RURAL ELECTRIFICATION AGENCY

ENERGY = EMPOWERMENT = EFFICIENCY

CREATING AN ENABLING ENVIRONMENT FOR A 10,000 MINI GRIDS MARKET

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

June 2019

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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

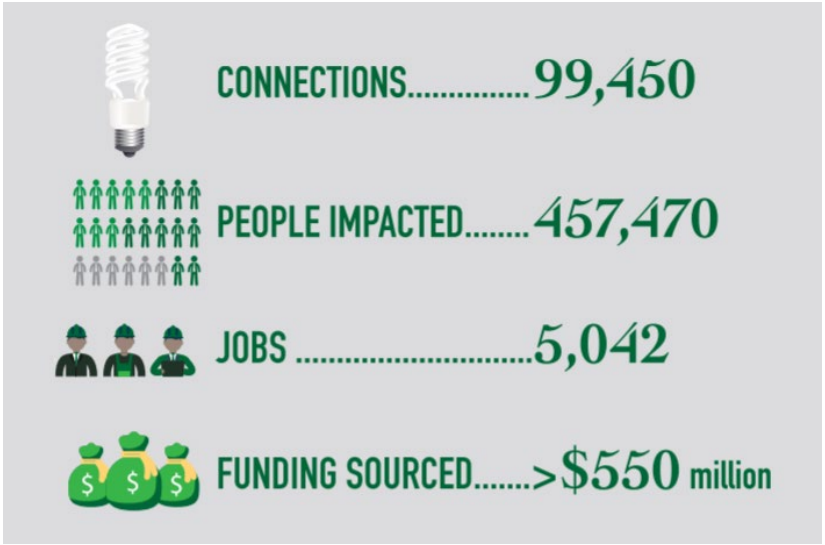
To provide access to reliable electric power supply for rural dwellers irrespective of where they live and what they do, in a way that would allow for reasonable return on investment through appropriate tariff that is economically responsive and supportive of the average rural customer

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

REA Achievements

over the last 20 months



REA OFF GRID STRATEGY – Decentralised approach

REA programmes

	Stand-Alone Systems	Minigrids	Energizing Education	Energizing Economies
Who will be served?	Remote customers with low load or low ability to pay	Communities with load less than 1 MW	37 universities, 7 teaching hospitals, and the surrounding communities	Economic clusters: areas with high commercial activity and high growth impact on the economy
What is REA's role?	Promote development and roll-out	Promote community, private development	Develop independent power plants to serve	Project development and enabling environment
Benefits to community	Provide critical basic services; cheaper than kerosene or other energy alternatives; create jobs	Promotes economic activity; interconnection potential	Provide nearly 100 MW generation across 6 geo-political zones; improve educational quality	Replace costly, inefficient, polluting diesel with centralized power source; promote MSME growth
Benefits to developer	Supportive regulatory environment, coordination around market expansion, education and awareness	10,000+ potential sites offer high customer density, clustering; access and scaling in Africa's largest market	Solar hybrid and gas engine plant generation opportunities	High load and customer concentration; clear value proposition to customers

Crosscutting energy database – online visualization of resources for energy development

APPROACH FOR PRIVATE SECTOR-LED ELECTRIFICATION

Support FGN's goal of increasing electricity access

Support **data driven private sector-led mini grid and off grid models**

Utilize funding from NEP as a **catalyst** to scale up rapid implementation of mini grid and off- grid solutions across Nigeria

Contribute to **Sustainable Development Goal 7 (SDG7)**, Sustainable Energy for All (SEfor4ALL), the World Bank's Energy Sector Directions Paper (ESDP), and is aligned with the **Multi-Tier Framework for Energy Access (MTF)**

Increase **gender Inclusion** in the Nigerian power sector

Increase **economic growth** in critical sectors e.g. **Agriculture/Productive use of power**

GENDER INCLUSION

Increased the number of women in senior management at the REA from 1 to 6 over the last 20 months

Under NEP, tender companies must have 30% female employment for eligibility

25 female project managers working across different REA initiatives

20 female engineering students will have internships at each of the universities – more than 700 in total

