

Nigerian Rural Electrification Agency

Off-Grid Planning: Integrated Energy Planning for Rural Electrification



RURAL ELECTRIFICATION AGENCY

ENERGY = EMPOWERMENT = EFFICIENCY

INTRODUCTION

- Nigeria presents the largest and one of the most attractive off-grid opportunity in Africa.
- With more than 80 million people without access to electricity, the country is one of the best locations in the world for mini grids.
- More than \$14 billion is spent annually on poor quality, polluting, inefficient, expensive and noisy generators.
- There is large potential for scaling—installing 10,000 mini-grids of 100 kW each can occur for 10 years and only meet 30% of anticipated demand.
- The Rural Electrification Agency (REA), tasked with developing the Nigerian off-grid power market, created the Off-Grid Electrification Strategy as part of the Power Sector Recovery Programme (PSRP).

ABOUT REA

The Nigerian Rural Electrification Agency (REA) is the Implementing Agency of the Federal Government of Nigeria tasked with electrification of rural and unserved communities

MISSION

To provide access to reliable electric power supply for rural dwellers irrespective of where they live and what they do, in a way that would allow for reasonable return on investment through appropriate tariff that is economically responsive and supportive of the average rural customer

MANDATE

1. Promote Rural Electrification in the Country
2. Co-ordinate Rural Electrification Programs in the country
3. Administer the Rural Electrification Fund (REF) to promote, support and provide rural electrification through Public and Private Sector Participation

How: Electrification planning



Off-Grid Integrated Planning Approach

Shift from centralized power generation and distribution to decentralized approach

- Economic Viability
- Demand-driven
- Market-oriented
- Private sector focused

SOLAR HOME SYSTEMS

- Promote the development and roll-out of stand-alone systems
- These systems to help provide critical services for hardest-to-reach customers

MINI / UNDER GRIDS

- Development of mini/under-grids for off grid communities
- Mini grid of 100 kW – no permit required
- 100 kW to 1 MW – requires permit from NERC

ENERGIZING ECONOMIES

- Promote efficient, clean and sustainable power to Economic clusters
- Economic clusters selected primarily for their high level of commercial activities

ENERGIZING EDUCATION

- Developing off grid independent power plant (“IPP”) to thirty (37) Federal Universities and seven (7) University Teaching Hospitals and surrounding communities

