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GIS Portfolio

Project Name: Electricity Transmission Company of Nigeria (Lagos Electric Grid Optimization: Enhancing Energy Accountability & Efficiency")

Problem: Transformers delivering electricity to customers are allocated on a street-by-street basis, resulting in corresponding billing practices. This approach has created challenges as customers are grouped and billed based on the transformer allocated to their location, this makes it difficult to determine the actual energy consumption per transformer accurately. This discrepancy arose because customers in the same area or street were not consistently tied to the same transformer. Furthermore, buildings were unevenly distributed to transformers scattered around the area, and some customers were not included in the billing system. Additionally, illegal tapping of electricity from transformers not allocated to specific streets occurred, leading to energy loss and accountability concerns within the electrical sector of Lagos, Nigeria.

Goals:

The aim of this project was to enhance the efficiency, accuracy, and accountability of electricity distribution in Lagos, Nigeria. This is by optimizing transformer allocation and billing practices, thereby reducing energy loss, and ensuring fair billing for all customers through energy audit accounting. The specific goals are highlighted below.

1. **Geospatial Mapping:** The first goal of the project was to perform a comprehensive geospatial data capture and inventory encompassing the precise geographical locations of all electrical assets both surface and underground infrastructure, along with the precise mapping of streets associated with these assets, while also implementing comprehensive customer data capture to ensure proper alignment of the number of customers and types of buildings per street with their designated transformer.

2. **Data Segregation:** the second goal was to implement a comprehensive data segregation process, categorizing customers according to their corresponding transformers. This initiative involved systematically enhancing the customer and billing database to ensure the incorporation of precise and up-to-date information.

3. **Meter Implementation:** the third goal was to implement electricity meters for each building and transformer to prevent energy loss and enhance accountability. Metering allowed for accurate energy allocation and consumption data per transformer and building.

My Role in the Project:

1. **Data Cleansing and Gap Analysis**: Our team used ArcGIS Pro's Data Reviewer for automated data validation and rectification to ensure data accuracy, which was crucial for maintaining data integrity and reliability.

2. **Loading Analysis**: ArcGIS Pro's Data Management tools facilitated load data integration, while spatial analysis tools allowed for precise load analysis, enabling efficient electricity distribution and demand forecasting.
3. **Network Analysis:** The "Network Analyst" extension in ArcGIS Pro was employed for modeling the electrical infrastructure, and "Location-Allocation" and "Route Analysis" tools were used for resource optimization, resulting in improved energy efficiency and accountability.
4. **Data visualization and Asset Management**: ArcGIS Pro's cartographic and geoprocessing tools were used for data visualization and optimization. These tools helped in creating clear visual representations and optimizing maintenance schedules, reducing energy losses, and extending equipment lifespan.

Results Achieved:

1. **Data Preparation:** Leveraging ArcGIS Online and ArcGIS Pro, we meticulously delineated the project area of interest in preparation for data capture, establishing a strong foundation for subsequent tasks.

2. **Data Collection:** The Esri Collector application facilitated the on-field collection of data related to transformers, electrical assets, road networks, and customer information. Our team updated all relevant systems with this information.

3. **Data Visualization:** Utilizing ArcGIS Pro, we created an operational map to visualize the electrical asset network, data, and analysis results.

4. **Data Accuracy:** Accurate information was captured and analyzed, updating the database to enhance energy auditing and accountability.

5. **Meter Implementation:** A milestone achievement in our project was the successful deployment of meters for transformers and buildings mitigating energy loss. The energy distribution company can now accurately monitor energy allocation per transformer and manage electrical assets, and consumer information. This includes monitoring electricity consumption rates per building, identifying debtors, and tracing energy losses for accurate energy auditing, load distribution, and loss management.

Some of the maps produced during the course of the project are presented below:

