

Distribution System Digital Mapping

A case study on NRECA International's NESCO project in Bangladesh



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NRECA in the United States

- Electric cooperative utility trade association
- Established in 1942 to address common needs, such as access to financing, insurance, wholesale power, education and training, and advocacy in Washington, D.C.
- Member utilities contribute about \$1 per meter in dues to NRECA
- NRECA affiliates fulfill functions such as insurance, pensions, marketing & branding, and international programs



NRECA International



**Homestead
Funds**



**Touchstone Energy®
Cooperatives**



**National Rural Utilities
Cooperative Finance Corporation**



ECBA
ELECTRIC COOPERATIVE BAR ASSOCIATION



**FEDERATED RURAL ELECTRIC
INSURANCE EXCHANGE**



NRECA International

Empowering Communities Worldwide

A world map with a light gray background. Countries in Latin America, Sub-Saharan Africa, and South and Central Asia are highlighted in a teal color. These highlighted regions correspond to the 48 countries mentioned in the text.

Powering communities and hope by creating

250 rural utilities

across the globe.

Serving **160 million** people in **48 countries**.

4× the number of U.S. rural co-op connections.

- NRECA International was formed in 1962 to promote rural electrification around the world.
- Our purpose is to power communities and empower people to improve their quality of life.
- We've worked in 48 countries, focusing now on Sub-Saharan Africa



NRECA's geospatial planning approach

- The platform was developed for GIS specialists and engineers to perform short, medium and long-term electrification planning
- Geospatial planning follows the steps that an electric utility planner typically runs manually, allowing for analysis at a greater scale more efficiently
- Manages all input data and results from a single, relational database (SQL)
- Provides bidirectional data channels for syncing data to and from the GIS and engineering platforms
- Produces reports and plans from the geodatabase in pdf and html (static and interactive)
- Integrates with financial analysis to prioritize projects based on cost per consumer, NPV, etc.



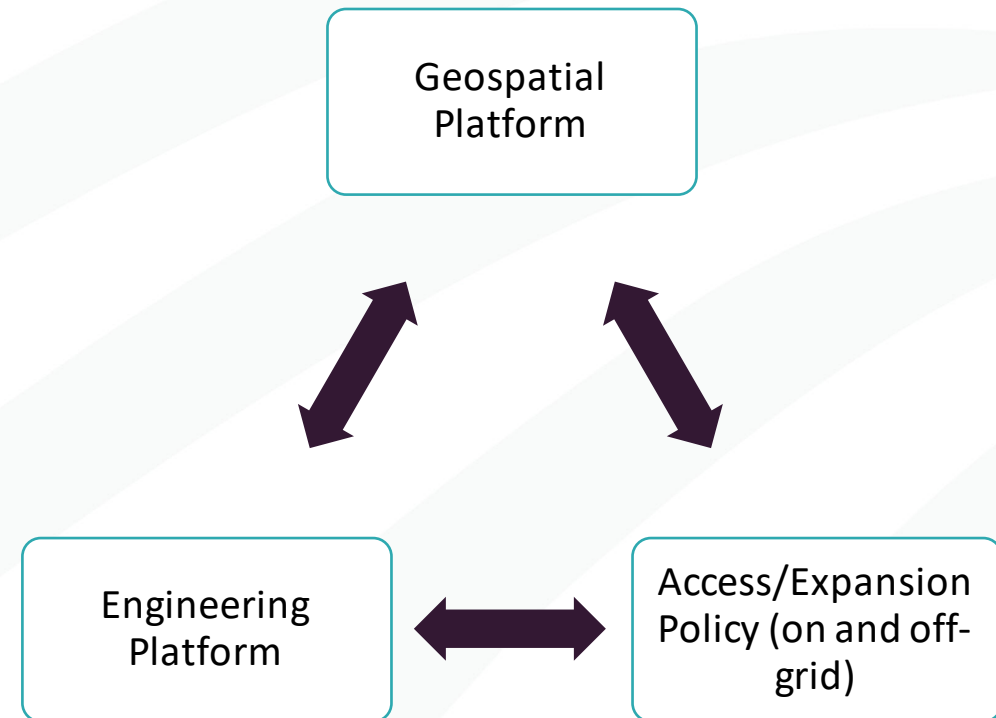
Why geospatial platforms are important

NRECA has purposely developed geospatial products with the intention of integrating the geospatial planning platform into annual and multi-year grid strengthening studies

