RURAL ELECTRIFICATION AGENCY

ENERGY = EMPOWERMENT = EFFICIENCY

GEOSPATIAL PORTFOLIO PLANNING FOR MINI GRIDS IN NIGERIA

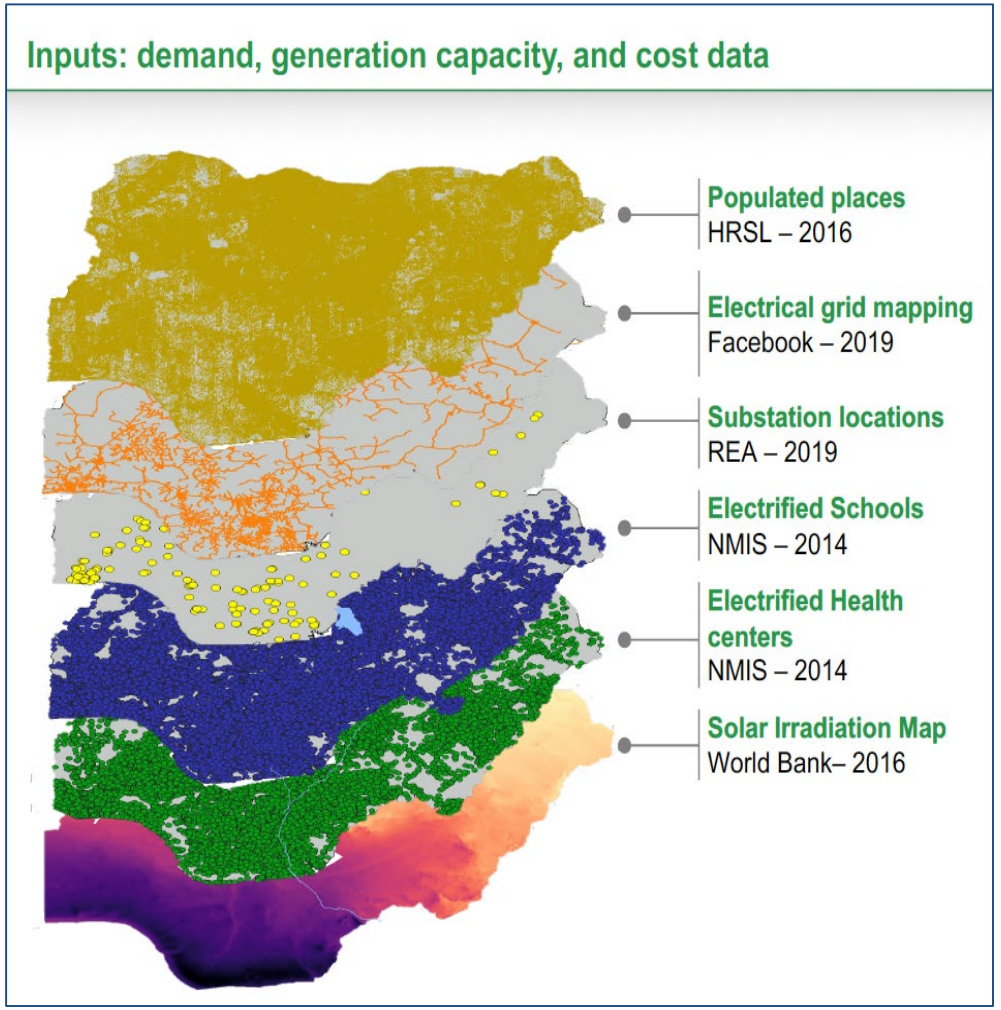
World Bank Mini Grid Action Learning Event and Summit, Accra, June 24-28

June 2019

NIGERIAN UNVERSIAL ACCESS ELECTRIFICATION MODEL

A geospatial model was developed to determine the least-cost electrification mix to electrify Nigeria's unelectrified population