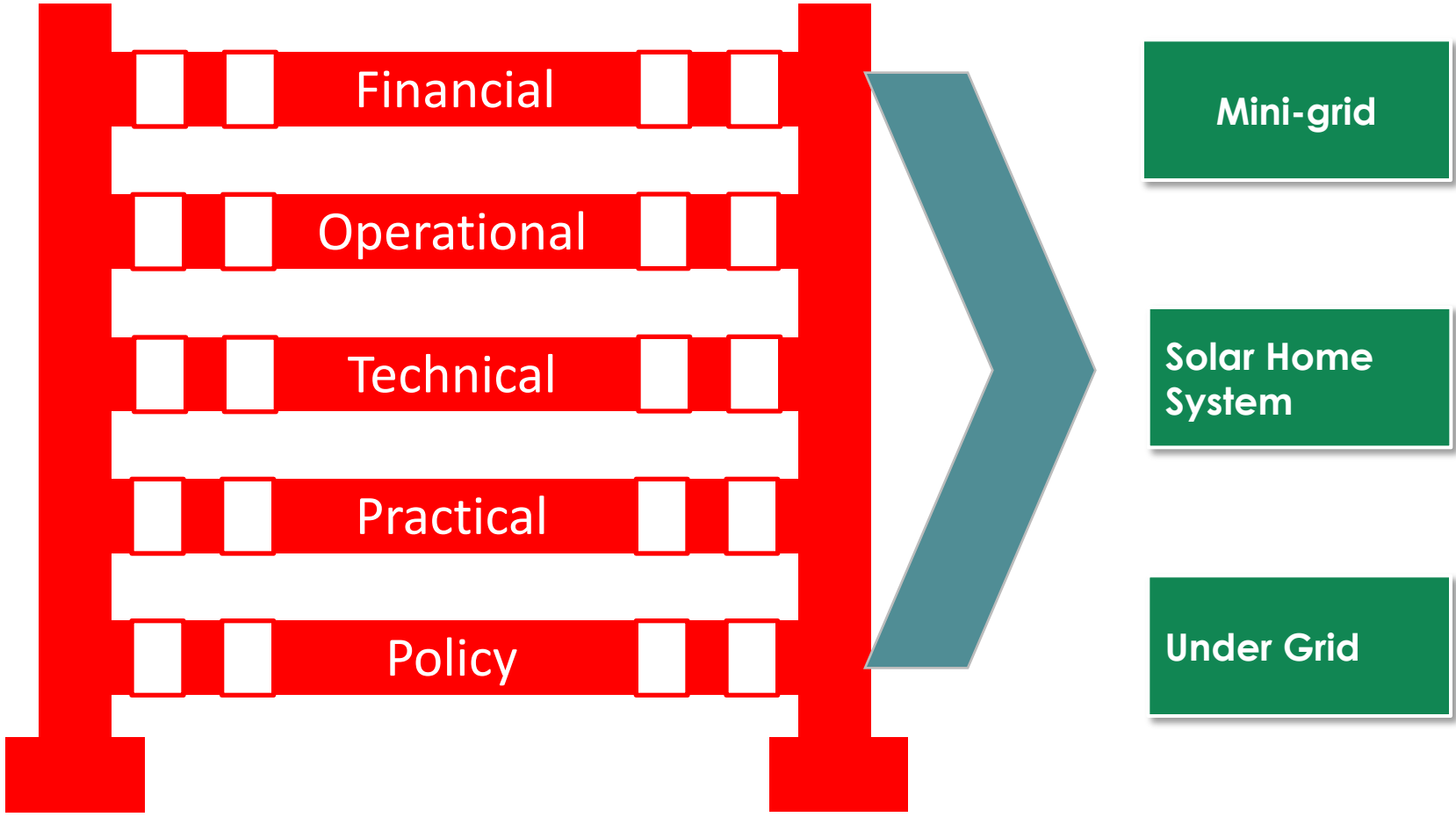
ENERGY DATABASE

- Online visualization on communities, economic clusters, population, energy demand, solar irradiance etc.