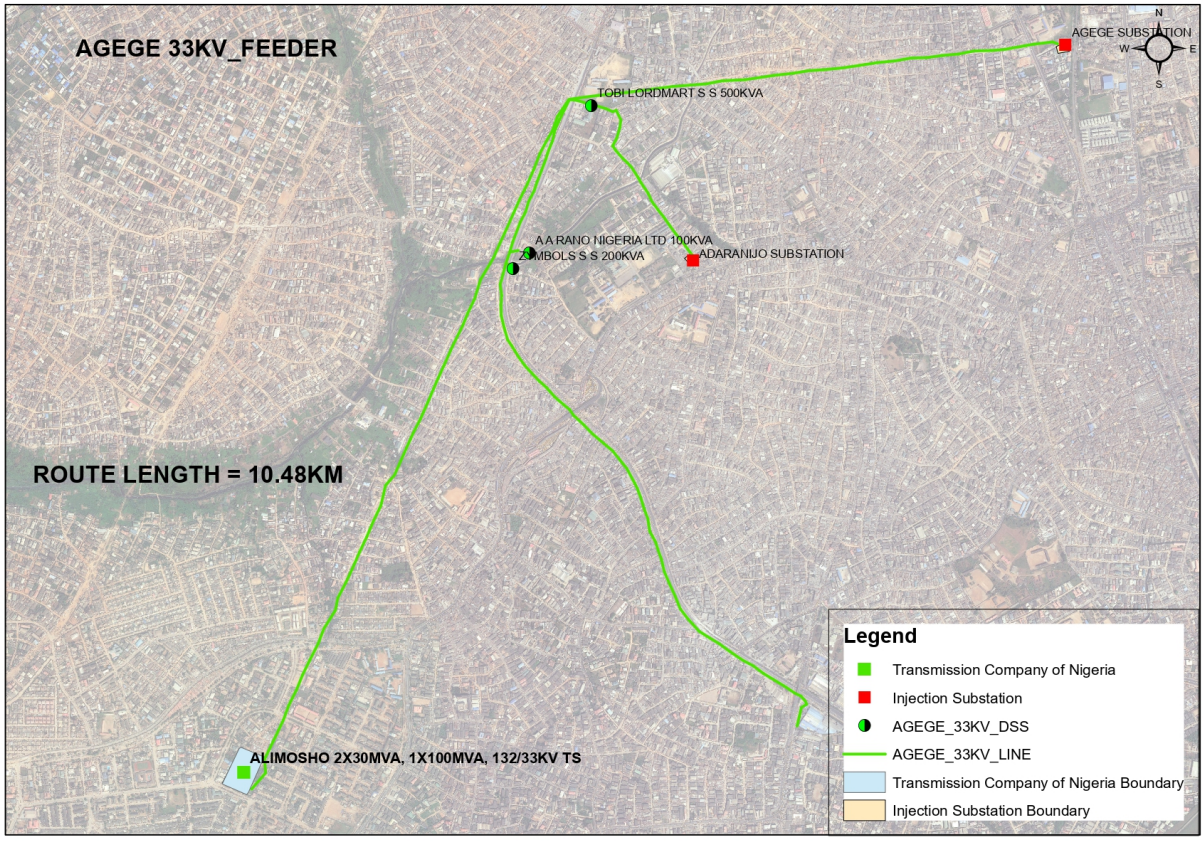

Figure 1: Electrical assets dataset overlaid on the imagery basemap in Agege

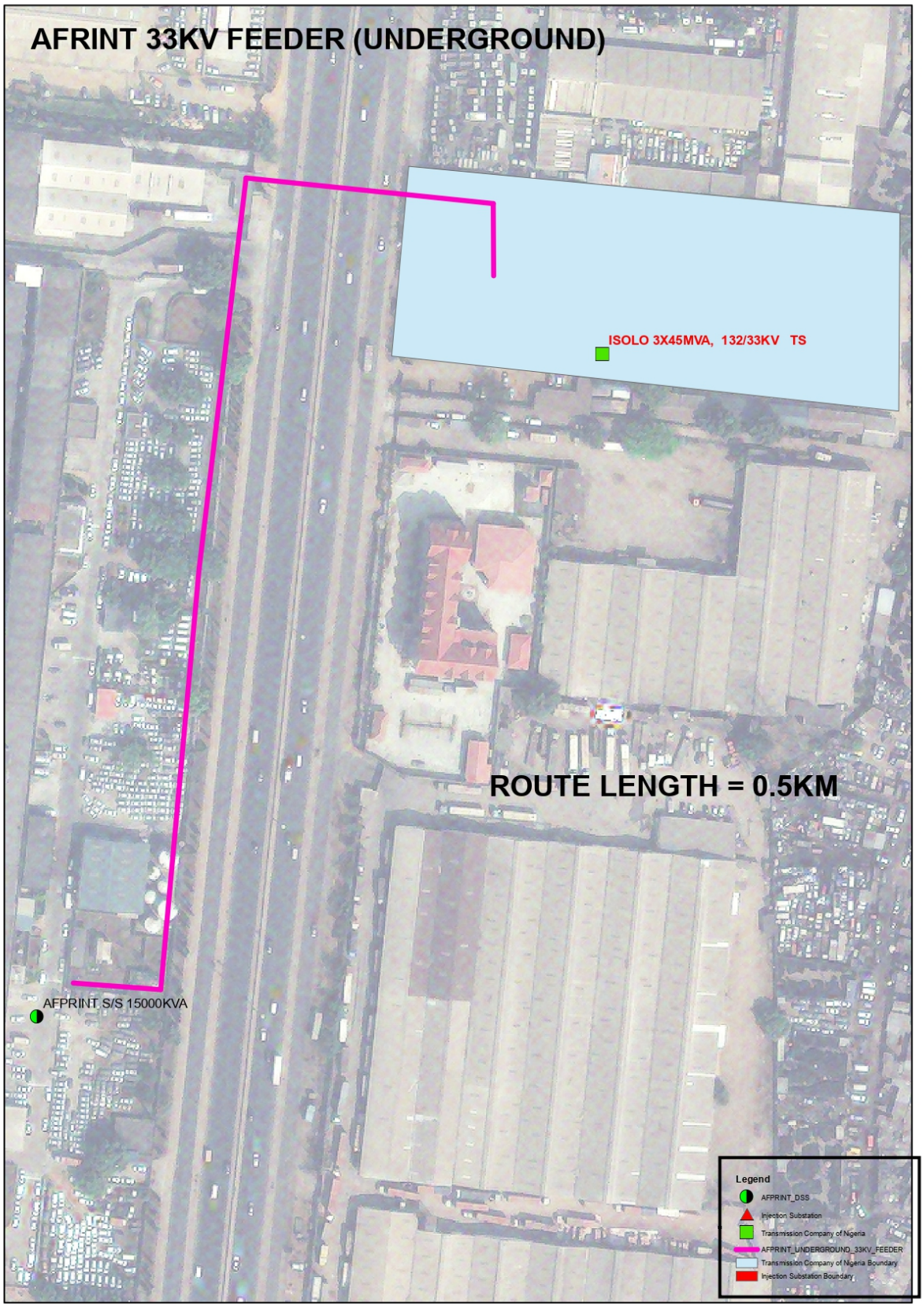
AFRINT 33KV FEEDER (UNDERGROUND)
ISOLO 3X45MVA, 132/33KV TS
ROUTE LENGTH = 0.5KM
AFPRINT S/S 15000KVA
Legend
AFPRINT_DSS
Injection Substation
Transmission Company of Nigeria
AFPRINT_UNDERGROUND_33KV_FEEDER
Transmission Company of Nigeria Boundary
Injection Substation Boundary