1 Define unelectrified households	2 Calculate household demand	3 Determine energy generation potential	4 Determine least-cost technology per household	5 Test sensitivities of key inputs
a Identify unelectrified population	Define level of consumption in tiers	Define sources of energy generation mapped to consumption tiers	Define bottom up cost of each technology per connection	Check input sensitivity to provide assurance on model logic
b Define settlements in rural and urban areas	Map settlements to consumption tiers		Select least-cost technology per settlement	
c Project future population density	Project future demand growth			

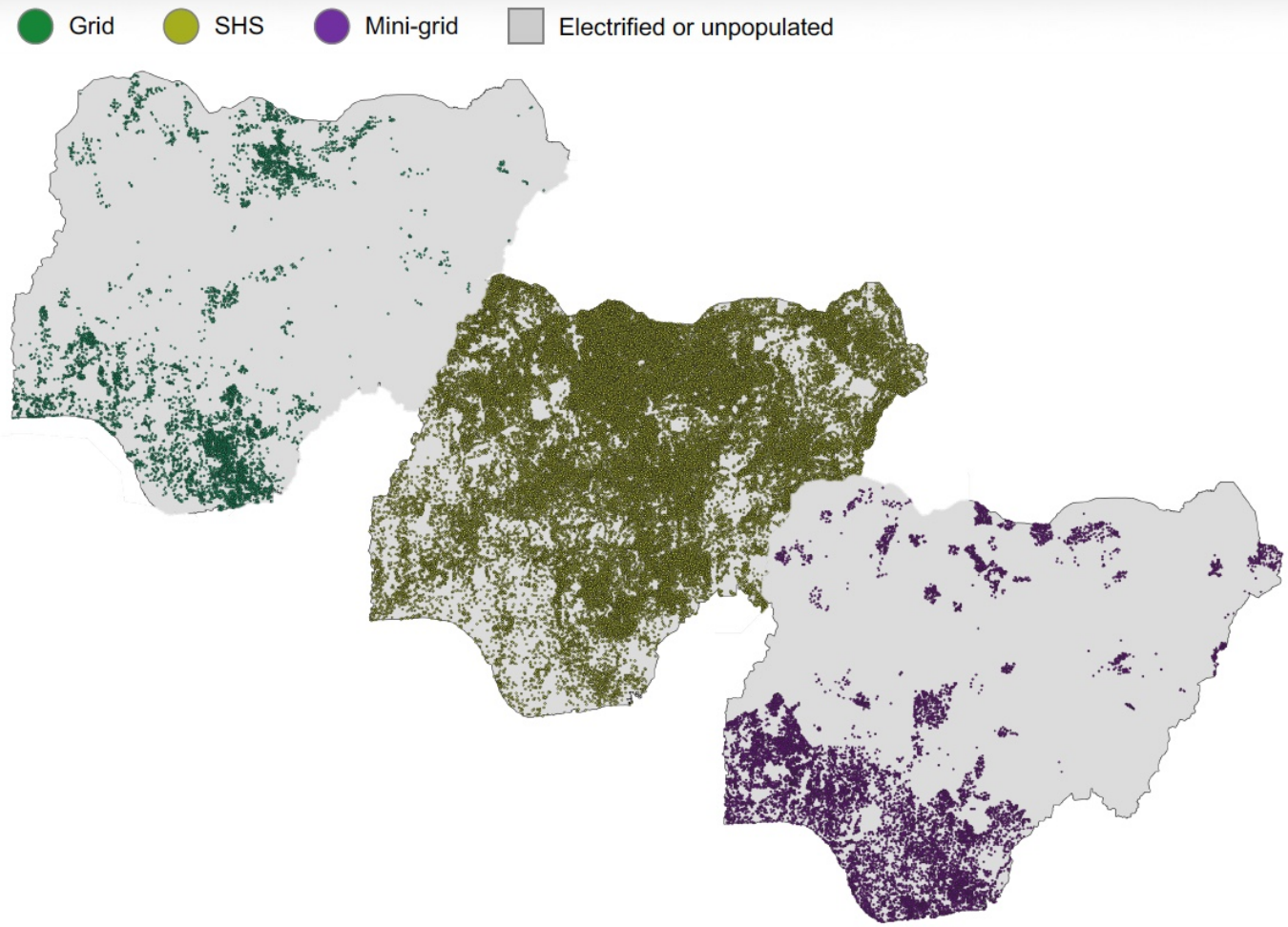


SOURCE: Rural Electrification Agency

NIGERIAN UNVERSIAL ACCESS ELECTRIFICATION MODEL

Mini Grids are estimated to be the least-cost electrification method for approx. 15.3 million people

