Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project ID AG2-544/AG2-545

Silver Lake 345kV

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 Facility located in, McHenry County, IL with a designated PJM Project ID of AG2-544. The installed facilities will have a total Maximum Facility Output (MFO) of 200 MW with 80 MW of this output being recognized by PJM as Capacity.

The The Project Developer (PD) has proposed an additional storage Facility located in, McHenry County, IL with a designated PJM Project ID of AG2-545. The installed facilities will have a total Maximum Facility Output (MFO) of 400 MW with 160 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 expansion at TSS 138 Silver Lake. The point of change in ownership will be located at the first dead-end structure inside the TSS 138 Silver Lake substation fence line.

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 138 Silver Lake 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:

The PD is responsible for construction of the additional 200MW of storage. The PD is also responsible for four (4) 345kV circuit breakers, three (3) generator step-up transformers (GSU), and a 345kV generation lead line with associated structures terminating at TSS 138 Silver Lake.

At AG2-544/AG2-545, in general, IPP relaying, etc. to follow section 6.1 (Design F) of latest version of EED interconnection guidelines (for Generator at Transmission Level) Rev. 2 Effective 12/16/2021, with the following project specific notes (where applicable):

- New gas circuit breakers to auto trip and isolate for critical gas level
- New 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.
- Project Developer to include over/under frequency and voltage protection at battery storage collector bus. Suggested settings will be provided by ComEd. Under-frequency settings are to comply with MAIN Guide 1B.
- Dual bus protection for secondary buses.
- 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.

IPP Project Developer to provide transformer test reports for 345kV - 34.5kV step up transformers, for ComEd short circuit modeling. Test reports must include %Z impedance and load loss.

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
- Foundations and structures to support all/new equipment

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 138 Silver Lake Substation.

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

a. For an open SF6 gas bus-tie 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.
b. For a closed bus-tie 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 circuit of the circuit breaker shall be opened.

Install 3 phase 3000:1 CCVTs on 345kV side of transformer to be used for System 1 and System 2 relay protection.

The PD is to provide two, physically diverse, Single Mode Fiber paths between TSS 138 Silver Lake and AG2-544/AG2-545 Collector Substation that are physically diverse from each other. One path will be for System 1 relay/schemes, and the other path will be for System 2 relay/schemes, and there should be a minimum of 48 fibers in each cable. IPP fiber demarcation will be FDP within the Substation control building.

For 345kV L138XX (GIC LINE): GIC Project Developer to install and own standard ComEd 345kV GIC interface relaying consisting of a System 1 87L-1/SEL-411L-1 and a System 2 87L-2/SEL-411L-1 current differential scheme.

a. GIC Project Developer to send a Transfer Trip to TSS138 Silver Lake for MPT1, MPT2, and MPT3 345kV CB Breaker Failure. Ability to isolate 87L and DTT functions is required. Example scheme/settings can be provided by ComEd.

b. Add current contributions from the MPT1, MPT2, and MPT3 345kV CB CT's to 345kV L138XX line relays.

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.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AG2-544/AG2-545 project to Commonwealth Edison transmission system. These facilities shall be designed according to Commonwealth Edison Applicable Technical Requirements and Standards. Once built, Commonwealth Edison will own, operate, and maintain these Facilities.

ComEd Scope of Work (Transmission Owner)

- Design ComEd-owned facilities per applicable ComEd technical requirements and standards; upon completion, ComEd will own, operate, and maintain the Transmission Owner facilities.
- Perform TSS138 Silver Lake network upgrades, including installation of new 345kV breakers and motor-operated disconnects, metering CT/PT units and CCVTs, removal/addition of buswork and jumpers, and relocation of resiliency transformers (including civil works such as foundations, containment pits, and cable raceway).
- Implement protection, control, and communications work at TSS138 Silver Lake associated with the new configuration, including 345kV line interface relaying (System 1 and System 2), breaker failure relaying and breaker monitoring for new breakers, bus protection, SCADA/RTAC

integration, relay/CT/CCVT rewiring, and review/updates to adjacent line relay settings (including remote terminals), as required by the detailed design and PRC-027 coordination requirements.

- Provide and maintain the fiber demarcation hardware (FDP) within the TSS138 Silver Lake control building (Project Developer provides and maintains the two physically diverse single-mode fiber cables to the FDP).
- Provide oversight of Project Developer engineering and construction activities for the interconnection substation at the Project Developer's cost.
- Revenue/retail metering ownership and services: ComEd-installed metering is located on the ComEd side of the Point of Change in Ownership; ComEd will own, operate, maintain, inspect, and test ComEd/PJM revenue and AMI metering equipment at the Project Developer's expense, consistent with PJM and ComEd requirements.
- Environmental and permitting activities for ComEd work: obtain required environmental approvals and permits (including endangered species studies/monitoring as required) at the Project Developer's expense; complete geotechnical soil borings/resistivity study/analysis for substation and transmission upgrades at the Project Developer's expense.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

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

- A 138kV 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 rated 3000A continuous, with ACCC D06.
- Three (3) metering CTs, three (3) metering PTs, or a combination unit, meters, and associated equipment to meter L.138XX
    - 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 138kV L.138XX, on the ComEd side of the POI per ComEd applicable standards.
- Three (3) surge arresters
- Foundations and structures

2. STAND ALONE NETWORK UPGRADES

None.

3. NETWORK UPGRADES

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

The existing substation, TSS138 Silver Lake, will be expanded/upgraded to interconnect the project with the ComEd transmission system.