Figure 2: Electrical assets dataset overlaid on the imagery basemap in Afprint

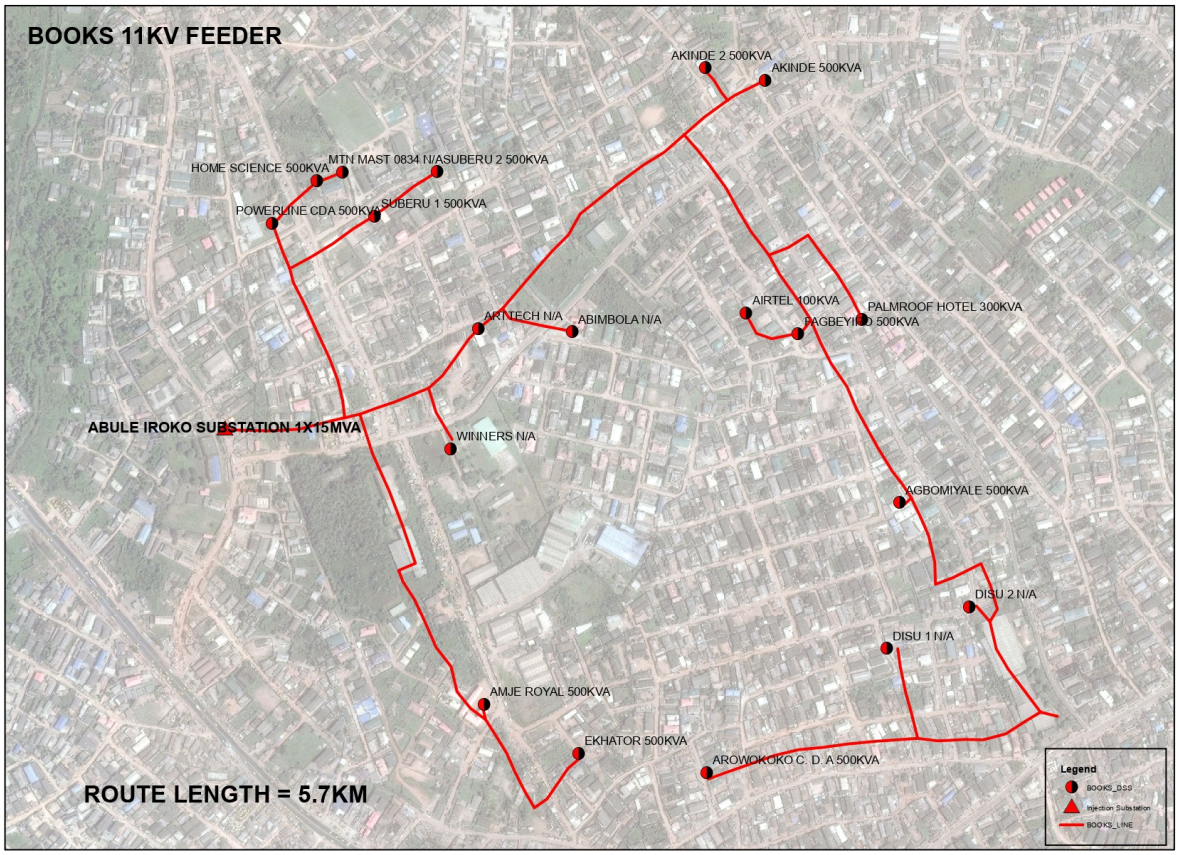

Figure 3: Electrical assets dataset overlaid on the imagery basemap in Books