Meaning that they are integrated with government and utility specific engineering analysis platforms

They replace a manual planning process, allowing a utility to analyze the financial and economical performance of each investment before committing funds

Geospatial platforms should be integrated into the engineering and policy planning process, not single use systems



Case study on the NESCO project in Bangladesh

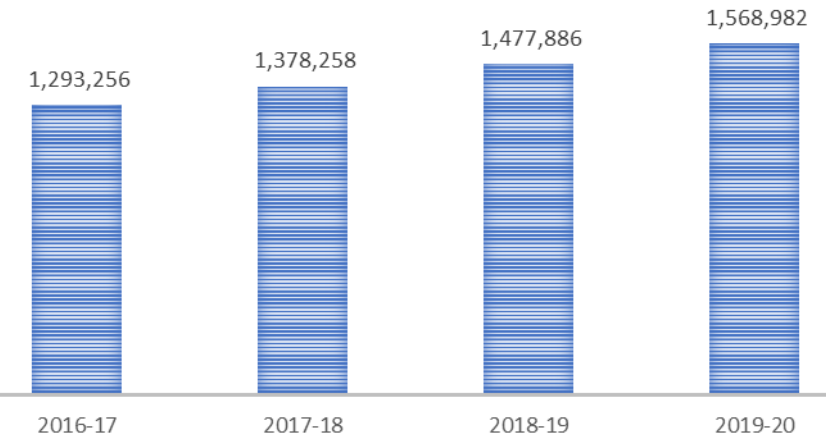


About NESCO

- Northern Electricity Supply Company Ltd (NESCO) is one of 86 distribution utilities in Bangladesh
- Operates 50 Sales and Distribution Division
- NESCO serves 1.57 million consumers (growth rate 92K/year)
- 19,849 km of Distribution line (growth rate 1,267 km/year line and 456 Tr/year)

