Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request Project ID AH1-564

Rockford Battery Storage – 150MW 138kV Expansion

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." Make sure this added in the FSR under introduction section.

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer (PD) has proposed a storage uprate to a planned/existing natural gas Generating Facility located in, Winnebago County, IL with a designated PJM Project ID of AH1-564.

This project is an increase to the AC1-114/AC2-116 projects, and will share the same Point of Change in Ownership.

The AH1-564 project is a 150 MW uprate (150 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 330 MW with 177 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 194 Sabrooke 138kV 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 194 Sabrooke 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 150MW of storage as well as 138kV/34kV 150MVA transformer and two (2) 138kV breakers. An additional metering CT will also be required. This CT will be owned by ComEd.

4.2. At AH1-564 collector station, GIC to follow section 6.2 (Design E) of the latest version of

ComEd Interconnection Guidelines for Generators at Transmission Level (Rev 2: Effective 12/16/2021).:

- 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. 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 138kV transmission line to TSS 194 Sabrooke 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 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.

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

4.8 GIC Project Developer to provide transformer test reports for the step-up transformers, to be used for ComEd short circuit modeling. Test reports to include %Z Impedance and load loss.

4.9 Verify load-ability of existing line for bi-directional power flow due to addition of battery storage.

4.10 If existing fiber from Project Developer location to TSS 194 Sabrooke can be used, then use it to run fiber between TSS 194 Sabrooke and AH1-564 Rockford Battery Storage, If not, then install two direct-on-fiber cables (unknown distance) for 138kV L98221 between TSS 194 Sabrooke and AH1-564 Rockford Battery Storage. Each cable shall be Single Mode, physically diverse from one another, and minimum count of 48 each. This will be owned and maintained by the developer.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AH1-564 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 194 Sabrooke L.98221 and shall be verified for the addition of the AH1-564:

- A 138kV 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.98221
- 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.

Relay Upgrades

TSS 194 Sabrooke

a. 138kV L98221:

i. Replace 87L-1 LFCB-102 relay with an 87L-1 SEL-411L using non-SBM design per GDD 1940 and direct fiber to Project Developer TSS982 Rockford II Energy Center.

1. Use existing single mode fiber between the stations. Verify FDP bulkhead connector type.
2. Run two pairs of ST-ST (or SC) single-mode fiber jumpers from System 1 SEL-411L relay to FDP (active & a spare). Remove old fiber jumpers once the new relay is in service.
3. If the space permits, utilize the same corrugated tubing for the new fiber jumpers; otherwise work with SSC to place a new tube from the FDP to relay panel.
4. Include the existing load rejection scheme by having the line breaker 52b contact initiate the TT-AUX-1 NGA relay (refer to GDD 4003 for load rejection design).
5. Connect to existing RUGGEDCOM RST2228 Aux Switch A and B via MM Fiber (LC-LC).

ii. Replace 11-2 SEL-321 relay with an 11-2 SEL-411L for POTT using non-SBM design per GDD 1940 and direct fiber to Project Developer TSS982 Rockford II Energy Center (Example TSS945 345kV L94507).

1. Use existing single mode fiber between the stations. Verify FDP bulkhead connector type.
2. Run two pairs of ST-ST (or SC) single-mode fiber jumpers from System 2 SEL-411L relay to FDP (active & a spare). Remove old fiber jumpers once the new relay is in service.
3. If the space permits, utilize the same corrugated tubing for the new fiber jumpers; otherwise work with SSC to place a new tube from the FDP to relay panel.
4. Include the existing load rejection scheme by having the line breaker 52b contact initiate the TT-AUX-2 NGA relay (refer to GDD 4003 for load rejection design).
5. Make POTT mirrored bit fiber connection on port 2.

a. Since Project Developer will upgrade secondary SEL-321 to SEL-411L, secondary protection will use Current Diff per the GDD and not POTT.

6. Connect to existing RUGGEDCOM RST2228 Aux Switch A and B via MM Fiber (LC-LC).

iii. Replace 79/25 SEL-279H and 50/2 BF SEL-251C relays with a single 50BF/25/79 SEL-451-5 relay and associated LOR per GDD1930.

