ENUGU ELECTRICITY DISTRIBUTION COMPANY

ASSET REGISTRATION AND CUSTOMER ENUMERATION PROJECT

Enumerators' Training & Orientation Manual

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EEDC ENUGU CHQ

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DEFINITION OF TERMS

- **EEDC:** Acronym for Enugu Electricity Distribution Company. The Electricity Distribution Company serving South-East Nigeria.

- **GIS:** Acronym for Geographic Information System. An information system including people and processes that integrate, stores, edits, analyzes, shares, and displays geographic information and proffer solutions based on geographic information.

- **NERC:** Acronym for Nigerian Electricity Regulatory Commission. The Regulatory body for the Electricity Power Sector in Nigeria

- **CIN:** Acronym for Customer Indexation Number (Nomenclature). A unique identification Number for Electricity Customers in Nigeria to be produced after the Customer Enumeration Exercise.

- **ASSET REGISTRATION:** The activities involved in the collection and cataloging of data relating to Electricity Distribution Assets.

- **CUSTOMER ENUMERATION:** The activities involved in the collection of data and enumeration of Electricity Customers in Nigeria as directed by NERC.

- **ISO 19157:** International Quality Standard for Geospatial Data issued by the International Standards Organization (ISO).

- **GIS CLOUD:** A Collaborative Mapping Platform created by GIS Cloud Ltd - a London-based company with the capabilities that allow for the seamless collection of data on the field, monitoring, off-field management, and synchronization. GIS Cloud platform will be utilized for the EEDC GIS-enabled Asset Registration and Customer Enumeration.

- **MDC:** Acronym for Mobile Data Collection. A GIS-enabled Mobile Data Collection Application for Smart-phones (Android and IOS) developed by GIS Cloud Ltd.

- **TRANSMISSION SUBSTATION:** A station in the Electricity Transmission and Distribution Chain with infrastructures that converts electricity into two transmission voltages. There are two main types of Transmission Substation in Nigeria; 330KV/132KV Substation steps down transmission voltage from 330KV (from Generation source) to 132KV and 132KV/33KV Substation steps down transmission voltage from 132KV to 33KV.

- **INJECTION SUBSTATION:** A Station in the Electricity Distribution Chain with infrastructures that steps down electricity from 33KV to 11KV.

SECTION 1: PURPOSE OF THE MANUAL

1.1 INTRODUCTION

Nigerian Electricity Regulatory Commission in exercising its constitutional powers directed all Electricity Distribution companies in Nigeria to enumerate electricity customers within its network.

This manual presents and explains the technical procedures and operational standard of Enugu Electricity Distribution Company's GIS-enabled Asset Registration and Customer Enumeration Project based on NERC Guidelines and procedures for Customer enumeration of March 2016.

1.2 OBJECTIVES OF THE MANUAL

This enumerator training and orientation manual are guided by the following objectives:

I. To orientate Enumerator and field workers on the technical and operational standards required during the EEDC Assets Registration and Customer Enumeration project;

II. To ensure the understanding of Electricity distribution system so as to enable the effective collection of data in line with required standards;

III. To present the project procedures and processes in reference to data collection, data quality management, coding, and tagging structure;

IV. To present safety rules and guidelines that will be observed during the EEDC Assets Registration and Customer Enumeration project in line with Industry based HSE standards;

V. To present security tips, practices and procedures to be inculcated during the EEDC Assets Registration and Customer Enumeration Project.

1.3 PROJECT QUALITY MANAGEMENT

The data quality standard for the Enugu Electricity Distribution Company (EEDC) GIS-enabled Asset Registration and Customer Enumeration Project is based on NERC guideline and procedures for Distribution Licensees Customer Enumeration (March 2016) and International best practices on Geospatial data quality as defined by ISO 19157:2013.

Data quality management during data collection, transformation, transmission and storage for the project will be based on and certified by these standards and regulation as issued by Nigerian Electricity Regulation Commission (NERC) and International Standard Organization (ISO).

SECTION 2: ENUGU ELECTRICITY DISTRIBUTION COMPANY (EEDC)

2.1 COMPANY BACKGROUND

Figure 1: EEDC Coverage State

The Electric Power Sector Reform Act 2005 (Act No. 6 of 2005) unbundled the Power Holding Company of Nigeria (PHCN) into 11 Distribution companies, 1 Transmission Company, and 6 Generation companies giving birth to Enugu Electricity Distribution Company (EEDC).

Enugu Electricity Distribution Company (EEDC) is licensed to distribute and market Electricity in the five (5) South Eastern States of Nigeria, namely; Abia, Anambra, Ebonyi, Enugu, and Imo State. This license includes the management of Electricity distribution assets and facilities as well as Electricity Customers within these listed States.

Customers in the Five States which EEDC covers are served by its 18 districts and over 150 service centers with the headquarter located in Enugu, Enugu State. Enugu Electricity Distribution Company also manages 61 Injection Substations and several thousand distribution substations which form part of its electricity network infrastructure.

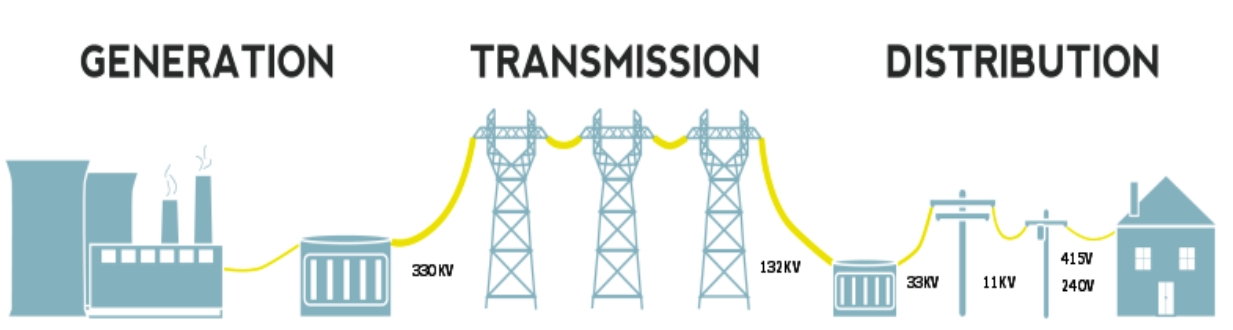
2.2 CORE VALUES

Enugu Electricity Distribution Company (EEDC) stands on three pillars known as the company core values, namely **Integrity, Customer Service,** and **Performance.**

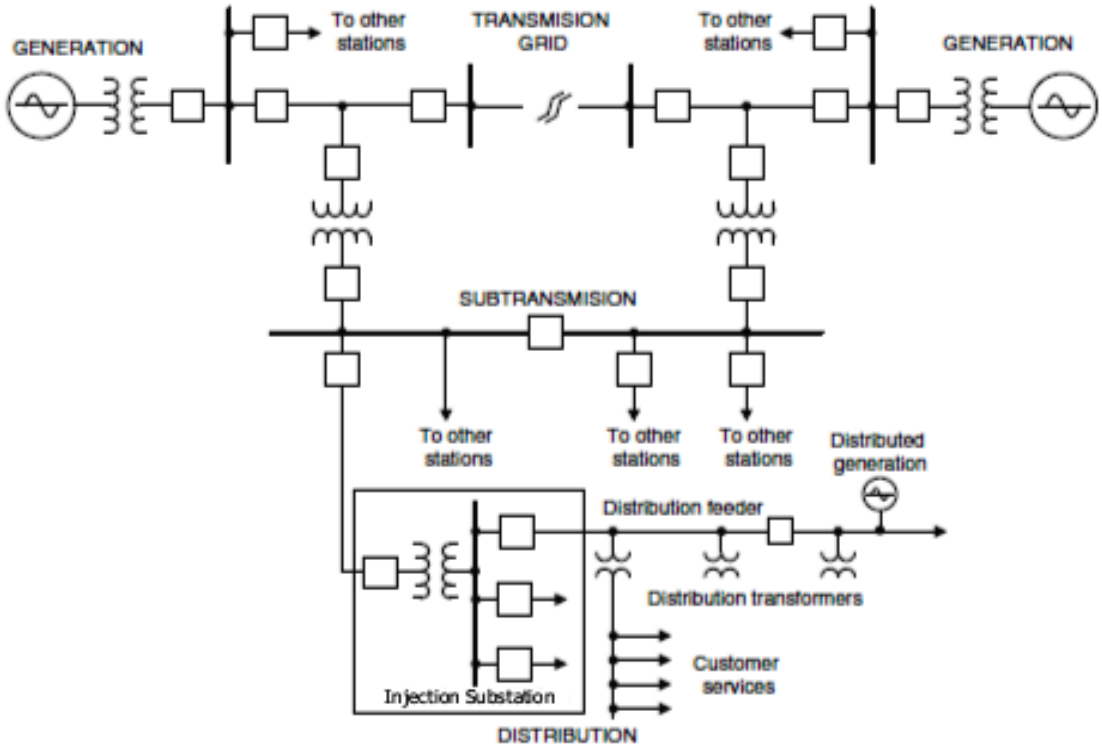
SECTION 3: UNDERSTANDING ELECTRICITY DISTRIBUTION SYSTEM

3.1 ELECTRICITY DELIVERY PROCESS

The Delivery of Electricity for public use is divided into three stages: Generation, Transmission, and Distribution.



After Electricity is generated (either by Hydro, Coal, Gas, Nuclear, Biogas, Wind or Solar) and moved along high-voltage transmission lines (330KV powerline), It comes off first at the transmission substation where it is reduced by stepped down Transformers to 132KV for onward re-transmission and then at Sub-Transmission Substations (also referred to as Transmission Substation) where it is further stepped down to 33KV for Distribution.



Electricity Distribution is the final stage in electricity delivery, at this stage electricity is moved from the transmission system to individual consumers. Electricity Distribution starts from the Medium Voltage 33KV output from the sub-transmission substation distributed through High Tensioned Distribution Feeder Lines which are either served to Industrial Consumers, distributed to long distance rural areas or are further stepped down to 11KV at Injection Substations and redistributed through High Tensioned Distribution Feeder Lines in Urban Neighborhoods. The High tensioned Distribution Feeder Lines serve Distribution Substation which has transformers with the capabilities to step down electric power from Medium Voltage to Low Voltage (415V). Low Voltage electricity is distributed through Low Tensioned distribution Wires which deliver electricity to the final consumers via their service wires (service drops).

3.2 ELECTRICITY DISTRIBUTION ASSETS

The Electricity Distribution System involves the interaction of various electrical equipment at various point in the chain of electricity distribution from the Transmission system to the final consumers. This equipment and the point of their location and function are regarded as Electricity Distribution Assets.

Electricity Distribution assets are categorized by their point of function. They include;

- Injection Substation and related assets
- Feeder Lines and related assets
- Distribution Substation and related assets
- Distributor Lines and related assets
- Service Wire/point

3.2.1 INJECTION SUBSTATION

Injection Substation operates at a Voltage level of 33KV coming from the sub-transmission substation. The 33KV medium voltage is stepped down to 11KV medium voltage for onward re-distribution especially in urban areas.

In the Injection Substation switchyard, various equipment interacts to aid in the effective conversion and redistribution of the incoming voltage. Injection Substation switchyard consists of several bays. Each bay has its own functions and equipment;

- *The Incoming feeder bay* is where the incoming 33KV feeder lands and is controlled within the substation transmission system. Each incoming 33KV feeder line has its own Feeder bay with its own equipment such as circuit breakers, voltage Transformers, Earth Switch, Isolators. The Bus Bar (section) links several feeder bays in the Substation switchyard.

- *The Transformer bay* houses the power transformer and other equipment such as current Transformers, line isolators, lightning arrestors that aid the step-down of voltage. Each Power Transformers in the Substation switchyard has its own bay.

- *The Outgoing feeder bay* is where the outgoing 11KV is distributed. In most cases, the Outgoing feeder bay is housed in the Substation Control Building with equipment linked to a transformer bay in the substation transmission system. There exists the bus section linking two Outgoing feeder bays.

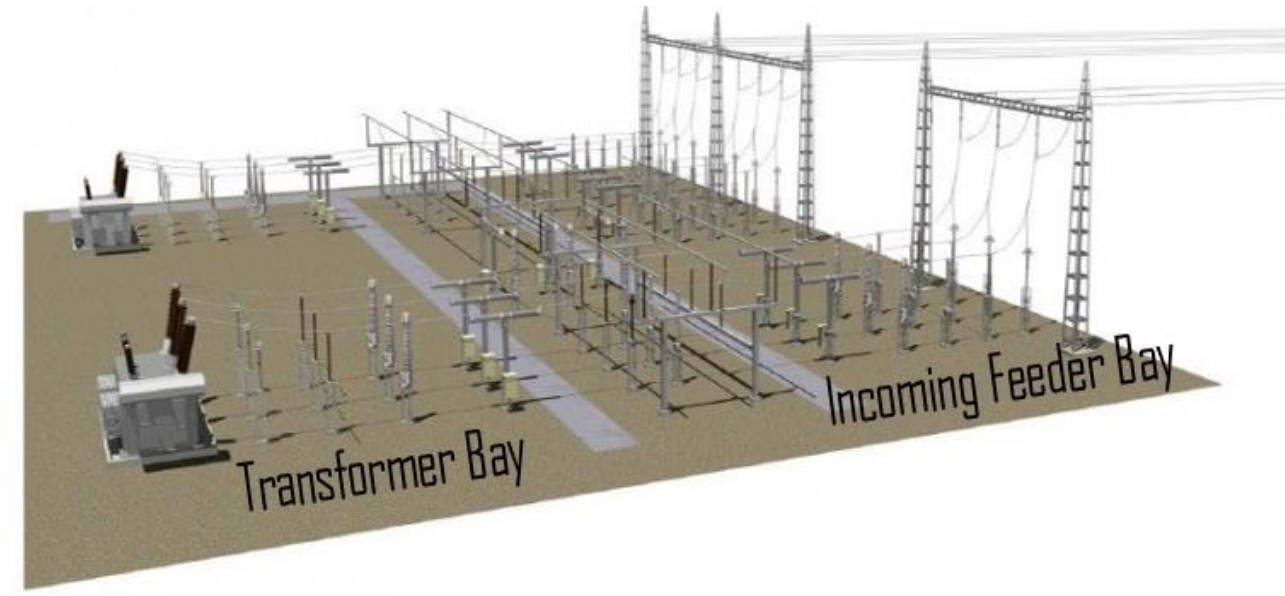


Figure 2: Injection Substation Switchyard

In the substation switchyard, it is normal practice for a specific Incoming feeder bay to serve a specific transformer bay which also serves specific outgoing feeder bay. However, the bus sections allow for the interoperability of the feeder bays. It is in this way that the bays in the substation are linked.

The single line diagram of the injection substation below presents the structure and arrangement of the equipment in the Injection substation.

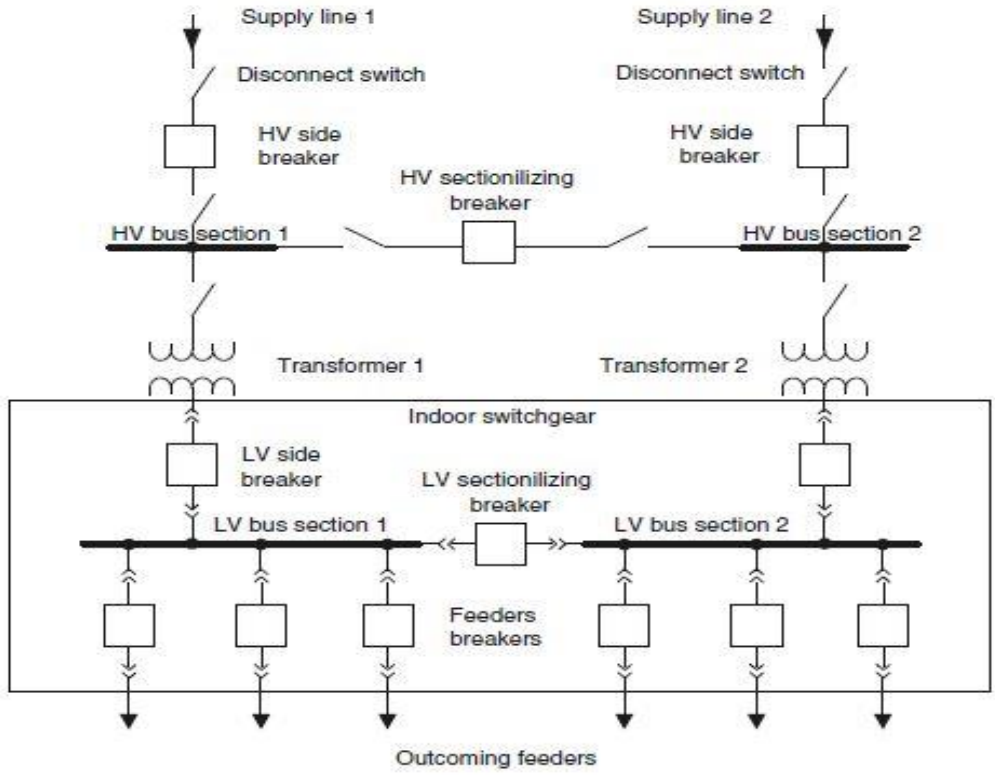


Figure 3: Single Line Diagram of Injection Substation

3.2.1.1 LINE SWITCH (ISOLATOR)

Line switch isolators are used to provide visible disconnect to enable safe access to the isolated equipment. In a substation switchyard, Line Isolator is used to physically disconnect any incoming HV lines to allow work on the transmission line to be performed. Usually, there are more than one Line isolators in an Injection Substation switchyard at least two of which are found in the Incoming feeder bay and one in the transformer bay.

The Line switch voltage rating is similar to that of the incoming feeder line which for injection substations is 33KV.

3.2.1.2 EARTH SWITCH

Earth switch is used to discharge voltage on the circuit to the earth for safety. They are usually mounted on the frame of isolators and used with isolator. When the isolator is in Open condition, the earth switch is closed, and voltage passes through the earth switch to the ground. When line isolator is closed, the earth switch is opened.