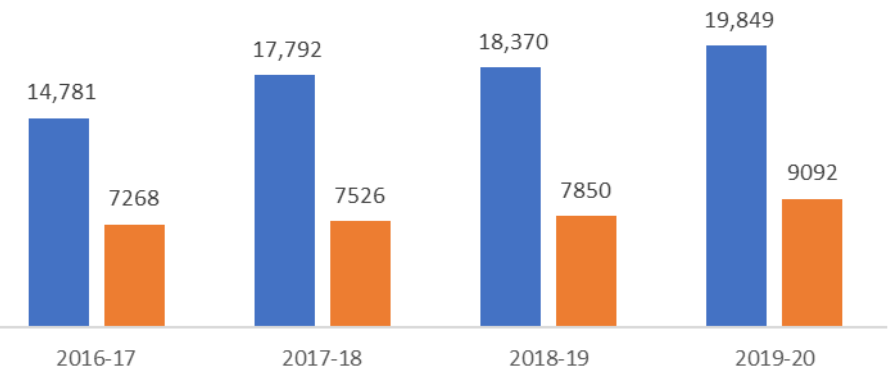


NUMBER OF NESCO CONSUMERS



NESCO distribution lines and transformers

■ Distribution Line (km) ■ Distribution Transformer



Source: NESCO
annual report
2019-2020

NESCO Geospatial Platform Intended Outcomes

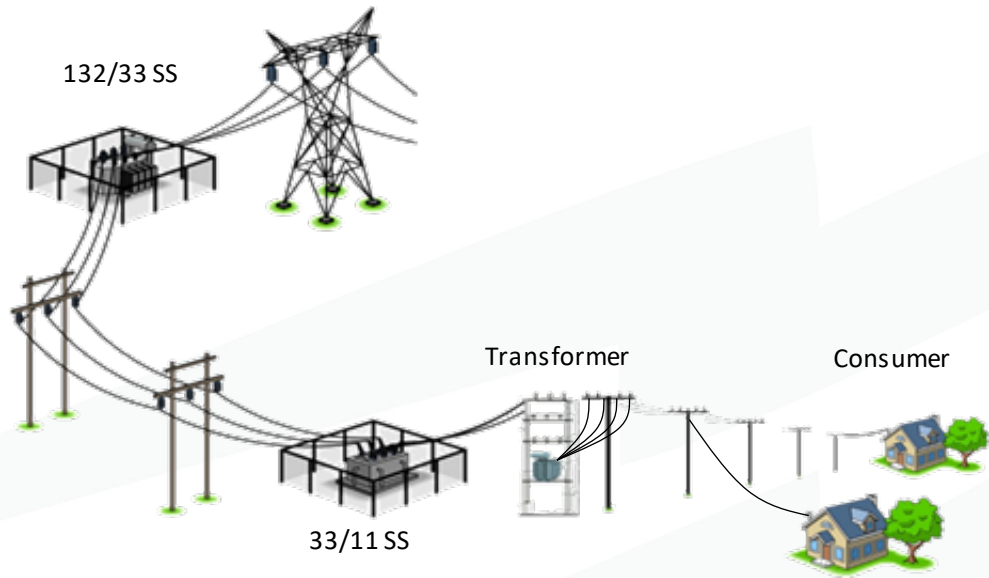
Overall GIS utilization

- Modernize planning, operations, maintenance, and customer service
- Reduce system losses, monitor distribution line outages, and provide a platform for asset management

NESCO GIS use cases

- Geolocate assets with attributes
- Network load flow (S&D level)
- GIS based customer information
- Outage management and restoration system
- Management of work orders

Project Scope and Methods



Scope:

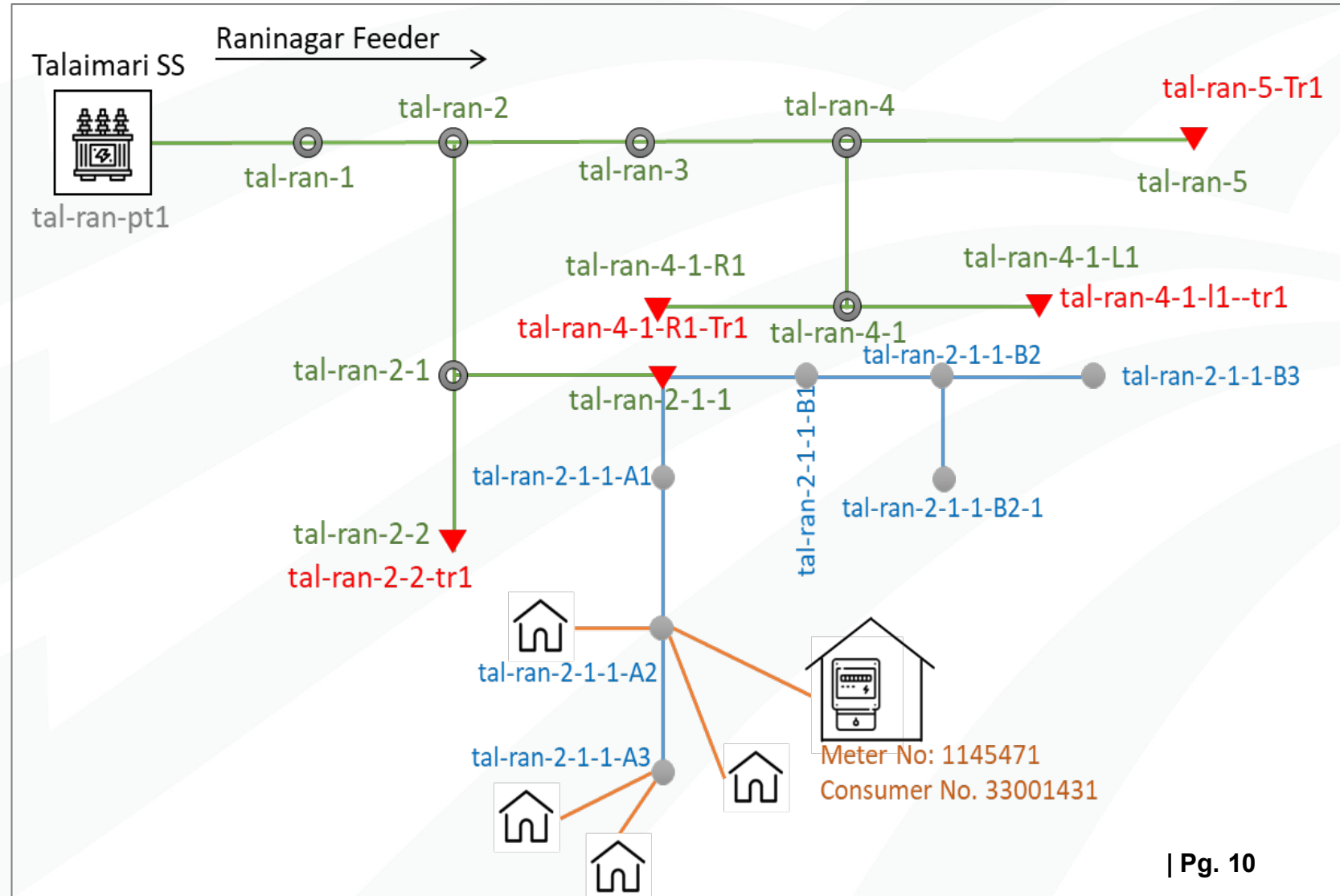
- Primary substation to customer meter
- Ensuring precise GPS location