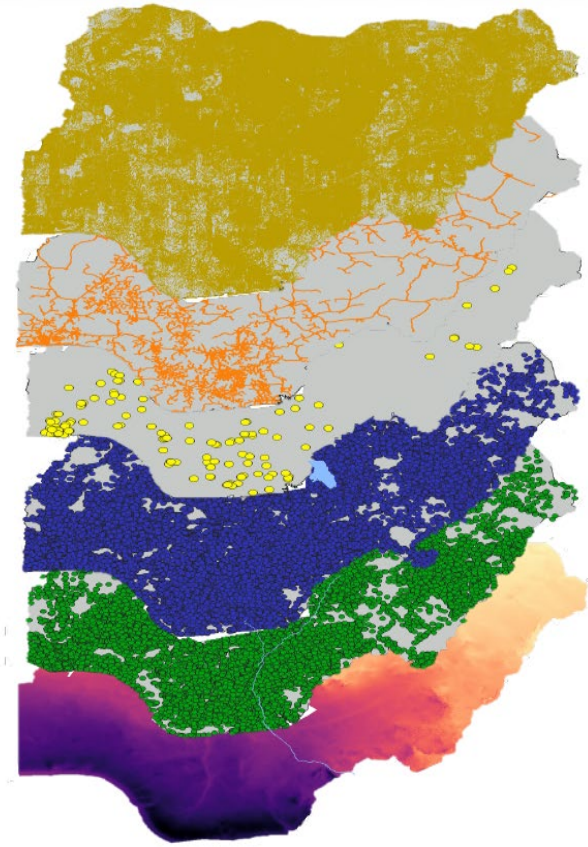
Quarterly gender focused workshops

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			

Inputs: demand, generation capacity, and cost data



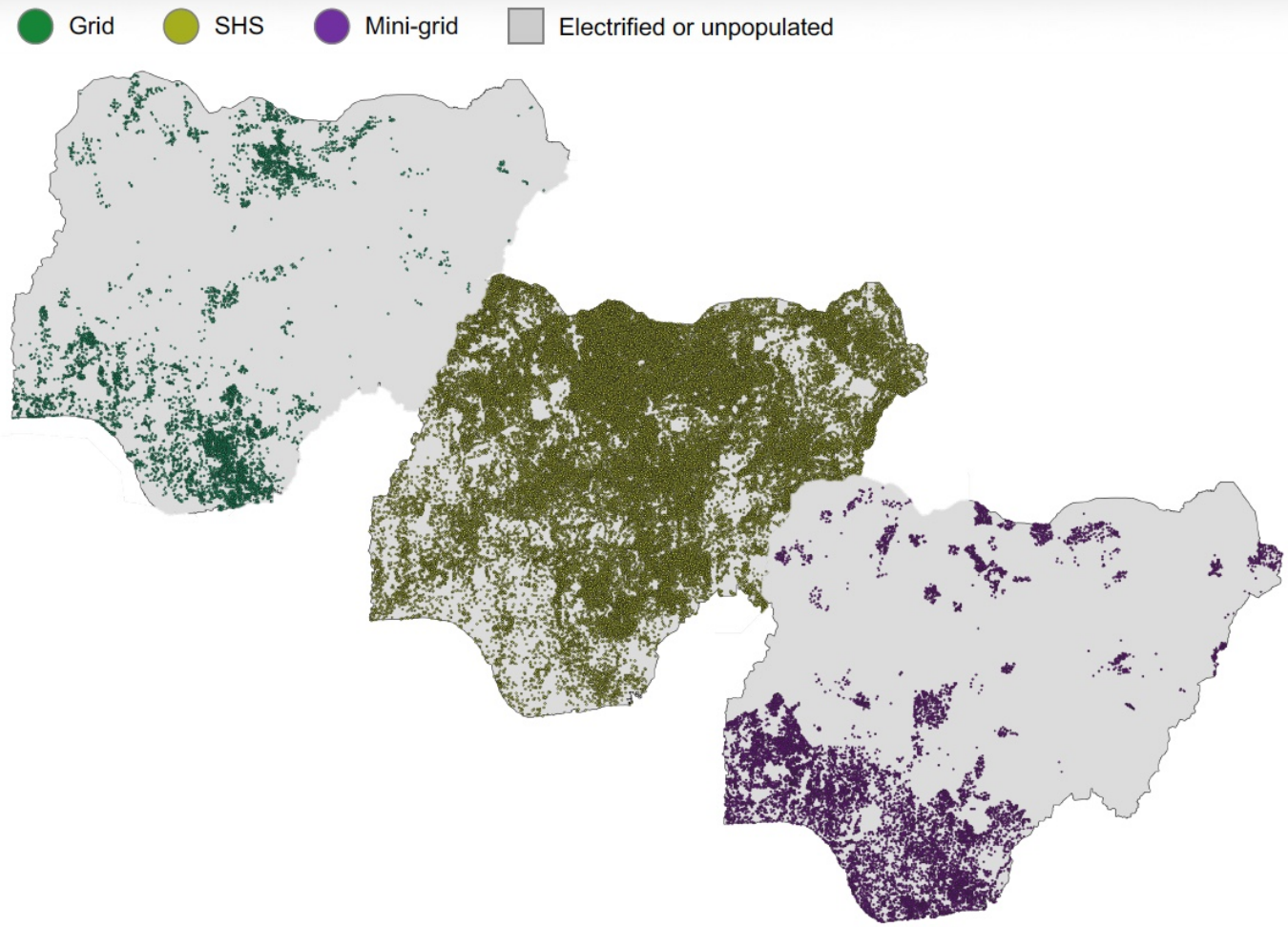
- **Populated places** HRSL – 2016
- **Electrical grid mapping** Facebook – 2019
- **Substation locations** REA – 2019
- **Electrified Schools** NMIS – 2014
- **Electrified Health centers** NMIS – 2014
- **Solar Irradiation Map** World Bank– 2016

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



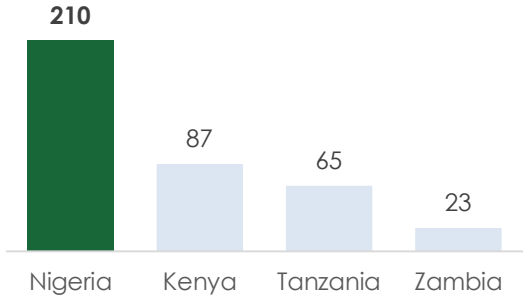
	Grid	Mini-grid	SHS	Total
# of residential connections	3.6m	1.4m	7.5m	12.5m
% of residential connections	29	11	60	100
# of settlements	6,723	11,720	70,897	89,340
Total Cost, (USD B)	3.9	1.5	7.1	12.4
Population (millions)	32.0	15.3	69.6	116.9
Total Energy (GW)	0.9	0.3	0.9	2.1