Earth switch are in same positions as the line isolators. The Voltage of the Earth switch is the same as the voltage of the circuit passing through it.

3.2.1.3 CURRENT TRANSFORMER

This is a type of instrument transformer used for the measuring of alternating current (AC) and monitoring of operation in the power grid. Current Transformers transform current from a high value to low value allowing currents to be measured easily. The transformation of current is usually in proportion to the primary current.

The CT ratio is the ratio of the primary line to the secondary line. A CT ratio of 100/5A means the primary line current is 100A while the secondary line current is 5A.

3.2.1.4 POTENTIAL (VOLTAGE) TRANSFORMER

Voltage Transformer is another type of instrument transformer used in transforming voltage from a high value to low value for relay and measuring equipment. They insulatethe metering circuit from the primary high voltage system.

The Voltage ratio of the potential transformer is the ratio of its primary line to the secondary line and different from the voltage ratio of the power transformer in the injection substation.

3.2.1.5 BUS BAR (BUS)

Bus Bar is a thick strip or a group of strips of Copper or aluminum conductors supported on an insulator such as porcelain. They are used to carry currents, collecting from incoming feeders and to distributing to outgoing feeders or other multiple devices such as Transformers.

In the Substation switchyard, the Bus separates the Feeder bay and the Transformer bay and links two feeder bays allowing for switching of current if there is a fault. The Busbar has its rated current and exists in different types depending on the arrangement of the Bus.

3.2.1.6 OUTDOOR CIRCUIT BREAKER (OCB)

The Outdoor Circuit breaker protects equipment and control circuits in the Injection substation. It protects equipment from damages in the substation transmission system due to overloading (excessive currents not due to faults), transformer faults, or short circuits.

The OCB functions like an automatic switch and trips off to protect the equipment. It functions within its rated current. They are classified by the medium used in extinguishing their arc which may be oil (Bulk or minimum), Air, Vacuum or Gas (SF6).

3.2.1.7 LIGHTNING ARRESTOR

Lightning Arrestor is used to protect the conductors and equipment in the substation from the damaging effects of Lightning. The Lightning arrestors typically consist of a high voltage terminal which traps current surge on Feeder lines due to Lightning and a ground terminal which diverts the surge to the earth.

Lightning arrestors are found close to the transformer in the transformer bay. It may exist also in the incoming feeder bay.

3.2.1.8 POWER TRANSFORMER

Power Transformer is the most crucial equipment in the Injection substation performing the function of stepping down line voltage from incoming line feeder to that of outgoing line feeder.

Power Transformers found in Injection and Transmission substations differ from Distribution Transformers due to their capacity. Power Transformers used for high voltage transmission stepping down or stepping up voltages and are rated in MegaVolt-Ampere (MVA) while distribution Transformers are used for lower voltage distribution and are rated in KiloVolt-Ampere (KVA).

The Voltage ratio (33KV/11KV) of a Power Transformer is governed by the sub-transmission (primary voltage) and distribution voltage level (secondary voltage) of the substation. The nameplate of the Power Transformer contains details of other key attributes of the transformer such as core types and the other key ratings of the transformer.

3.2.1.9 CABLE

Electricity is usually transmitted and distributed via a network of wires and cables[1]. These cables vary depending on size, number of cores, conductor material, and insulator material.

The cables referred as part of the assets to be captured during the Asset registration are the cables connected to the power transformers at the Injection Substation. Transformer cables are usually armored cables. They may be single core or three cores and responsible

[1] A **wire** is a single conductor (material most commonly being copper or aluminum) while **cable** is two or more insulated **wires** wrapped in one jacket.

for bringing higher voltage electricity to the power transformer (incoming) while also redistributed lower voltage electricity from the power transformer (outgoing). Transformer cables vary in sizes but the minimum size standard allowed is 70mm^2.

Figure 4: Single Core vs Three Cores

Cable joints are used to connect cables to transformers at terminal point. There are two main types of cable joint: The Straight-Through Joint and Marriage Joint.

Figure 5: Marriage Joint

Figure 6: Straight-Through Joint

3.2.1.10 INDOOR CIRCUIT BREAKER

Like the Outdoor Circuit Breaker, the Indoor Circuit Breaker controls circuit in the injection substation protecting equipment. The Indoor Circuit Breaker control circuit distribution between the power transformer and the outgoing feeder lines.

The Indoor Circuit Breaker component in the Injection Substation is made up of the following distinct but aggregated equipment.

- INCOMER PANEL: This controls the voltage coming from the Power Transformer

- OUTGOING PANEL: Which controls the voltage distributed to the Outgoing Feeder.
- BUS SECTION: Which links the outgoing panels of the Feeders and also connects two Indoor Circuit Breaker.

The Indoor Circuit breaker is a component of the Outgoing Feeder Bay.

3.2.1.11 TRANSFORMER CONTROL PANEL

The Transformer control panel monitors performance level and provides protection to the Power Transformer in the Injection Substation. It is one of the Indoor equipment in the Injection Substation and mostly found in the Control Building.

Each Transformer in the Injection Substation has its own Control Panel.

3.2.1.12 LINE CONTROL PANEL

The Line Control panel is a switch/relay system that controls the incoming feeder line in the Injection Substation. It is also used for monitoring line performance and in detecting line faults. Each 33KV Feeder Line coming into the Injection Substation has its own Control Panel

3.2.1.13 CAPACITOR BANK

The Capacitor Bank is a grouping of several identical Capacitors interconnected in series or parallel. These Capacitors store electric energy and aid the maintenance of a stable electrical power factor by compensating the reactive power of the equipment and systems in the distribution substation.

3.2.1.14 TRIPPING UNIT

Tripping Unit is a unit of interconnected batteries which supplies DC current required in the injection substation for the protection and tripping of power distribution equipment.

The tripping unit comprises an inverter and a battery bank.

3.2.2 FEEDERS

Feeders[2] are line network of high tensioned cable carrying medium voltage (11kv or 33kv) from Injection Substation or sub-transmission substations to distribution transformers and injection substation.

Feeder Lines are supported either by Poles (wooden, steel or concrete) or by towers. A typical feeder support has an insulator[3] which holds the line firmly while providing insulation to the support system. Feeder support insulators are of three types (pin, disc, shackles).

Figure 7: Insulators

For feeder poles, the support system also includes cross-arms (Wooden or Steel), tie strap and base support wire (with Strain Insulator).

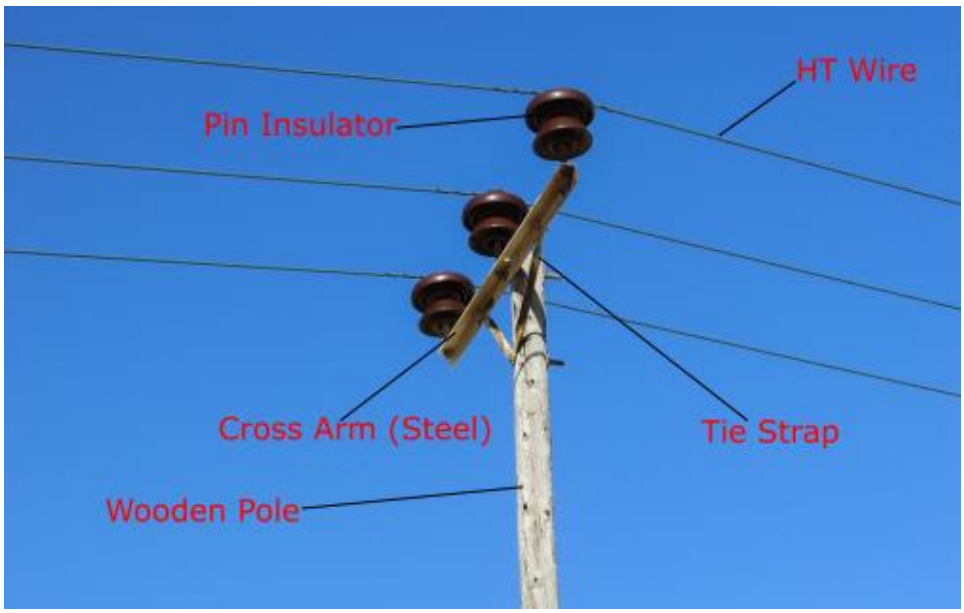


Figure 8: HT Pole Structure

[2] Sub-Feeders are feeders that are not directly connected to sub-transmission substation power transformer. They are connected to a direct feeder (main feeder) as a sectionalized/boosted extension of the main feeder.

[3] 33kv lines and 11kv lines are differentiated by the number of insulator rings. Typically, there are less than three insulator rings for 11kv lines and three or more rings for 33kv lines.

3.2.3 RING MAIN UNIT

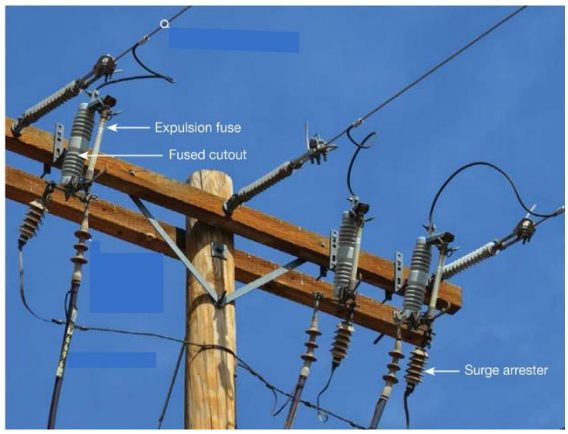
Ring Main Unit (RMU) is an 11KV or 33Kv panel having a totally sealed, gas insulated switchgear unit. The Switchgear unit usually has three switches - Two for incoming and one for outgoing. The Ring Main Unit enables consumers to use two sources of HT Power at the same metering point. They are outdoor equipment mostly found at strategic places along Feeder Line networks. The Ring Main Unit is also used to control faults along feeder line networks.

3.2.4 DISTRIBUTION SUBSTATION (DSS)

Distribution Substations connects to the transmission/sub-transmission network via the primary feeder, receives electric energy at a distributed voltage level[4], steps down the electricity to a lower (service) voltage level through the Distribution Transformer and distribute the electric energy to industrial and residential consumers.

Distribution Substations are usually small in landmass than the Injection substation and the Transmission Substations. Like the Injection substation, the DSS also has several assets that enable the stepping down of electrical voltage. These include:

3.2.4.1 SUBSTATION GANTRY



Incoming Electric energy from the feeder line comes into the Distribution Substation through the substation gantry. The substation gantry is usually a twin pole structure along feeder line that connects to the Distribution substation. The Substation Gantry has several electricity distribution equipment that enables it to connect to the network, manage connection and supply to the Distribution Transformer. This equipment include:

- **Lightning arrestor**: This is placed on the top of the cross-arm on the substation gantry. The lightning arrestor performs the function of protecting the conductors and instruments in the Distribution substation from the damaging effect of lightning.
- **Gang Isolator:** Performs the function in the DSS like that of the line isolator in the Injection substation.

[4] Voltage Level is the level of incoming voltage a station or consumer uses. Voltage levels varies depending on the station/consumer. The voltage level for sub-transmission and injection substation are 132KV and 33KV respectively. For DSS, its 33KV, 11KV or 6.6KV while for consumers voltage levels are 33KV, 11KV or 6.6KV (for industrial consumers) and 415V or 220V for Residential Consumers.

- **Drop-Out Fuse:** This is a combination of a fuse and a switch, used in primary feeder lines to protect distribution transformers from current surges and overloads.

3.2.4.2 DISTRIBUTION TRANSFORMER

The Distribution Transformer is the most important electrical asset in the Distribution Substation. It is the device responsible for the stepping down of the electrical voltage to the level required by the consumer. The voltage ratio of the Transformer is the ratio of the incoming voltage level and the outgoing voltage level. Distribution Transformers vary in capacity measured in KVA.

Distribution Transformer may be pole mounted or grounded.

3.2.4.3 FEEDER PILLAR

Feeder Pillar is a cabinet-like electrical equipment mounted close to the Distribution Transformer used to control electricity supply to the neighborhood served by the Transformer. Inside the Feeder Pillar are fuses which control the electrical supply. The number of fuse partition in the Feeder Pillar usually denotes the number of supply network group (upriser) served by the transformer.

3.2.5 UPRISER & DISTRIBUTORS

Distributors (Upriser network) are secondary distribution low voltage lines emanating from Distribution substations supplying electricity to a neighborhood. Distributors supplying electricity to a given neighborhood belong to a supply network group from their Distribution Transformer served by an Upriser cable (hence, the name Upriser network).

Upriser Network consists of four Low Tensioned wire (Three phase, one neutral) of 0.415KV Voltage level supported by Low Tension Poles.

3.2.6 SERVICE WIRE (SERVICE DROPS)

Consumers in a neighborhood are connected to the distributor network through their service wires also known as service drops. A service wire emanates from the low-tension pole to the consumer's metering point.

SECTION 4: ASSET REGISTRATION AND CUSTOMER ENUMERATION PROJECT

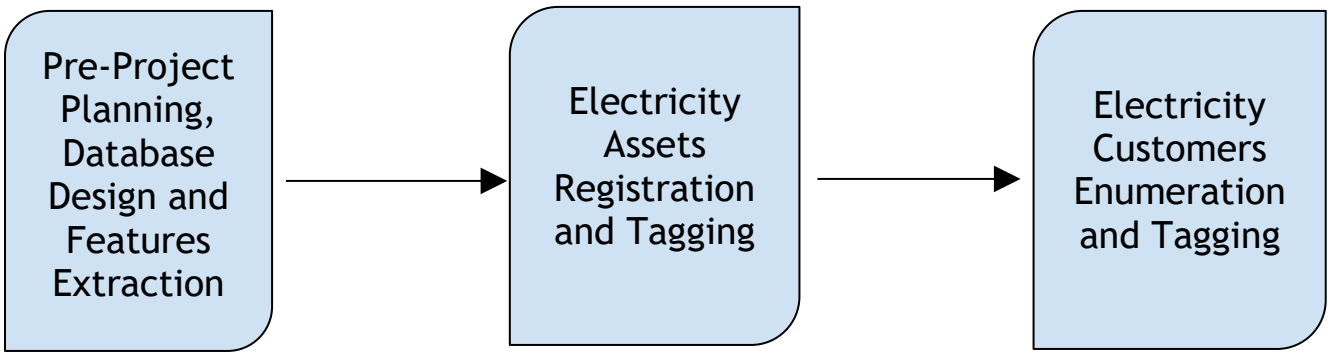
4.1 PROJECT BACKGROUND

Nigerian Electricity Regulatory Commission (NERC) directed all Electricity Distribution Company to carry out an enumeration exercise of electricity customers in their areas of coverage. The aim of this exercise is to create a uniform database of electricity customers across the country; uniquely identify electricity customers using the numeric-based Customer Indexation Nomenclature (CIN) and to enable the linking of customers to electricity assets serving them through the specified coding format of the CIN.

Enugu Electricity Distribution Company's GIS-enabled Asset Registration and Customer Enumeration Project is carried out in fulfillment of this directive and in line with the provisions of the Guidelines and Procedures as issued by NERC. The GIS approach is adopted not only to fulfill to the optimum the directive on Customer enumeration but also to build efficiency in Electricity Distribution System operations and Management in line with Global best practices.

Geographic Information System (GIS) is proven to be an effective tool and process in electricity distribution system management and operation. Using GPS-enabled Data Capturing devices, the location and thematic attributes of electricity distribution assets and customers will be captured during this project allowing for the spatial linking of assets to assets and assets to customers as well as the spatiotemporal visualization of assets and customers on the Map.

The EEDC GIS-enabled Asset Registration and Customer Enumeration Project is to be carried out in three phases presented below.



At this time, Feeder asset mapping and feature extraction have been concluded across EEDC coverage area. Customer enumeration has been concluded in two districts (Abakpa and Ogui in Enugu state) and ongoing concurrently in three states.

