Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request
Project ID AG2-114

DRESDEN-PONTIAC MIDPOINT 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 Solar Generating Facility located in Livingston County, Illinois with a designated PJM Project ID of AG2-114. The installed facilities will have a total Maximum Facility Output (MFO) of 100 MW with 60 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 newly constructed 345kV breaker and a half substation, TSS 990 Livingston County, tapping the TSS 80 Pontiac – STA 12 Dresden 345kV line, L.8014, approximately 7.5 miles from TSS 80 Pontiac and 35.8 miles from STA 12 Dresden.

The construction of the new interconnection substation will result in the splitting of the existing TSS 80 Pontiac and STA 12 Dresden 345kV L.8014 into two lines on the transmission system. The new L.99008 will connect TSS 990 Livingston County to STA 12 Dresden, and L.8014 will connect TSS 990 Livingston County to TSS 80 Pontiac.

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 of L.99001 inside the TSS 990 Livingston County interconnection 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) 345kV circuit breaker
- One (1) 345kV motor-operated disconnect switch
- One (1) 345kV generator lead line, 345kV L.99001, from the Generating Facility to the Point of Interconnection
- Relaying at the Project Developer facility to send a Transfer Trip to TSS 990 Livingston

Commented [VG1]: @Choudhary, Rajesh:(Contractor - ComEd) this MOD is not shown on Project Developer side. It is shown on ComEd side.

County for 345kV circuit breaker failure. Ability to isolate 87L and DTT functions is required. Example scheme/settings can be provided by ComEd.

- Install three (3) 3000:1 CCVTs on the 345kV side of the power transformer to be used for System 1 and System 2 relay protection.
- For the new dead tank 345kV gas circuit breaker, install CB motor operated disconnects on both sides. All new 345kV current transformers are to be rated 3000 overall ratio with at least 1.5 RF for a minimum 3000A continuous thermal rating. New dead tank breakers to have 2 sets of 3000:5 overall ratio bushing CTs on each side. CTs to be multi-ratio with standard taps and C800 class. All new CBs will have CB monitoring and Breaker Failure scheme. New gas circuit breaker control for loss of SF6 gas condition should be as follows (See Engineering Practice EP-5206E and relay specifications):
    - For an open circuit breaker, when SF6 gas drops to the critical level, the close circuit of the breaker shall be opened, and both CB motor operated disconnects shall be opened.
    - For a closed-circuit breaker, when SF6 gas drops to the critical level, the circuit breaker shall be opened, and both CB motor operated disconnects shall be opened.
- Project Developer to provide transformer test reports for 345kV-34.5kV step-up transformer. Test reports must include %Z impedance and load loss, including type of inverters used for ComEd short circuit modeling.
- In general, Project Developer relaying, etc. to follow section 6.1 (Design F) of latest version of ComEd Interconnection Guidelines for Generators at Transmission Level (Rev 2: Effective 12/16/2021), with the following project specific notes:
    - New 345kV gas circuit breaker 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 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. Suggested settings will be provided by ComEd. 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.
    - Project Developer to provide final lead length of 345kV L.99001, electrical characteristics, construction configuration, size of conductors, and impedance

characteristics.

- Power output from the Developer site shall be in accordance with the power quality standards contained in the IEEE Standard 519. The generating units and all associated equipment at the Developer site shall not introduce any distortion of ComEd's waveform or telephone or carrier interference that is inconsistent or conflicts with such standard.
- Relay and protective equipment, telecommunications equipment, and Supervisory Control and Data Acquisition (SCADA) to comply with ComEd's Applicable Technical Requirements and Standards. 345kV L.99001 will require two Single Mode Fiber paths from TSS 990 Livingston County to the developer substation control building (Prairie Dock Solar). One fiber path will be dedicated for System 1 relays/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 fiber cables will be owned and maintained by the Developer, and the demarcation of ownership will be in an FDP within the TSS 990 Livingston County 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 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 1study 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.

SCOPE OF THIS PROJECT (SUMMARY)

This project provides the physical interconnection of PJM Generation Interconnection Request AG2-114 (100 MW solar generating facility in Livingston County, IL) to the ComEd 345kV transmission system via a new breaker-and-a-half interconnection substation (TSS 990 Livingston County) tapping the Pontiac–Dresden 345kV line (L.8014). Scope includes Developer-owned facilities up to the Point of Change in Ownership (PCO) and ComEd-owned interconnection facilities, network upgrades, protection/SCADA, and required fiber communications.

