Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project ID AG2-585

“Kensington 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 solar uprate to a planned solar Generating Facility located Kankake Country, Illinois with a designated PJM Project ID of AG2-585.

This project is an increase to the existing AF2-350 project, and will share the same Point of Change in Ownership.

The AG2-585 project is a 55 MW uprate (33 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 155 MW with 93 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 199 Kensington Road 138kV substation.

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 TSS 199 Kensington Road 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 Transformer – 66/88/110 MVA OA/FA/FA. 138kV Y-grounded, 34.5kV Y-

grounded with a a 13.8kV delta tertiary. The Z% = 8.5% on a 66 MVA base. X/R = 36.0 (high side to low side)

- Two (2) 138kV circuit breakers
- Three (3) 138kV disconnect switch
- Install 3 phase 1200:1 CCVTs on 138kV side of the transformer to be used for System 1 and System 2 relay protection scheme
- At AG2-585 Grand Marsh II Solar 125MW, in general, Generator Interconnection Customer (GIC) relaying, etc. to follow section 6.2 (Design E) of latest version of EED interconnection guidelines (for Generator Greater than 10MW) Rev 2: Effective 12/16/2021, with the following project specific notes:
    - New 138kV gas circuit breakers to auto trip and isolate for critical gas level.
    - For 138kV L19904 (Generator Interconnection (GIC) LINE): GIC to install and own standard ComEd 138kV GIC interface relaying for the remote end station consisting of a System 1 and System 2 current differential protective relay scheme. A ComEd settings template will be provided to the Developer for the scheme to work with the relays at TSS199:
        - GIC Developer to send a Transfer Trip to TSS199 for L19904.
        - The ability to isolate 87L and DTT functions is required. Example scheme/settings can be provided by ComEd.
        - The GIC interface relaying will be the only point of interface with ComEd relaying. Current contributions from all Developer breakers to be combined and wired to the System 1 and System 2 relays for 87L scheme.
        - The ComEd line relay CT contributions shall be from the bus side of the line CB.
    - New 138kV Tie Line terminal relay types and firmware to be the same as ComEd terminal relays.
    - 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 for all lines, transformers, and solar inverters to model in a short circuit program.
    - 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.
    - Witness testing by ComEd or a DA will be required and must be pre-scheduled at least 90 days in advance.

- GIC to provide transformer test reports for 138kV-34.5kV step up transformers. Test reports must include %Z impedance and load loss, including type of Inverter/s used for ComEd short circuit modeling.
- New Gas Circuit Breaker control for loss of SF6 gas condition should be as follows (see Engineering practice EP-5206E and relay specifications):
    - 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.
    - 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.
    - 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.
- 138kV L.19904 will require two Single Mode Fiber paths from TSS 199 Kensington Road to the developer substation control building. 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 Developer, and the demarcation of ownership will be in an FDP within the TSS 199 Kensington Road control building.
- 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, at 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.
- 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.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AG2-585 project to ComEd transmission system. These facilities shall be designed according to [TO] Applicable Technical Requirements and Standards. Once built, ComEd will own, operate, and maintain these Facilities.

COMED SCOPE OF WORK (TRANSMISSION OWNER)

ComEd will design, own, operate, and maintain the following facilities and upgrades required to interconnect PJM Project AG2-585 to the ComEd transmission system (subject to applicable ComEd technical requirements and standards and the assumptions/dependencies noted in this report).