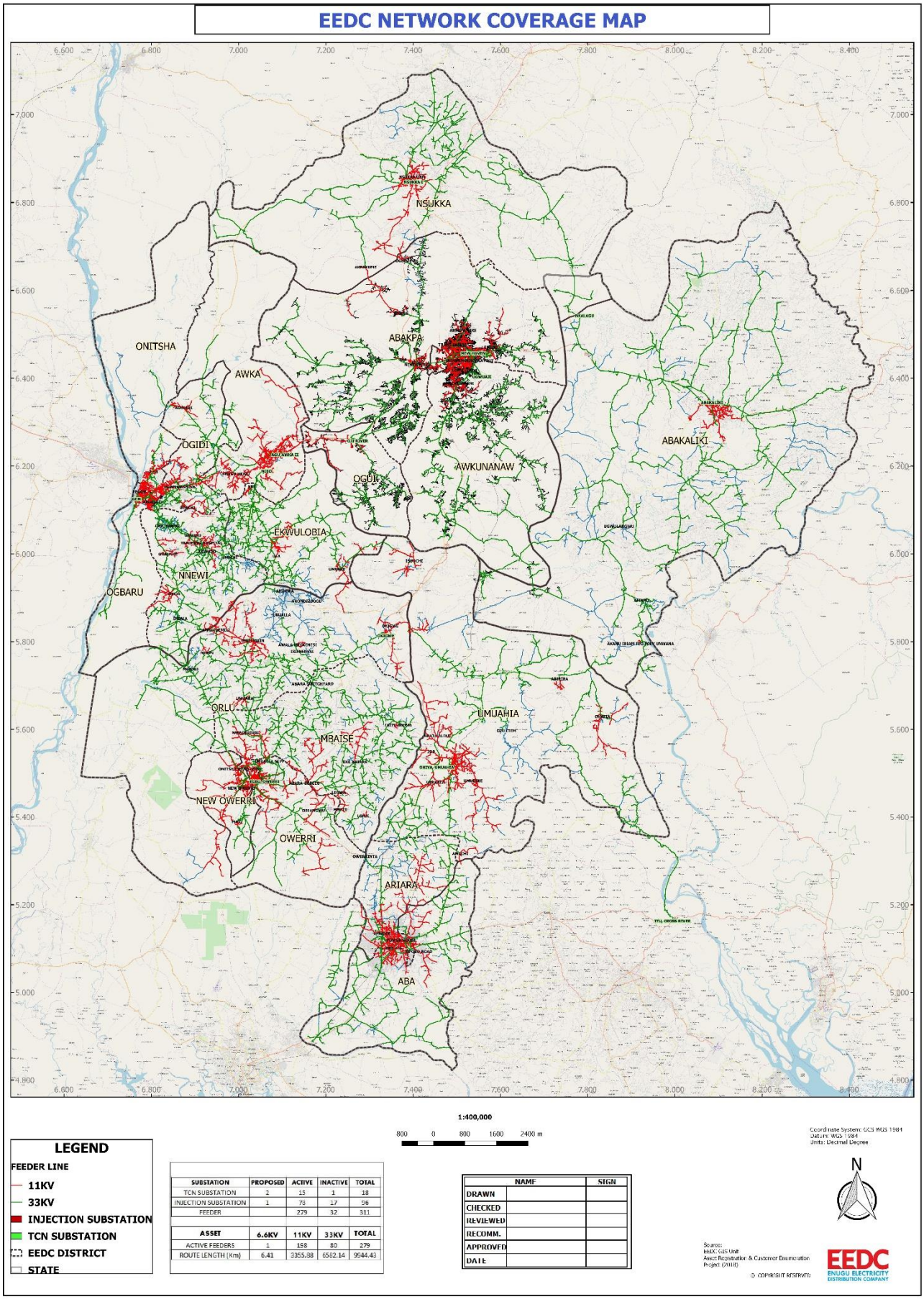


Figure 9: EEDC Network Coverage Map

4.2 ASSET REGISTRATION

Asset registration involves the collection of geometry and attributes information of electricity assets within EEDC coverage area. This is the first stage of the Data Collection process. The assets to be collected and coded include:

1. 132KV/33KV Transmission Substation
    a. Power Transformer
2. 33KV/11KV Injection Substation
    a. Power Transformer
    b. Outdoor Circuit Breaker
    c. Transformer Control Panel
    d. Line Control Panel
    e. Indoor Circuit Breaker
        i. Incomer Panel
        ii. Outgoing Panel
        iii. Bus Section
    f. Line Switch/Isolator
    g. Cable
    h. Capacitor Bank
    i. Earth Switch
    j. Bus Bar
    k. Current Transformer
    l. Potential (Voltage) Transformer
    m. Lightning Arrestor
    n. Tripping Unit
3. 33KV Feeder Pole (High Tension Pole)
4. 11KV Feeder Pole (High Tension Pole)
5. Ring Main Unit (RMU)
6. Distribution Substation
    a. Distribution Transformer
    b. Substation Gantry
        i. Lightning Arrestor
        ii. Drop out Fuse
        iii. Gang Isolator
    c. Cable
    d. Feeder Pillar
    e. Fuse
7. 0.415KV Pole (Low Tension Pole)

4.2.1 ASSET CODING

At the end of the Asset registration exercise, assets will be uniquely identified and coded. The procedure for coding the assets especially those that make up the 24-digit Customer Indexation Number have been defined by Nigerian Electricity Regulatory Commission's Guideline for Customer Enumeration. The asset component of the Customer Indexation Number (CIN) is presented below.

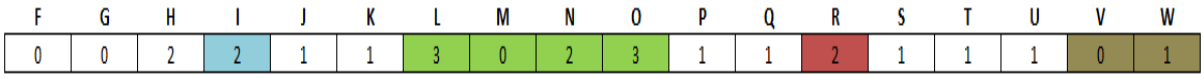


Figure 10: Asset Code Component of the CIN

The Table below presents the coding structure for each of the assets based on coding system above.

Asset	Code Length	NERC Code Structure	Remark
132KV/33KV Transmission Substation	3	FGH	
33KV/11KV Injection Substation	3	FGH	Similar Coding Structure with the Transmission Substation.
132KV/33KV Transmission Substation Power Transformer	4	FGHI	Transmission Substation three-digit Code plus the Power Transformer Number within the Substation
33KV/11KV Injection Substation Power Transformer	4	FGHI	Injection Substation three-digit Code plus the Power Transformer Number within the Substation
33KV Feeder	6	FGHIJK	Transmission Substation Power Transformer's four digits code plus two-digit Feeder Number output from the Transformer
11KV Feeder	6	FGHIJK	Injection Substation Power Transformer's four digits code plus two-digit Feeder Number output from the Transformer
33KV Pole	10	FGHIJKLMNO	33KV Feeder's six digits code plus four-digit Pole number within the Feeder network

11KV Pole	10	FGHIJKLMNO	11KV Feeder's six digits code plus four-digit Pole number within the Feeder network
Distribution Substation	12	FGHIJKLMNOPQ	33KV or 11KV Feeder Pole ten digits code plus two-digit substation number based on Pole.
Upriser	13	FGHIJKLMNOPQR	Distribution Substation's 12 digits code plus one-digit upriser number output from the Distribution Substation.
LT Pole	16	FGHIJKLMNOPQRSTU	Upriser's 13 Digit code plus three digits LT Pole number within the Upriser Network.
Service Point (Service Wire)	18	FGHIJKLMNOPQRSTUVW	LT Pole's 16-digit code plus two digits service point number based on LT Pole

4.2.2 DATA CAPTURE PROCEDURE

Data Capture is to be carried out using a GPS enabled device[5] with GIS Cloud Mobile Data Collection Application Pre-loaded and configured. Location attribute, Image of assets and Thematic (Electrical) attribute of the assets are the data to be captured.

To ensure proper management of data in line with quality standards and in fulfillment of regulatory requirements, the data capture procedure for the assets are as follows:

Stage	Assets to be Captured
Stage 1	- 132KV/33KV Transmission Station and its related assets - 33KV/11KV Injection Substation and its related assets
Stage 2	- 33KV Feeder Poles (High Tension Pole) - 11KV Feeder Poles (High Tension Pole) - Distribution Substation and its related assets - Ring Main Unit
Stage 3	- 0.415KV Poles (Low Tension Pole)

4.2.3 FORM STRUCTURE

The asset registration forms capture the data to be collected for each of the assets. The form for each of the assets is created as projects on the GIS Cloud platform and loaded on the GIS Cloud Mobile Data Collection app registered to each Enumerator on his provided device.

[5] Location Data is to be captured at a sub-meter accuracy level (less than 1 meter)

There are twenty-four (24) asset registration forms each of the 23 asset categories to be captured as well as an issue log form. Each of these forms has been designed for ease of data collection while ensuring top quality of data collected. These forms included:

1. ***EEDC Asset Form_Transmission Substation:*** This form is used to capture data (Locational and thematic attribute) relating to the 132KV/33KV Transmission Substation.

2. ***EEDC Asset Form_Transmission Substation_Power Transformer:*** Location, thematic and image data relating to the Power Transformers in the 132KV/33KV Transmission Substation will be captured using this form.

3. ***EEDC Asset Form_Injection Substation:*** This form is used to capture data (Locational and thematic attribute) relating to the 33KV/11KV Injection Substation.

4. ***EEDC Asset Form_Injection Substation01_Line Isolator:*** This form captures locational, thematic and image data relating to the Line Isolator in the Injection Substation. The form makes provision for the capture of more than one line Isolator (Line switch) if such exist in an Injection Substation.

5. ***EEDC Asset Form_Injection Substation02_Earth Switch***: This form captures locational, thematic and image data relating to the Earth switch in the Injection Substation.

6. ***EEDC Asset Form_Injection Substation03_Potential Transformer:*** This form captures locational, thematic and image data relating to the Potential (Voltage) Transformer in the Injection Substation.

7. ***EEDC Asset Form_Injection Substation04_Bus Bar***: This form captures locational, thematic and image data relating to the Bus bar Component in the Injection Substation.

8. ***EEDC Asset Form_Injection Substation05_Outdoor Circuit Breaker:*** This form captures locational, thematic and image data relating to the Outdoor Circuit Breaker Component in the Injection Substation.

9. ***EEDC Asset Form_Injection Substation06_Current Transformer:*** This form captures locational, thematic and image data relating to the Current Transformer Component in the Injection Substation.

10. ***EEDC Asset Form_Injection Substation07_Lightning Arrestor:*** This form captures locational, thematic and image data relating to the Lightning Arrestor Component in the Injection Substation.

11. ***EEDC Asset Form_Injection Substation08_Power Transformer:*** This form captures locational, thematic and image data relating to the Power Transformer Component in the Injection Substation.

12. ***EEDC Asset Form_Injection Substation09_Cable:*** This form captures thematic and image data relating to the Cable connected to the Power Transformer in the Injection Substation. This form makes provision for the capture of both incoming and outgoing cable of the Power Transformer.

13. ***EEDC Asset Form_Injection Substation10_Indoor Circuit Breaker_Incomer Panel:*** This form captures locational, thematic and image data relating to the Incomer Panel Component of the Indoor Circuit breaker[6] in the Injection Substation.

14. ***EEDC Asset Form_Injection Substation11_Indoor Circuit Breaker_Bus Section:*** This form captures locational, thematic and image data relating to the Bus Section Component of the Indoor Circuit breaker in the Injection Substation.

15. ***EEDC Asset Form_Injection Substation12_Indoor Circuit Breaker_Outgoing Panel:*** This form captures locational, thematic and image data relating to the Outgoing Panel Component of the Indoor Circuit breaker in the Injection Substation.

16. ***EEDC Asset Form_Injection Substation13_Transformer Control Panel:*** This form captures locational, thematic and image data relating to the Transformer Control Panel in the Injection Substation.

17. ***EEDC Asset Form_Injection Substation14_Line Control Panel:*** This form captures locational, thematic and image data relating to the Line Control Panel in the Injection Substation.

18. ***EEDC Asset Form_Injection Substation15_Capacitor Bank:*** This form captures locational, thematic and image data relating to the Capacitor Bank in the Injection Substation.

19. ***EEDC Asset Form_Injection Substation16_Tripping Unit:*** This form captures locational, thematic and image data relating to the Tripping Unit System in the Injection Substation.

20. ***EEDC Asset Form_HT_Poles:*** This form captures the data relating to the High-Tension Poles that make up the Feeder Network. The form is structured to allow for the categorization of the poles into 11KV and 33KV poles to cater for those two categories of High-Tension Pole. In using this form, data collectors are expected to trace the Feeder Network from its source in the Transmission Substation (for 33KV Feeders) or Injection Substation (For 11KV Feeder) collecting data on all High-Tension Pole supporting Feeder Lines and other unconnected Pole within the Feeder network till the termination point of the Feeder. Appendix C1 contains information on the Attribute columns that make up this form.

21. ***EEDC Asset Form_Ring Main Unit:*** This form captures the Ring Main Unit (RMU). The Ring Main Unit panel is usually found along Feeder Line Network.

22. ***EEDC Asset Form_Distribution Substation:*** This form captures the Distribution Substations. The form is structured to also capture the various assets found in the Distribution Substation. These assets include; Distribution Transformers, Substation Gantry, Feeder Pillar, Fuse and Cable. Appendix C2 contains information on the Attribute columns that make up this form.

[6] The Incomer Panel, Bus Section and Outgoing Panel all make up the Indoor Circuit Breaker Component of the Injection Substation. Data pertaining each of these three components should be captured differently notwithstanding if they share similar attributes.

23. ***EEDC Asset Form_LT Poles:*** This form captures data relating to the Low Tension (0.415KV) poles that make up the upriser network. These poles have their origin from the Distribution Substation. This form is also used to capture streetlight data[7], Feeder pillar[8] and road attribute data. Appendix C3 contains information on the Attribute columns that make up this form.

24. Issue Log Form: This form captures data of issues encountered during field data collection. This issues to be captured are issues that affect the quality of data, safety issues relating to Electricity assets, and energy theft issues. These issues will require validation, investigation, and cataloging of resolution. The issue log form is utilized both during the asset mapping and Customer Enumeration.

4.2.3.1 FORM DESIGN AND USAGE INSTRUCTION

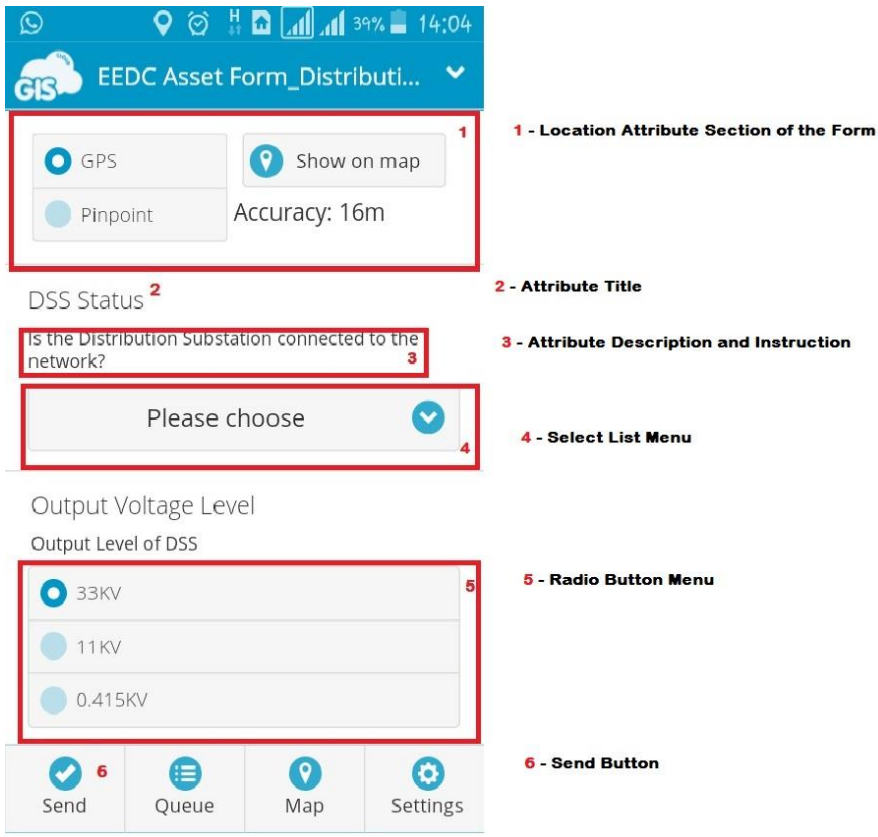


Figure 11: GIS Data Collection Form Interface

1. *Select List and Radio Button:* The Select List provides a drop-down list of options while the Radio Button provides a list of options with a radio button beside every item on the list allowing for the applicable option to be ticked. Ensure the following are strictly adhered to when using either the Select List or Radio Button:

[7] The Streetlight data been capture refers to Streetlights which are sole consumers and connected to a private Distribution Substation.

[8] The Feeder Pillars been captured are Feeder pillars which form the distributor network for Distribution Substation with underground electricity distribution.

a. Select ONE option from the drop-down list

b. Tick applicably ONE option from the list of options with radio buttons.

c. Do not leave any list attribute blank. If the required option is not provided use the option 'Others' on the list.

2. *Location Attribute:* The Locational Attribute of any given asset is captured once the Send button is clicked. Ensure that the following conditions are set before the Location attribute is captured.

    a. All other attributes in the form have been filled as required.

    b. The accuracy level of the GPS is pegged at a sub-meter level (less than 1 meter) before the location attribute is captured.[9]

3. *Image Attribute:* Where desired, the form makes provision for the picture of an asset to be captured. Ensure the following rules are applied when capturing images;

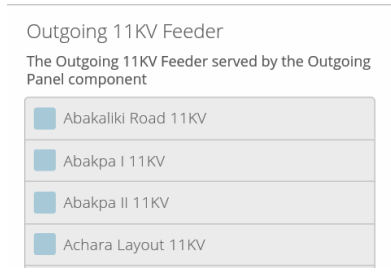
    a. Ensure the photo quality in your Mobile Data Collection App is set to HIGH so that images capture will be of high quality depending on the resolution of your camera

    b. Set your device camera in a position that allows the capture of the extent of the asset including some portion of its environment. For Poles, the required extent covers the entire length of the pole. For Distribution Substations, the required extent covers the component assets of the Distribution Substation.

    c. Preview the captured image to verify its sharpness.

4. *Numeric Attributes*: Where the input of numbers is required in filling the details of an attribute, the form design makes provision for such. Ensure you adhere strictly to the designated limit.

5. *Checkboxes:* Checkboxes allow for multiple selections from a list for an attribute. Ensure you select as appropriate from the list.



6. *Text:* The Text option is used when a domain list is not provided, or numeric type not required for a given attribute. Adhere strictly to the following instruction when entering attribute details as Text;

[9] Never use the Pinpoint Button to capture location Data for Electricity assets. Ensure that your GPS button is selected, and its accuracy displayed.

a. All text must be entered using Capital letters.
b. Ensure Text are correctly entered.

7. *General Instructions*

a. All required fields must be filled before submission. This includes but not limited to Select List fields, Radio Button fields, and checkboxes.

b. Adhere to the accuracy limit for location attribute before submission.

c. EEDC technical officers will be on the ground to assist Enumerators in the identification of assets especially in Injection Substation and Transmission Substation.

d. Installed Electricity distribution assets not actively connected to the Electricity distribution network (Idle Assets) should also be enumerated. The forms make provisions for such assets. Assets not installed and not connected are to be captured as POIs

e. The capture of the image of the Injection substation is very important. The captured image should show the Feeder bay(s), Transformer bay (with the power transformer) and the injection substation room.

f. Feeder Lines and upriser network have tee-offs from the main line. When tee-offs are encountered in the course of HT Pole enumeration, ensure you enumerate the poles in the tee-offs before continuing on the main line.

g. Composite Poles bearing more than one distribution lines such as Poles bearing two different feeder lines or poles bearing a feeder line and a distributor line will be captured. The high-tension lines are to be enumerated as high tension line (when enumeration HT poles) and as low tension line (when enumerating LT poles). The data capture form makes provision for the categorization of the Composite Pole type.

h. Constituent Poles in a Twin Pole or a Triple pole structure are to be captured individually. During the capture, each pole will be uniquely identified with each having its own Pole number (Pole ID). The data capture form also makes provision for the attributes relating to the twin or triple nature feature of poles.

i. Distribution Substations are numbered based on the Feeder Pole supplying them. Usually, these poles supplying a DSS are twin poles. Each of the poles is to be assigned their own number. However, the first pole number (of the two poles) is the one identified with the DSS. If that pole is numbered 6 and it supplies only one DSS at its point, then the DSS is numbered 1 on Pole 6. If more than one DSS is supplied on Pole 6 then they are numbered accordingly.

j. The capturing of the image of the Distribution Substation is very important. When capturing this image, the Distribution Transformer MUST be visible as well as its environment and assets relating to it.