Non-technical scope brief (AG2-114): Connect the proposed 100 MW Prairie Dock Solar project to ComEd's 345 kV grid by building a new interconnection substation and the communications needed to operate and protect the line. Work includes installing a new 345 kV breaker arrangement at the new TSS 990 Livingston County site, cutting in the existing Pontiac–Dresden 345 kV line to route through the new station, and adding roughly 30 miles of new fiber-optic communications so the substations can share protection and control signals reliably.

- Build/extend approximately 30 miles of new single-mode fiber routes (overhead and underground) between TSS 990 and the neighboring substations, with separate/diverse paths as required.

Commented [GV2]: @Choudhary, Rajesh:(Contractor - ComEd) figure out if this paragraph is applicable

Commented [RC3R2]: This is a standard note in the relay notes. Phase 1 engineering is the next step once Facilities Studies turn into projects with signed agreements. We recommend reaching out to relay and protection if there are further questions.

Commented [GV4R2]: @Rusk, James:(Contractor - ComEd) - Jim, I changed wording a bit to eliminate confusion with word "study"

Commented [CC5R2]: @Halder, Qasim:(ComEd) - Do you agree with the change in the wordings for the PRC-027? Need your set of eyes for the TC2 Studies for this new substation build.

Commented [HQ6R2]: I agree with the update

- Install a new 345 kV breaker-and-a-half interconnection substation at TSS 990 (including new breakers/disconnects and associated equipment).
- Loop (cut-in) the existing 345 kV transmission line into the new station so the line is split into two segments connected at TSS 990.
- Enable required monitoring, metering, and remote control (SCADA) so the system can be operated safely and meet PJM/ComEd requirements, including:
  - Remote indications and controls for major equipment (e.g., breaker open/close, disconnect/MOD status, alarms such as low SF6) from ComEd's control center.
  - Real-time telemetry for operations and compliance (MW, MVAR, voltage, MWh, and equipment status) for ComEd and PJM as applicable.
  - Substation communications and SCADA hardware in the control building (e.g., RTAC/RTU cabinet, operator/engineering interfaces) integrated with ComEd's station network architecture.
  - Redundant communications paths where required (separate channels for primary/secondary protection and reliable data exchange with the Developer site).
  - Commissioning, end-to-end testing, and witness testing with ComEd prior to energization.

Project Developer scope (PCO and Developer side):

- Design, build, own, operate, and maintain the Project Developer Interconnection Facilities on the Project Developer side of the PCO.
- Developer 345kV equipment and generator lead line (345kV L.99001) from the generating facility to the POI/PCO, including associated breaker/disconnect equipment as specified.
- Developer protection, transfer-trip interface, metering/SCADA interfaces as required, and provision of equipment test data/modeling inputs.
- Provide two physically diverse, separate single-mode fiber paths between TSS 990 and the Developer substation building (one dedicated to System 1, one to System 2), minimum 48-count each; Developer-owned and maintained with demarcation at an FDP in the TSS 990 control building.
- Obtain required permits/approvals for construction of TSS 990 Livingston County, the Developer substation, and 345kV L.99001; provide required site restoration and bear associated costs as stated in the report.

ComEd scope (ComEd-owned facilities once built):

- ComEd interconnection facilities on the ComEd side of the POI/PCO (e.g., dead-end structure, bus leads, MOD switch, metering CT/PT and revenue metering equipment, surge arresters, foundations/structures).
- Stand-alone network upgrades: construct the new 345kV breaker-and-a-half interconnection substation TSS 990 Livingston County (breakers, disconnects, CCVTs, control building, batteries/AC-DC panels, protection, communications, SCADA, metering, station bus/IEC 61850 Gen 2 implementation, and associated yard/control building fiber).
- Transmission line cut-in: cut and loop the Dresden–Pontiac 345kV line into TSS 990, including conductor/shield wire installation and required structure replacements/installations.
- Upgrades at neighboring stations (STA 12 Dresden and TSS 80 Pontiac) including relay

upgrades, SCADA RTAC upgrades as noted, labeling/drawings updates, and related commissioning.

