Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project ID AG1-354

Summer Shade – Green County 161 kV

Revision 0: December 2024

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff. The Transmission Owner (TO) is East Kentucky Power Cooperative ("EKPC").

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer (PD) has proposed a solar generating facility located in Green County, Kentucky. The installed facilities will have a total Maximum Facility Output (MFO) of 150 MW with 90 MW of this output being recognized by PJM as Capacity.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the East Kentucky Power Cooperative ("EKPC") transmission system via a newly constructed 161 kV Breaker-and-a-Half ("BAAH") substation, Liletown Road Substation, tapping the Summer Shade – Green County 161 kV line, approximately 19.4 miles from Summer Shade and 10.4 miles from Green County.

The construction of the new interconnection substation will split the existing Summer Shade – Green County 161 KV line into two lines on the transmission system. These two new lines will connect the new Liletown Road Substation to the existing Summer Shade and Green County substations.

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 (PCO) will be located at the Project Developer (PD) side of a 161 kV disconnect switch to be installed by EKPC at the interface between the PD-owned substation facilities and EKPC's substation facilities at the Liletown Road 161kV Substation. The switch shall be installed on a steel transmission line monopole structure located outside the substation fence. The exact location will be determined during project detailed design and EKPC will install, own, operate, and maintain the switch.

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:

- Main Power Transformer(s) (MPT), Generation step-up (GSU) transformer(s) or final transformation, as applicable.
- Circuit breakers and associated equipment located between the high side of the MPT(s) or GSU(s) and the Point of Change in Ownership
- Generator lead line from the Generating Facility to the Point of Change in Ownership
- Relay and protective equipment, telecommunications equipment, and Supervisory Control and Data Acquisition (SCADA) to comply with EKPC's Applicable Technical Requirements and Standards.

The proposed facility must meet EKPC's published facility connection requirements. The latest version of these requirements can be accessed via the following link:

https://www.pjm.com/planning/design-engineering/to-tech-standards/ekpc.aspx

Reference section 5.9 for inverter-based generating facilities.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AG1-354 project to the EKPC transmission system. These facilities shall be designed according to EKPC Applicable Technical Requirements and Standards. Once built, EKPC will own, operate, and maintain these Facilities.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

A 161 kV transmission line monopole dead-end structure and foundation outside the fence of the Interconnection Substation, to terminate the Project Developer's generator lead line will be considered Transmission Owner Interconnection Facilities (TOIF). A 161 kV 3-pole disconnect switch will also be mounted to this monopole dead-end structure serving as the PCO.

The TOIF will also include the line conductor from the dead-end structure to the bus position in the switchyard of the EKPC interconnection substation.

Installation of fiber cable circuits

EKPC shall use telecommunications equipment that matches its current network and equipment requirements.

Two 48-strand fiber-optic cables will be installed between the EKPC substation control house at Liletown Road substation and the PD facility for relaying, metering, and SCADA circuit requirements. The exact details and installation plans for this fiber will be developed during project scoping.

2. STAND ALONE NETWORK UPGRADES

Liletown Road 161 kV Interconnection Substation

A new 161 kV BAAH switching substation, Liletown Road, will be constructed along the Summer Shade – Green County 161 kV transmission line to interconnect the project with the EKPC transmission system.

Scope of Work

The major equipment and materials associated with the new Liletown Road substation is listed below:

QTY	Unit	DESCRIPTION
1	Each	161 kV Low Profile structure

5	Each	161 kV, 2000A, Circuit Breaker
11	Each	161 kV GOAB Switches
1	Lot	Electrical Material (insulators, terminals, etc.)
2	Each	Station Service Transformer, 161 kV, 1 PH
9	Each	Arresters, Lightning 276 kV Station 220 kV MCOV Polymer
3	Each	Metering CT's, 161 kV
9	Each	Line CCVT's, 161 kV
6	Each	Bus PT's, 161 kV

The PD shall be responsible for acquiring all property required for this new EKPC interconnection substation and shall deed that property to EKPC. EKPC will have no responsibility to acquire any property associated with the substation, either initially or if it is determined later that additional property is required.

System Protection

The following system protection scope of work applies for this project. All system protection equipment described in this section will be owned, operated, and maintained by EKPC.

Control House: EKPC shall procure and install a drop-in style control building fully furnished and complete with the relay panels described below, along with auxiliary AC, and two 125V DC battery banks, and all required operating equipment.