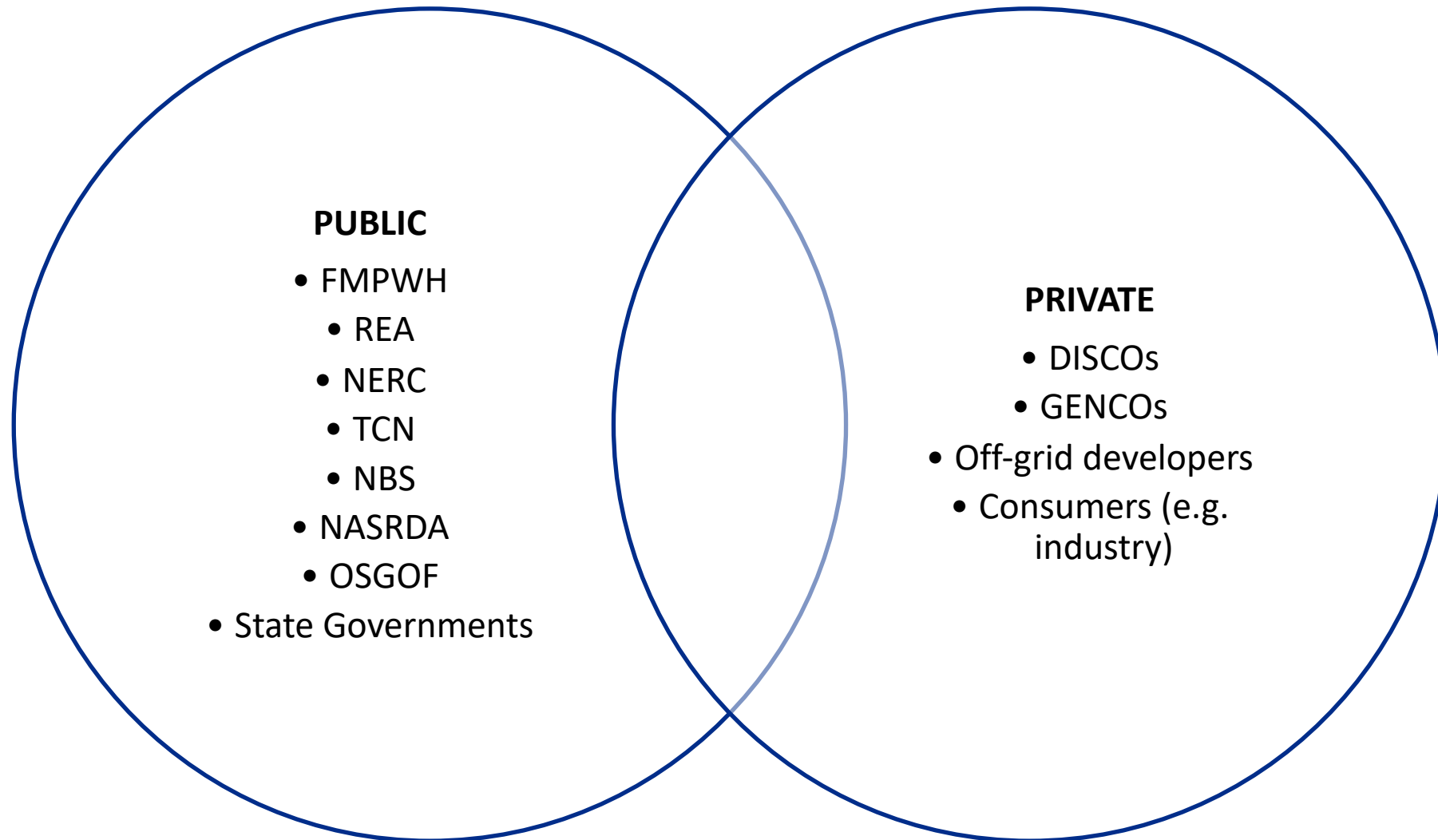
CHALLENGES IN EFFECTIVE ELECTRIFICATION PLANNING

- Lack of accurate and up-to-date data (settlement locations, population distribution, electrification status).
- Data are in analogue format and dispersed amongst different Ministries and Agencies on the Federal and State level working in silo mode.
- Lack of capacity by key Ministries and Agencies as regards electrification geo-data management systems (incl. virtual/physical infrastructure and online interfaces).
- High capital investment: Obscured grid extension planning from Disco
- Profitability concerns in rural areas (so there is a need for temporary solution for non-priority loss-making areas).

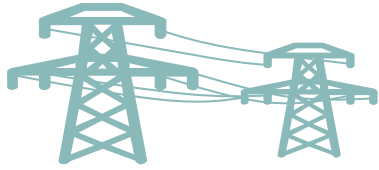
Identifying viable off-grid sites / Locations – Building block?