- Install two physically diverse, minimum 48-count single-mode fiber paths from TSS 990 to STA 12 Dresden and from TSS 990 to TSS 80 Pontiac (ComEd-owned and maintained); engage UCOMM for new path installations.
- Obtain environmental approvals/permitting required for ComEd work on L.8014 and L.99008, with costs at the Project Developer's expense as stated in the report.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AG2-114 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:

- A 345kV 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 4000A continuous, with ACCC D06.
- Three (3) metering CTs, three (3) metering PTs, or a combination unit, meters, and associated equipment to meter 345kV L.99001.
    - Install equipment necessary to provide bi-directional revenue metering (kWh, kVARh) and real-time data (kW, kVAR, and circuit breaker status and 345kV voltage) for 345kV L.99001, on the ComEd side of the POI per ComEd applicable standards.
- Three (3) surge arresters
- Foundations and structures

2. STAND ALONE NETWORK UPGRADES

TSS 990 Livingston County Interconnection Substation **AG2-114**

A new breaker and a half substation, TSS 990 Livingston County 345kV, will be constructed along the 345kV L.8014 transmission line to interconnect the project with the ComEd transmission system.

- Two (2) 345kV transmission line dead-end structures with testing to check proper phase and identification is correct.
- Six (6) 345kV station class surge arresters.
- Three (3) 345kV IPO circuit breakers rated 4000A continuous, and interrupting capability of 63kA at -40 degrees F. Circuit breaker to be equipped with a motor operated disconnect switch (MOD) on both sides of the breaker. All equipment associated with the breaker termination should meet or exceed the thermal capability of the breaker including CB disconnects, leads, CTs, metering, relays, etc. Nameplates to reflect actual maximum

Commented [GV7]: @Choudhary, Rajesh:(Contractor - ComEd) Check with EOC what really has to be in TOIF scope and Stand alone scope. Where is the scope for the Tline, cutting transmission and tying in generation?

Commented [VG8R7]: @Rosso, Christopher:(ComEd) - Jalseen, Merlin and I reviewed and we agree with the TOIF scope outlined here. It is basically the scope from the PCO to POI. If you look at SLD down below it aligns with that.

Commented [RC9R7]: @Holm, Jasleen:(ComEd) @Gorbatyuk, Vitalina:(ComEd) What i'm not understanding is the "Structure and foundation WITHIN THE FENCE...to terminate the Project Developer's generator lead line." The scope up to the PCO should be part of the stand along network upgrade. Thinking of it this way... if the developer claims OTB, then this is saying they build the substation but ComEd still owns the dead end structure connected to their gen lead line?

Commented [VG10R7]: @Rosso, Christopher:(ComEd) Chris, developer can elect OTB for TOIF and Stand Alone scopes of work. Tariff separates TOIF and stand alone scope of work.

Commented [VG11R7]: @Rosso, Christopher:(ComEd) I also checked the PJM slides

Commented [VG12R7]: @Holm, Jasleen:(ComEd) ; @Shekhani, Merlin:(ComEd) - copying you for visibility

Commented [RC13R7]: Understood, so we're required to separate these two. Let's just update the language so that the TOIF is from the dead-end structure to the connection to the first pole outside ComEd's property line.

Commented [HJ14R7]: @Rosso, Christopher:(ComEd) Will do also just to add to Vita's point this same situation is shown in the PJM TOUI user guide and it is categorized under TOIF . Thanks

capability of equipment (NOT minimum requirements specified).