Relay Panels: EKPC shall install the following protection and control panels.

East Bus Differential Panel – EKPC shall install a standard bus panel complete with P1 SEL-587Z and P2 SEL-487B relays tripping P1 & P2 bus lock-out relays.

West Bus Differential Panel – EKPC shall install a standard bus panel complete with P1 SEL-587Z and P2 SEL-487B relays tripping P1 & P2 bus lock-out relays.

Bay #1 Control Panel – EKPC shall install a bay control panel with three SEL-451 relays, one for both line breakers and the tie breaker in the bay. The SEL-451 relays will be used for breaker control breaker failure, and reclosing.

Bay #2 Control Panel – EKPC shall install a bay control panel with three SEL-451 relays, one for the PD generator line breaker, a future line breaker and a tie breaker in the bay. The SEL-451 relays will be used for breaker control breaker failure, and reclosing.

Panel for protection of the Project Developer (PD) facility connection– EKPC shall install a standard line panel with P1 & P2 SEL-411L relays. Line relays shall utilize a line current differential protection scheme.

Line Panel for the Summer Shade 161kV Line Exit (19.4 miles) – EKPC shall install standard line panel with P1 & P2 SEL-411L relays for each line exit. The P1 & P2 relays shall utilize a Line Current Differential tripping scheme over fiber.

Line Panel for the Green County 161kV Line Exit (10.4 miles) – EKPC shall install standard line panel with P1 & P2 SEL-411L relays for each line exit. The P1 & P2 relays shall utilize a high-speed com-assisted tripping scheme over fiber.

SCADA Panel – EKPC shall install a standard SCADA panel with an Orion LX+ and dual metering for the PD. P1 Meter shall be an ION8650A, and P2 Meter shall be a SEL-735.

DFR Panel – EKPC shall install a fault recording panel with two SEL Axion 2240 I/O modules and a SEL-3555 RTAC unit.

EKPC requires the PD to utilize all Schweitzer Engineering Laboratories (SEL) relays and related protective equipment for facilities interconnecting or communicating with EKPC relaying. EKPC reserves the right to specify relays or other protective equipment utilized in the PD substation as required based on the protection schemes utilized. All protection system designs shall be reviewed by EKPC System Protection or its designer during the design phase to ensure proper clearing times, coordination, and compliance with applicable NERC regulations.

Control cables shall be pulled from new breakers and other required equipment to the control house.

Commissioning: Each relay panel shall be fully commissioned prior to being placed in service. Commissioning shall include AC current and potential circuits, DC functional, relay testing, SCADA alarms, and end-to-end testing where required.

3. NETWORK UPGRADES

Transmission Line Tie-in for new interconnection substation:

The EKPC Summer Shade – Green County 161 kV line will be cut and looped into the new interconnection substation.

The new transmission line loop-in facilities will be owned, operated, and maintained by EKPC. The tap from the existing transmission line into the new switching station will consist of two (2) direct embed guyed steel 3-pole dead-end structures. All existing wire or structures on the Summer Shade – Green County line in between the two tie-in structures will be removed. Each end of the tie-in is assumed to extend no longer than 150 feet.

Upgrades to neighboring facilities:

Summer Shade Substation

Relay settings shall be reviewed for the Summer Shade – Green County 161 kV line to accommodate the new Liletown Road substation, and relay files will be updated accordingly. New modern SEL-411L relays shall be installed for communication with Liletown Road substation.

Green County Substation

Relay settings shall be reviewed for the Summer Shade – Green County 161 kV line to accommodate the new Liletown Road substation, and relay files will be updated accordingly. New modern SEL-411L relays shall be installed for communication with Liletown Road substation.

Installation of fiber cable circuits:

Overhead optical ground wire (“OPGW”) installation will be required to meet communications requirements for the new EKPC Liletown Road Substation. New OPGW will need to be installed on the Summer Shade - Liletown and the Liletown – Green County 161 kV line sections (a total of approximately 29.8 miles).

4. OTHER SCOPE OF WORK

No other scope has been identified for the construction of the Liletown Road substation.

5. MILESTONE SCHEDULE FOR COMPLETION OF EKPC WORK

Facilities outlined in this report are estimated to take 51 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, and the ability to obtain outages to construct and test the proposed facilities.