2024 least-cost technology mix: Grid extension possible within 10km of grid



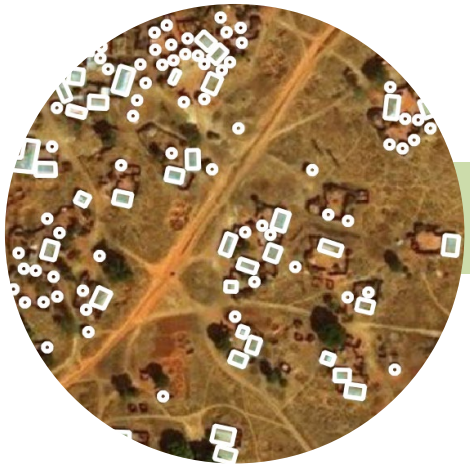
	Grid	Mini-grid	SHS	Total
# of residential connections	3.6m	1.4m	7.5m	12.5m
% of residential connections	29	11	60	100
# of settlements	6,723	11,720	70,897	89,340
Total Cost, (USD B)	3.9	1.5	7.1	12.4
Population (millions)	32.0	15.3	69.6	116.9
Total Energy (GW)	0.9	0.3	0.9	2.1

SOURCE: Rural Electrification Agency

Geospatial Studies - Process overview

Step 1: Cluster analysis

Automatic identification of settlement locations using primarily HRSL data (http://ciesin.columbia.edu/data/hrsl/)



Step 2: Remote mapping

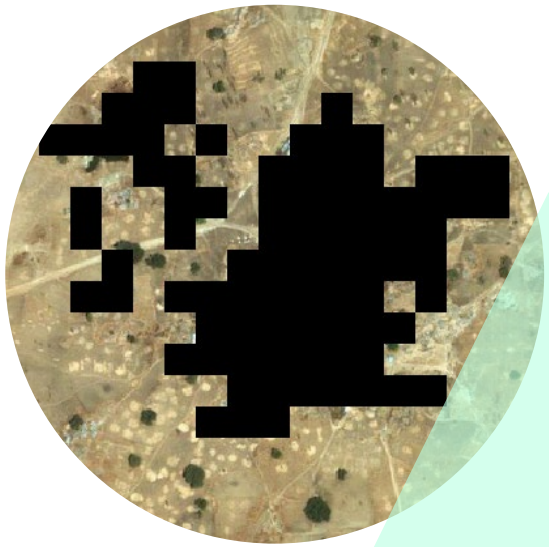
Manual mapping of buildings and other features within an identified cluster to better describe the cluster characteristics

Step 3: On-site surveys

Collection of primary data that cannot be viewed remotely (e.g. detailed information on building use type and businesses)

Graphics sources; Background: Bing Aerial, building outline: © OpenStreetMap contributors