- Eight (8) 345kV motor operated breaker disconnect switches: one (1) on each side of the 345kV circuit breakers and one (1) for each 345kV transmission line (L.99008 and L.8014). These disconnect switches shall have the same minimum thermal capability as the circuit breakers above and will therefore be rated 4000A continuous, with ACCC D06.
- Nine (9) 345kV 3000:1 CCVTs without carrier accessories used for System 1 and System 2 relay protection.
- Foundations and structures for all new equipment.
- A 345kV control building to ComEd specifications to accommodate System 1 and System 2 batteries, battery chargers, AC/DC panels, protective relaying, communication, SCADA, metering equipment, etc. 125VDC battery system DC distribution panels, System 1 and System 2 relay panels, marshalling cabinet, aux AC power panels, building HVAC system, fire/security system, SCADA, and metering equipment. Building shall be masonry or precast.
- All 345kV circuit breakers are required to have an SEL-2411 relay pre-installed inside of the breaker control cabinet for monitoring. Multimode fiber from the yard to the control building is required.
- The substation relaying will employ IEC 61850 “Generation 2” design using GOOSE tripping (all ComEd schemes). During detailed engineering, consult Relay Engineer for latest standards and reference prior ComEd projects.
- For all new outdoor 345kV GCBs, for SCADA controls and 50BF/25/79 functions, use dual SEL-451 relays for S1 and S2. Hardwire Bus pots to SEL-451 for synch closing. Hardwire critical gas trips to breaker MODs. Auto-reclosing will be enabled on all Overhead lines, if applicable. Both relays will be in a relay cabinet to be located near the breaker with MB connection between relays and wired to trip and close the CB. The relays can also be located inside the control building depending on the station layout. Utilize 3000:5 C800 CTs for all new 345kV SF6 gas circuit breakers.
- For 345kV line L.99001, install System 1 87L-1/SEL-411L-1 and System 2 87L-2/SEL-411L-1 current differential schemes. Utilize full 3000:5 CT ratio for both systems of line relaying. In addition, install load rejection logic such that transfer trip is initiated on both System 1 and System 2 relaying to the Project Developer site if both BT 2-3 and BT 1-2 at TSS 990 are opened (referred to GDD 4003 for load rejection design).

345kV L99001	Function	TSS990		Prairie Dock Solar (GIC)	
87L-1 SEL-411L-1 (Direct Fiber)	Current Diff, LTT, BFTT	T	R	T	R
87L-2 SEL-411L-1 (Direct Fiber)	Current Diff, LTT, BFTT	T	R	T	R

- For 345kV line L.8014, install System 1 87L-1/SEL-411L-1 and System 2 87L-2/SEL-411L-1 current differential schemes over direct fiber. Utilize full 3000:5 CT ratio for both systems of line relaying. DTT will be internal to the relays.

345kV L8014	Function	TSS990		TSS80	
87L-1 SEL-411L-1 Direct Fiber	Current Diff, LTT, BFTT	T	R	T	R
87L-2 SEL-411L-1 Direct Fiber	Current Diff, LTT, BFTT	T	R	T	R

- For 345kV line L.99008, install System 1 87L-1/SEL-411L-1 and System 2 87L-2/SEL-411L-1 current differential schemes over direct fiber. Utilize full 3000:5 CT ratio for both systems of line relaying. DTT will be internal to the relays.

345kV L99008	Function	TSS990		STA12	
87L-1 SEL-411L-1 Direct Fiber	Current Diff, LTT, BFTT	T	R	T	R
87L-2 SEL-411L-1 Direct Fiber	Current Diff, LTT, BFTT	T	R	T	R

- SF6 critical will automatically trip the CB and open MODs on either side of the CB.
- Install a SEL-2411 relay for line MODs' Remote Trip, Close, "89a", "89af", "89b", and "89bf" statuses to be sent to SCADA.

- Fiber, All Network devices to be installed with provisions for the future devices.
    - Only Station Bus Fiber to be used.
    - All Station Bus fiber will be run in Panduit covered fiber through and will be OM3 50mm MM Fiber, 12 count jumper.
    - Jumpers will be spliced in a Main FDP Cabinet. One Main FDP for each A & B Network. Main FDP will have LC Connected jumpers to the SDN Switches.
    - Remote end of OM3 fiber jumpers will be spliced into a Corning DIN Rail Mount FDP.
    - Local LC Connectors will be used to go between the Local A or Local B FDP to the S1 and S2 5A & 5B ports, respectively.

SCADA network will be based on IEC 61850 design for prior ComEd projects.

- One SCADA cabinet:
    - One (1) Raymar-Telenetics modem and Black Box Splitter
        - Three (3) serial connections from RTU RTAC and two (2) from ENG RTAC.
    - One (1) SEL-3555 RTU RTAC
        - Install one pair of serial fiber connections for each Developer RTU data exchange to be coordinated with ComEd SCADA Engineering:
            - Breaker statuses
            - MW, MVAR, MWh and voltage values
    - One (1) SEL-3555 ENG RTAC
        - With mouse, keyboard, and monitor on the engineering desk
    - Two (2) SEL-3555 HMI RTAC
        - With mouse, keyboard, and monitor on the operator desk
    - One (1) Omicron Station Scout RBX1
    - One (1) Local/Remote Switch, wired to I/O DPAC 1
    - One (1) SEL-3350 Blueframe
    - ComEd-owned revenue shall connect to IP switch architecture.
- One standalone PDC Cabinet (per GDD 2911)
- Two (2) Station Bus Cabinets, each including the following:
    - One (1) SEL-2488 GPS clock
    - One (1) SEL-3350 Blueframe with Flow Controller
    - One (1) SEL-2741 Master Switch
    - SEL-2741 Station Bus Switches
        - Number of switches to be determined during detailed engineering design.
    - One (1) SEL-2440 I/O DPAC, 48 Digital Inputs
    - One (1) RSG910C Access Switch