- **Transmission Owner Interconnection Facilities (138kV L.19904 / POI area):**
  - Provide (or verify adequacy and reuse, where applicable) the 138kV dead-end structure and foundation outside the interconnection substation fence to terminate the Project Developer generator lead line.
  - Install line conductor from the dead-end structure to the bus position in the switchyard of the interconnection substation.
  - Install one (1) motor-operated disconnect switch (minimum thermal capacity 1892/2022/2072/2250 A (376/483/495/538 MVA) SN/SLTE/SSTE/SLD continuous).
  - Install metering equipment to meter L.19904 (three (3) metering CTs, three (3) metering PTs or a combination unit, meters, and associated equipment), including equipment necessary to provide bi-directional revenue metering and real-time data (kW, kVAR, circuit breaker status, and 138kV voltage) on the ComEd side of the POI per ComEd applicable standards.
  - Install three (3) surge arresters.
  - Install associated foundations and structures.
- **Network Upgrades (TSS 199 Kensington Road):**
  - Replace existing SEL-3530 RTAC with SEL-3350 RTAC and install new local/remote switch.
  - For 138kV L19901, L19902, L19906, L19907, and L19904: review and reset relay settings (retain existing relays).
  - Review and update, if required, AMI & revenue metering equipment considering the new total generation output; install 138kV standard interconnection metering and telemetry to ComEd TSO including CB status, MW, MVAR, MWh, and voltage values.
  - Install one pair of serial fiber connections for Developer RTU data exchange (breaker statuses and line analog values) coordinated with ComEd SCADA Engineering; verify and update SCADA settings as needed.
  - Implement transfer trip / anti-islanding related updates described in this report (including revision of SPOG 2-47 and updates at ESS K323 CSL Behring, TSS70 Bradley, TSS86 Davis Creek, and TSS199 Kensington, as applicable).
- **Upgrades to Neighboring Facilities:**
  - At TSS938, TSS949, and ESS K-323: for L19901, L19902, L19906, and L19907, review and reset relay settings at remote terminals.
  - Update fault data in CAPE and check for PRC-027 compliance.
- **Dependency / prior-queue note:** The report notes AF2-350 is responsible for necessary substation re-configuration and new 138kV L19904 installation; if AF2-350 is withdrawn, AG2-585 would either withdraw or inherit AF2-350 scope. If AF2-350 is completed before AG2-585, review and reset the L19904 relays.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

A 138kV dead-end structure and foundation outside 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.

The ComEd Interconnection Facilities will include, but not be limited to, the following which are planned to be installed by AF2-350 project and need to verified as adequate for the addition of the AG2-585:

- The existing 138kV dead-end structure and foundation outside of the Interconnection Substation shall be reused to terminate the Project Developer's generator lead line.
- One (1) Motor operated disconnect switch with a minimum thermal capacity of 1892/2022/2072/2250 A (376/483/495/538 MVA) SN/SLTE/SSTE/SLD continuous.
- Line conductor from the dead-end structure to the bus position in the switchyard of the interconnection substation.
- Three (3) metering CTs, three (3) metering PTs, or a combination unit, meters, and associated equipment to meter L.19904.
    - 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.19904, on the ComEd side of the POI per ComEd applicable standards.
- Three (3) surge arrestors
- Foundation and structures

2. STAND ALONE NETWORK UPGRADE

This section is not applicable.

3. NETWORK UPGRADES

TSS 199 Kenginston Road Upgrade

The existing substation, 138kV TSS 199 Kensington Road, will be upgraded to interconnect the project with the ComEd transmission system.

- Replace existing SEL-3530 RTAC with SEL-3350 RTAC. Install new local/remote switch.
- At TSS199 Kensington, the preceding project number AF2-350 (PD# 0p240026) is responsible for all the necessary substation re-configuration and new 138kV L19904 installation. If project AF2-350 is withdrawn, project AG2-585 would either have to withdraw or inherit all of the AF2-350 scope. Note: If project AF2-350 is completed before AG2-585, review and reset the L19904 relays.
- At TSS199 Kensington, for 138kVkV L19901, L19902, L19906, L19907, L19904:
    - Review and reset relay settings.
    - Retain existing relays
- Review and update if required the AMI & Revenue metering equipment. The review will take into consideration the new total generation output. The metering equipment will be sized to properly meter the output when the generation is in online as well as metering power supplied from the ComEd system for generator aux. power requirements when the generation is offline.