4.2.4 ASSET TAGGING

During the Asset Registration exercise, the assets as presented in Section 4.2.2 above will be tagged. The codes for each of the assets to be tagged will be generated by the EEDC GIS team and while tagging of these assets will be done by the enumerators.

Tagging of assets will be done after the registration and generation of the codes for the assets before customer enumeration. Poles with be tagged by writing their unique codes using oil paint and brush[10]. Transformers, Ring Main Unit, and other similar assets will be tagged using plastic durable material.

The Tagging procedure for Poles depends on the type of pole, the design of the pole and the arrangement of the pole within the feeder/upriser network. Based on this tagging procedure for high tension poles are categorized into the following;

- **ONE POLE, ONE FEEDER/UPRISER**

  This procedure applies to High Tension Poles belonging to one feeder network or Low-tension Poles belonging to an upriser network. Such Pole will have cross-arms and three conductor line for Feeder Poles or four wires for distributor poles.

  When tagging such poles, the following procedures apply;

  i.) Printing of the unique ID for the poles will be done vertically on the smooth surface part of the Pole facing the road.

  ii.) The last digit of the Pole ID should be placed at a height not lower than 1.5 meters from the ground surface.

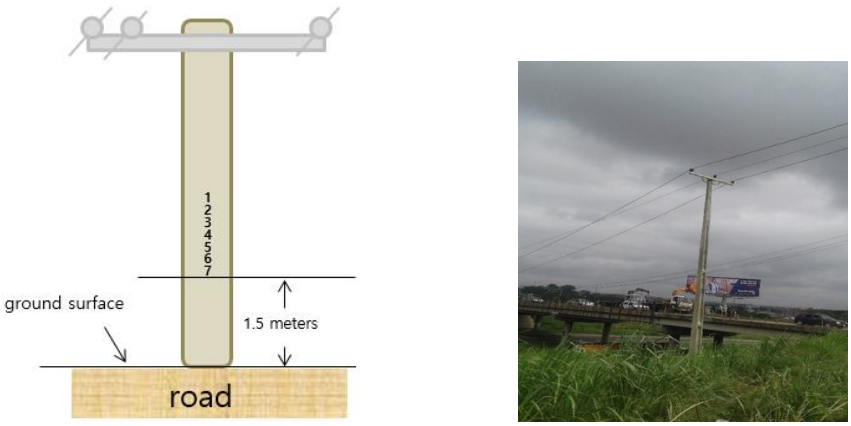


Figure 12: One Pole, One Feeder/Upriser

- **ONE FEEDER, TWIN POLE (H-POLE)**

  This procedure applies to High Tension Twin Poles belonging to one feeder network. Such Pole will have cross-arms touching both poles forming an H symbol. When tagging such poles the following procedures apply;

  i.) Printing of the unique ID for the poles will be done vertically on the smooth surface part of the Pole facing the road for each of the poles. Each pole will have its own unique ID.

[10] When Tagging Poles, ensure the Codes are written legibly.

ii.) The last digit of the Pole ID should be placed at a height not lower than 1.5 meters from the ground surface.

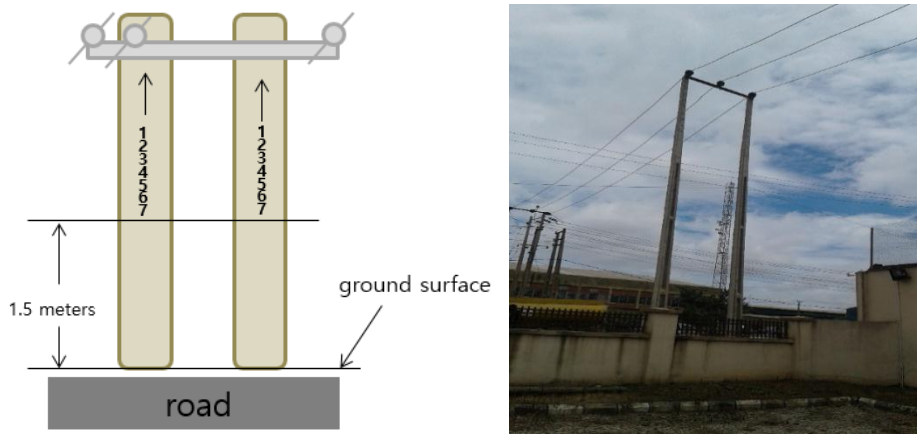


Figure 13: Two Feeder (Vertical), Twin Pole

❖ **TWO FEEDERS (HORIZONTAL), TWIN POLE (H-POLE) WITH TWO CROSS-ARMS**

This procedure applies to High Tension Twin Poles belonging to twin feeder network having two cross arms. Such Pole will have two cross-arms touching both poles forming an H symbol with one cross-arm bearing one feeder. When tagging such poles, the following procedures apply;

i.) Printing of the unique ID for the poles will be done vertically on the smooth surface part of the Pole facing the road for each of the poles. Each pole will have its own unique ID.

ii.) The upper feeder pole ID must be printed above the lower feeder pole ID

iii.) The last digit of the lower Pole ID should be placed at a height not lower than 1.2 meters from the ground surface.

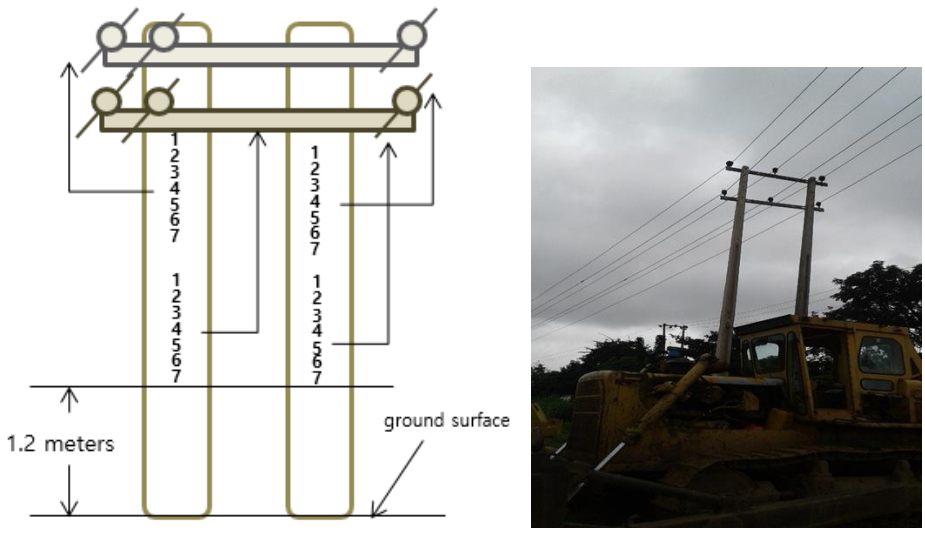


Figure 14: Two Feeder (Horizontal), Twin Pole (H-Pole) with Cross-Arms

❖ **TWO FEEDERS (VERTICAL), TWIN POLE WITH THREE CROSS-ARMS**

This procedure applies to High Tension Twin Poles belonging to twin feeder network having three cross arms. Such Pole will have three cross-arms touching both poles with each cross-arms having insulator at the opposing ends. A set of insulator vertical arranged relates to one feeder. When tagging such poles, the following procedures apply;

i.) Printing of the unique ID for the poles will be done vertically on the smooth surface part of the Pole facing the road for each of the poles. Each pole will have its own unique ID which will relate to its own feeder.
ii.) The left feeder pole ID must be printed on the left pole while the right feeder pole ID must be printed on the right pole.
iii.) The last digit of the lower Pole ID should be placed at a height not lower than 1.5 meters from the ground surface.

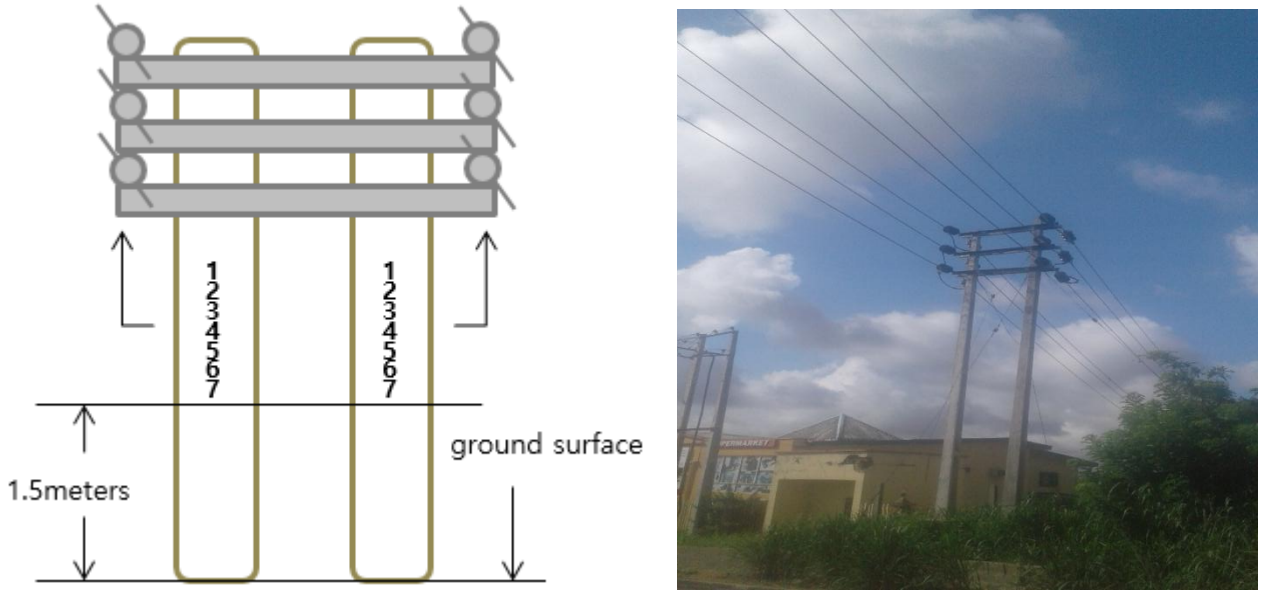


Figure 15: Two Feeder (Vertical), Twin Pole with three cross-arms

❖ **TWO FEEDERS (HORIZONTAL), ONE POLE**

This procedure applies to High Tension single Pole belonging to twin feeder network having two cross arms. Such Pole will have two cross-arms on the pole with both cross arms separated by a vertical extension of the pole. When tagging such poles, the following procedures apply;

i.) Printing of the unique ID for the pole will be done vertically on the smooth surface part of the Pole facing the road.
ii.) The upper feeder pole ID must be printed above the lower feeder pole ID
iii.) The last digit of the lower Pole ID should be placed at a height not lower than 1.2 meters from the ground surface.

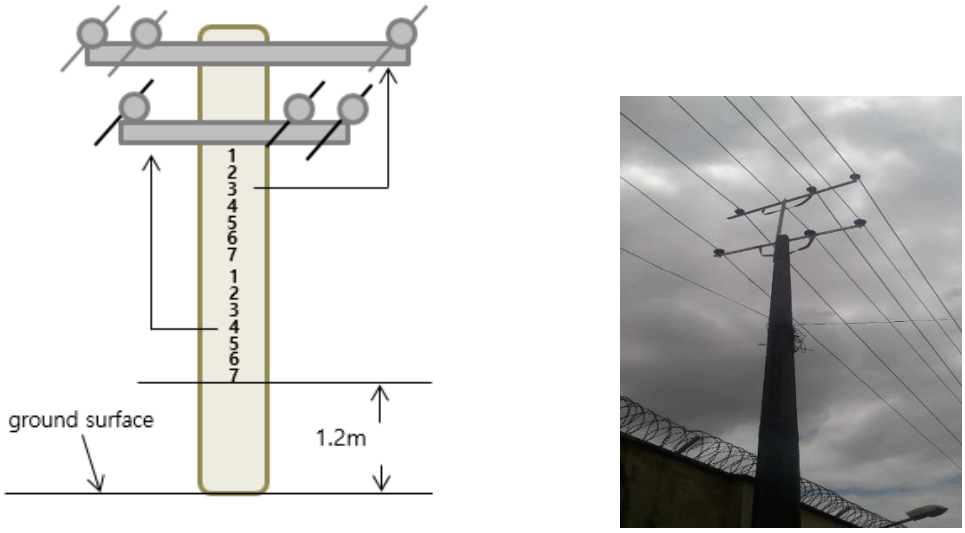


Figure 16: Two Feeder (Horizontal), One Pole

❖ **TWO FEEDERS (VERTICAL), ONE POLE**

This procedure applies to High Tension single Pole belonging to twin feeder network having three cross arms. Such Pole will have three cross-arms on the pole with each cross arm held together by the pole and vertically separated from each other. When tagging such poles the following procedures apply;

iv.) Printing of the unique ID for the pole will be done vertically on the smooth surface part of the Pole facing the road.

v.) The left feeder pole ID must be printed on the left side of the pole while the right feeder pole ID must be printed on the right side of the Pole.

vi.) The last digit of the lower Pole ID should be placed at a height not lower than 1.5 meters from the ground surface.

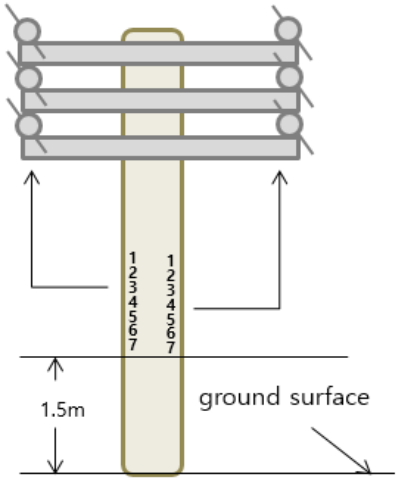


Figure 17: Two Feeders (Vertical), One Pole

NOTE: *This procedure also applies for distribution Towers carrying conductor lines for two different feeders and having three cross-arms or three set of insulator rings on either side of the tower.*

4.3 CUSTOMER ENUMERATION

The Customer Enumeration Exercise is the climax of EEDC GIS-enabled Asset Registration and Customer Enumeration project. It is the second stage of the project.

During the Customer Enumeration Exercise, Electricity Customers within EEDC coverage region will be enumerated, cataloged and linked to the Electricity Distribution system through the Electricity Distribution assets supplying them.

4.3.1 DATA CAPTURE PROCEDURE

Data Capture is to be carried out using a GPS enabled device[11] with GIS Cloud Mobile Data Collection Application Pre-loaded and configured. The data to be captured during the Customer Enumeration Exercise includes;

- ***Customer Information:*** Location, Bio-data, Building Information, Billing Information and Meter Information of Consumers and Buildings as well as Points of Interest within EEDC coverage areas

4.3.2 HOW TO IDENTIFY A CUSTOMER

In the heart of the EEDC GIS-enabled Asset Registration and Customer Enumeration Project is the identification of Electricity Customers and Consumers within EEDC coverage region, the validation of electricity Customers existing in EEDC Customer database, the migration of non-registered customers (consumers) into the Customer database and the resolution of issues relating to Customer categorization.

Who is a Customer?

An Electricity Customer is a consumer of electricity who is billed for the consumption of electricity based on customer category and who pays for the consumed energy.

To be an Electricity Customer one must be an electricity Consumer. The Table below presents the Classification of Electricity Users.

S/N	Condition	Customer		Consumer	Non-Consumer
		Active	Inactive		
1	Uses Electricity[12]	✓	✓	✓	✓
2	Connected to EEDC Electricity Distribution System	✓	✓	✓	✗

[11] Location Data is to be captured at a sub-meter accuracy level (less than 1 meter). Pinpoint feature also allows the capture of points allowing for customer points to be placed in building footprints.

[12] Electricity can be privately generated or public generated. Non-Consumers generate electricity themselves and are not connected to the public grid controlled by EEDC.

3	Correct Customer Categorization[13]	✓	✓	×	×
4	Has EEDC issued Electricity Bill or Receipt[14]	✓	✓	×	×
5	Pays Bill with evidence of payment	✓	×	×	×

For the purpose of this project, Customers are regarded as Electricity users who fulfill the conditions 1 - 4 as presented in the table above. During Customer Enumeration, Enumerators are mandated to request for the electricity bill of the Customer visited and to capture some data as presented on the bill.

4.3.3 HOW TO IDENTIFY 'NO BILL' CUSTOMER

The Customer Enumeration exercise is not only reserved for Billed Customers. No-Bill Customers (Consumers) are also expected to be captured and brought into the system.

No-bill Customers are Electricity users who fulfill only conditions 1 and 2 as presented in the table in section 4.3.2.

The following procedures help identify 'No Bill' Customers (Consumer);

- Connects directly or indirectly[15] to the EEDC managed Electricity Distribution System (EDS).
- Has no Electricity Bill/receipt or haven't been issued electricity bill or paid for energy within three months prior to enumeration.
- Is not part of a Rural Bulk Billing System[16].

4.3.4 FORM STRUCTURE AND USAGE INSTRUCTION

The data to be captured during the Customer Enumeration stage of the EEDC GIS-enabled Asset Registration and Customer Enumeration Project have been structured into a Data Collection Form known as '***EEDC_Customer Enumeration Form'***. This form is created as a project on the GIS Cloud platform and loaded on the GIS Cloud Mobile Data Collection app registered to each Enumerator on his provided device.

[13] Electricity Customers Category are as defined by NERC.

[14] Electricity Bills are issued to Postpaid Customers while receipts of Payment containing customer billing and other information are issued to prepaid customers after recharging their prepaid meter. Both Bill and receipt contains the EEDC Account Number which identifies a Customer.

[15] Indirect Connection is the connection to the EDS through an existing registered customer (looping) in such manner that the connection is not billed but rather masked by that of the registered customer.