SOURCE: Rural Electrification Agency

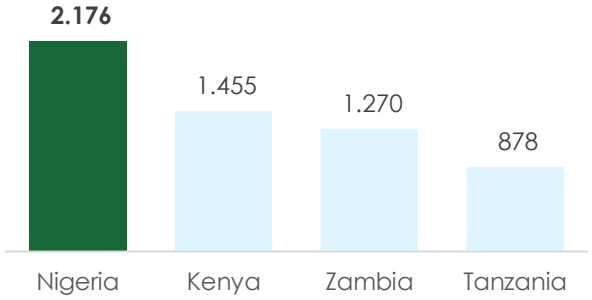
FAVORABLE ECONOMICS, POLICIES, AND PROGRAMS THAT INCENTIVIZE PRIVATE CAPITAL DEPLOYMENT

Attractive project economics from dense and vibrant communities

Population density
People / sq.km



Income level
GDP per capita, USD



Established regulations and policies de-risk mini-grid investments

Permitting
Exempt <100kW

Tariff
Cost reflective

Grid Integration
Outlined and costed

Support from an array of programs from regulators, donors, and advisors

RURAL ELECTRIFICATION AGENCY

Primary Implementing Agency

THE WORLD BANK
European Commission

Primary sources of grant funding for the respective programs

USAID FROM THE AMERICAN PEOPLE
POWER AFRICA A U.S. GOVERNMENT-LED PARTNERSHIP
UKaid from the British people

Supporting REA in implementation

Nigerian Electricity Regulatory Commission (NERC) Mini Grid Regulations 2017

What is the MINI GRID Regulation ?

1. Designed to accelerate electrification in Unserved and Underserved areas.
2. Promote the engagement of the private sector, communities, Non Governmental Organizations in achieving nationwide electrification
3. Minimize major risks associated with Mini Grid investments such as:
   - Sudden tariff changes: as tariffs would have been agreed in advance by the relevant parties;
   - Stranded Mini Grid Operator investments due to the connection of the main grid to Mini Grid

Types of MINI GRIDS Covered in the regulation

1. Isolated Mini Grids up to 100 kW of Distributed Power (**Registration required)**
2. Isolated Mini Grids larger than 100 kW of Distributed Power and up to 1MW of Generation Capacity **(Permit required)**
3. Interconnected Mini Grids larger than 100 kW of Distributed Power and up to 1MW of Generation Capacity - Tripartite Contract which becomes binding on parties upon approval by the Commission. **(Permit required)**
4. All Mini Grids larger than 1MW must apply for a full generation and distribution license.

The complete version of the MINI GRID REGULATION 2016 can be downloaded from www.nercng.org

How to REGISTER AN ISOLATED MINI-GRID PROJECT
(DISTRIBUTED POWER BELOW 100KW)

Step 1

Identification Of The Eligibility Of Underserved Area

Step 2

Contact With The Community To Sign Off On Exclusivity Agreement

Step 3

System Design

Step 4

Sign Commercial Agreement With Community

Step 5

Acquire land and Necessary Building Approvals

Step 6

Construct, Test and Commission Mini Grid

Step 7

Registration with NERC

ISOLATED MINI GRIDS < 100 kW

ACCOMPANYING DOCUMENTATION FOR REGISTRATION REQUIRED BY NERC

I. Contract between the Community Representative and Mini-Grid Operator.

II. Power station layout drawings

III. Map with position of power station and distribution network marked using indicators to distinguish single phase and three phase as well as medium voltage networks

IV. Certified Copy of Certificate of Incorporation, Memorandum and Articles of Association, particulars of shareholding and directors

V. Certified copy of Certificate of Occupancy or Lease Agreement for Project Site

The complete version of the MINI GRID REGULATION 2016 can be downloaded from www.nercng.org

How to get a permit for an isolated Mini-grid
with capacity up to 1MW and distribution above 100kW

Step 1

Identification Of The Eligibility Of Underserved Area

Step 2

Contact With The Community To Sign Off On Exclusivity Agreement

Step 3

System Design

Step 4

Sign Commercial Agreement With Community

Step 5

Acquire land and Necessary Building Approvals

Step 6

Apply To NERC For Operating Permit For Intended Area

Step 7

Construct, Test and Commission Mini Grid

ISOLATED MINI GRIDS (100 kW – 1MW)

ACCOMPANYING DOCUMENTATION FOR PERMIT APPLICATION REQUIRED BY NERC

I. Contract between the Community Representative and Mini-Grid Operator

II. Power station layout drawings

III. Map with position of power station and distribution network marked using indicators to distinguish single phase and three phase as well as medium voltage networks

IV. Certified Copy of Certificate of Incorporation, Memorandum and Articles of Association, particulars of shareholding and directors

I. Certified copy of Certificate of Occupancy or Lease Agreement for Project Site

II. Certified copy of building permit

III. Filled Standardized Spreadsheets for Tariff Calculation

The complete version of the MINI GRID REGULATION 2016 can be downloaded from www.nercng.org

How to get a permit for an interconnected Mini-grid with capacity up to 1MW and distribution above 100kW

Step 1

Identification Of The Eligibility Of Underserved Area

Step 2

Initiate Contact with Disco And Community

Step 3

Contract with the DisCo and Community for Exclusivity Period

Step 4

Tripartite Contract and Registration

Step 5

System Design

Step 6

Acquire land and Necessary Building Approvals

Step 7

Apply to NERC Operating Permit for Intended Area

Step 8

Construct, Test and Commission Mini Grid

INTERCONNECTED MINI-GRID (100 kW to 1 MW) ACCOMPANYING DOCUMENTATION FOR PERMIT APPLICATION REQUIRED BY NERC

I. Certified Copy of Certificate of Incorporation, Memorandum and Articles of Association, particulars of shareholding and directors
II. Certified copy of Certificate of Occupancy or Lease Agreement for Project Site
III. Certified copies of building permit
IV. Signed Tripartite Agreement
V. Filled Standardized Spreadsheets for Tariff Calculation
VI. Map of the interconnected network
VII. List of deficiencies in the distribution grid
VIII. Distribution network infrastructure installed by the mini-grid operator
IX. Map of plot for power generation assets
X. Diagram of fixed infrastructure for generation assets
XI. Boundary values of the distribution grid