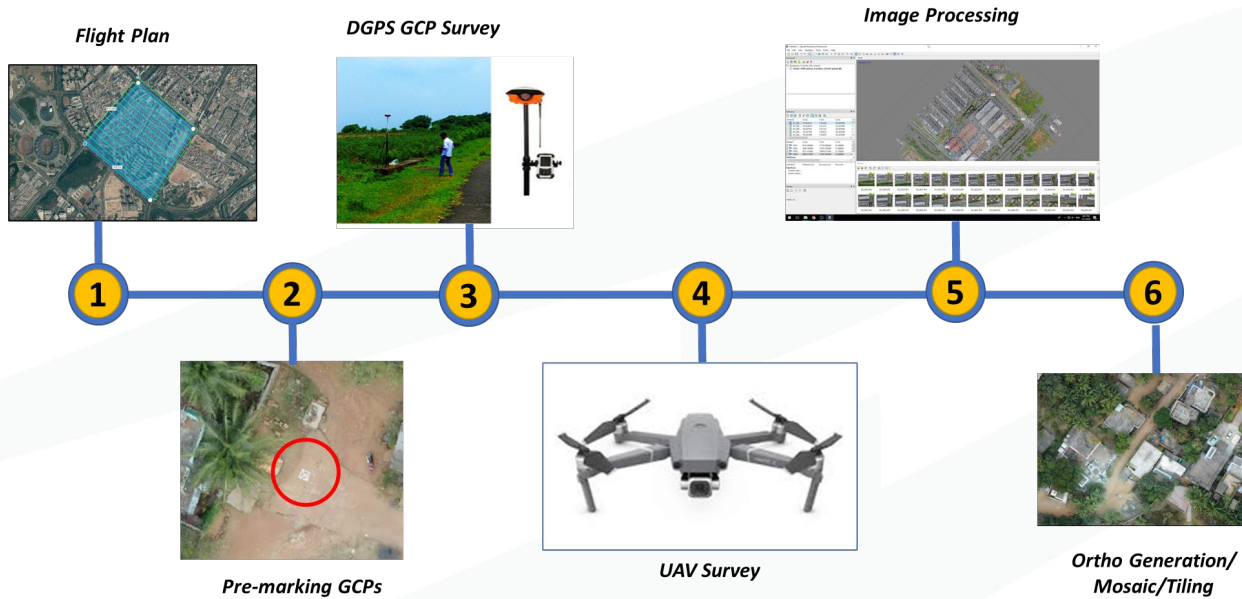
- Utility asset data
- Electrical networks
- Digital ERC
- Consumer locations