Identifying viable off-grid sites / Locations – (1) stakeholder mapping



Identifying viable off-grid sites / Locations – Indicator mapping



Distance
to the grid



Productive
uses



Ability and
Willingness
To pay

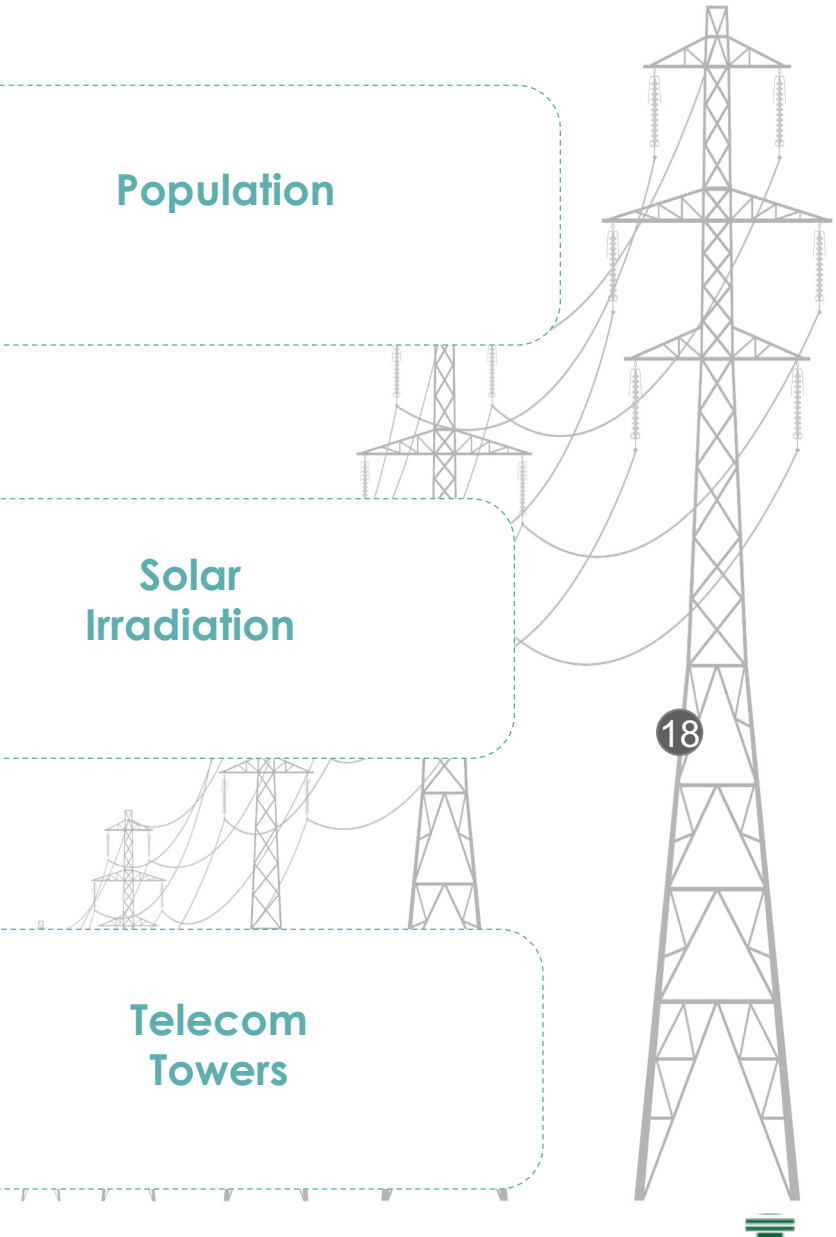


Solar
Irradiation



Telecom
Towers

Population



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Methodology.....

For this analysis a combination of GIS tools, energy system simulations and literature analysis is chosen to derive an overview of the potential on SHS, undergrid and PV hybrid Mini-Grids for rural electrification in whole Nigeria. GIS analyses by QGIS to

- derive consumer cluster
- identify status of electrification
- define priority areas for electrification by grid extension, Mini/Under-Grids, SHS
- # of poles requiring replacement – under grid
- Detailed network layout – under grid
- Existing network condition – under grid
- Existing supply conditions – under grid

Literature analyses

- define loads and electricity consumption for Mini/Under-Grids
- define size of SHS for stand-alone electrification

Energy system modelling to

- derive shares of PV energy in one typical Mini/Under-Grid as baseline for extrapolation of PV Mini / Under-Grid potential

Methodology... data collection and tools

- Development of Questionnaires.
- Survey divided into four categories
 - Household Survey
 - Commercial Survey
 - Community Survey
 - Environmental and Social
 - Geotag
- Development of Computer Aided Personal Interview Application powered by android phones.
- Community/ Stakeholder engagement.
- Training of Enumerators on interview and use of Applications

Total Households: 376

Household Penetration rate:		
		75%
	Count	Avg. kWh/day
Household distribution		
Small HH - Hut	225	0.3
Med HH - Bungalow	113	1.9
High HH - Modern House	38	4.8
Public		
Health Center - Small	1	10
Health Center - Med	0	60
Health Center - Large	0	150
School small	3	3
School large	0	10
Community center	0	3
Religious buildings	2	3
Commercial		
Beauty salon	1	3
Tailor	1	3
Petty trader	3	3
Barbing saloon	1	3
Productive		
Welder	1	12
Restaurant	1	6
Farmer (grinding)	3	7
Farmer (milling)	1	7