The complete version of the MINI GRID REGULATION 2016 can be downloaded from www.nercng.org

Policy on Grid Expansion: Depending on Mini Grid Type

Interconnected Mini grids

- DisCo can takeover interconnected mini grids and re-integrate them into its network once the tripartite contract expires.
- DisCo must provide a written proof of endorsement by the connected community, and a notification to the NERC

ISOLATED MINI GRIDS HAVE TWO OPTIONS

Isolated Mini grids

1. Convert into an interconnected mini grid or;
2. Sell assets to the DisCo

Compensation for Developers

Within Five Years

- Corresponds to the depreciated value of assets, including construction and development costs, plus revenue generated from the mini grid over preceding 12 months

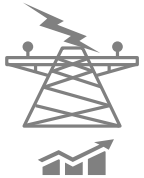
After Five years

- Depreciated value of assets, excluding construction and development costs, plus revenue generated from the mini grid over preceding 12 months

NIGERIA ELECTRIFICATION PROJECT Overview

Objective: Increase access to electricity services for households, public educational institutions, and micro, small and medium enterprises throughout Nigeria

US$350 million facility with 4 components



Component 1: Solar Hybrid Mini Grids for Rural Economic Development ($150m)

Provide subsidies and performance-based grants for mini-grid developers to build solar hybrid mini-grids in rural areas.

1. **Minimum Subsidy Tender ($80m)**
2. **Performance based Grants ($70m)**

Component 2: Standalone Solar Systems for Homes, Enterprises ($75m)

Provide market-based incentives to standalone solar system providers to install solar home systems (SHS) for underserved households and SMEs

1. **Output Based Fund ($60M)**
2. **Market Scale Up Challenge Fund ($15M)**

Component 3: The Energizing Education Programme (EEP) ($105m)

Support the construction and operation of solar hybrid mini grids for federal universities and adjoining teaching hospitals under Phase II of the Programme.

Component 4: Technical Assistance ($20m)

Support project implementation, broad-based capacity building, and help develop a framework for scaling up rural electrification.

Minimum Subsidy Tender - Programme Design

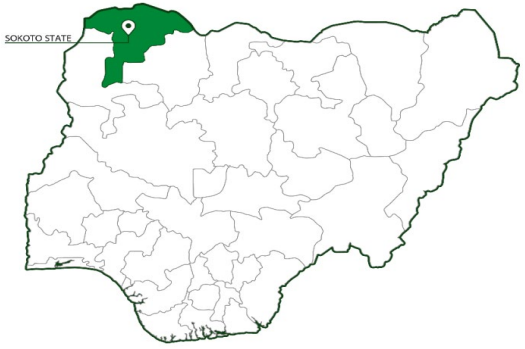
OBJECTIVES

- Develop mini grids on a build-own-operate model and catalyze mini grid deployment at scale to kick-start the market
- **250** sites to be tendered based on geo-referenced data on population clusters and sites, including population density, number and type of productive end-uses, productive loads and estimated load profiles

PROGRAMME DESIGN

- **Phase 1:** Tender for 57 sites across four states: Niger, Sokoto, Ogun, and Cross River states
- **Phase 2:** Scale up to complete 250 sites across these four states

Sokoto State



Ogun State

Niger State

Cross-River State

Phase 1 tender expected to bring clean energy to:

- 20,000 households
- 1,000 small and medium businesses and public institutions

PERFORMANCE BASED - PROGRAM DESIGN

PROGRAMME DESIGN

- A Performance-Based Grant will be available for eligible projects on a rolling basis.
- Developers will carry out geospatial studies, energy audit and community surveys to select viable sites
- REA provides support through the Zonal offices in accessing remote offgird locations
- Grant will be set at **USD350 per new connection**
- Eligible projects:
  - Solar hybrid mini grids
  - Mini grids in unserved areas
- Grant disbursement once connection is made, on a first-come first-served basis

MINIGRID PRE-FEASIBILITY EVALUATION AND SITES SELECTION

First-cut prioritization with existing data has identified 200+ sites with at least 100kW demand

Detailed surveys completed: REA visited top 200 sites across 5 priority states (Nov. 2017)

REA teams prioritized sites by:

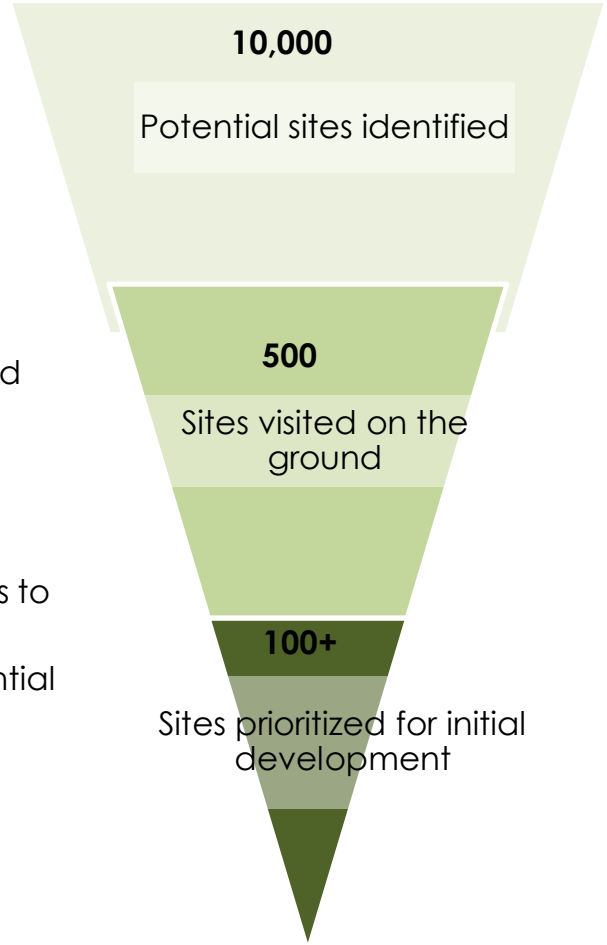
- Sufficient load/density
- Productive-use, daytime, and flexible loads
- Supportive local and state government
- Community engagement
- Accessibility

REA site selection process provides clarity, reduces risk, and accelerates process for private minigrid development

REA teams are gathering detailed data at these sites and using that data to improve site-selection

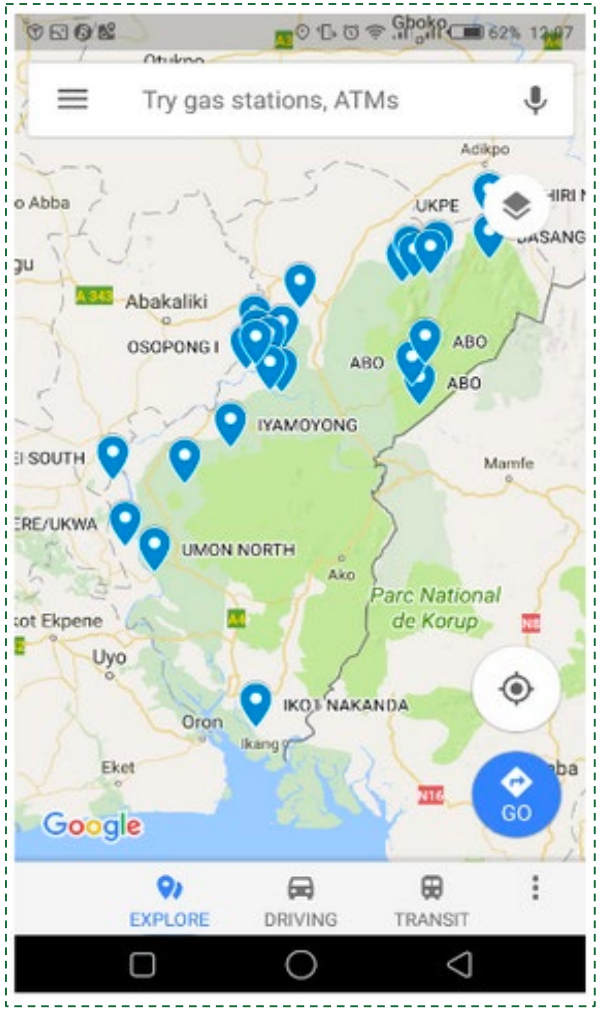
REA survey data includes:

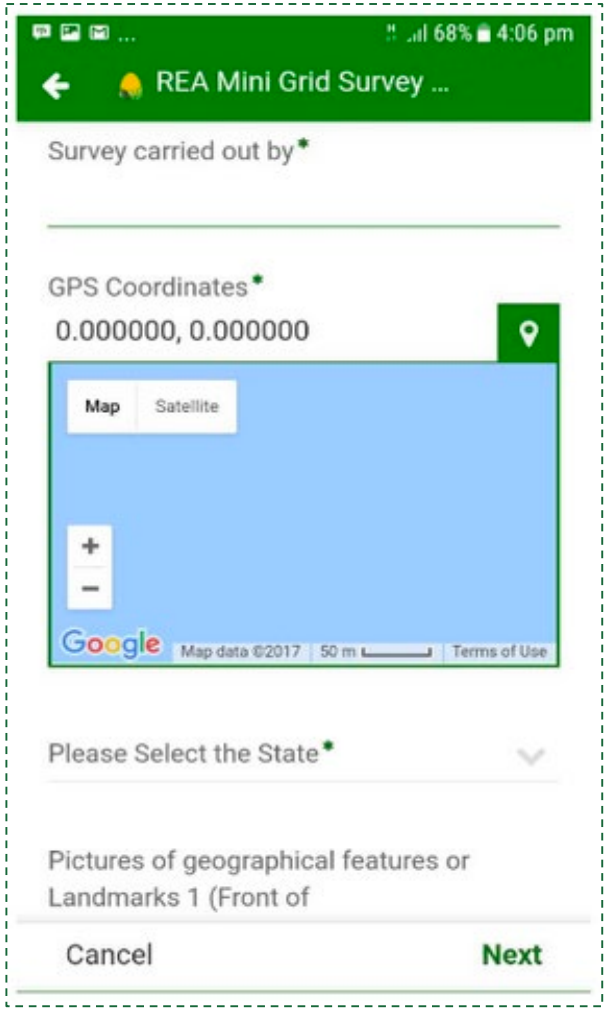
- Number of households, shops, productive loads, and other institutions
- Appliances, productive loads, time of use
- Estimated load profile
- Existing self generation (size and number of units)
- Fuel price and availability
- Cellular service (providers and reliability)
- Current income and willingness to pay
- GIS data for villages and potential customers