Description	Start month	Finish month
Detailed Design	1	12
Procurement	2	40
Construction	39	51

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

Transmission Line Assumption:

1. The new substation will be constructed on the west side of EKPC's line right-of-way. This estimate will need to be re-evaluated if it is located on the east side of the right-of-way.
2. The PD is responsible for either providing deeded property or obtaining any new ROW/easements on behalf of EKPC for routing the looped-in transmission line to the new substation.
3. Any required tree / vegetation clearing for the new substation and the transmission line loop-in work will be the responsibility of the PD.
4. It is assumed that standard drilled piers can be used. If geotechnical assessment reveals poor soil conditions or contamination, additional measures may be required.
5. Required transmission line outages can be scheduled as planned. Transmission line outages are:
    a. typically, not taken in the summer (June-August) or winter (December-February),
    b. cancelled during extreme weather conditions, and
    c. In some cases, required to be scheduled twelve (12) or more months in advance.
6. No delays due to equipment or material delivery, environmental, regulatory, permitting, real estate, extreme weather, or similar events.
7. No significant sub-surface rock is encountered during construction, and soil conditions are suitable for standard foundation installations.
8. No structure replacements are required for the installation of fiber circuits.
9. All outages required for installation of fiber circuits will be able to be taken.

The following engineering assumptions have been included for the transmission line information.

provided:

1. Neither foundation nor transmission pole structural analyses have been performed. The information provided assumes that no significant foundation or structural issues are present.
2. Construction will be scheduled to avoid winter peak load periods (December -February).
3. The preliminary schedule assumes that transmission line outages can be obtained as necessary.

4. Material and equipment costs are based on current pricing at the time of this study.
5. Environmental permits and reviews shall be completed by EKPC and can be completed in a timely manner.

Substation & System Protection Assumptions:

The following general assumptions have been included for the substation information provided:

1. No delays due to equipment or material delivery, environmental, regulatory, permitting, property/easement acquisitions, extreme weather, or similar events.
2. No significant sub-surface rock encountered during construction, and soil conditions are suitable for standard ground-grid and foundation installations.
3. PD shall acquire an adequate and suitable site and grant ownership to EKPC to accommodate EKPC's interconnection substation, as mentioned above.
4. The PD will provide all necessary easements for a permanent road to provide substation access. This substation access shall be from an existing county or state road. The IC will convey these rights to EKPC if they own the property on which the substation access road will be located. Otherwise, EKPC will need to acquire the access rights from the owner of the property.

The following engineering assumptions have been included for the substation information provided:

1. Neither foundation nor structural analyses have been performed. Information provided assumes that no significant foundation or structural issues are present.
2. The schedule assumes no issues related to scheduling outages of existing transmission lines to terminate into the new substation.
3. Material and equipment-related costs are based on current pricing at the time of this study.
4. Environmental permits and reviews will be completed by EKPC and can be completed in a timely manner.
5. No relay coordination issues exist outside of the remote end stations. Further coordination will be studied during detailed design.

Metering Assumptions:

The following assumptions have been included for the metering information provided:

1. No delays due to equipment or material delivery, environmental, regulatory, permitting, real estate, extreme weather, or similar events.
2. Fiber-optic cable and associated equipment installation is completed as scheduled.
3. Material and equipment-related costs are based on current pricing at the time of this study.
4. Once fiber-optic cable installation is complete, the fiber will not be damaged.

Communications Assumptions:

The following assumptions have been included for the telecommunications information provided:

1. No delays due to equipment or material delivery, environmental, regulatory, permitting, real estate, extreme weather, or similar events.
2. Material and equipment-related costs are based on current pricing at the time of this study.
3. Once fiber-optic cable installation is complete, the fiber will not be damaged.

7. REVENUE METERING REQUIREMENTS

All metering needed for this interconnection project must meet the metering requirements stated in Appendix 2, section 8 of the AG1-354 GIA, and in PJM Manuals M01 and M14D. The details of applicable revenue metering requirements are given in EKPC's Facility Connection Requirements Document posted on the PJM website.

The revenue metering will be installed on the EKPC side of the PCO, and will be, owned and maintained by EKPC. Metering requirements for this facility include the installation of EKPC's standard revenue quality metering package, including potential transformers and current transformers.

The cost for installation of the metering facilities contained in the new EKPC substation are included in the substation costs provided.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

Land requirements for the Interconnection Substation needed for this interconnection project must meet the requirements in the EKPC Facility Connection Requirements Document posted on the PJM website. The PD shall be responsible for acquiring all property required for this new EKPC interconnection substation and shall deed that property to EKPC. EKPC will have no responsibility to acquire any property associated with the substation, either initially or if it is determined later that additional property is required.