Key approach (1): linking customers to poles

- Pole and asset numbering
- Linking customers with poles



Key approach (2): UAV image capturing

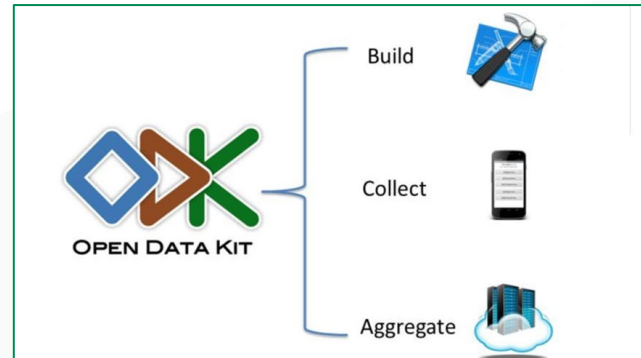


- Higher quality images
- Up to date images
- Urban environment degrades satellite signals to the GPSs



Geospatial data development tools

- Input
- ODK Collect
- OSMAnd
- Mergin
- Apache Tomcat
- Aggregate Server
- PostgreSQL & PostGIS
- QGIS



**Open source or
low cost**



Data collection workflows

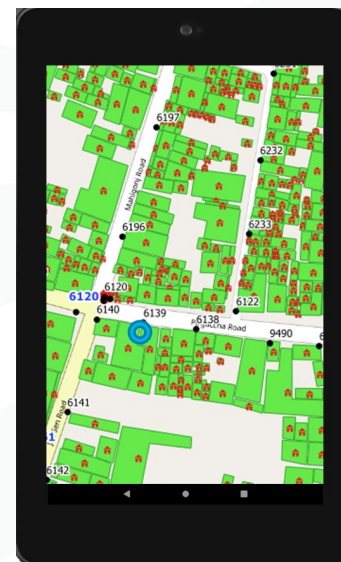
Tablet based
data collection

Online data
storage and
synchronization

Two-way data
quality checking

NESCO
Resource
involvement

- Preloaded geodata and attributes
- Drop down menus
- Offline capability
- Online data server
- Enumerators and inhouse GIS personnel use same database
- Bi-directional data synchronization
- Server data merging
- 3 steps Data quality checking
- Throughout the data collection process