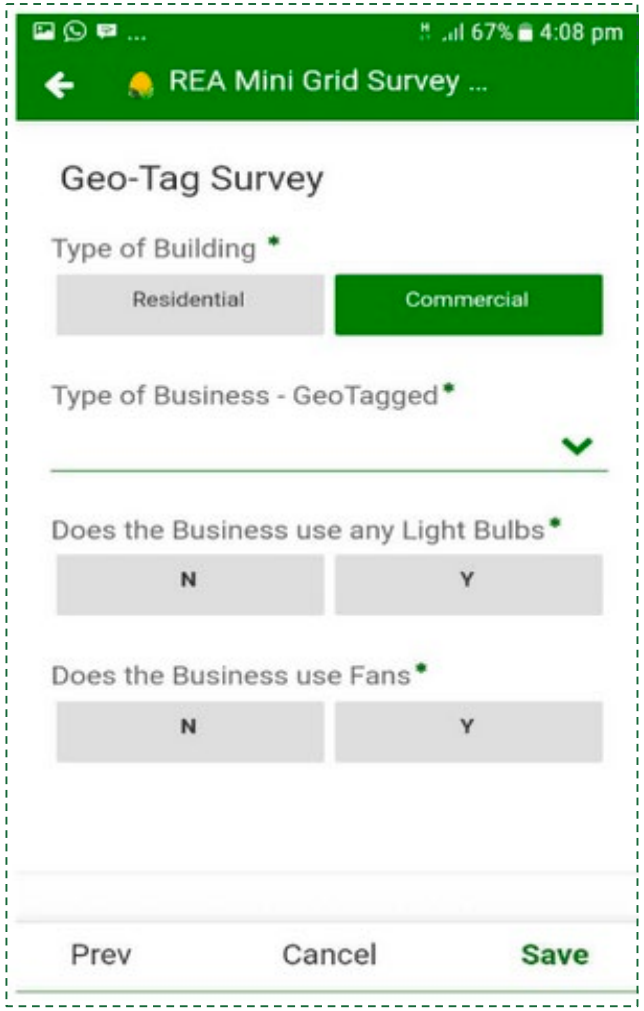


Surveys Carried out using computer aided personal interview app on an Android device

1. Community survey
2. Simplified household Census Survey
3. Commercial Survey
4. Geo-tag Survey







COMMUNITY ENGAGEMENT

Objective

To attain the buy-in of NEP communities through tactical community engagement activities. Engagement will include advocacy, consultation and collaboration in the communities throughout NEP 5 year implementation.

Stakeholder Groups

- Community Leaders
- Women's Groups
- Youth Groups
- Physically challenged
- Religious Organizations
- Schools
- Healthcare Facilities
- Community Vigilante
- Electricity Users Association

REA teams visited 100 communities to sensitize the communities on NEP

Electricity Users Cooperative Society – EUCS

OBJECTIVES

- To create awareness and promote productive use of electricity
- Educate rural communities on energy efficiency
- Encourage partnership developers towards the provision affordable electricity
- Medium to seek cooperation, understanding and support of all stakeholders in the electricity business for the provision of electricity in the rural communities.

REA has embarked on community awareness raising campaigns to mobilize and sensitize rural communities across the country to form Electricity Users Cooperative Society (EUCS).

Communities are expected to own operate and maintain their electricity networks in collaboration with private companies providing the know-how required to operate such systems effectively and efficiently.

Sensitized Communities - 497

105 NORTH EAST COMMUNITIES HAVE BEEN SENSITIZED	**97** NORTH WEST COMMUNITIES HAVE BEEN SENSITIZED	**103** NORTH CENTRAL COMMUNITIES HAVE BEEN SENSITIZED
69 SOUTH WEST COMMUNITIES HAVE BEEN SENSITIZED	**52** SOUTH EAST COMMUNITIES HAVE BEEN SENSITIZED	**71** SOUTH SOUTH COMMUNITIES HAVE BEEN SENSITIZED