9. ENVIRONMENTAL AND PERMITING

EKPC or its representative will perform all necessary environmental assessments and obtain all necessary permits/approvals associated with construction of all EKPC facilities required to facilitate the interconnection of the new generating facility. This includes the Storm-water Pollution Prevention Plan ("SWPPP"), obtaining KYR 10 storm-water permit, and conducting the necessary SWPPP inspections prior to all construction activities.

C. APPENDICES

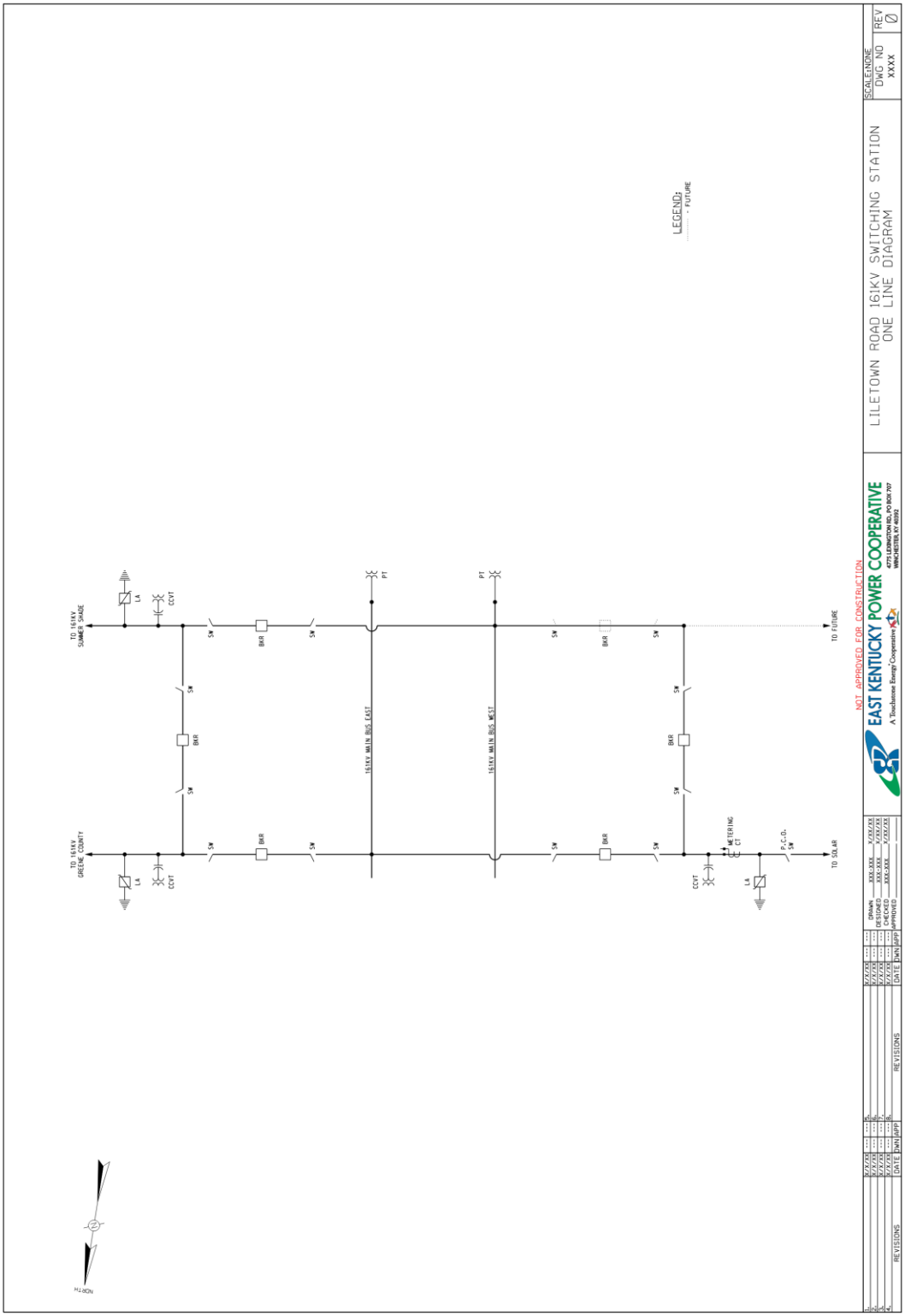
Attachment #1: Conceptual Single line Diagram