1. Connect to existing RUGGEDCOM RST2228 Aux Switch A and B via MM Fiber (LC-LC).

System 138 kV L98221	Function	TSS194	TSS982
Primary SEL-411L – Direct Fiber	87L, LTT, BFTT, Load Rejection TT	T	R
Primary SEL-411L – Direct Fiber	87L, LTT, BFTT	R	T
Secondary SEL-411L – Direct Fiber	87L, LTT, BFTT, Load Rejection TT	T	R
Secondary SEL-411L – Direct Fiber	87L, LTT, BFTT	R	T

b. Substation Engineering to perform the battery calculations.
c. Modify all mimic boards as required.
d. SB-98221 will be updated to reflect new primary and secondary relays and any setpoint changes.
e. Update CD-98221 to reflect the new System 1 and System 2 relays. Provide the EMS team revised CDs to update the Voyager screen.
f. Check if Anti-Islanding is present or required. Transmission Planning to provide guidelines ahead of the Engineering design.
g. Upgrade existing RTAC 1 from SEL-3530 to SEL-3350.
h. Connect new relays to existing dual IP architecture.
i. Install one pair of serial fiber connections for each Project Developer RTU data exchange to be coordinated with ComEd SCADA Engineering:
    i. Breaker statuses
    ii. MW, MVAR, MWh and voltage values.
j. If a new ComEd-owned revenue meter is required by Metering Group, connect to IP switch architecture
k. EOC to perform battery calculations

Upgrades to neighboring facilities:

<u>TSS982 Rockford II Energy Center</u>

a. For 138kV L98221:
    i. Install standard ComEd 138kV GIC interface relaying for the remote end station consisting of a dual SEL-411L-1 current differential scheme per GDD1940 (more details below). Project Developer to have same relay

firmware; part number can be different due to power supply and Comm Ports requirements.

1. Transfer Trip to TSS194 for L98221 138kV CB Breaker Failure. Ability to isolate 87L and DTT functions is required.
2. The GIC interface relaying will be the only point of interface with ComEd relaying. Current contributions from all Project Developer breakers to be combined and wired to 411L for 87L scheme.

ii. All new relay contributions and trips are rewired to CTs on new L98221 138kV circuit breaker being installed downstream of the new battery storage tie-point.

iii. Replace Primary LFCB-102 relay with an SEL-411L with direct fiber to ComEd TSS194 Sabrooke to perform Current Differential and Direct Transfer Trip.

1. Recommended: SEL-411L P/N: SEL 0411L1X6X5C7DCXH52424XX (ComEd CAT ID: 1616117)
2. Use existing single mode fiber between the stations. Verify FDP bulkhead connector type.
3. Recommended Project Developer run two pairs of single-mode fiber jumpers from new System 1 SEL-411L relay to FDP (active & a spare). Remove old fiber jumpers once the new relay is in service.
4. If the space permits, utilize the same corrugated tubing for the new fiber jumpers; otherwise, recommended Project Developer place a new tube from the FDP to relay panel.
5. Recommended Project Developer includes SBM switch to enable/disable Current Differential scheme for ease of isolating and tagging out of service in future outages.
6. Recommended Project Developer includes SBM switch to enable/disable Direct Transfer Trip Receiver for ease of isolating and tagging out of service in future outages.
7. Verify with Project Developer that necessary points are being included on existing Modbus connection.

iv. Replace Backup SEL-321 relay with an SEL-411L to be used for current diff (87L) and Direct Transfer Trip.

1. Recommended: SEL-411L P/N: SEL 0411L1X6X5C7DCXH52424XX (ComEd CAT ID: 1616117)
2. Use existing single mode fiber between the stations. Verify FDP bulkhead connector type.
3. Recommended Project Developer run two pairs of single-mode fiber jumpers from new System 2 SEL-411L relay to FDP (active & a spare). Remove old fiber jumpers once the new relay is in service.
4. If the space permits, utilize the same corrugated tubing for the new fiber jumpers; otherwise, recommended Project Developer place a new tube from the FDP to relay panel.
5. Recommended Project Developer includes SBM switch to enable/disable Current Differential scheme for ease of isolating and tagging out of service in future outages.

6. Recommended Project Developer includes SBM switch to enable/disable Direct Transfer Trip Receiver for ease of isolating and tagging out of service in future outages.

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.

An additional CT will be needed on the 138kV Bus at TSS 982 Rockford II Energy Center. This will be installed on the Project Developer 138kV bus but will be owned by ComEd.

5. MILESTONE SCHEDULE FOR COMPLETION OF COMED WORK

Facilities outlined in this report are estimated to take 30 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
Construction	12	30

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 AH1-564. 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.
- 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.
- 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 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).
- 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 194 Sabrooke and TSS 982 Rockford II Energy Center.
- Assumes TSS 982 Rockford II Energy Center is still active at time of project.

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 AH1-564 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.

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 "ComEd Interconnection Guidelines" and "Guidelines on Land Requirements for Interconnection Substations" posted on the PJM website.

9. 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: Single line Diagram for the Physical Interconnection

SINGLE LINE DIAGRAM