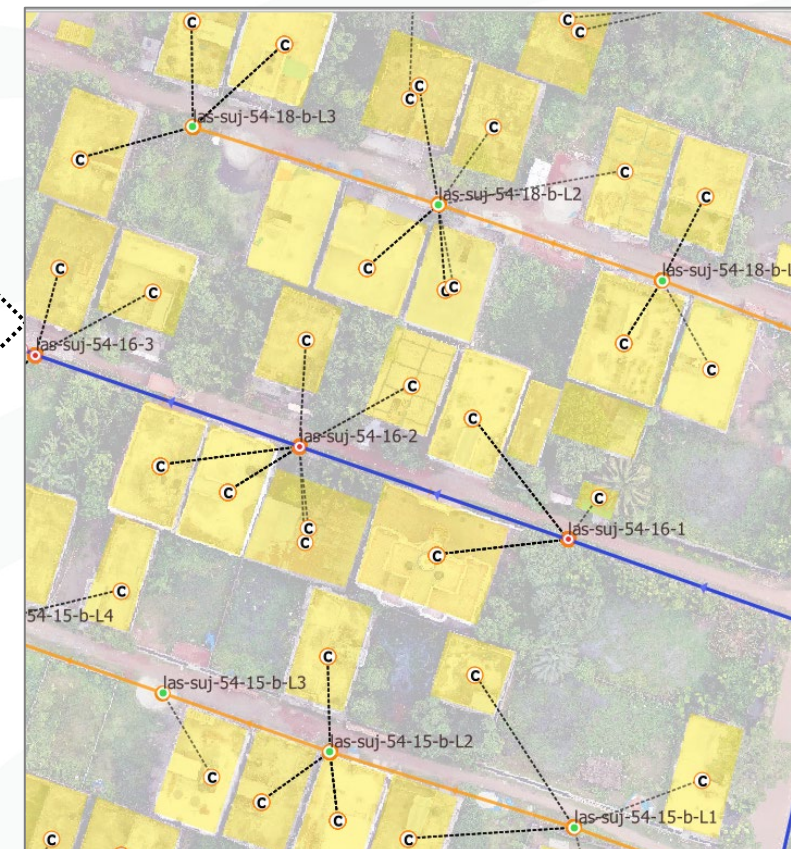
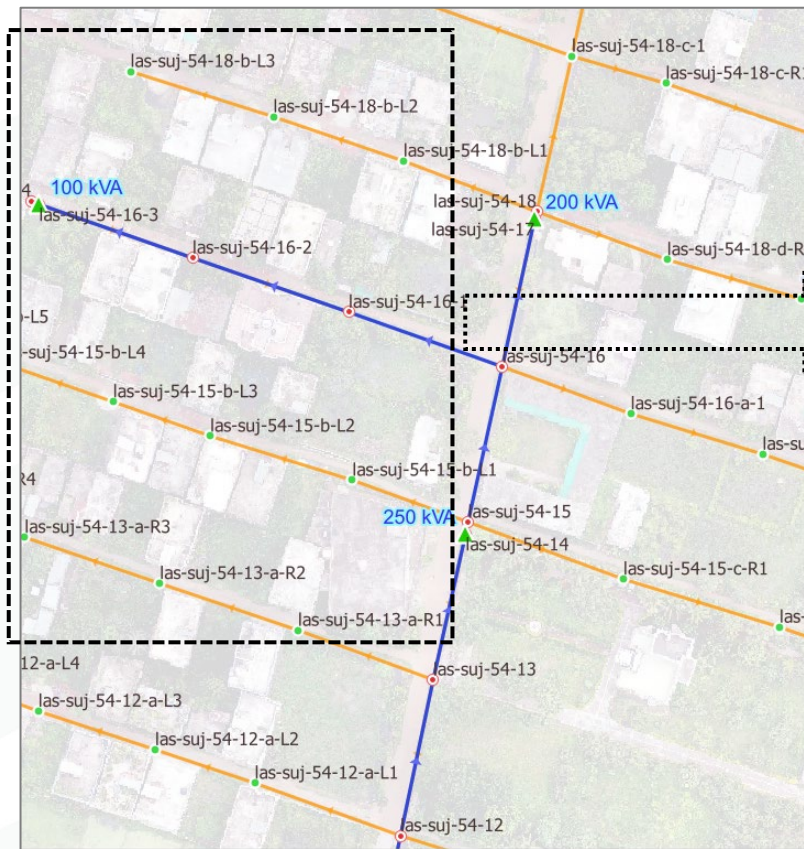
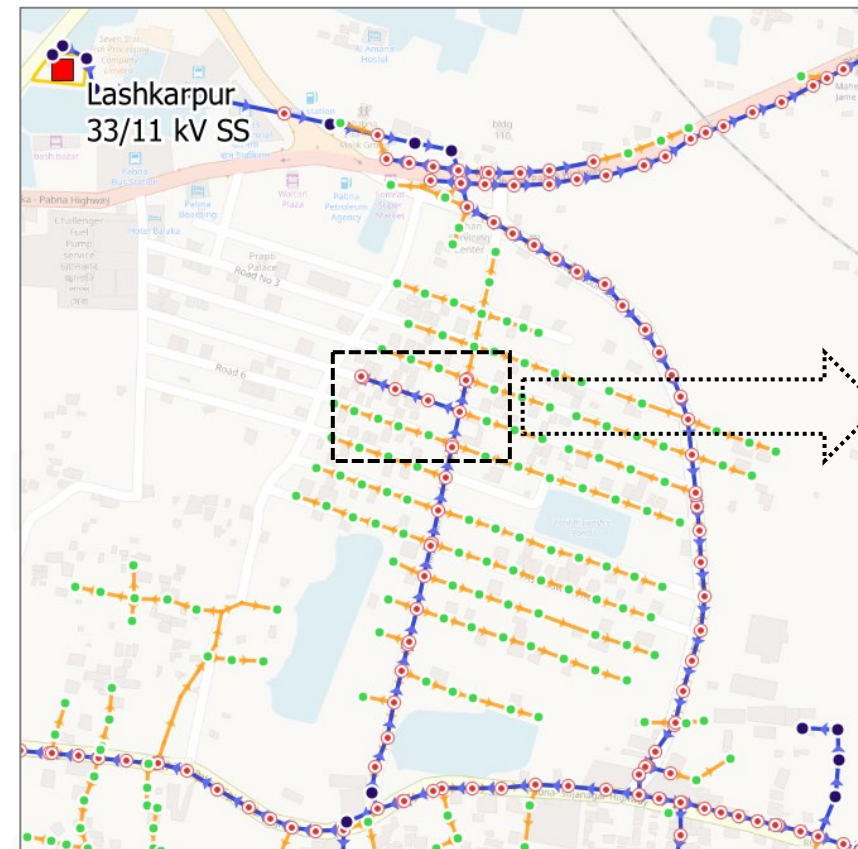