- One Desk Hoffman Box
    - One (1) DC to AC inverter
    - One (1) 2x2 Ethernet RJ45 Patch Box with connections to the following:
        - Station Bus A via RSG910C
        - Station Bus B via RSG910C
        - SCADA WAN via SEL-2731
        - Cooperate Access via UCOMM patch panel
- One (1) Operator Desk
    - Two (2) 27” Monitors (HMI 1 and HMI 2 RTACs)
    - Two (2) Keyboard and Mouse
    - One (1) Ergotron LX Dual Mount Stacking Arm
- One (1) Engineering Desk
    - Two (2) 27” Monitors (ENG RTAC and Spare)
    - Two (2) Keyboard and Mouse
    - One (1) Ergotron LX Dual Mount Stacking Arm
- Witness testing by ComEd is required.
- Install normal and emergency sources to provide three-phase 208Y/120VAC auxiliary power through local service request process. The normal and emergency sources shall be supplied from diverse 12kV or 34kV sources and approved by local utilities planning group.
- For any new equipment connection to the Bulk Electric System, rated at 100kV or above, ComEd requires the associated System 1 and System 2 protective schemes to have a minimum redundancy; connected CTs, PTs, DC control circuits, auxiliary trip relays, circuit breaker trip coils, and communication circuitry.
- AG2-114 Prairie Dock Solar switchyard ground grid shall not be tied to TSS 990 Livingston County ground grid.
- Dedicated site drainage pond shall be provided for the new TSS 990 Livingston County substation in addition to the substation footprint and to be exclusively used by ComEd.
- Drainage pond property and storm water piping system shall be conveyed to ComEd.
- The Project Developer will be responsible for the cost of security system design and installation. Substation security level and requirements shall be assigned/determined by Exelon Security Operations. All fencing and security design shall be coordinated with and approved by Exelon Security team.
- All relaying is to be in accordance with the PJM Transmission 7 Substation Design Subcommittee Technical Requirements.
- It is the responsibility of the Project Developer to obtain any permitting required for this project. See environmental section for details.
- Bus insulators, supports, and equipment leads shall follow ComEd standards.

Installation of Auxiliary Power Services (3PH – 12kV)

- Normal Source – S405 – Extension of 3-phase Overhead is required due to lack of 3PH Overhead sources within the project area. Proposed tap location is located North of the intersection of E 1800 N Rd & N 2100 E Rd, Pontiac. Overhead scope includes adding approximately 7,900' of C-Phase primary along existing pole line beginning at junction point. Additionally, approximately 7,900' of A & C-Phase primary wire extension is needed heading North beginning near 19487 N 2100 E Rd, Pontiac. The entrance into TSS 990 for Auxiliary power is proposed through 1,850' of new conduit along E 2100 N Rd. This duct can potentially be combined with the required fiber routing to eliminate multiple duct runs. This proposed route overlaps with make-ready work required for fiber needs related to TSS 80 Pontiac tie-in. Proposed pad-mount transformer sizing is assumed to be 500kVA. Capacity Planning feedback states that a PD will most likely be required due to extensive distribution scope for both Normal and Emergency feeds. This route includes multiple TROW (transmission right-of-way) crossings.
- Emergency Source – S433 – Proposed tap location is located south of the intersection of E 2400 N Rd & N 2300 E Rd, Odell. Overhead scope includes adding approximately 15,850' of A & B-Phase primary along existing pole line beginning at junction point. Approximately 10, 500' of overhead reconductoring scope overlaps with proposed make-ready work required for fiber needs related to STA 12 Dresden tie-in. The entrance into TSS 990 for the second emergency Auxiliary power source is proposed through 9,000' of new conduit along E 2100 N Rd. This duct can potentially be combined with the required fiber routing to eliminate multiple duct runs. Proposed pad-mount transformer sizing is assumed to be 500kVA. This route includes multiple TROW (transmission right-of-way) crossings.

