Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project ID AH1-165

Will County 138kV

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, Will County, IL with a designated PJM Project ID of AH1-165. The installed facilities will have a total Maximum Facility Output (MFO) of 72 MW with 0 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 STA18 Will County. The point of change in ownership will be located at the first dead-end structure inside the STA18 Will County 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 of Change in Ownership will be located at the first dead-end structure inside the STA18 Will County 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:

4.1. The PD is responsible for construction of the additional 72MW of storage. The PD is also responsible for one (1) 138kV circuit breakers, one (1) generator step-up transformers (GSU) rated 72 MW, %Z=8.0, and X/R=26, and a 138kV generation lead line with associated structures terminating at STA18 Will County.

4.2. At AH1-165, in general, IPP relaying, etc. to follow section 6.2 (Design E) 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 developer relay protection design drawings and relay settings.
- Developer equipment impedance and/or test data must be provided to ComEd Protection and Control Engineering to model in a short circuit program.
- 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.

4.3. IPP developer to provide transformer test reports for 90MVA 138kV - 34.5kV step up transformers, for ComEd short circuit modeling. Test reports must include %Z impedance and load loss, including type of Inverter/s used for ComEd short circuit modeling.

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
- Foundations and structures to support all/new equipment

4.5 The PD will be responsible to purchase real estate or obtain the necessary right-of-way easement to install the 138kV transmission line to STA18 Will County.

a. New Gas Circuit breaker control for loss of SF6 gas condition should be as follows (see Engineering practice EP-5206E and relay specifications):
    i. For a normally-open bus-tie 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.
    ii. For a normally-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.

iii. For a transformer circuit breaker, when SF6 gas drops to the critical level, the circuit breaker shall be opened, the close circuit of the breaker shall be opened, and motor operator disconnects on the bus side of CB shall be opened.

b. 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.

c. The project developer is to install, own, and maintain two, physically diverse, Single Mode Fiber paths between STA18 Will County and AH1-165 Collector Substation that are physically diverse from each other. One path will be for Primary Relays, and the other path will be for Secondary Relays, and there should be a minimum of 48 fibers in each cable. IPP fiber demarcation will be FDP within the Substation control building.

i. For L1801 (GIC LINE): GIC developer to Install standard ComEd 138kV GIC interface relaying for the remote end station consisting of a dual SEL-411L-1 current differential scheme per GDD1940.

ii. GIC developer to send a Transfer Trip to STA18 Will County for TR 138kV CB Breaker Failure. Ability to isolate 87L and DTT functions is required. Example scheme/settings can be provided by ComEd.

iii. Two physically diverse paths of Single Mode Fiber with a minimum 48-count, will need to be run between STA18 Will County and Will County Energy Storage for L1801. Both of these Fibers and cables will be owned and maintained by the developer, and terminated at the ComEd FDP in STA18. There will be a System 1 Fiber cable for the System 1 Relays, and a System 2 Fiber cable for the System 2 Relays. The demarcation of ownership for these Fiber cables will be in the Fiber Distribution Panel (FDP) in ComEd STA18. The developer will own and maintain both Fiber cables from ComEd's STA18 FDP all of the way to their Will County Energy Storage. Additional circuits for SCADA, Metering, telephony, etc. may be placed on the unused Fiber strands in either cable

4.6 Comm Summary:

System 138kV L1801	Function	STA18 Will County		Will County Energy Storage (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 STA18, any of the below conditions occur (logic via 52b breaker aux contacts): L1801 CB is open.

4.7 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.

Fiber cable circuits

Developer to provide two, physically diverse, Single Mode Fiber paths between STA18 Will County and AH1-165.

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 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 STA18 Will County 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 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 STA18 Will County Substation. ComEd will own and maintain the FDP.

The developer will own and maintain both Fiber cables from ComEd’s STA18 FDP all of the way to their AH1-165.