Cluster analysis



Input:
High resolution settlement layer

Processing:
- Vectorizing
- Buffering
- Dissolving

Output:
Cluster boundaries

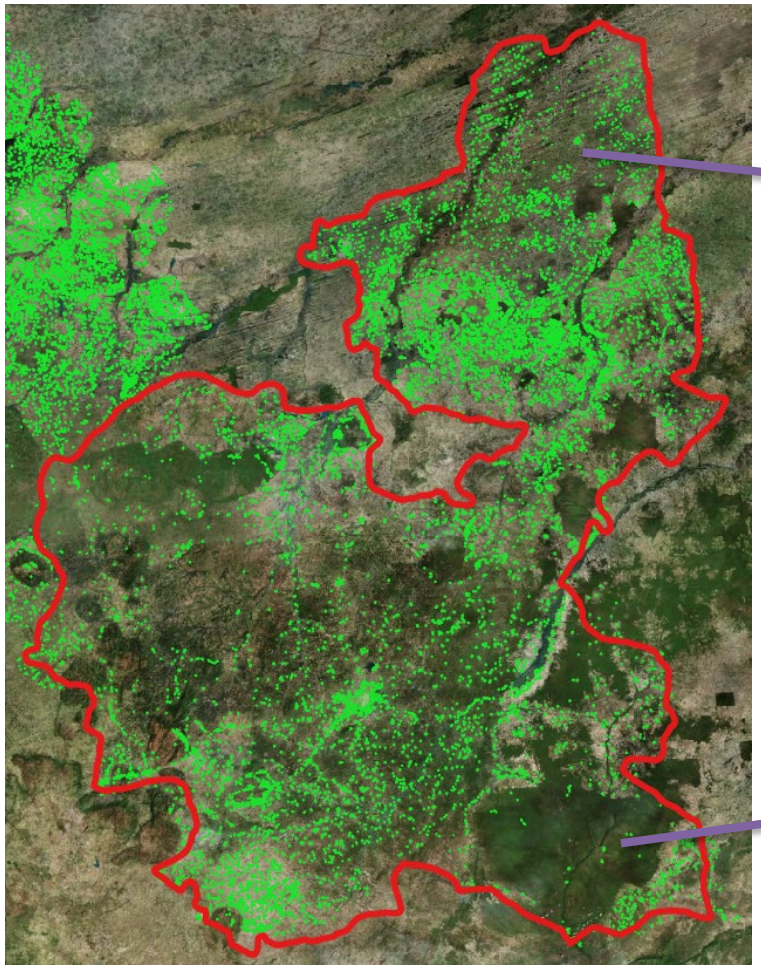
The first step "Cluster analysis" is the processing of country-wide secondary datasets to generate an accurate view of where built-up areas are located.

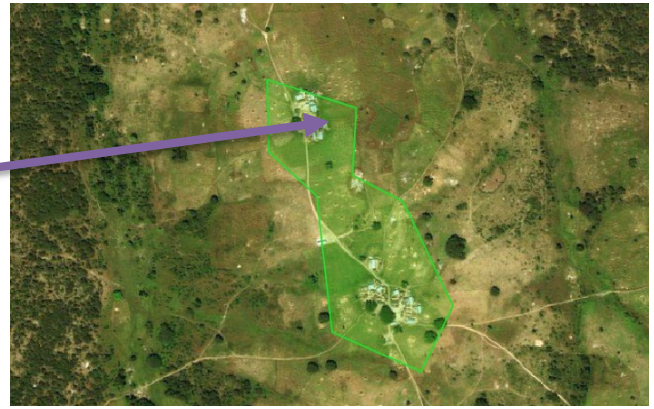
A key settlement used in generating the cluster dataset for Nigeria is the HRSL layer. This layer can be combined with other secondary datasets to create additional attributes for the cluster.

The clusters can then be **ranked** in order of priority to provide a sequence plan for the remote mapping activity.

Graphics sources; Background: Bing Aerial, HRSL: http://ciesin.columbia.edu/data/hrsl/