- Installation of two (2) 345kV Circuit Breakers
- Installation of four (4) 2000A 345kV Motor Operated Disconnects
- Installation of six (6) 3000:1 345kV CCVTs

- Removal of existing buswork and jumpers and addition of new buswork and jumpers.
- Relocation of resiliciency transformers including new foundations, containment pits, cable raceway, etc.
- For 345kV L138XX, install standard ComEd 345kV GIC interface relaying consisting of a System 1 87L-1/SEL-411L-1 and a System 2 87L-2/SEL-411L-1 current differential scheme per GDD1940. Utilize full 3000:5 CT ratio for both systems of line relaying. Two separate Single Mode Fiber paths will be required between TSS138 Silver Lake and the AG2-544 & AG2-545 common collector substation. One 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 TSS138 Silver Lake control building. Fiber installation requirements will be specified by P&CE Communication Engineering. In addition, install load rejection logic such that transfer trip is initiated on both System 1 and System 2 relaying to GIC site if both BT1-11 and BT10-11 at TSS138 are opened (referred to GDD 4003 for load rejection design).

Function	TSS138 Silver Lake	AG2-544 & AG2-545
Sys 1 (411L): 87L-1, LTT, BFTT, Load Rejection** (Direct Fiber)	T	R
Sys 1 (411L): 87L-1, LTT, BFTT (Direct Fiber)	R	T
Sys 2 (411L): 87L-2, LTT, BFTT, Load Rejection** (Direct Fiber)	T	R
Sys 2 (411L): 87L-2, LTT, BFTT (Direct Fiber)	R	T

** Load rejection transfer trip if at TSS138, any of the below conditions occur (logic via 52b breaker aux contacts): Both BTs 1-11 & 10-11 are open.

- Install new breaker failure relaying per GDD2303 and CB monitoring for all new BT circuit breakers.
    - CB monitoring to be performed by an SEL-2411 installed for each new CB.
- 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.
- Modify tripping for existing line relaying and BT breaker failure per the new station layout.
- Install dual SEL-487B relays for 345kV Bus 10 per GDD1920.
- Relays will be connected to SCADA RTAC’s. SCADA architecture requirements and SCADA Notes will be issued separately.

- New CBs will have two sets of 2000:5 (or 3000:5) CTs on each side, C800 accuracy class, and at least a 1.5 times thermal rating factor. CB will have MODs on each side that will be tripped/opened on critical gas if GCB.
- Review and reset relay settings on adjacent 345kV line L14401 including remote terminals.
- Substation Engineering to perform the battery calculations
- Modify all mimic boards as required
- 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.
- Add new relays to existing dual IP switch architecture.
- Add new SEL-2411 breaker monitors over serial fiber to existing SEL-3350 RTAC.
- 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:
    a. Breaker statuses
    b. MW, MVAR, MWh and voltage values

Installation of fiber cable circuits

Project Developer to provide two, physically diverse, Single Mode Fiber paths between TSS 138 Silver Lake and AG2-544/AG2-545.

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 the TSS 138 Substation. 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 a minimum of 48 Fibers. The demarcation for the Fibers in this cable will be in a Fiber Distribution Panel (FDP) inside of the TSS 138 Substation. ComEd will own and maintain the FDP.

The Project Developer will own and maintain both Fiber cables from ComEd’s TSS 138 FDP all of the way to their AG2-544/AG2-545.

Spare Fibers may be used for telephony, SCADA, Metering, Fire Protection, or other data purposes.

PM to engage UCOMM Fiber Engineering early in the process.

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.

ComEd to provide oversight to the Project Developer at the Project Developer’s cost or the engineering and construction of the interconnect substation.

5. MILESTONE SCHEDULE FOR COMPLETION OF COMED WORK

Facilities outlined in this report are estimated to take 60 months to construct, from the time the Generation Interconnection Agreement is fully executed. This schedule is 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	22
Permitting	16	46
Construction	46	60

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

This study is based on the Phase 2 System Impact Report for PJM Generation Interconnection New Service Request Project AG2-544/AG2-545. 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 Phase 2 System Impact, are complete prior to this Queue Position being placed in service.

The schedule is based on ISA/CSA contract being executed by all parties and the deposit received.

ComEd cost estimates assume that work will be performed during normal weekdays and with no overtime.

Transmission line outages for the tap construction have not been identified, but generally are available in spring (March to May) and fall (September to November). These outages are controlled by PJM.

The PD will be responsible to request and bearing the cost for relocation of existing transmission or distribution lines (including structures) that may be required for transmission line crossings, the transport of any large equipment, such as cranes, etc. The backfeed date identified in earlier sections is not yet approved. Formal submittal of this request to ComEd's TSO for ultimate review by PJM can be made 7 months prior to the back feed request date.

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

Upgrades are subject to change based on detailed design development

Costs are based on 2026 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

ComEd cost estimate is valid for six (6) months after Phase 3 System Impact release by PJM.

This Facility Study is time-dependent. If the project is not into construction within one year of the issuance, the FS will be void and the project re-studied, requiring the completion of a new FS.

PD owned line L.138XX is assumed to be exiting the station to the North. Final determination of line exit will be determine during detailed design.

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 AG2-544/AG2-545 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 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'.

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.

BATTERY TERMINAL AMI METERING 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.

Advanced Metering Infrastructure (AMI) equipment including AMI Meter and Current Transformer/Potential Transformer (CT/PT) at the output terminal of the battery storage facility to measure power flow from transmission system to charge the battery storage facility.

Fiber cable to provide communication link to transmit AMI 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 “ComEd Interconnection Guidelines” and “Guidelines on Land Requirements for Interconnection Substations” posted on the PJM website.

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 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

1) Attachment #1: One Line Diagram