Registered Communities - 99

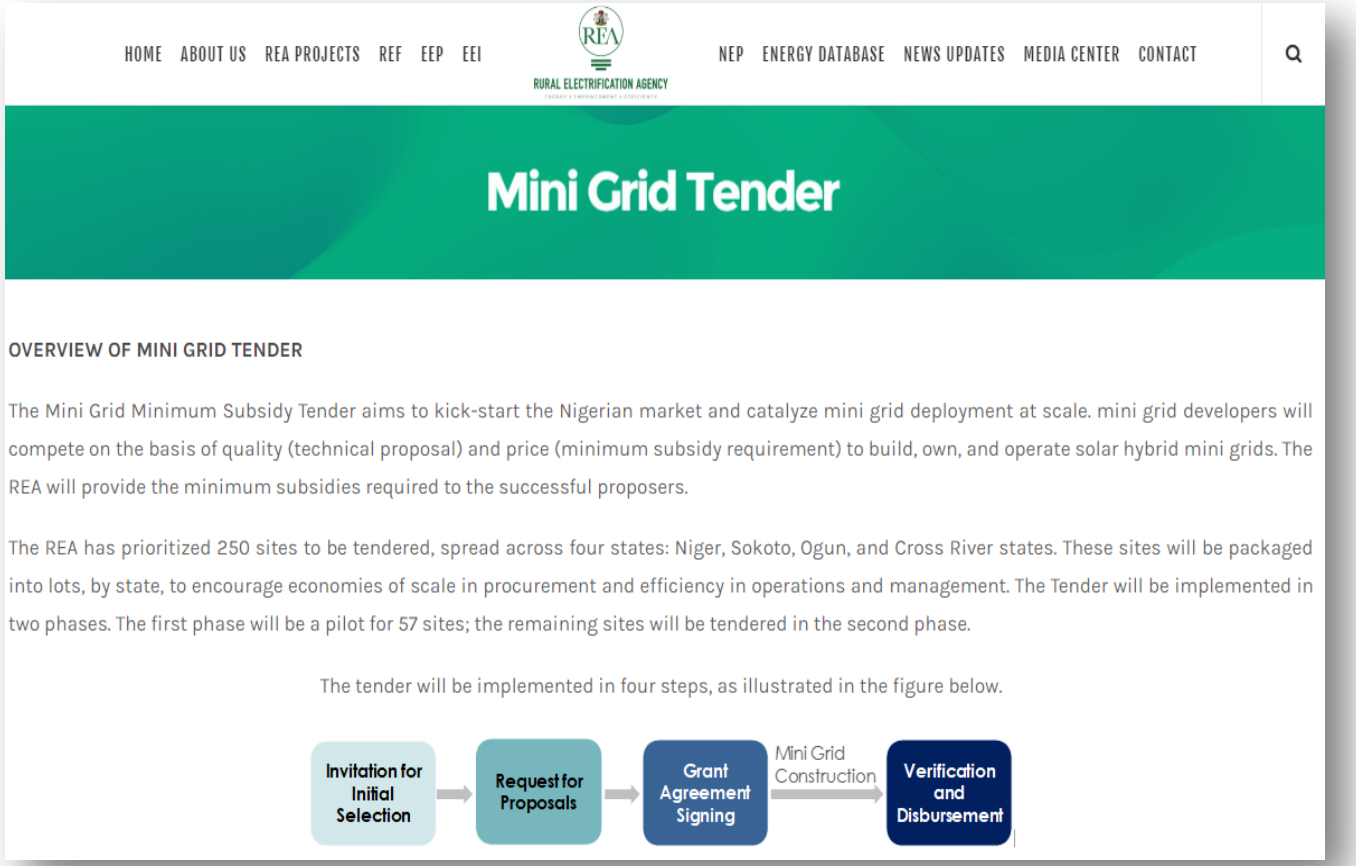
22 NORTH EAST COMMUNITIES HAVE BEEN CERTIFIED	**32** NORTH WEST COMMUNITIES HAVE BEEN CERTIFIED	**9** NORTH CENTRAL COMMUNITIES HAVE BEEN CERTIFIED
10 SOUTH WEST COMMUNITIES HAVE BEEN CERTIFIED	**11** SOUTH EAST COMMUNITIES HAVE BEEN CERTIFIED	**15** SOUTH SOUTH COMMUNITIES HAVE BEEN CERTIFIED

Project Planning, Implementation and Monitoring: Integration with Odyssey

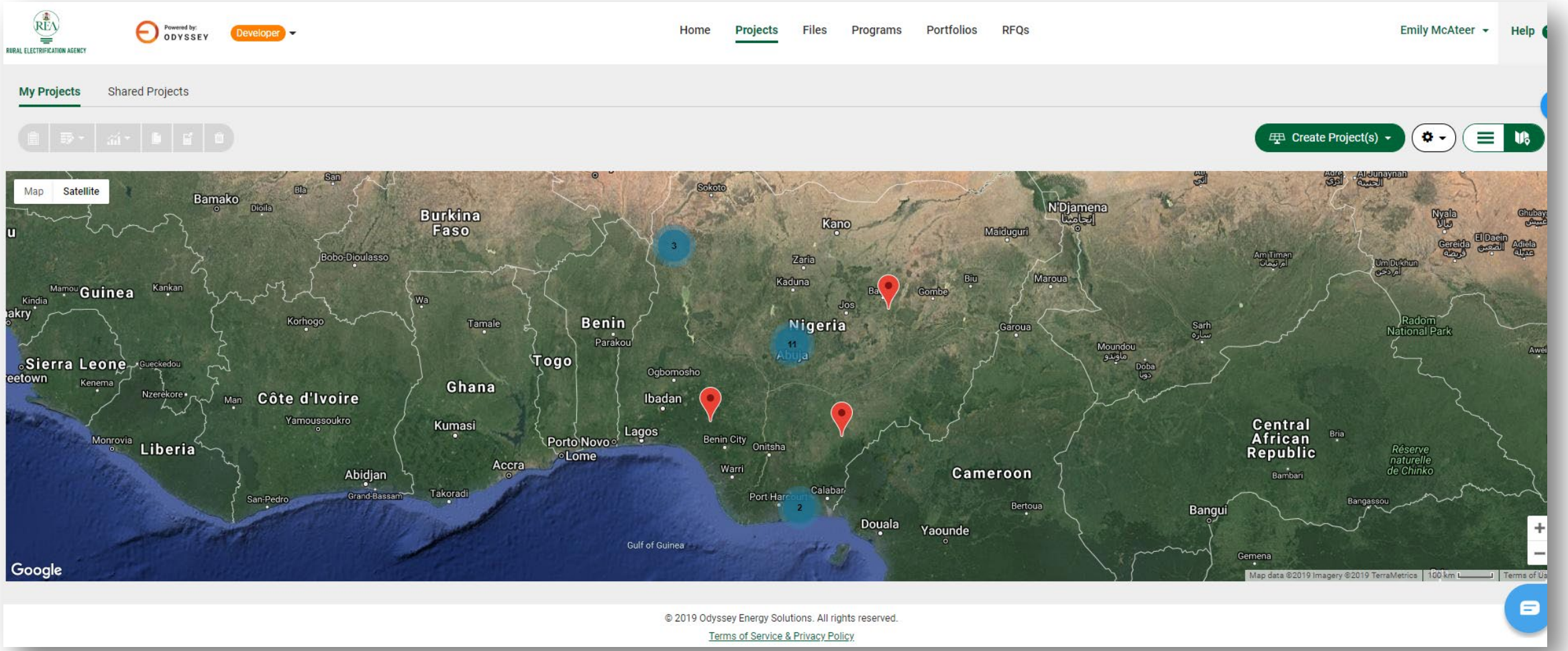
The Opportunity: In Nigeria, the REA and World Bank has launched the **$350M Nigeria Electrification Program**