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.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AH1-165 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.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

STA 18 Will County

1. Installation of one (1) three-phase 3000A 138kV Circuit Breakers
2. Installation of two (2) three-phase 3000A 138kV, ACCC D06 Motor Operated Disconnects
3. Installation of three (3) metering CT/PT units on L.1801
4. Installation of three (3) 1200:1 138kV CCVTs
5. Modify existing 138kV Bus 3 “super” bus diff 87B3-(1 and 2)A and 87B3-(1 and 2)BC relays to add CT contributions from new L1801 breaker and LOR trips/close inhibits to new line CB.
6. For each new 138kV CB
    a. Install 50BF/79 SEL-451-5 relay and LOR per GDD 1930 on new line 138kV CB. New CBs must have sync check through the relay for Manual close, SCADA close, and automatic reclosing.
    b. CB will include a SEL-2411 installed for CB Monitoring per GDD2411.
    c. CB will have two sets of 3000:5 CTs on each side, C800 accuracy class, and at least a 1.5 times thermal rating factor. Tap all CTs at full ratio.

    d. CB will have MODs on each side that will be tripped/opened on critical gas if GCB.
7. For new 138kV L1801
    a. Install 3-phase 1200:1 CCVT's with two winding outputs to be used for Primary and Secondary relay protection on the line side of the CB.
    b. Install ComEd 138kV 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 3000:5 CT ratio for both systems of line relaying. Developer to install, own, and maintain two Single Mode Fiber paths that are physically diverse from each other, and to connect to the STA18 Will County Fiber Distribution Panel (FDP). One path will be for Primary Relays and the other path will be for Secondary Relays, and there should be a minimum of 48 fibers in each cable. IPP fiber demarcation will be FDP within the STA18 control building. Fiber installation requirements will be specified by the P&CE Communication Engineering. Refer to GDD 1940 modified for direct fiber connection. In addition, install load rejection logic such that transfer trip is initiated on both Primary and Secondary relaying to GIC site if Line CB at STA18 is opened (refer to GDD 4003 for load rejection design).
        i. Developer to install, own, maintain Primary and Secondary SEL-411L-1 relays to interface with ComEd per GDD1940 at their site.
    c. Verify load-ability of new line for bi-directional power flow.
    d. Check if Anti-Islanding is present or required. Transmission Planning to provide guidelines ahead of the Engineering design.
    e. New SB-1801 and CD-1801 will be created for the new line.

8. Consider installing new L1801 SEL-411Ls and CB SEL-451 in the same panel due to space concerns in the STA18 138kV Control building.
9. Connect new relays and SEL-2411 CB Monitoring to existing dual IP architecture.
10. Install one pair of serial fiber connections for each developer RTU data exchange to be coordinated with ComEd SCADA Engineering:
    a. Breaker statuses
    b. Line analog values
11. If a new ComEd-owned revenue meter is required by Metering Group, connect to IP switch architecture.
12. Modify all mimic boards as required.

2. STAND ALONE NETWORK UPGRADES

None.

3. NETWORK UPGRADES

None.

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.

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 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	12
Permitting	12	30
Construction	30	36

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 AH1-165. 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.
- 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 2026 rates and do not reflect a potential increase in Labor or Material costs after 2026.
- 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 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.
- This Phase 3 System Impact 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 Interconnection Construction Services Agreement (ICSA).
- PD owned line L.1801 is assumed to be exiting the station to the East. FinalN determination of line exit will be determine during detailed design.
- Final station location and transmission plan and profiles will be determined during detailed design due to any changes in final site location.

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 AH1-165 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.

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”.

10. ENVIRONMENTAL AND PERMITING

No environmental concerns and/or permitting requirements were identified as needed by this study. However, should detailed engineering and design and/or construction activities identify the need for an environmental study and/or permit requirements, the developer is fully responsible for the costs related to any environmental study, any actions to address the identified environmental impacts and the permits. Also, the schedule will be adjusted accordingly to account for the necessary time to perform the environmental study, address the identified environmental impacts and to obtain the permits, if applicable. All environmental studies, actions to address environmental impacts and permit actions shall comply with all ComEd requirements as detailed in "ComEd Environmental Requirements for Third Party Developers”, and with all local, city, county, state, and federal requirements.

C. APPENDICES

Attachment #1: High Level Project Diagram Depicting Interconnection Facilities for Physical Interconnection and Points of Ownership/Demarcation

Attachment #1:

High Level Planning Diagram Depicting Interconnection Facilities and Points of Ownership/Demarcation