[16] Rural Bulk Customers are Customers especially in rural areas that are collectively billed based on the Distribution Transformers (DSS) or locality.

This form is designed to capture Customer data viz-a-viz locational attribute, bio-data attribute, billing information, meter information as well as the attribute information of all buildings and Points of Interest in EEDC coverage region.

The instructions relating to the general understanding and usage of elements of the GIS Data Collection Forms as contained in section 4.2.2.1 articles 1 - 6 of this manual applies to the Customer Enumeration exercise. However, the following instructions also apply when collection data during the Customer Enumeration stage of this project;

I. When capturing Location Data for Customers using the Customer Enumeration Form, ensure such data is captured

    A. The GPS location of the device is on.

    B. Use the pinpoint tool to drop customer point on the building footprint.

    C. For buildings with multiple Customers, ensure that Customer points are properly placed in the building based on the order in which Customers are situated in the building using the left-first rule[17].

    D. For Customer points with Vectorized buildings, ensure that points are placed are the proper place on the map were the building exists to enable easy vectorization of buildings.

II. For billed Customer, the most recent electricity bill/receipt is required for the filling of some details in Customer Enumeration form always request for the bill/receipt during customer enumeration.

III. Ensure that the attribute information for all buildings and structures are captured notwithstanding if the building or structures uses electricity. The Customer Enumeration Form provides for the capture of all buildings.[18]

IV. For Connected Customer who has ‘‘No Bill” or for whom the enumerator is unable to get access to the building or customer to collected Billing and bio-data information, the Call-back form (see Appendix for sample) is dropped to enable the Customer to reach out to EEDC to provide the needed information.

V. Indirectly connected ‘No Bill’ Customer vary depending on the situation. When capturing such customers, the focus should be on

    A. consumers in the same compound but different owners,

    B. structures in the different compound but connected via a loop, and

[17] The left-first rule state that in situation whereby a feature exists to the left and right side of a point, the left side is considered first before the right side. This rule is applicable for numbering and placement of flats, rooms, shops in Apartment blocks.

[18] Information of buildings not vectorized should also be captured during the exercise.

C. Temporal structures used by electricity consuming artisans (such as welder) but whose connection to the Electricity Distribution System is not visible.

The usage of discretion is allowed for other variety of indirectly connected consumers, especially in dense shanty areas.

VI. EEDC enumerator can now recommend an Indirect Consumer for separation. The Customer enumeration form makes provision for the enumerator to suggest separation of consumer and for the consumer to show willing to be separated. Separation suggestion is based on the following conditions: That the indirect consumer is

A. is a different household from the Direct Customer

B. has a different building use from the Direct Customer

C. Lives in a shack used for commercial purposes (e.g. vulcanizer, welder, mechanic, ice block business)

D. Lives in residential shacks using heavy appliances (e.g. AC, pumping machine, deep freezers etc.)

4.3.5 CUSTOMER INDEXATION NOMENCLATURE (CIN)

Upon completion of the Customer Enumeration exercise, as directed by NERC, each customer is expected to be uniquely identified using the Customer Indexation Nomenclature (CIN).

The CIN is a 26 character purely numerical code like identification numbers used for VISA CARD, MASTER CARD, BVN etc. The CIN is coded in a standard format to link assets that feed a customer service address. As such, accurate customer service and transformer - circuit Feeder - line Equipment - substation connectivity, cumulative energy per circuit segment can be determined.

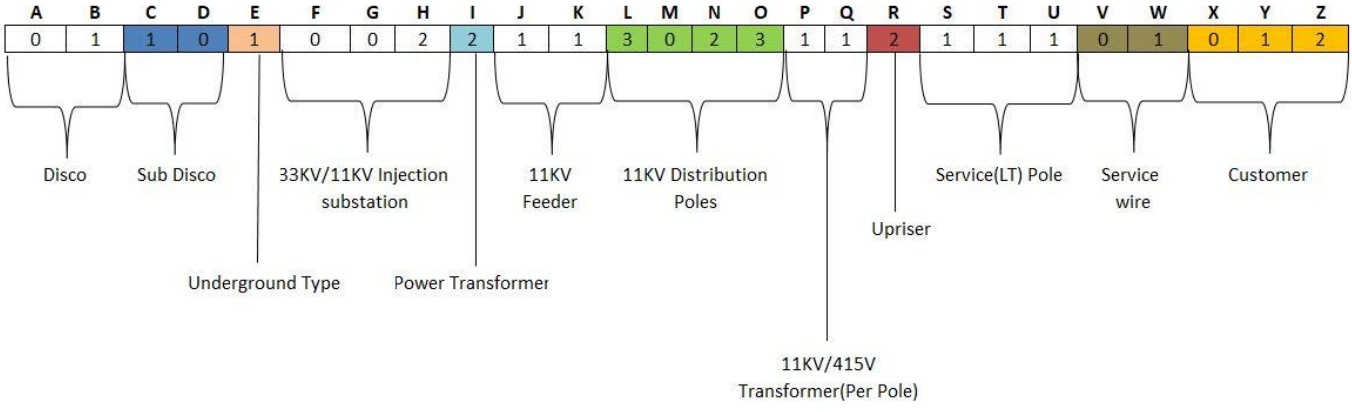


Figure 18: Customer Indexation Nomenclature (CIN)

4.3.6 CUSTOMER TAGGING

As required by NERC the Customer Indexation Number (CIN), the Customer Address and Billing Information are to be encoded into a QR (Quick Response) sticker and tagged on the building of every customer.

The Customer QR code sticker is made of a highly durable material that can withstand inclement weather conditions. EEDC Customer QR Code sticker also contains the EEDC Building Code for the building.

Prior to the QR sticker tagging, the Customer Indexation Number (CIN) will be generated by the EEDC GIS team. Encoding of the QR sticker/tagging will be done by the vendors' enumerators. The Customer QR code sticker is to be placed in a visible position preferably on the wall of the building.

4.4 ERROR HANDLING PROCEDURES

One of the key aims to be achieved at the end of the EEDC GIS-enabled Asset Registration and Customer Enumeration Project is to ensure that the data collected at the end of the project meets International Data Quality standards (ISO 19157:2013) as well as conforms to regulatory requirement (NERC).

Our Data Quality process focuses on ensuring that the data collected is

- Complete (i.e. Data is exact with no missing or duplicate items)
- Consistent (i.e. The collection and placement of Data satisfy the logic of our Business)
- Accurate (i.e. the Location information of the assets and customer is true and matches what obtains in the real word)
- Precise (i.e. Attributes are the correct description of the data collected)

Some processes to ensure the quality of the data to be collected meets with the required quality are already imbibed in the data collection form, however, in the cause of field data collection, some errors are likely to occur. The Table below presents some of the likely sources of field errors and how they can be handled to ensure top quality data.

SOURCES OF FIELD ERROR AND HOW TO HANDLE THEM

No	Error Source	Causes	Consequences	Handling Procedures
1	Fatigue	The process of Field Data Collection can be physically and mentally stressful leading to fatigue	- Data may not be accurately captured, - Data description may not be precise and consistent	- When tired, endeavor to take a break and rest before continuing. - Always ensure that the data is correct at all points.

2	Device Malfunction	Device malfunctioning can lead to issues such as GPS inaccuracy, Data upload error, Network error, Battery issues	- This leads to Data inaccuracy and incompleteness	- Ensure Device is functioning optimally each day before use. - Ensure Device batteries are fully charged, and backup batteries provided - If GPS receiver is not functioning, you restart the device or consult device manual for error checks.
3	Poor Identification of assets	Assets may not be properly identified during the field data collection	- Data imprecision	- Refer to this training manual when unsure of the identity of assets. - At the Injection Substations and Transmission Substations, the technical officers have been mandated to aid during the data collection. Always consult them. - A team of technical officers are also readily available to assist. Always reach out to them when uncertain.
4	Environmental Factors	Such as - Inaccessible assets due to vegetation, locked assets, and terrain - Inclement Weather conditions	- Data Incompleteness, Inaccuracy and Imprecision	- Steps have been taken to ensure areas where vegetation impedes access to assets have been cleared. Notify your supervisors whenever you notice such areas. - Steps have also been taken to ensure locked assets such as Distribution Substation are opened for data collection. - Notify your supervisors whenever inclement weather conditions impede field data collection activity.

5	Customers not Available	Customers may not be readily available when visited for Customer Enumeration	- Data incompleteness	- Make use of the Call back form. - Report to your supervisors who will escalate matters to Project Team.
6	Security Threats	Security of lives of Enumerator and that of their properties may be threatened during fieldwork	- Data not been collected	- As much as possible, the security unit of EEDC will provide updates on hotspot areas and provide instructions on how to handle issues. - When faced with issues of Security, ensure you try as much as you can to protect yourself and properties. - Report to your supervisor who will escalate matters to the security unit.

4.5 DATA DELIVERABLES AND MONITORING

We are concerned about the quality of our data hence, we have developed a structured sequence of procedures to verify and validate data (either created or captured from the field) before committing into our central database.

Two kinds of quality checks will run consecutively on any data delivered to us by the vendors namely;

1. Automated QA checks have been designed to accurately identify and eliminate certain errors associated with our data.
2. A manual QA check will follow the automated QA checks where location domain knowledge will be used in aiding further decision making.

For our data collection vendors, the following instruction applies with regards the mode of deliverable:

- Uniform Coordinate Referencing System (CRS) Geographical - WGS-84 (EPSG: 4326).
- Uniform spatial data format - Shapefile recommended.
- Daily submission routine of data collected. i.e. we expect data delivery on daily basis.

- All prescribed data to be collected is to be submitted as point layers. Alongside the point layer, we will require as deliverables the submission of the following data in another layer format;
    - Injection Substation - Polygon layer
    - Transmission Substation - Polygon Layer
    - Roads and Railway - Line layer

- We expect the data to be delivered should be in line with the attributes column as defined by our Data collection forms.

Monitoring has been introduced into this project as a way of reducing errors and ensure the right data is captured in the right place. Field Data Capturing will be monitored remotely from our office in real time. We will also carry out routine field visitation to validate and verify the data collected especially in cases of data conflict.

SECTION 5: SAFETY RULES AND GUIDELINES

Safety (**freedom from harm**) is the number one priority in the business of EEDC. It is the goal of EEDC to achieve accident-free operation - No injury to a person; No damage to equipment and associated losses.

Every worker (Staff or Contractor) working on EEDC's network must be safety compliant. Safe System of Work (SSW) must be applied in every activity.

5.1 HSE ORIENTATION

HSE department shall organize Contractor Orientation Program for the workforce and EEDC GIS Supervisors.

The following issues shall be addressed:

- EEDC HSE Policy.
- Unsafe Act/Unsafe Condition Auditing
- Incident Line of communication/Reporting.

5.2 MONTHLY HSE REVIEW MEETING

- Identify and establish HSE matters.
- Identify and follow up reports or recommendations and HSE audits.
- Discuss Incidents, near misses, Accidents and disseminate learning points to the workforce.
- Entertain suggestions on HSE matters from the workforce.
- Instill safe work attitudes in the workforce.

5.3 ACRONYMS

- **TBM**: Tool Box Meeting- A brief meeting held on daily between ten to fifteen (10-15) minutes where the task for the day is discussed, hazards associated with the task are identified and control measures are ensured to be in place before workforce is mobilized to the site.
- All members of the Enumeration team are expected to be part of the daily TBM and it must be documented. See TBM template below.

5.4 RISK ASSESSMENT FOR GIS ENUMERATION

UNIT JOB STEP		HAZARDS	WHO MIGHT BE HARMED	CONSEQUENCES	RISK LEVEL	CONTROL	RECOVERY MEASURES	ACTION PARTY
MOBILIZATION TO SITE		• Overloading of materials and personnel. • Rain	• Enumeration Team. • EEDC GIS Supervisor.	• Body strain. • Body injury. • Cold. • Death.	L	• TBM. • Vehicle Inspection. • Observe road traffic rules. • Defensive Driving. • No work under the rain.	First Aid. Medevac.	EEDC GIS Supervisor/ Enumeration Foreman
ASSET REGISTRATION	POLE	• Tilt Pole. • Weak pole. • Sagged conductors. • Stay wire without the separator.	• Enumeration Team. • EEDC GIS Supervisor.	• Body injury. • Electric shock. • Burns • Electrocution.	L	• Visual Inspection. • Do not rest on the pole. • Treat all stay wire as live wires.	First Aid. Medevac.	EEDC GIS Supervisor/ Enumeration Foreman
	DISTRIBUTION SUBSTATION	• Contact with the energized part. • Trailing intermediate cable. • Vegetation threat. • Pest/Reptiles threat	• Enumeration Team. • EEDC GIS Supervisor.	• Body injury. • Electric shock. • Burns • Electrocution.	H	• TBM. • Avoid body contact. • Weed vegetation. • Fumigation	First Aid. Medevac.	EEDC GIS Supervisor/ Feeder Mgr./District Network Mgr.
	INJECTION SUBSTATION	• Energized exposed part of injection substation. • Vegetation threat. • Pest/ reptiles threat	• Enumeration Team. • EEDC GIS Supervisor.	• Body injury. • Electric shock. • Burns • Electrocution.	H	• TBM. • Report to DSO on arrival. • Avoid body contact. • Avoid unauthorized contact and movement inside switchyard. • Weed vegetation.	First Aid. Medevac.	DSO/Station Supervisor/Network Mgr./Enumeration Foreman
CUSTOMER ENUMERATION		• Excess workload • Customer`s act of Bully. • Customer`s Assault. • Improper method of approach. • Lone working. • Extreme weather condition	• Enumeration Team. • EEDC Supervisor.	• Body strain. • Body injury. • Robbery. • Cold/Catarrh • Death.	M	• TBM. • Observe break time • Be polite. • Be patient. • Apply Appeal work procedure. • Be time conscious. • No lone working. • Ensure availability of security back up. • Do not work under rain.	First Aid. Medevac.	Enumeration foreman/EEDC Supervisor/ Feeder Mgr./District Network Mgr.

5.5 SAMPLE TOOL BOX FORM

EEDC
ENUGU ELECTRICITY DISTRIBUTION COMPANY

DATE		TOOLBOX TALK FORM (TBM)
SERVICE CENTRE:	WORK LOCATION	

LIST OF ATTENDANTS			
NAMES	DESIGNATION	SERVICE CENTRE	SIGNATURE
1			
2			
3			
4			
5			
6			
7			
8			
9			

TOOLBOX TALK DISCUSSION			
REQUIRED PPE (EQUIPMENT CHECK REQUIRED)			
TOOLS (EQUIPMENT CHECK REQUIRED)			
WORK ANALYSIS			
STATION GUARANTEE REQUIRED			
OTHER IDENTIFIED ISSUES			
TITLE	NAME	DESIGNATION	SIGNATURE
Feeder Manager			
Enumeration foreman			
EEDC GIS supervisor			

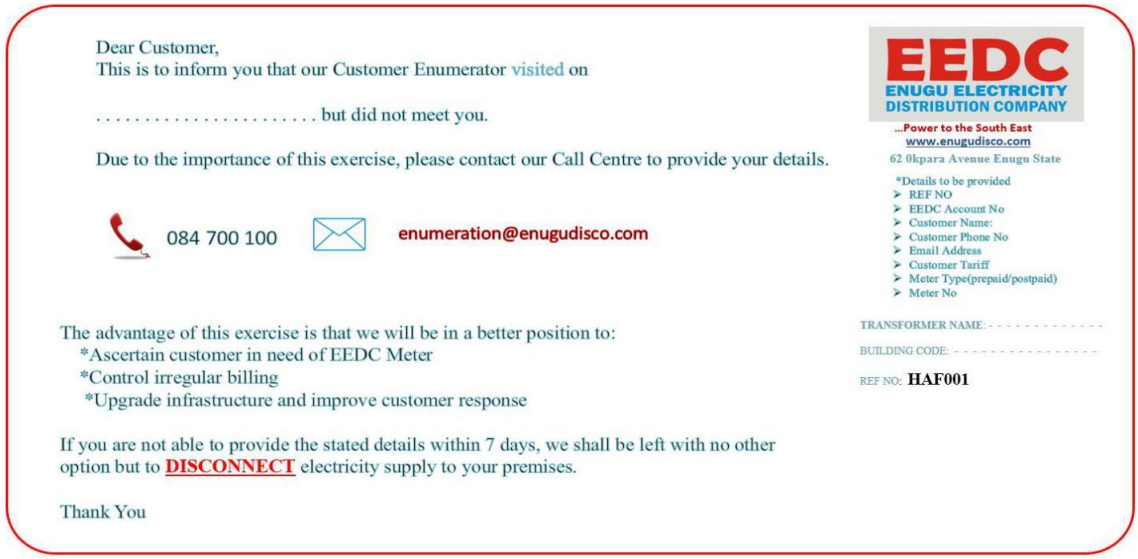
SECTION 6: SECURITY TIPS

The Safety of our Enumerators during the project is of key concern to us. All Enumerators are advised to adhere to the security tips below.

1. Always make on the spot assessment of the susceptible nature of the person(s) in a given home, society or environment you intend to work on.
2. Always be civil in your approach to members of the public.
3. On no account must you lose your temper to quarrel or fight with anybody, no matter the provocation, instead report back to the office for advice and further necessary action.
4. Always respect cultural practices of a given area and try your best not to invade people's privacy especially women, to avoid attack or assault on you.
5. Always introduce yourself and mission to the people in the course of your job to enable you to gain free access to even restricted areas and avoid frivolous allegations by unscrupulous person(s)
6. Guard your tools/equipment jealously as the loss of any could cause you embarrassment or even delay your completion of the project on schedule.
7. In the event of any assault on you/loss of tools or equipment, report such incident to the nearest police station and quickly contact Security Department to follow up the matter for diligent investigation and prosecution.

APPENDIX

APPENDIX A: CALL BACK FORM



Dear Customer,
This is to inform you that our Customer Enumerator visited on

. . . . . but did not meet you.

Due to the importance of this exercise, please contact our Call Centre to provide your details.