Attachment #2: Substation General Arrangement

Attachment #3: Preliminary Site Layout Plan

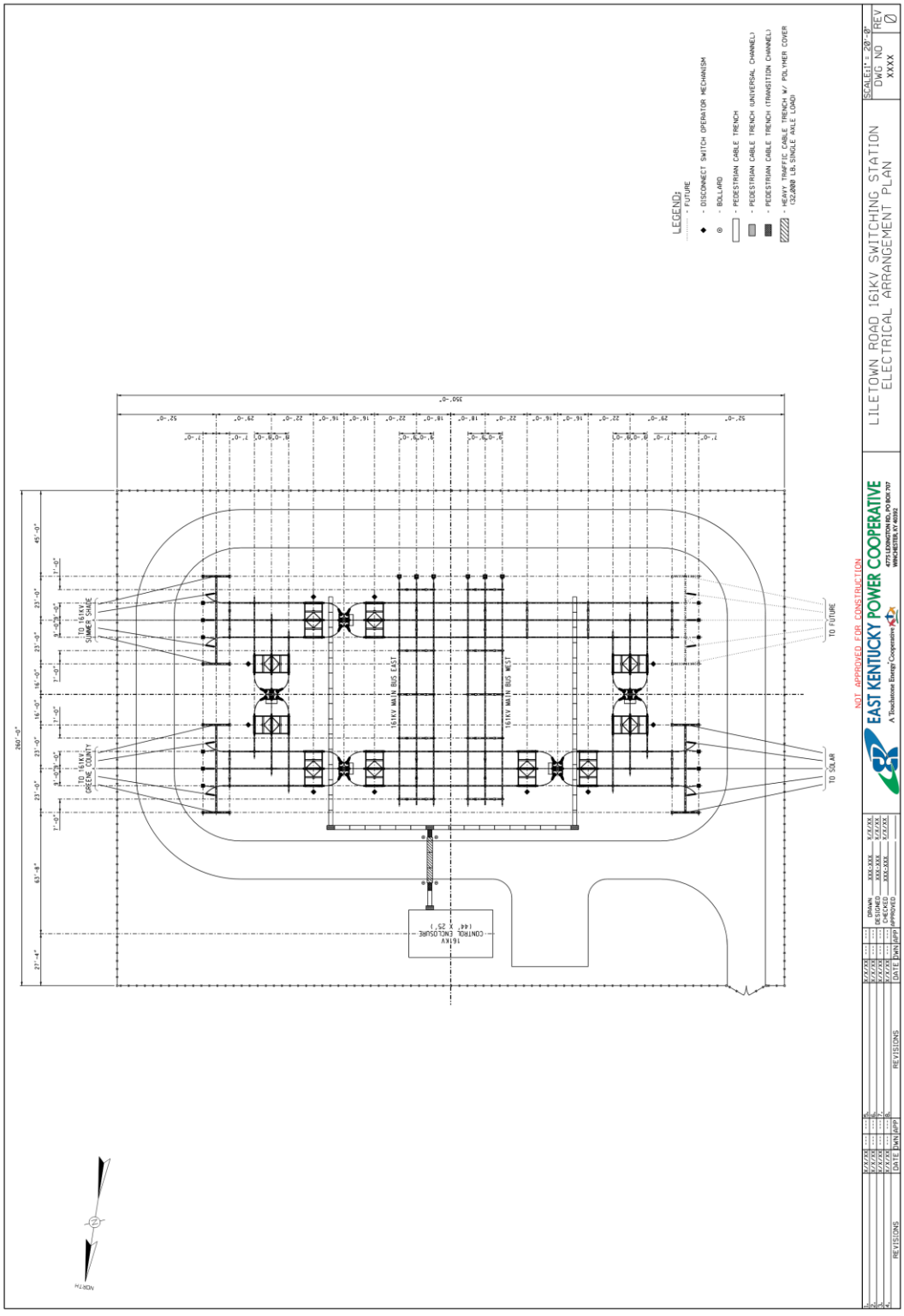
Attachment 1:

Conceptual One Line Diagram



Attachment 2:

Substation General Arrangement



Attachment 3:

Preliminary Site Layout Plan