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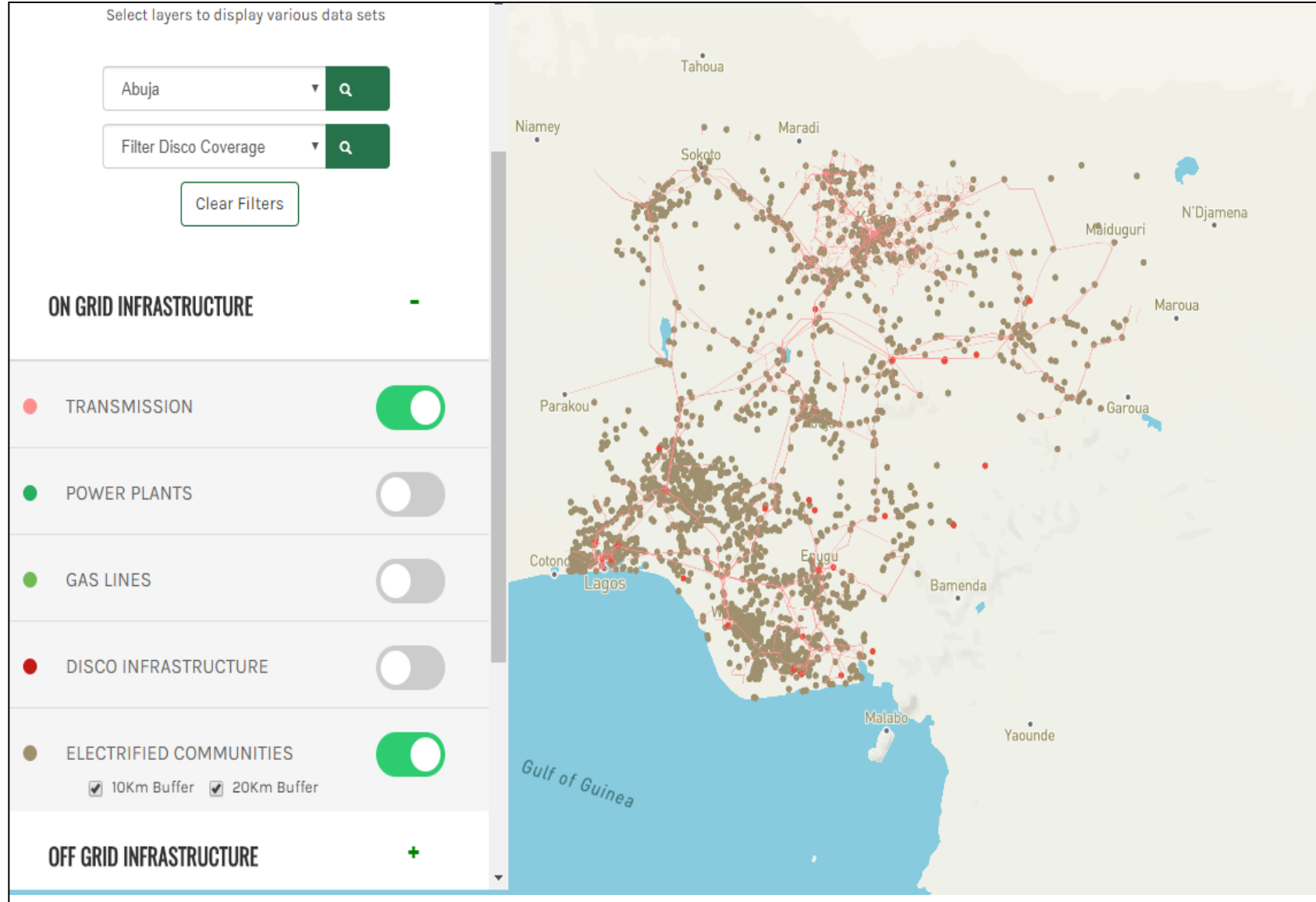
Methodology... data collection (GIZ)

1. **Reconnaissance drive:** Searching, locating and collecting electricity distribution infrastructure data in approx 2m of geospatial accuracy.
2. **Mobile mapping:** High precision / speed mapping with full 360° view of all locations and digitalization of all visible objects in geo-database.



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REA's unique tool allows developers and investors to identify promising sites for off grid development



Features

On Grid Infrastructure

- Transmission
- Power Plants
- Distribution Infrastructure
- Electrified Communities

Off Grid Infrastructure

- Potential Mini Grid Communities
 - 10 km or 20 km from the grid
- Potential SHS Communities
 - 10 km or 20 km from the grid

Community Details

- Population, Load Profiles

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Resources

- Mines
- Solar Irradiance
- Roads

Amenities

- Schools
- Water Points





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