poles - Feature Attributes

Survey Voltage	Pole Information	Completed Pole	MV line information
Pole numbering in GIS: NULL			
Pole Height: 12 Meter			
Pole Structure Type (Materials): SPC			
Pole Class with DaN: 11kV_400 dan			
Pole Status: Good			
Is there any pole guy? <input checked="" type="checkbox"/>			
Pole Guy Information			
Number of pole guy: 1			
Type of Pole Guy: Down			
Pole guy against: Angle			
Circuit Count			
Number of 33kv line in this pole: (NULL)			
Number of 11kv line in this pole: 1			
Number of LV line in this pole: 1			

OK Cancel

Geospatial outputs



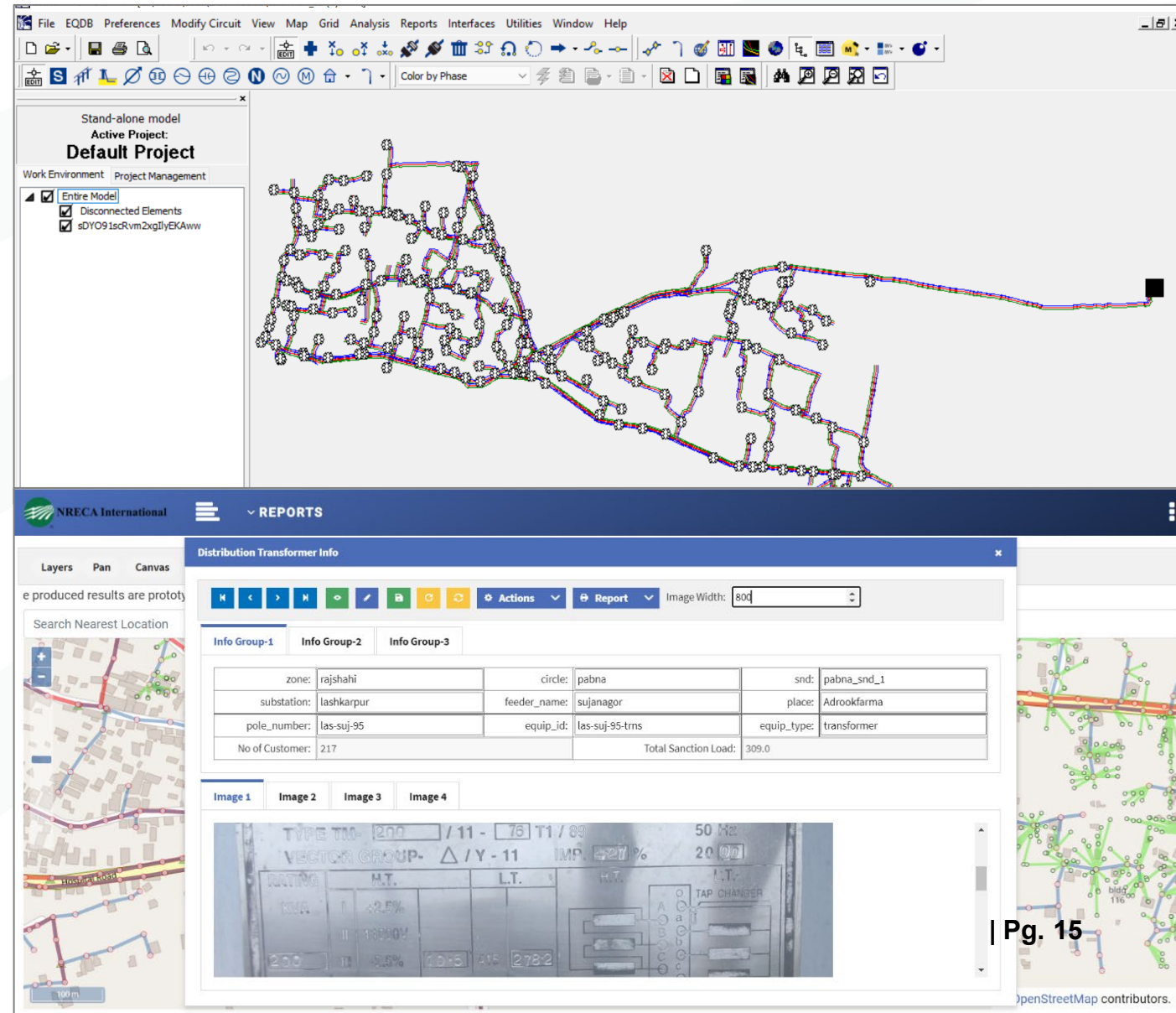
- Digitized pole, equipment, MV, and LV line with attributes