The Challenge: How to manage three different financing windows, survey sites and share that data with applications, track results for results based financing, make data publicly available, and do it all at a **scale of thousands of projects?**

The Solution: Odyssey has created one central NEP hub, that enables data driven decision making and an efficient project evaluation process. **Odyssey built the tool for conducting and managing data for hundreds of feasibility studies. Odyssey is tracking all connections and project performance all while driving down the costs of running the program**

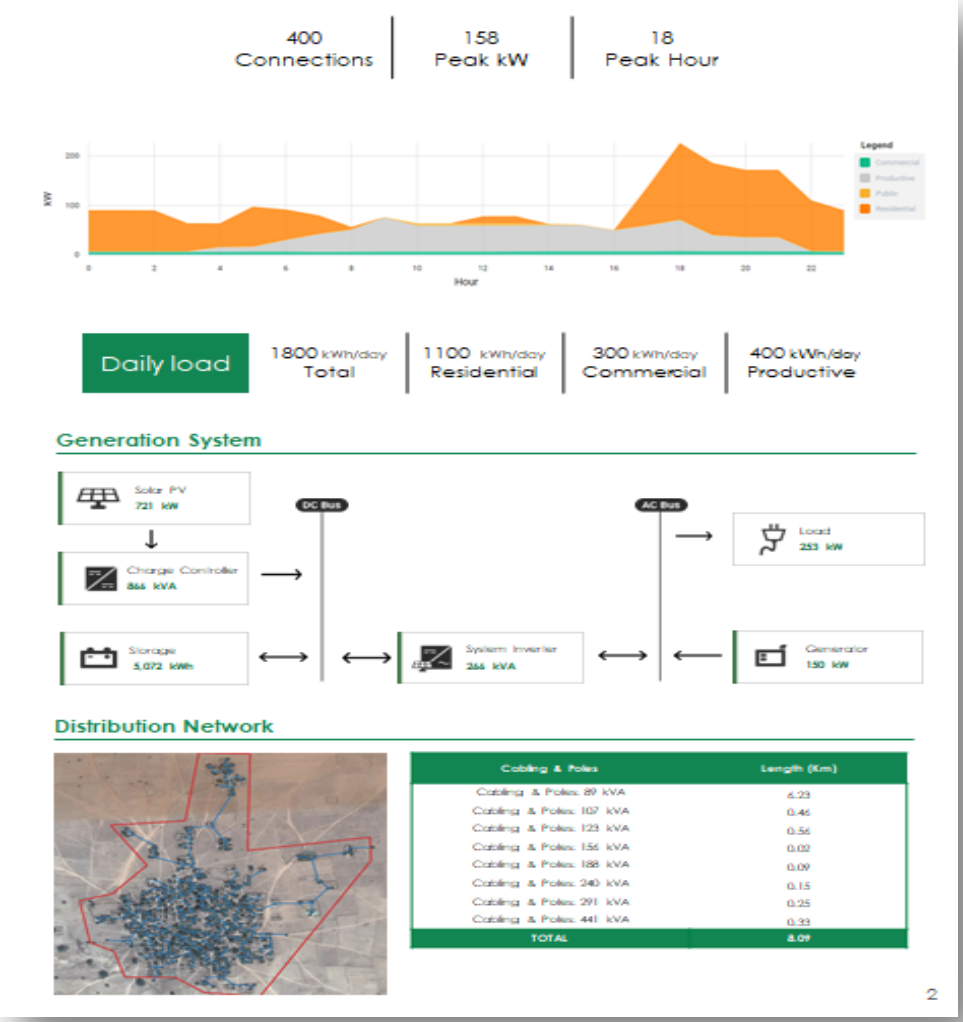


Odyssey is the official web-based platform of the Nigeria Electrification Project



With Odyssey, REA is able to manage <u>all</u> mini-grid and solar home system data through the entire lifecycle of the project – across thousands of deployed systems in the country

Odyssey and REA are creating the world's largest database of detailed site-specific mini-grid data and analysis



As REA's data platform, Odyssey is:

- Generating forecasted load profiles, generation system sizes, optimized distribution designs & financials for hundreds of sites
- Enabling the Rural Electrification Agency to run data queries & analytics across hundreds of mini-grid projects to understand customer loads, costing trends, and more
- Giving project developers sophisticated tools to create more comprehensive & detailed proposals modeled via third-party standards
- Streamlining evaluation with consistent and transparent bids
- Aligning commercial investors on the platform to close the capital stack
- Enabling post-construction project monitoring

REA

RURAL ELECTRIFICATION AGENCY

ENERGY = EMPOWERMENT = EFFICIENCY

THANK YOU FOR LISTENING

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