084 700 100 enumeration@enugudisco.com

The advantage of this exercise is that we will be in a better position to:
*Ascertain customer in need of EEDC Meter
*Control irregular billing
*Upgrade infrastructure and improve customer response

If you are not able to provide the stated details within 7 days, we shall be left with no other option but to DISCONNECT electricity supply to your premises.

Thank You

EEDC
ENUGU ELECTRICITY DISTRIBUTION COMPANY
...Power to the South East
www.enugudisco.com
62 Okpara Avenue Enugu State

*Details to be provided
- REF NO
- EEDC Account No
- Customer Name:
- Customer Phone No
- Email Address
- Customer Tariff
- Meter Type(prepaid/postpaid)
- Meter No

TRANSFORMER NAME: - - - - - - - - - - - -
BUILDING CODE: - - - - - - - - - - - - - -
REF NO: HAF001

APPENDIX B: REFERENCE TABLES

B1: OUTPUT VOLTAGE LEVEL

Id	Output Voltage Level	Type	Description
1	132KV	HT	Voltage Usage Level for Customer with input from 330KV
2	33KV	HT	Voltage Usage level of 33KV for Customer of station with input supply level of 132KV
3	11KV	HT	Voltage Usage level of 11KV for Customer or station with input supply level of 132KV or 33KV
4	6.6KV	HT	Voltage Usage Level of Customers on High Tension
5	415V	LT	Voltage Usage level of 0.415KV for Customer with input supply level of 33KV or 11KV (Usually three line phase Customers)
6	240V	LT	Voltage Usage level of 0.240KV for Customer with input supply level of 33KV or 11KV (usually single line phase Customers)

B2: SUPPLY TYPE

Type	Code
11KV/415V supply structure	1
11KV/415V Urban undergound structure	2
33kV/415V supply structure	3
33kV/11kV supply structure	4
132KV/33KV supply structure	5
330KV/132KV supply structure	6

B3: TARIFF CLASS

TARIFF CLASS	TARIFF ID	TARIFF CODES	SOURCES OF SUPPLY & TYPE OF METER (DESCRIPTION)	CUSTOMER'S DEMAND LEVELS
RESIDENTIAL	1	R1	Single phase supply with single phase meter with consumption on 50KWH &below	<5kVA;<50kwH
RESIDENTIAL	2	R2S	Single phase supply with single phase meter with consumption above 50KWH	>5KVA<15kVA
RESIDENTIAL	3	R2T	Three phase supply with three-phase meter with consumption below 45kVA	>15KVA<45kVA
RESIDENTIAL	4	R3	Three phase supply with three-phase meter; LV Maximum Demand	>45KVA<500kVA
RESIDENTIAL	5	R4	Large three phase residential supply on 6.6/11KV and/or 66/33KV with load above 500KVA; HV MD	>500kVA<2mva
COMMERCIAL	6	C1S	Single phase commercial supply with single phase meter with the load not exceeding 15kVA	>5kVA<15kVA
COMMERCIAL	7	C1T	Three phase commercial supply with three-phase meter with the load not exceeding 45kVA	>15KVA<45kVA
COMMERCIAL	8	C2	Three phase commercial supply and with the load not exceeding 500kVA; LV Maximum Demand	>45kVA<500kVA
COMMERCIAL	9	C3	Three phase commercial supply on 66/33KV with load above 500KVA; HV MD	>500kVA<2mva
INDUSTRIAL	10	D1S	Single phase industrial supply with single phase meter with a load below 15KVA	>5kVA<15kVA
INDUSTRIAL	11	D1T	Three phase industrial supply with three-phase meter with a load below 45KVA	>15kVA<45kVA
INDUSTRIAL	12	D2	Industrial customers on three phase supply with load above 45KVA; on three phase energy meters with a load below 500KVA; LV Maximum Demand	>45kVA<500kVA
INDUSTRIAL	13	D3	Large three phase industrial supply on 6.6/11KV and/or 66/33KV with load above 500KVA; HV MD	>500kVA
SPECIAL	14	A1S	Religious house, Agro-allied enterprises involving crop cultivation and/or livestock farming with single phase supply with load above 5kVA; and below 15kVA	>5kVA<15kVA
SPECIAL	15	A1T	Religious houses, Agro-allied enterprises involving crop cultivation and/or livestock farming with three phase supply with load above 15kVA and below 45kVA	>15kVA<45kVA
SPECIAL	16	A2	Universities etc. and Government Hospitals with load above 45kVA and below 500kVA; LV Maximum Demand	>45kVA<500kVA
SPECIAL	17	A3	Universities etc. and Government Hospitals on 6.6/11KV and/or 66/33KV with load above 500kVA; HV MD	>500kVA
STREET LIGHTING	18	L1	Street lighting Tariff	1-Ph.,3Ph.

APPENDIX C: DATA COLLECTION FORMS ATTRIBUTE LIST AND INSTRUCTIONS

TABLE KEY

C Attribute column is Compulsory and must be filled to enable form submission

CR Attribute column is compulsory and required for other columns in the form

O Attribute column is Optional and should be left blank if desired values cannot be populated.

C1: HT POLE FORM ATTRIBUTE LIST

S/N	COLUMN	STATUS	COLUMN DESCRIPTION	INSTRUCTION
1	POLE CONNECTION STATUS	CR	The status of the Pole's connection to the Electricity Distribution System	• ***Connected***: A Feeder Pole is connected when there is a physical attachment (in terms of electricity wires) between the pole and other poles whose source is either from the Injection Substation or the Transmission substation. • ***Not Connected***: A Feeder Pole is not connected if no physical attachment exists between the pole and other poles within the Feeder network and is of the standard height peculiar to Feeder Poles. Not Connected Poles are mostly idle poles within a Feeder network.
2	FEEDER TYPE	CR	The type of Feeder	• ***11KV***: refers to a Feeder network with distribution voltage capacity of 11KV (11000Volts). This option is selected if the feeder emanates from the 33KV/11KV Injection Substation. • ***33KV:*** refers to a Feeder network with distribution voltage capacity of 33KV (33000Volts). This option is selected if the feeder emanates from the 132KV/33KV Transmission Substation.
3	33KV FEEDER	C	A list of 33KV Feeder within the EEDC network as well as their unique codes	• The availability of this option is dependent on the value of the preceding column. • The name of the 33KV Feeder whose HT Pole is to be mapped is selected in this column.
4	11KV FEEDER	C	A list of 11KV Feeder within the EEDC network as well as their unique codes	• The availability of this option is dependent on the value of the preceding column. • The name of the 11KV Feeder whose HT Pole is to be mapped is selected in this column.
5	POLE NO	C	The unique sequential number of HT Pole within a feeder network	• The HT Pole number follows progressively from the first pole in the feeder.
6	POLE LATITUDE_Y	C	The Latitudinal coordinate value of the HT Pole	• Ensure your Device GPS is switched on. The GISCloud automatically captures the value of the Coordinates once data is sent. • Ensure data is sent when the GPS accuracy level is within allowed limits.
7	POLE LONGITUDE_X	C	The Longitudinal coordinate value of the HT Pole	• Ensure your Device GPS is switched on. The GISCloud automatically captures the value of the Coordinates once data is sent. • Ensure data is sent when the GPS accuracy level is within allowed limits.

8	CONDUCTOR TYPE	C	The type of conductor material used in the manufacturing of the wire of the feeder line span	• ***Aluminum Coated Steel Reinforced (ACSR):*** High strength conductor wire with inner strand made of steel and outer strand made of Aluminum. • ***All Aluminum-Coated (AAC):*** Conductor wire made solely from Aluminum. • ***Copper:*** Conductor wire made solely from Copper
9	CONDUCTOR SIZE	C	The Diameter size of wire conductor in a line span	• ***35mm***: Wire is 35mm in diameter • ***50mm:*** Wire is 50mm in diameter • ***70mm:*** Wire is 70mm in diameter • ***100mm:*** Wire is 100mm in diameter • ***150mm:*** Wire is 150mm in diameter • ***185mm:*** Wire is 185mm in diameter
10	PHASE AND WIRE	C	The number of wires and the number of Phases present in a line span	• ***3 Phase, Four Wires:*** Line span comprises four wires, three of which are phase wires of equal voltage and current with the fourth been a small wire used as a lightning conductor. This Phase and Wire type is mostly peculiar to Feeder Towers • ***3 Phase, Three Wires:*** Line span comprises three wires all of which are phase wires with equal voltage and current.
11	SUPPORT TYPE	C	The type of pole support structure for the HV Network at the captured point	• ***Concrete Pole:*** Pole made of concrete (a mixture of cement and sand) • ***Wooden Pole:*** LV pole made of wood • ***Bamboo:*** LV Pole made of Bamboo • ***Steel Pole:*** LV Pole made of Steel • ***Tower:*** Pole is a tall steel-made structure. Also known as Pylon
12	INSULATOR TYPE	C	Type of Insulating support used to attach Feeder Line on the Pole	• ***Pin:*** Insulator type is Pin which is secured to the cross-arm on the pole. • ***Disk:*** Insulator type is Disk suspended on the Pole. • ***Shackle:*** Insulator type is of the shackle type fixed directly with a bolt either on the pole or the cross arm. • ***None:*** Pole does not have an insulator.
13	POLE_FROM	C	Pole Number of Preceding Pole in direct connection to the current pole	• The Pole_from for the first pole is 0. • For Poles coming after a Twin or Triple Pole structure. The Pole_from is the Twin 1 Pole of the twin or triple pole structure.
14	POLE_TO	C	Pole Number of Current Pole	•
15	LINE CONNECTION PATTERN	C	The line connection pattern of poles (between the pole_from and pole_to) depleting the connection pattern of a line span	• ***Overhead:*** Feeder line suspended by poles between a line span • ***Underground:*** Feeder line running underground between a line span
16	EARTH WIRE PRESENCE	C	The Presence of Earth Wire on the Pole	• ***Yes:*** Earth Wire is Present. • ***No:*** Earth Wire not present.

17	CROSS ARM TYPE	C	The Type of Cross Arm on the Pole support the insulator and Feeder wire	• ***Wooden:*** Cross Arm is made of wood • ***Fiber:*** Cross Arm is made of fiber material • ***Steel:*** Cross Arm is made of Steel material • ***None:*** There is no Cross Arm on the Pole. • This option is only present for Single and Twin 1 Poles.
18	TIE STRAP PRESENCE	C	The Presence of Tie strap holding the cross-arm firm	• ***Yes:*** Tie Strap is present. • ***No:*** Tie Strap not present.
19	BASE SUPPORT PRESENCE	C	The Presence of Base Support for the Pole	• ***Yes:*** Base support is present • ***No:*** Base support not present
20	ISOLATION POINT	C	Isolation Points are Pole structures usually Twin Poles characterized by the presence of Line Isolators. It is in the Pole Feeder Line are separated from one point to another	• ***Yes:*** Line Isolator is present on the Pole • ***No:*** Line Isolator not present on the Pole • Most Feeder Points serving as Substation Gantry usually have isolation points. However, the isolation point referred to here are those that are not served by a Distribution substation
21	POLE DESCRIPTION	C	The description of Pole Structure	• ***Standard:*** A Pole is standard if its length is about 28meter for LV Poles and 40meters for HV Poles. • ***Undersized:*** A Pole is undersized if it is lower than the specified length.
22	LINE DESCRIPTION	C	Description of Line span	• ***Sagging:*** A Line is sagging when is sinks or bugles downwards underweight or pressure or due to lack of strength • ***Tension:*** A Line is tensioned when it is properly stretched or strung.
23	POLE CONDITION	CR	The Condition of the Pole	• ***Good:*** A pole is Good if it is properly erected, showing no signs of decay (for wooden poles), and is not bent or broken. • ***Bad:*** A Pole is Bad if it is not properly erected, or is decay, bent or broken
24	IMAGE OF FAULTY POLE	C	Image of faulty Pole	•
25	TRANSFORMER ATTACHED	C	Is there a transformer connected to the Feeder network through this Pole	• ***Yes:*** There is a transformer connected to the network via the Pole • ***No:*** There is no transformer connected to the network via the Pole.
26	IMAGE OF UNCONNECTED POLE	C	Image of unconnected Pole	•
27	COMPOSITE POLE	CR	A Composite Pole is a pole supporting two different line networks. This may be two different Feeder networks, or two different distributor network or a combination of a Feeder network and distributor network	• ***Yes:*** Pole is a composite Pole. • ***No:*** Pole is not a composite Pole
28	COMPOSITE POLE TYPE	C	The different type of a composite structure denoted	• ***33KV/33KV:*** A composite pole structure comprising two 33KV Feeder networks.

			by the categories of line network combination present in a composite Pole	• ***33KV/11KV:*** A composite structure comprising of one 33KV and one 11KV Feeder network. • ***33KV/415V:*** A composite structure comprising of one 33KV network and one or more distributor line network • ***11KV/415V:*** A composite structure comprising one 11KV network and one or more distributor line network. • ***415V/415V:*** A composite structure comprising of two distributors (upriser) line network
29	POLE CHARACTERISTICS	CR	The Pole characteristics with regards to being either a single Pole, a Twin Pole or a Triple Pole	• ***Single:*** Pole is a single Pole structure • ***Twin 1:*** Pole is the first component of a Twin Pole structure. • ***Twin 2:*** Pole is the second component of a Twin Pole structure. • ***Triple:*** Pole is the third pole of a Triple Pole structure. • The Twin 1 Pole in a Twin Pole or Triple Pole structure is the reference pole. All other poles within the Twin pole structure or triple pole structure refers to it. • In the numbering of Twin Poles or Triple Pole structure, the Pole to the left is the usually the Twin 1 Pole.
30	RELATED POLE NUMBER	C	The Pole number of a Twin 1 Pole which a Twin 2 Pole and a Triple Pole refers to	•

C2: DISTRIBUTION SUBSTATION FORM ATTRIBUTE LIST AND INSTRUCTION

S/N	COLUMN	STATUS	COLUMN DESCRIPTION	• INSTRUCTION
1	DSS STATUS	CR	The status of the Distribution Substation's connection to the Electricity Distribution System	• ***Connected***: A Distribution Substation is connected when there is a physical attachment (in terms of electricity wires) between the DSS and a connected Feeder pole whose source is either from the Injection Substation or the Transmission substation. • ***Not Connected***: A Distribution Substation is not connected if no physical attachment exists between the substation and Feeder pole or between its attached pole and other poles within the Feeder network. Not Connected DSS are mostly idle transformers within a Feeder network.
2	FEEDER TYPE	CR	The type of Feeder	• ***11KV***: refers to a Feeder network with distribution voltage capacity of 11KV (11000Volts). This option is selected if the feeder emanates from the 33KV/11KV Injection Substation. • ***33KV:*** refers to a Feeder network with distribution voltage capacity of 33KV (33000Volts). This option is selected if the feeder emanates from the 132KV/33KV Transmission Substation.
3	33KV FEEDER	C	A list of 33KV Feeder within the EEDC network as well as their unique codes	• The availability of this option is dependent on the value of the preceding column.
4	11KV FEEDER	C	A list of 11KV Feeder within the EEDC network as well as their unique codes	• The availability of this option is dependent on the value of the preceding column.
5	33KV POLE	C	The 33KV Pole a DSS existing on a 33KV Feeder network is connected to	• The availability of this option is dependent on the value of the preceding column. • Most DSS are connected to the Feeder via a Twin Pole Structure which serves most times as the substation gantry. When selecting the connected Pole option, refer and utilized the Pole number of the Twin 1 Pole.

6	11KV POLE	C	The 11KV Pole a DSS existing on an 11KV network is connected to	• The availability of this option is dependent on the value of the preceding column. • Most DSS are connected to the Feeder via a Twin Pole Structure which serves most times as the substation gantry. When selecting the connected Pole option, refer and utilized the Pole number of the Twin 1 Pole.
7	DSS NUMBER	C	The unique number of the DSS with reference to the number of DSS per pole	• The numbering of the DSS is based on a Pole - the Pole of connection such that if a DSS is connected to the Feeder via Pole 30, the DSS_no is 1 and if other Poles are connected to the Feeder via this Pole (Pole 30), the take-up successive number 2, 3, ... up to the total number of DSS connected to the Feeder via Pole (Pole 30) • If more than one DSS connects to the Feeder via a single pole, there is usually an RMU to enable this connection
8	OUTPUT VOLTAGE LEVEL	C	The output Voltage level of the DSS	• ***33KV:*** The DSS outputs voltage at 33KV. This is usually through a Power transformer feeding from a 132KV transmission network. • ***11KV:*** The DSS outputs voltage at 11KV. This is usually through a power transformer feeding from a 33KV network. • ***0.415KV:*** The DSS outputs voltage at 415V. This is the common case for all transformers less than 1KVA capacity feeding from either the 11KV or the 33KV network.
9	SUPPLY TYPE ID	C	The voltage ratio of the Distribution Substation i.e. the ratio of the input voltage and output voltage	• ***11KV/415V:*** Distribution substation with 11KV input Feeder voltage and output distribution voltage of 415V. • ***33KV/415V:*** Distribution substation with input Feeder voltage of 33KV and output distribution voltage of 415V. • ***33KV/11KV:*** Distribution substation with a 33KV input voltage and 11Kv output voltage. • ***132KV Direct:*** Distribution substation receiving an input voltage at 132KV • ***11KV/415V underground:*** Distribution substation with an input voltage of 11KV and output voltage of 415V running underground.
10	DSS LAT_Y	C	The Latitudinal coordinate value of the Distribution substation	• Ensure your Device GPS is switched on. The GISCloud automatically captures the value of the Coordinates once data is sent. • Ensure data is sent when the GPS accuracy level is within allowed limits.
11	DSS_LONG_X	C	The Longitudinal coordinate value of the Distribution substation	• Ensure your Device GPS is switched on. The GISCloud automatically captures the value of the Coordinates once data is sent. • Ensure data is sent when the GPS accuracy level is within allowed limits.
12	DSS IMAGE	C	The Image of the Distribution Substation	• When capturing the image of the Distribution Substation ensure that all component of the substation especially the Transformer is captured.
13	LINE CONNECTION PATTERN	C	The line connection pattern of Distribution Transformer to the Feeder Pole	• ***Ground level:*** The DSS is connected to the HT Pole via a Cable running over ground • ***Underground:*** The DSS is connected to the Feeder network via a cable running underground.
14	NAME OF DSS	C	The name of a Distribution Substation	• The name of the DSS could be the name of the Street where it is located for Public Transformers or Name of Customer/Village for Bulk or Point Load transformers.
15	ADDRESS	C	Location Address of the DSS	• This refers to the Street Address of the DSS
16	DISTRICT	C	The EEDC District of the location of the Distribution substation	•
17	TRANSFORMER MOUNTING	C	The type of support the Transformer is attached to.	• ***Pole Mounted:*** The Transformer is mounted on a Pole. • ***Grounded:*** The Transformer is mounted on the ground
18	DSS TYPE	C	The Type of the Distribution Substation in terms of the user	• ***Point Load:*** The DSS is used by a single Customer (Private) • ***Public:*** The DSS is used by the Public consisting of several Customers connected to the source via LV Network and billed individually.