- Unique number for each asset
- Equipment info –
 - Nameplate, maintenance and physical conditions

- Digitized consumer buildings
- Consumer meter locations
- Connected pole
- Service drop conductors

Application of geospatial data

- Data for electrical modeling
- Web visualization tools
 - Inspection
 - Queries
 - Quantification and planning
 - Budgeting
 - Trace network features upstream or downstream
- Complaint management system



The screenshot displays the NRECA International software interface, which is used for electrical modeling and web visualization. The top section shows a menu bar with options like File, EQDB, Preferences, Modify Circuit, View, Map, Grid, Analysis, Reports, Interfaces, Utilities, Window, and Help. Below the menu is a toolbar with various icons for file operations, editing, and analysis. The main workspace is divided into several panels:

- Stand-alone model**: Active Project: Default Project. Work Environment: Project Management. A list of elements is shown, including "Entire Model", "Disconnected Elements", and "sDY091scRvm2xgllyEKAwv".
- Color by Phase**: A dropdown menu for selecting colors for different phases.
- REPORTS**: A section for generating reports. It includes a "Distribution Transformer Info" panel with a table of data.
- Layers**: A panel for managing map layers.
- Search Nearest Location**: A panel for searching for specific locations on the map.
- Image 1**: A panel showing a photograph of a transformer with technical specifications.

The central map area displays a complex network of electrical lines and nodes, color-coded by phase. The bottom right corner shows a map with a grid overlay, likely representing a geographic area.

Info Group-1			Info Group-2		Info Group-3	
zone:	rajshahi	circle:	pabna	snd:	pabna_snd_1	
substation:	lashkarpur	feeder_name:	sujanagor	place:	Adrookfarma	
pole_number:	las-suj-95	equip_id:	las-suj-95-tms	equip_type:	transformer	
No of Customer:	217	Total Sanction Load:		309.0		

Image 1: A photograph of a transformer with technical specifications. The text on the transformer includes: TYPE TM-200 / 11 - 76 T1 / 69, VECTOR GROUP- Δ / Y - 11, IMP. 4.27 %, 50 Hz, 2000, 11, 0.0%, 10x5, 415, 2782, TAP CHANGER.

Challenges when starting the geospatial platform

- Dense unplanned urban environment
- Utilities employ mainly manual record keeping practices
- Lack of maintenance information
- Local construction practices are variable
- Interaction with customers is complex
- Lack of updated information



Institutionalization of the geospatial platform

Key requirements for sustainability:

- Training
- Involvement
- Ownership
- Technology and equipment transfer



Coweta-Fayette Electric Cooperative Presentation (Jessica Williams)