All metering equipment in accordance to ComEd Standards. Revenue grade metering must meet the requirements established by the published EED interconnection guidelines. Metering shall include registration of the generator output and auxiliary power usage. Install 138kV standard interconnection metering and telemetry to ComEd TSO including CB status, MW, MVAR, MWh and voltage values

- Install one pair of serial fiber connections for each Developer RTU data exchange to be coordinated with ComEd SCADA Engineering:
    - Breaker statuses
    - Line analog values
- Verify and update SCADA settings as needed
- Below are the communication specifcaitons required at TSS 199.

138kV L19906, B-phase

Function	TSS 199 Kensington	TSS 157 Kankakee	ESS K323 CSL Behring
DCB (Carrier)	T R		T R
DTT (Carrier)	T R	R	T R

138kV L19907, B-phase

Function	TSS 199 Kensington	TSS 157 Kankakee	ESS K323 CSL Behring
DCB (Carrier)	T R		T R
DTT (Carrier)	T R	R	T R

138kV L19904

System 138kV L19904	Function	TSS199 Kensington	AF2-350 & AG2-585 Grand Marsh Solar
1 – Direct Fiber	SEL 411L (87L-1, LTT, BFTT, LRTT)	T	R
	SEL 411L (87L-1, LTT, BFTT)	R	T
2 – Direct Fiber	SEL 311L (87L-2, LTT, BFTT, LRTT)	T	R
	SEL 311L (87L-2, LTT, BFTT)	R	T

- Load rejection transfer trip if at TSS199, any of the below conditions occur (logic via 52b breaker aux contacts): Both BT5-6 and BT5-8 at TSS199 Kensington are opened or if L19906 BT CB's are open and BT2-7 CB are opened or if both L19906 & L19907 BT CB's are opened.

- SPOG 2-47 will be revised and Transmission Planning to provide guidelines ahead of the Engineering design. Work required to update Anti-Islanding Scheme at ESS K323 CSL Behring, TSS70 Bradley, TSS86 Davis Creek and at TSS199 Kensington.

Upgrades to neighboring facilities:

TSS938, TSS949, ESS K-323

1) For L19901, L19902, L19906 and L19907, review and reset relay settings at remote terminals

2) Update fault data in CAPE and check for PRC-027 compliance

4. OTHER SCOPE OF WORK

This section is not applicable.

5. MILESTONE SCHEDULE FOR COMPLETION OF COMED WORK

Facilities outlined in this report are estimated to take 18 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	6
Construction	7	18

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

- It is assumed that the equipment installed during project “PJM Queue Project AF2-350 Kensington 138 kV” including Generator lead line, Single Mode fiber cable, revenue metering CTs/CCVTs located at the ComEd side of 138kV L.19904 is sufficiently rated for the additional load installed during AG2-585.
- Assumes dual Single Mode Fiber cables, owned and maintained by Developer, are already in place for System 1 and System 2 Relays for 138kV L19904 between TSS 199 Kensington Road and Grand Marshall Solar.
- ComEd estimate does not include costs of design and construction of AG2-585 Grand Marsh II, and transmission as described in IC scope of work. ComEd estimated schedule is based on ISA/CSA contract being executed by all parties.
- 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.
- 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.
- Assumes no additional foundations are needed.
- ComEd cost estimate is valid for six (6) months after Facilities Study release by PJM.
- Upgrades are subject to change based on detailed design development.
- It is assumed that ComEd facilities included in this document will not require a sound study
- It is assumed no geotechnical soil borings, resistivity study, and analysis for substation will be needed.
- 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 the 138kV L.19904 line relays installed during AF2-350 are to be re-used for this project AG2-585.

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 AG2-585 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 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.
        - 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. APPLICABLE TECHNICAL REQUIREMENTS AND STANDARDS

This section is not applicable.

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: Single line Diagram for the Physical Interconnection