				• ***Rural Bulk:*** The DSS is used by several individuals connected to the source via an LV Network but billed as a collective unit. This is prevalent in Rural Areas.
19	NUMBER OF UPRISERS	C	The Number of outputs Upriser emanating from the Distribution Substation	•
20	FENCED OR UNFENCED	C	The presence of a Perimeter Fence for the Distribution Substation	• ***Fenced:*** A Fence is present • ***Unfenced:*** A fence is not present
21	ACCESSIBILITY (TRANSFORMER)	CR	Accessibility of the Transformer	• ***Yes:*** Transformer is accessible • ***No:*** Transformer is not accessible
22	NAMEPLATE VISIBILITY	CR	Visibility of the nameplate of the Transformer	• ***Yes:*** Nameplate is visible • ***No:*** Nameplate is not visible
23	TRANSFORMER MAKE	C	The Maker of the Transformer	• Select from the list of an available option if applies. Select 'Others' if the available option does not apply
24	SPECIFY TRANSFORMER MAKE	C	Specify Transformer Make if the Others option is selected	•
25	TRANSFORMER SERIAL NO	O	Serial Number of the Transformer	•
26	TRANSFORMER CAPACITY	CR	The capacity of the Transformer in KVA	• Select from the list of an available option if applies. Select 'Others' if the available option does not apply
27	SPECIFY TRANSFORMER CAPACITY	C	Specify Transformer Capacity if the Others option is selected	•
28	TRANSFORMER IMPEDANCE	O	Transformer Impedance value in %	• Available on the nameplate of the Transformer
29	TRANSFORMER VOLTAGE RATIO	C	The Voltage Ratio of the Transformer (Similar to the Supply Type)	•
30	TRANSFORMER VECTOR GROUP	O	Transformer vector Group	• Available on the nameplate of the Transformer
31	MAXIMUM TAP	O	Transformer Maximum Tap Value	• Available on the nameplate of the Transformer
32	NOMINAL TAP	O	Transformer Nominal Tap Value	• Available on the nameplate of the Transformer
33	MINIMUM TAP	O	Transformer Minimum Tap Value	• Available on the nameplate of the Transformer
34	HV PROTECTION	C	Presence of Protection for the High Voltage Cable	• ***Yes:*** HV Cable is protected • ***No:*** HV cable is not protected
35	LV PROTECTION	C	Presence of Protection for the Low Voltage Cable	• ***Yes:*** LV Cable is protected • ***No:*** LV Cable is not protected
36	SUBSTATION GANTRY PRESENCE	CR	Presence of Substation Gantry (Comprising all or most of the component of the substation gantry)	• ***Yes:*** Substation Gantry is present • ***No:*** Substation Gantry is not present
37	LIGHTNING ARRESTOR PRESENCE	C	Presence of Lightning Arrestor component in the substation gantry	• ***Yes:*** Lightning Arrestor is present • ***No:*** Lightning Arrestor is not present
38	DROP OUT FUSE PRESENCE	C	Presence of Drop-out Fuse component in the substation gantry	• ***Yes:*** Drop-out fuse is present • ***No:*** Drop-out fuse is not present
39	GANG ISOLATOR PRESENCE	C	Presence of Gang Isolator component of the substation gantry	• ***Yes:*** Gang isolator is present • ***No:*** Gang isolator is not present
40	TRANSFORMER CABLE PRESENCE	CR	Presence of a cable output from the Transformer to the Feeder Pillar or Customer	• ***Yes:*** Cable is present • ***No:*** Cable is not present

41	CABLE TYPE	C	Type of transformer cable	• ***Single Core:*** Cable is a single core cable • ***4 Core:*** Cable is a four-core cable
42	CABLE SIZE	C	The diameter size of the transformer cable	• Select from the list of available option.
43	CABLE LENGTH	O	Length of Transformer Cable	•
44	CABLE JOINT TYPE	C	Joint type of cable with the Transformer	• ***Straight Joint:*** Transformer Cable is joined to the Transformer in such manner that both maintain the same vertical or horizontal orientation. • ***Marriage Joint:*** Transformer cable is intertwined with the Transformer connection point
45	FEEDER PILAR PRESENCE	CR	Presence of a Feeder Pillar in the Distribution Substation	• ***Yes:*** Feeder Pillar is present • ***No:*** Feeder Pillar is not present
46	FEEDER PILLAR MAKE	CR	Make of Feeder Pillar	• Select from the list of options
47	SPECIFY FEEDER PILLAR MAKE	C	Specify Feeder Pillar Make If OTHERS	•
48	FEEDER PILLAR TYPE	O	Type of Feeder Pillar	•
49	FEEDER PILLAR VOLTAGE	O	Voltage of Feeder Pillar	•
50	FEEDER PILLAR CURRENT RATING	O	Feeder Pillar Current rating	•
51	NUMBER OF FUSE IN FEEDER PILLAR	O	Number of Fuse in the Feeder Pillar	•
52	FUSE TYPE	C	The of Fuse present in the Feeder Pillar	• ***Cartridge:*** Fuse is cartridge-like in structure • ***Non-Cartridge:*** Fuse is not made of cartridge

C3: LT POLE FORM ATTRIBUTE LIST AND INSTRUCTIONS

S/N	COLUMN	STATUS	COLUMN DESCRIPTION	INSTRUCTION
1	IS THE POLE CONNECTED (CONNECTION STATUS)	CR	The status of the Pole's connection to the Electricity Distribution System	▪ ***Yes:*** A Pole is connected when there is a physical attachment (in terms of electricity wires) between the pole and other poles whose source is the Distribution Substation. ▪ ***No:*** A Pole is not connected if no physical attachment exists between the pole and other poles within the Upriser network. Not Connected Poles are mostly idle poles within an upriser network.
2	FEEDER TYPE	CR	The type of Feeder serving the Distribution Substation.	▪ ***11KV***: refers to a Feeder network with distribution voltage capacity of 11KV (11000Volts). This option is selected if the DSS serving the upriser is fed by such Feeder. ▪ ***33KV***: refers to a Feeder network with distribution voltage capacity of 33KV (33000Volts). This option is selected if the DSS serving the Upriser network is fed by such Feeder.
3	33KV FEEDER	CR	A list of 33KV Feeder within the EEDC network as well as their unique codes	▪ The availability of this option is dependent on the value of the preceding column.
4	11KV FEEDER	CR	A list of 11KV Feeder within the EEDC network as well as their unique codes	▪ The availability of this option is dependent on the value of the preceding column.

5	DSS ID	C	The Distribution Substation whose LV Network is to be mapped	▪ This is a list of all DSS connected to the Feeder. ▪ This List is dependent on the selected Feeder in preceding columns. ▪ The DSS whose LV network is to be mapped is selected from this option
6	LT POLE LONGITUDE	C	The Longitudinal coordinate value of the LT Pole	▪ Ensure your Device GPS is switched on. The GISCloud automatically captures the value of the Coordinates once data is sent. ▪ Ensure data is sent when the GPS accuracy level is within allowed limits.
7	LT POLE LATITUDE	C	The Latitudinal coordinate value of the LT Pole	▪ Ensure your Device GPS is switched on. The GISCloud automatically captures the value of the Coordinates once data is sent. ▪ Ensure data is sent when the GPS accuracy level is within allowed limits.
8	UPRISER NO	C	A unique number of the Upriser emanating from the DSS whose LT Network is to be mapped. The Upriser No is the unique identity defining the Upriser network within the DSS and all LT Poles connected to it	▪
9	LT POLE NUMBER	C	The unique sequential number of LT Pole within an upriser network	▪ The LT Pole number follows progressively from the first pole in the upriser.
10	POLE TYPE	C	The type of pole support structure for the LV Network at the captured point	▪ ***Concrete Pole:*** Pole made of concrete (a mixture of cement and sand) ▪ ***Wooden Pole:*** LV pole made of wood ▪ ***Bamboo:*** LV Pole made of Bamboo ▪ ***Steel Pole:*** LV Pole made of Steel
11	COMPOSITE POLE	CR	A Composite Pole is a pole supporting two different line networks. This may be two different Feeder networks, or two different distributor network or a combination of a Feeder network and distributor network	▪ ***Yes:*** Pole is a composite Pole. ▪ ***No:*** Pole is not a composite Pole
12	COMPOSITE POLE TYPE	C	The different type of a composite structure denoted by the categories of line network combination present in a composite Pole	▪ ***33KV/33KV:*** A composite pole structure comprising two 33KV Feeder networks. ▪ ***33KV/11KV:*** A composite structure comprising of one 33KV and one 11KV Feeder network. ▪ ***33KV/415V:*** A composite structure comprising of one 33KV network and one or more distributor line network ▪ ***11KV/415V:*** A composite structure comprising one 11KV network and one or more distributor line network. ▪ ***415V/415V:*** A composite structure comprising of two distributors (upriser) line network
13	POLE DESCRIPTION	C	The description of Pole Structure	▪ ***Standard:*** A Pole is standard if its length is about 28meter for LV Poles and 40meters for HV Poles. ▪ ***Undersized:*** A Pole is undersized if it is lower than the specified length.

14	POLE CONDITION	CR	The Condition of the Pole	▪ ***Good:*** A pole is Good if it is properly erected, showing no signs of decay (for wooden poles), and is not bent or broken. ▪ ***Bad:*** A Pole is Bad if it is not properly erected, or is decay, bent or broken
15	IMAGE OF FAULTY POLE	C	Image of Faulty Pole	▪
16	POLE_FROM	C	Pole Number of Preceding Pole in direct connection to the current pole	▪ The Pole_from for the first pole is 0.
17	POLE_TO	C	Pole Number of Current Pole	▪
18	LINE CONNECTION PATTERN	C	The line connection pattern of poles (between the pole_from and pole_to) depleting the connection pattern of a line span	▪ ***Overhead:*** Distributor line suspended by poles between a line span ▪ ***Underground:*** Distributor line running underground between a line span
19	WIRE CONDUCTOR TYPE	C	The type of conductor material used in the manufacturing of the wire	▪ ***Aluminum:*** line span wire conductor is made of aluminum ***Copper:*** Line span wire conductor is made of Copper
20	CONDUCTOR SIZE	C	The diameter size of wire conductor in a line span	▪ ***35mm***: Wire is 35mm in diameter ▪ ***50mm***: Wire is 50mm in diameter ▪ ***70mm***: Wire is 70mm in diameter ▪ ***100mm***: Wire is 100mm in diameter ▪ ***150mm***: Wire is 150mm in diameter ▪ ***185mm***: Wire is 185mm in diameter
21	PHASE AND WIRE	CR	The number of wires and the number of Phases present in a line span	▪ ***3 Phase, Four Wires:*** Line span comprises four wires, three of which are phase wires connected to the main supply with the fourth be the neutral wire. ▪ ***2 Phase, Three Wires:*** Line span comprises three wires, two of which are phase wires connected to the main supply with the third be the neutral wire. ▪ ***1 Phase, Two Wires:*** Line span comprises two wires, one of which is a phase wire connected to the main supply with the other wire been the neutral wire ▪ ***Service Wire:*** Line span consists ofa number of Wire and phases not captured in any of the options above but is a Service Wire such as Recline Cables or other insulator-coated cable supplying electricity to a given consumer.
22	LINE DESCRIPTION	C	Description of Line span	▪ ***Sagging:*** A Line is sagging when is sinks or bugles downwards underweight or pressure or due to lack of strength ▪ ***Tension:*** A Line is tensioned when it is properly stretched or stringed.
23	PRIORITY	O	The Name of the manufacturer of the Pole	▪ Usually found on the body of most poles
24	DATE OF SUPPLY RELEASE	O	The Date of the manufacturing/release of the Pole for use.	▪ Usually found on the body of most poles
25	LAMP POST TYPE	C	The number of lamps presence in a Street light Pole	▪ ***Single:*** Streetlight pole has a single lamp post ▪ ***Double:*** Streetlight pole has two lamp post

26	ROAD NAME	C	The name of the Road	• Road name should end with the appropriate street types depending on the class of Road. A typical example of street types includes Expressway, Road, Avenue, Street, Crescent, Boulevard, By-Pass, Drive, Close, Lane etc.
				• Connecting roads linking two major roads in an interchange is to bear the name of the destination road with the street type 'link' e.g. Enugu-Port Harcourt Expressway Link.
27	ROAD CLASS	C	The category of road	• ***Expressway***: These are specially designed and restricted highways divided with barriers which make traffic in opposite directions completely separated from each other. Each carriage has multiple road lanes. Expressways are part of the Nigeria Highway Trunk roads linking states. They are Major roads and have their road name ending with 'Expressway'. E.g. Enugu-Onitsha Expressway.
				• ***Primary:*** These area single carriage, two-lane highways with traffic flowing in opposite directions. Like expressway, they are interstate and form part of the Nigeria Highway Trunk roads. They are Major Roads. E.g. Old Enugu Onitsha Road.
				• ***Secondary:*** These area dual carriage, intra-city or inter-city roads with divided barriers and link various parts of a city or two major cities in a state. They are Major Road. E.g. Agbani Road
				• ***Tertiary***: These are single carriage roads which link rural (villages) areas within a state. They may be paved or unpaved. Single carriage intra city collector roads are also classified as tertiary roads. They can be minor or major roads depending on road condition. E.g. Amechi Road, Inyi-Achi Road.
				• ***Residential***: Single carriage local roads found in residential areas. E.g. Isiagu Street.
				• ***Service***: Private driveway for access to building and structure within a facility. E.g Roads inside a University Compound
				• ***Tracks***: Unpaved pathways in villages linking various path of villages or farmlands
28	NUMBER OF LANES	C	The number of lanes on the road	• The number of road lanes must be >= 1
29	ROAD LENGTH	O	Length of road in kilometers	•
30	DIRECTION	C	The Traffic direct for the road carriage	• ***One-way***: The traffic on the road carriage is moving in one direction. This is usually the case for individual road carriage in a dual carriage road and for single carriage roads designated as one-way. • ***Both-ways***: Traffic direction on the road carriage is moving in two directions (to and from). This is usually the case in most single carriage roads

31	ROAD CONDITION	C	The Condition of the road.	• ***Paved***: Road surface is covered with sealed material such as paving stone, tar, or concrete giving it a firm surface which makes the road suitable for travel. • ***Unpaved***: Road surface is bare such as dirt road or covered with an unsealed material such as road filled with gravel.
32	ROAD DESCRIPTION	O	Description of all road-like features	• ***Bridge***: Road span feature is a Bridge with river or railway, or another road crossing beneath • ***Tunnel***: Road span feature is a Tunnel • ***Roundabout***: Road span feature is a Roundabout • ***Interchange***: Road span feature is an interchange with one or more ramps permitting at least one highway to pass through with directly crossing any traffic stream • ***Road***: Road Span Feature does not belong to any of the above descriptions
33	MAXIMUM SPEED LIMIT	O	The maximum allowed speed on the road	• The maximum speed limit is usually found on Road signages.
34	TURN RESTRICTION	O	Turn restriction are traffic signals found beside road intersections or junctions restricting road traffic from entering another road.	• ***No Restriction***: There is no turn restriction on road span feature • ***No Left Turn***: Incoming Road traffic not allowed entry into a road at the left side of a junction. • ***No Right Turn***: Incoming Road traffic not allowed entry into a road at the right side of a junction • ***No U-Turn***: Incoming Traffic not allowed to make a U-turn.

C4: CUSTOMER FORM ATTRIBUTE LIST AND INSTRUCTION

S/N	COLUMN	STATUS	COLUMN DESCRIPTION	INSTRUCTION
1	CONNECTION STATUS	CR	The mode of connection of a building to the Electricity distribution system.	• ***Direct*** refers to a building/customer that is connected to the Electricity distribution network.
				• ***Indirect*** refers to a building/customer that connects to the distribution system through a customer in another building and pays the bill through the connected customer.
				• ***Not connected*** refers to a building with no traceable connection to the distribution system.
2	SUGGEST SEPARATION	CR	Separation suggestion for Indirect Consumers	• ***Yes:*** Consumer to be separated • ***No:*** Consumer not to be separated • The suggestion for separation by the field works is based on the following condition: That an Indirect Consumer ✓ is a different household from the Direct Customer ✓ has a different building use from the Direct Customer ✓ Lives in a shack used for commercial purposes (e.g. vulcanizer, welder, mechanic, ice block business) ✓ lives in residential shacks using heavy appliances (e.g. AC, pumping machine, deep freezers etc.)
3	BUILDING CODE	C	The code of the building as visible on the map.	• Points must fall on building associated with a building code.
				• If the building is not represented, a point should be captured with the theme 'no code'.