3. NETWORK UPGRADES

Transmission Line Tie-in for new interconnection substation:

The Dresden-Pontiac 345kV line will be cut and looped into the new interconnection substation. The new conductor type will be 2-1277 kcmil ACAR, and the new shield wire type will be 7#6 Alumoweld. Approximately 0.75 circuit miles of conductor and shield wire will be installed to facilitate the cut-in.

The following structure replacements and installations are required for the cut-in to TSS 990 Livingston County:

Structure Number	Line Number	Existing Structure Type	Comments
141	99008	LSV+20	Replace tower with new single-circuit vertical configuration suspension steel pole
141D	99008	N/A	Install new single-circuit vertical configuration deadend steel pole
141E,141F	99008	N/A	Install new single-circuit horizontal configuration deadend steel pole
142	8014	LSV+20	Replace tower with new single-circuit vertical configuration deadend steel pole

Structure Number	Line Number	Existing Structure Type	Comments
142D	8014	N/A	Install new single-circuit vertical configuration suspension steel pole
143	8014	LSV+20	Replace tower with new single-circuit horizontal configuration deadend steel pole

Upgrades to neighboring facilities:

- STA 12 Dresden
  - For new 345kV L.99008 (previously L.8014), upgrade existing line relays to dual SEL-411Ls performing line differential (87L). System 1 and System 2 relays will be on Direct Fiber.
  - Update substation labels, mimic panels, and station drawings to reflect new line number and remote end.
  - Revise reclosing settings as needed for 345kV BT12-14 and 345kV BT14-15.
  - Coordinate with Constellation as needed.
  - Install 2 diverse, minimum 48-ct single-mode fiber paths from TSS 990 Livingston County station to STA 12 Dresden. Engage UCOMM for new path installations. Fiber runs to be ComEd owned and maintained.
  - Upgrade existing SCADA SEL-3530 RTAC to SEL-3350.
  - Connect new relays to existing dual IP switch architecture.
- TSS 80 Pontiac
  - For new 345kV L.8014, upgrade existing line relays to dual SEL-411Ls performing line differential (87L). System 1 and System 2 relays will be on Direct Fiber.
  - Update substation labels and mimic panel to reflect new line number and remote end.
  - Revise reclosing settings as needed for 345kV BT6-7 and 345kV BT7-8.
  - Install 2 diverse, minimum 48-ct single-mode fiber paths from TSS 990 Livingston County station to TSS 80 Pontiac. Engage UCOMM for new path installations. Fiber runs to be ComEd owned and maintained.
  - Install new SCADA SEL-3350 RTAC.
  - Install dual RST-2228 Aux Switches for new IP relays.

Installation of fiber cable circuits

- Build Fiber path from TSS 990 Livingston County to existing Fiber to STA 12 Dresden, consisting of approximately 77,000' of new overhead fiber and 21,500' of new underground/bore fiber. One (1) new river crossing is expected for this fiber route. Use this fiber path for L.99008 System 1 and System 2 relays, and this fiber would be Single Mode, minimum 48-ct. The path between TSS 990 and STA 12 shall be physically diverse from the

Commented [GV15]: @Choudhary, Rajesh:(Contractor - ComEd) is this in the right section. It looks like a Network Upgrade.

Commented [GV16R15]: It should go to the end of the next section: Network Upgrade

Commented [RC17R15]: Our intention is to have the fiber and aux power within the Stand Alone Network Upgrades section. We tried to be helpful to create a sub-heading for fiber and aux power for clarity.

fiber path to TSS 80 and will be owned and maintained by ComEd. It is proposed to utilize portions of existing fiber rings BF-STA23-TSS939 & BF-TSS93-TSS905 to reduce the installation of new facilities between TSS 990 and STA 12. This item is pending UComm approval and may impact overall distances if unable to use. Additionally, a railroad and I-55 crossing would be expected if existing fiber portions cannot be used.