Cluster analysis – Bauchi



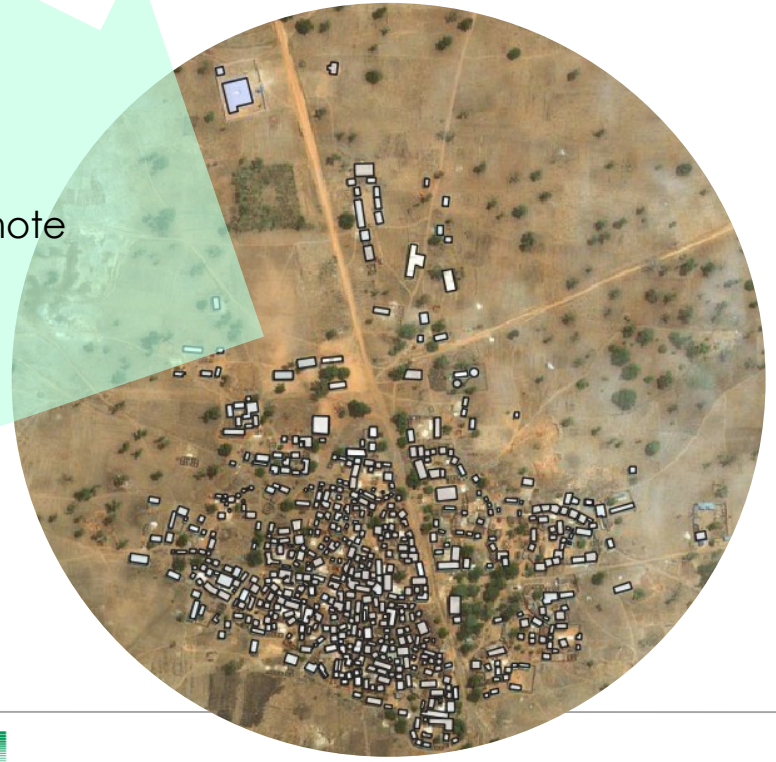


Remote mapping – Work in Progress

Input:
Cluster boundaries

Digitizing:
- Building outlines
- Other remote features

Output:
Digitized features



Cluster area is digitised for features that are visible from a satellite image. Such as

- Building area
- Roads and paths,
- Vegetation,
- Land use and compound walls.

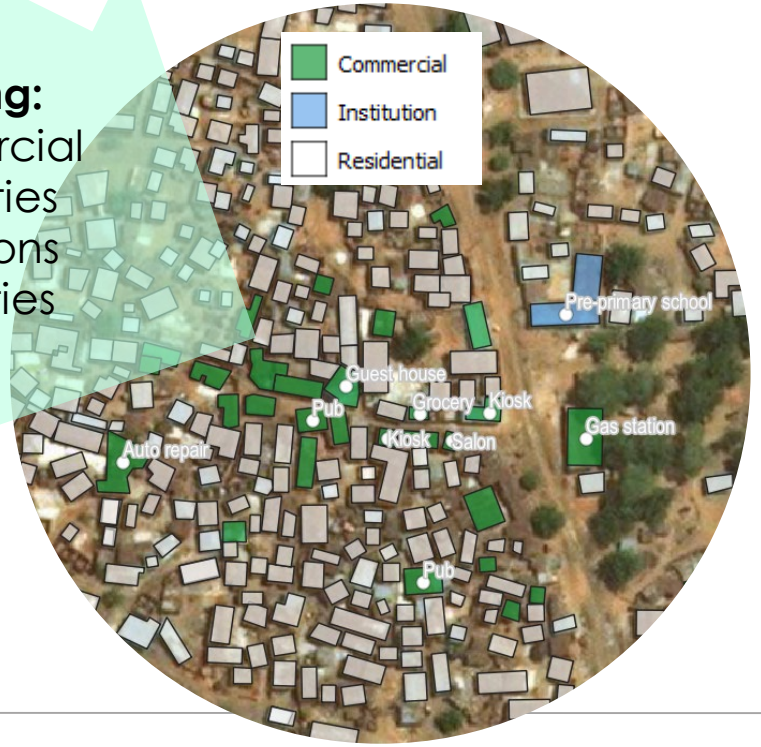
The data generated during this remote mapping phase is new valuable primary data that can give population indications (e.g. number of buildings in each cluster, or distribution of structure types).

On-site surveys

Input:
Digitized features

Surveying:
- Commercial properties
- Institutions
- Amenities

Output:
Labelled points of interest



- Electrification Verification to identify off-grid sites and shortlist potential Wards
- Clusters will be selected for a visit based on favourable attributes seen remotely. This settlement will then be surveyed, and data will be collected which is not visible on satellite imagery.

Land use type and business / institution names will be collected. This allows a full detailed view of the cluster with key primary datasets to be collected.

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THANK YOU

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