				• If the structure of the building as visible on the map is not the correct structure on the ground, the point should be captured to fall on the building. In this case, instead of the building code, the theme '**incorrect structure**' should be entered.
4	POI	CR	Is Building/Structure a Point of Interest?	• ***Yes:*** Building/Structure is a POI • ***No:*** Building/Structure is not a POI
5	POI NAME	O	The popular name associated with the building.	• This is specifically for Point of interests (poi) if the building is not a point of interest leave attribute empty.
6	POI CATEGORY	CR	Category of Point of Interest if Building/ Structure is a Point of Interest	• ***Automotive/Transport*** • ***Business*** • ***Eatery/Restaurant*** • ***Educational Institution*** • ***Financial Institutions*** • ***Government and Public Services*** • ***Healthcare*** • ***Hospitality/Living Accommodation*** • ***Leisure/Tourism*** • ***Religious Institution*** • ***Shopping*** • ***Sport*** • ***EEDC Facility*** • For Buildings that are POIs with several Customer points, only one Customer/Consumer should be attributed as a POI
7	POI SUB-CATEGORY	C	The sub-category group of the POI	• Value depending on the value above
8	BUILDING USE	CR	The use of the building by a specific customer/consumer in the building.	• ***Commercial*** building use is when the customer/consumer uses the whole building or his part of the building for commercial purposes such as business, educational, medical. • ***Residential*** building use is when the customer/consumer uses the whole building or his part of the building for residential purposes. • ***Industrial*** building use is when the customer/consumer uses the whole building or his part of the building for industrial purposes either micro or macro industry. • ***Special*** building use is when the whole building or part of the building relating to a customer is used as a government institution or for recreation, storage, religious activities or as any other purpose as related to this.
9	BUILDING SUB-USE	C	The subcategory of the use of a building by a customer relating to column 4 above.	•
10	BUILDING STATUS	C	The current status of a building.	• ***Abandoned*** relates to a building with no sign of lively activities for a while. This may be a completed or uncompleted building. • ***Completed*** relates to a building structure whose construction has been completed. • ***Ongoing*** relates to a building whose construction status is still in progress with a visible sign of construction activities. • ***Uncompleted*** relates to a building whose construction status is unfinished with no visible construction activity ongoing. Such building may be occupied or not.
11		C		• ***Occupied*** refer to a building been in use.

	OCCUPANCY STATUS		Refers to the residency or utilization status of a building.	• ***Not occupied*** refer to a building or part of a building not in use.
12	BUILDING TYPE	CR	The type of building been captured.	• ***Block of Flats*** refers to building blocks housing flat apartments such as single/multi-bedroom flats or self-contained apartment. A block of flat may be a single floor or multiple floors.
				• ***Block of Shop*** refers to a building block housing shops, kee-klamps, shades or a mall. Such may be a single floor or multiple floors.
				• ***Block of Rooms*** refers to a building block housing rooms which are not in a face-to-face pattern. Included in this definition are single room self-contained apartments.
				• ***Bungalow*** refers to a single floored building that is classified as a block of flat. Can be used for a variety of purposes.
				• ***Church*** refers to a building constructed in format peculiar to the Christian place of worship and used for that purpose.
				• ***Duplex*** refers to single dwelling unit spread over two floors connected by an indoor staircase.
				• ***Face-to-face*** refer to a group of one or two room apartments have their entrances facing each other along a walkway, which leads to the main entrance of the apartment building. This kind of building may have a single floor or multiple floors.
				• ***Filling station*** refers to a structure that houses a facility that sells fuel and engine lubricants for motor vehicles.
				• ***Hall*** refers to relatively large space enclosed by a roof and walls.
				• ***Mosque*** refers to a building constructed in format peculiar to the Islamic place of worship and used for that purpose.
				• ***Mud house*** refer to a structure constructed with mud
				• ***Office complex*** refers to a building housing office for firms and institutions
				• ***Semi detached*** refers to a single-family dwelling house built as one of a pair that shares one common wall.
				• ***Shack*** refers to a small dwelling constructed by hand using available materials such as roof sheets, woods etc. Most exists as a temporary structure.
				• ***Warehouse*** refers to a building for storing goods
				• ***Others*** refer to building types not part of any of the above category.
13	NUMBER OF FLOORS	C	Refers to the number of floors in the building.	• Number of floors start from 1 for a single floored building.
14	NUMBER OF FLATS	C	Number of Flats present in the Block of Flats, or Number of Apartments in a Face-to-Face, Or Number of shops in a block of shops	•
15	NUMBER OF HOUSEHOLDS	C	Refers to the number of Families in the Building for Residential or Number of Shops in	•

			Commercial Building (Shopping Center)	
16	ADDRESS NUMBER	C	The building number within a street.	• If the address number of a building cannot be gotten from the field, 0 should be used instead. Building address information should be obtained on ground based on actual information and must not be based on address information as seen on the bill.
17	STREET NAME	C	The name of the street where the building is located	• Only the conventional street name should be entered with no added information such as locality or address description should be entered here. E.g. Okpara Avenue, or Johnson Street, not Okpara Avenue ~~GRA~~ or Johnson Street ~~Achara Layout~~ • Address relates to the building. In collection address information, questions must be asked on the ground to get the real address of a building and the response should be used if it contradicts the address information on the Customer's bill.
18	ADDRESS DESCRIPTION	O	Further description of the building that will aid easy identification of the Building	• Address description can be used to enter sub-address number such as 3A or for address Numbering system that is not purely numeric such as PLOT Numbering system.
19	APARTMENT NUMBER	C	The number of a specific Flat or Room or Shop or Office within a Block of Flat or Block of Rooms or Block of Shops or Office Complex	• The assignment of Apartment Number must follow the Left-Hand first rule • The apartment number of a Flat within a block of flat must begin with the prefix FLAT (e.g. FLAT 1). • The apartment number of a Shop within a block of Shops must begin with the prefix SHOP (e.g. SHOP 1). • The apartment number of a Room within a block of Rooms must begin with the prefix ROOM (e.g. ROOM 1).
20	CLOSEST BUS STOP	O	Closest bus stop to the building.	•
21	CLOSEST LANDMARK	O	Closest landmark or Point of Interest to the building.	•
22	LOCALITY/AREA/VILLAGE	C	Neighborhood with a city/state or rural neighborhood where the building is situated.	•
23	STATE	C	State administrative boundary where the building is situated.	•
24	LAT_Y	C	The Latitudinal coordinate value of the Consumer	• Ensure your Device GPS is switched on. The GISCloud automatically captures the value of the Coordinates once data is sent. • Ensure data is Customer Point fall on the building where the building is vectorized or around the point of building location where the building wasn't vectorized
25	LONG_X	C	The Longitidunal coordinate value of the Consumer	• Ensure your Device GPS is switched on. The GISCloud automatically captures the value of the Coordinates once data is sent. • Ensure data is Customer Point fall on the building where the building is vectorized or around the point of building location where the building wasn't vectorized
26	DISTRICT-ID	C	The EEDC district administering the locality	•

			where the building is situated.	
27	SUPPLY TYPE ID	C	The supply type category of the customer based on the voltage ratio of the distribution transformers supplying him.	• Supply type id is the same for all customers connected to a distribution substation. • *11kv/415V*: The supply type for Customer feeding from a Distribution Substation that receives electricity from an 11KV Feeder network and distributes at a lower voltage of 415V. • *33KV/415V*: The supply type for Customer feeding from a Distribution Substation that receives electricity from a 33KV Feeder network and distributes at a lower voltage of 415V. • *33KV/11KV*: The supply type for Customer feeding from a Distribution Substation that receives electricity from a 33KV Feeder network and distributes at a lower voltage of 11KV. • *132KV Direct*: The supply type for Customer feeding from a Distribution Substation that receives electricity from the 132KV Direct transmission line. • *11KV/415V Underground*: The supply type for a customer Feeder from a Distribution Substation that receives electricity from an 11KV Feeder network and distributes at a lower voltage of 415V with the low voltage distribution and sometimes the 11KV distribution network running underground.
28	FEEDER ID	CR	Feeder ID for the feeder supplying electricity to the building.	•
29	DSS ID	C	Unique ID for distribution substation supplying electricity to the customer been captured.	•
30	UPRISER NO	C	A unique number of the Upriser network emanating from the distribution substation in which the customer is connected to.	•
31	LT POLE ID	C	Pole number of the LT pole a customer is connected to. Or the LT pole number closest to the indirect /not connected building.	•
32	SERVICE POINT NUMBER	C	The unique ID of the service point (a set of service wire) through which the customer connects to the Electricity distribution network. This is based on the number of service point on a LT pole.	• A building may have one service point with many customers in the building deriving supply from that service point. All these customers share the same service point. • For a building with many customers and many sets of service wire, each customer is tied to the service point supply him. • For Point Load DSS, the service point is 1 except there are more than one Customers connected to the DSS in which case there must be Distribution Poles.
33	SERVICE WIRE TYPE	C	The cable type for the service wire.	• *Single core cable* is a service wire comprises Cables with one core. • *Two core cable*s have two wire cores usually red and black. • Refer to Enumerator Manual Page 12.

34	PHASE AND WIRE	C	This is the number of wires and phases Making up a set of service wires. A set of service wire comprises one neutral wire and at least one live wire.	• ***Single phase two wires*** is a two wires structure service wire consisting of one live and one neutral. • ***Two phases, three wires*** is a three wire structure consisting of two live and one neutral. • ***Three phase, four wire*** structure is a four-wire structure consisting of three live and one neutral.
35	VOLTAGE LEVEL	C	The Voltage level of Customer Electricity Consumption	• ***132KV*** is the consumption voltage level of an Industrial Customer feeding from a Direct 330KV line • ***33KV*** is the consumption voltage level of an Industrial Customer Feeding from a Direct 132KV line • ***11KV*** is the consumption voltage level of an Industrial Customer Feeding from a 33KV High Tension line and utilizing Electricity at that consumption rate. • ***6.6V*** is the consumption voltage level of a Customer feeding from either a 33KV High • ***415V*** is the consumption voltage level of a Customer feeding from a Low-Tension Distributor network. Such Customer connects to the Distribution system using a three phase, four wire service wire structure. • ***240V*** is the consumption voltage level of a Customer feeding from a Low-Tension Distributor network. Such Customer connects to the Distribution system using a three-wire structure (two-phase, three wire) or a two wire structure (one phase, two wire).
36	CUSTOMER NUMBER	C	The unique number of the customer within the Upriser network.	• The customer number applies to only direct customers. It must be unique within the Upriser network. • The numbering sequence should follow the movement of the Upriser from the distribution substation to the last pole on the Upriser, taking into consideration the numbering of service points within poles.
37	LINKED CUSTOMER NUMBER	C	The unique customer number depleting the customer an indirect consumer is connected to.	• This attribute applies to an indirect connection only. For clarification about who an indirect consumer is, see explanation on connection status (Column number 1)
38	CUSTOMER SEPARATION REQUIRED	C	Category of Point of Interest if Building/ Structure is a Point of Interest	• ***No:*** The Consumer does not wish to be separated • ***Yes:*** The Consumer wish to be separated • ***Yes, If Meter is provided:*** The Consumer wish to be separated if the meter is provided on separation. • This column is available once the Enumerator deems an Indirect Consumer to be worthy of separation. The column seeks to find out from the Consumer if he/she desires separation
39	DISCONNECTED	C	Is the Customer/Not Connected Disconnected as at the time of Enumeration	• ***Yes:*** Customer/Not Connected Consumer is disconnected as at the time of Enumeration. • ***No:*** Customer/Not Connected Consumer is not disconnected as at the time of Enumeration
40	BILL OR NO BILL	CR	The billing status of an electricity consumer who has a direct connection.	• Upon discussion with the Electricity consumer, the enumerator must request for his or her electricity bill or receipt. • Bill presented must be EEDC bill/receipt, must contain the customer billing information, and must not be later than 1 year. • ***Bill***: this should be selected if the customer presents his or her bill.

				• *No Bill*: this should be selected if the customer is unable to provide his or her bill showing payment for electricity consumption.
				• *No access*: this should be selected if a customer is unavailable on the second visit after dropping a call back form during the initial visit.
41	CALL BACK FORM NUMBER	C	Unique serial number of Dropped Call Back form for No Access and No Bill Customers	• Call back form Number must be preceded by the acronym EEDC when been entered in the data collection form in the following manner: EEDC49877
42	EEDC ACCOUNT NUMBER	C	The unique account number of electricity customers issued by EEDC and used in paying for electricity.	• The account number must be gotten from the bill. The account number is based on any of the three formats below
				• xx/xx/xx/xxxx-xx – Metered/Unmetered (12 digits)
				• xx.xxxx.xxxx.xxxx – Metered(14 digits)
				• xxxxxxx - Metered (7 digits)
43	FIRST NAME	C	The first name of the customer as visible on the bill	•
44	MIDDLE NAME	O	The middle name of the customer as visible on the bill	• If the full name of the Customer as visible on the bill is in such manner that it forms a single piece (such as the name of an organization), the name on the bill should be divided in a manner that components of the full name will be spread across the three name columns.
				• There should be no repetition of the first name on the other three name columns.
45	LAST NAME	O	The last name of the Customer as visible on the bill	• Same instruction as column 34 above.
46	BUILDING OWNERSHIP STATUS	C	The status of the customer as a resident in the building.	• This refers to the customer whose name and account information is presented in preceding columns.
47	PHONE NUMBER 1	C	The telephone number of the customer.	• If the customer is unable to provide his or her phone number, the text 'no phone number' should be entered instead.
48	PHONE NUMBER 2	O	The telephone number of the landlord of the building if a customer whose details is specified above is a TENANT	•
49	EMAIL ADDRESS	O	the email address of the customer	•
50	BILLING ADDRESS	C	The address on the Bill of the Customer	• The enumerator is expected to enter in this section the address on the bill of the Customer if such address is different from the physical address as entered in Attribute number 16 and 17.
				• If the address on the bill is same as the physical address as entered earlier, Enumerator is expected to enter the value '*Same as Above'* in the place of the address on the bill.
51	LANDLORD TITLE	C	The applicable designated title (name) of the landlord.	• This is based on the list of option presented on the select list
52	LANDLORD FIRST NAME	O	The first name of the Landlord	•
53	LANDLORD MIDDLE NAME	O	The middle name of the landlord	•

54	LANDLORD SURNAME	O	The surname of the landlord	•
55	LANDLORD PHONE NUMBER	O	The landlord phone number	•
56	LANDLORD EMAIL	O	The landlord email	•
57	CUSTOMER TYPE	CR	This refers to the billing mode of the customer.	• ***Metered*** refer to a customer who has an electricity meter. • ***Unmetered*** refer to a customer who has no meter. • The customer type can be gotten on inquiry from the customer or from the bill/receipt
58	TARIFF CLASS	C	This refers to the billing Tariff category of the customer.	• This column applies to the billed customer. Information on the Tariff class of a customer must be gotten from his or her electricity bill.
59	DATABASE MATCHING	C	This column is used to validate if the details of the customer as collected match the customer details on availability.	• ***Match:*** The Customer details match the billing database available to the Enumerator ***Not Match:*** The Customer details does not match the billing database available to the Enumerator
60	METER TYPE	C	This applies to the metered customer and refers to the type of meter used by the customer.	• ***Prepaid***: These are meters that must be loaded with electricity units before been used. Prepaid meters are mostly digital and can be loaded either using meter cards or via token codes. • ***Postpaid***: these are meters which taken electricity consumption reading of the customer. These reading are usually calculated at the end of a period and bills issued. Postpaid meters in circulation are mostly analog meters.
61	METER NUMBER	C	The unique number of the meter.	• Meter numbers are mostly numeric. However, in some cases they are alphanumeric.
62	METER ACCESSIBILITY	C	This column captures data on the ease of accessibility of the meter.	• ***Yes:*** Meter is accessible • ***No:*** Meter is not accessible
63	METER FUNCTIONING	C	This column captures data on the functionality level of the meter.	• ***Yes:*** Meter is functioning properly • ***No:*** Meter is not functioning properly
64	METER SEALED	O	This column captures data on the presence of meter seal on the meter.	• ***Yes:*** Meter is sealed properly • ***No:*** Meter is not sealed properly
65	METER BRAND	O	This column captures data on the manufacturer name (brand) of the meter.	•
66	METER MODEL	O	This column captures data on the brand model of the meter.	•
67	METER CERTIFICATION NUMBER	O	This column captures the certification number of the meter	•
68	METER SEAL NUMBER	O	This column captures the meter seal number	•
69	METER MANUFACTURE DATE	O	This column captures the meter manufacture date	•

C5: ISSUE LOG REPORT FORM

S/N	COLUMN	STATUS	COLUMN DESCRIPTION	INSTRUCTION
1	STATE	C	The State where the issue is been reported	
2	DISTRICT	C	The EEDC district within a state where issue is been reported	
3	FEEDER NAME	C	The name of the Feeder covering the area where the issue is been reported	
4	ASSET	CR	The Asset affected by the noticed issue	• ***HT Poles/DSS***: This is selected if the issues noticed relates to Feeder Assets (HT Pole or DSS)
				• ***LT Pole***: This is selected if the issue noticed relates to Low Tension Pole or line
				• ***Customer***: This is selected if the issue noticed relates to the Customer or a set of customers within an area.
				• ***Building***: This is select if the quality issue noticed relate to a vectorized Building footprint.
5	FEEDER ASSET	CR	Category of issues affecting Feeder Assets and Network	• These include Faulty Pole, Broken Cross Arm, Bushy DSS, Tee-off with no DSS, Inaccessible Feeder Path. • ***Others***: This option is selected if the issue noticed do not fall under the category as stated above.
6	LT POLE ISSUES	CR	Category of issues affecting Low Tension Pole and network	• These include: Broken Pole, Shackle Point • ***Others***: This option is selected if the issue noticed do not fall under the category as stated above.
7	DSS NAME	C	The name of Distribution Substation covering the area where the issue is been reported	• This relates to all issue category except the Feeder Asset issues.
8	UPRISER	C	The Upriser Number of the upriser network covering the area where the issue is been reported	• This relates to all issue category except the Feeder Asset issues.
9	LT POLE	C	The pole number of the Low-Tension Pole close to the point where the issue is been reported	• This relates to the Customer and Building issue category
10	BUILDING CODE	C	The unique code of the building where the issue is been reported	• This relates to the Customer and Building Category
11	CUSTOMER ISSUES	C	Category of issues relating to Customers with emphasis on energy theft issues.	• These include Meter Bypass, illegal connection, Double Feeding. • ***Others***: This option is selected if the issue noticed do not fall under the category as stated above.
12	DESCRIPTION	C	Description of issues not specified in the options of noticed issues	•
13	IMAGE OF ISSUE	C	Capturing of image portraying the issue been reported.	• The image must be focused on the issue identified to provide clarity.