- Build Fiber path from TSS 990 Livingston County to existing Fiber to TSS 80 Pontiac, consisting of approximately 42,000' of new overhead fiber, 9,500' of new underground/bore fiber, and 13,000' of new underground fiber through existing conduit. Use this fiber path for L.8014 System 1 and System 2 relays, and this fiber would be Single Mode, minimum 48-ct. The path between TSS 990 and TSS 80 shall be physical diverse from the fiber path to STA 12 and will be owned and maintained by ComEd.
- Build two separate Single Mode Fiber paths between TSS 990 Livingston County and the AG2-114 Prairie Dock Solar substation building. One fiber path will be dedicated for System 1 relays/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 fiber cables will be owned and maintained by the Developer, and the demarcation of ownership will be in an FDP within the TSS 990 Livingston County control building.

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 60 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	22
Permitting/Procurement	16	32
Construction	33	60

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

- ComEd estimate does not include costs of design and construction of AG2-114 Prairie Dock Solar substation, and transmission as described in the Project Developer scope of work. ComEd estimated schedule is based on GIA/CSA contract being executed by all parties.
- ComEd estimate assumes that TSS 990 Livingston County is a low impact site (low security requirements). Chain link fencing, non-motorized gate, and no cameras.

- 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 issuance, the study will be void and the project re-studied, requiring the completion of a new Facilities Study.
- It is assumed no underground conflict exists in the area of the new substation. Survey of the property will be acquired. The Project Developer will be responsible for the cost of the survey.
- It is assumed that ComEd facilities included in this document will not require a sound study.
- TSS 990 Livingston County shall be designed for a 100-year BFE (base flood elevation) + 3ft at minimum. A flood study should be done early on to determine if any flood mitigations are needed such as elevating foundations.
- This study assumes the Developer will remove any trees and mitigate any wetlands present in the property that would restrict the cut-in to new TSS 990.
- Project Developer to upload as-built drawings to ComEd drawing system (Meridian).
- This document assumes that the Project Developer has completed, tested, and conveyed to ComEd the new TSS 990 substation (per ComEd guidelines) and transmission line tie-in up to the existing ComEd right of way to allow for the 345kV line energization and back feed.
- All real property conveyed in fee to ComEd must be remediated to and 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.
- ComEd Capacity Planning to confirm the "normal" and "emergency" designations for the auxiliary power sources during detailed engineering.

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 AG2-114 GIA, and in PJM Manuals M01 and M14D. The details of applicable revenue metering requirements are given in the 'ComEd Interconnection Guidelines' posted on the 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'.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

Land requirements for the Interconnection Substation needed for this interconnection project must meet the requirements in the 'ComEd Interconnection Guidelines' and 'Guidelines on Land Requirements for Interconnection Substation' posted on PJM website.

Upon completion of the construction and installation of the interconnection substation, the tie-line, access road, stormwater detention facility and related improvements and facilities, and the satisfactory completion of testing of the interconnection substation acceptable to ComEd, the Project Developer shall transfer all the Property Rights and Permits to ComEd, at no cost or expense to ComEd, pursuant to documentation that is acceptable to ComEd, including (without limitation) the Property Transfer Documents in fee simple.

All real property conveyed in fee to ComEd must be remediated to and 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.

Pursuant to PJM's site control requirements, the Project Developer is responsible for the acquisition of any land rights required for construction of a new substation. As such, the estimated total cost and schedule contemplated by this Facilities Study Report does not include the estimated cost and time necessary for the acquisition of any such land rights.

The total assumed fiber route is approximately 30 plus miles and traverses approximately 285 land parcels. The estimated total cost for acquiring required easements is $587,768.00 dollars. The fiber route identified in this study is preliminary and may change. The acquisition of easements necessary for the assumed fiber route is contingent upon landowner consent, and easement rights for fiber installation cannot be assured. Easement acquisition costs may vary by landowner.

9. APPLICABLE TECHNICAL REQUIREMENTS AND STANDARDS

- ComEd Interconnection Guidelines (For Generators at Transmission Level), Rev. 2, Dated 12/16/2021
- ComEd Guidelines on Land Requirements for Interconnection Substations, Rev. 2, Dated January 2026

10. ENVIRONMENTAL AND PERMITING

- The Project Developer will be responsible to obtain all environmental approvals and permitting required for the construction of TSS 990 Livingston County, Prairie Dock Solar substation, and 345kV L.99001.
- ComEd will be responsible to obtain all environmental approvals and permitting required for L.8014 and L.99008 work. 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.
- **T**he 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.

C. APPENDICES

Attachment #1: Single line Diagram for Physical Interconnection

