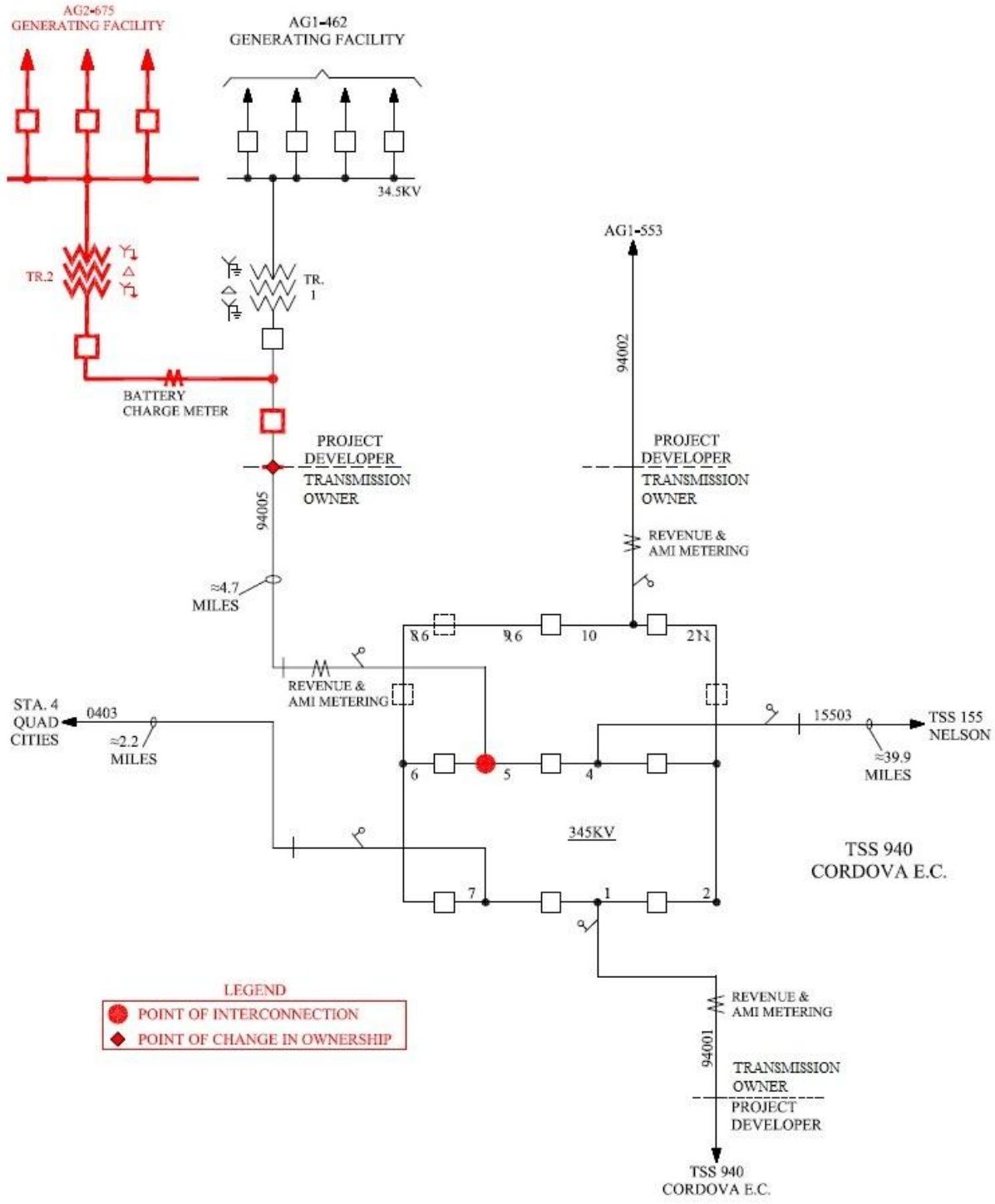
engineering, design and/or construction activities, if it is determined that there is a need for easements, access rights, or temporary or permanent real property rights or acquisitions, the developer is fully responsible for the costs to acquire these required land rights. Also, as necessary, the schedule 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.
- 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.
- Both (1) all real property conveyed in fee to ComEd must be remediated to and (2) 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.

## C. APPENDICES

Attachment #1: Single line Diagram for the Physical Interconnection


AG2-675
GENERATING FACILITY
AG1-462
GENERATING FACILITY
34.5KV
TR.2
TR.
1
BATTERY
CHARGE METER
PROJECT
DEVELOPER
TRANSMISSION
OWNER
94005
≈4.7
MILES
AG1-553
94002
PROJECT
DEVELOPER
TRANSMISSION
OWNER
REVENUE &
AMI METERING
8
9
10
11
REVENUE &
AMI METERING
STA. 4
QUAD
CITIES
0403
≈2.2
MILES
15503
TSS 155
NELSON
≈39.9
MILES
6
5
4
345KV
TSS 940
CORDOVA E.C.
7
1
2
LEGEND
POINT OF INTERCONNECTION
POINT OF CHANGE IN OWNERSHIP
REVENUE &
AMI METERING
94001
TRANSMISSION
OWNER
PROJECT
DEVELOPER
TSS 940
CORDOVA E.C.