Nigerian Energy Support Programme (NESP)

MINI-GRID, THE MISSING MIDDLE, AN OPPORTUNITY!

Abidjan, March 2017

Implemented by

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

NESP AT A GLANCE

- **Technical cooperation** programme
- Aim: Enabling framework for RE, EE and **Rural Electrification** (focus on mini-grids).
- Funded by **European Union and Germany**
- Implemented by FMPWH, states (Niger, Ogun, Cross River, Plateau, Sokoto) and GIZ
- Duration: **5 years** (03/2013 – 02/2018)
- As concerns our mini-grid activities, we cover the full spectrum (holistic approach)
  - TA on policy (e.g. PPP Guidelines) and regulation on State and Federal levels
  - TA on electrification planning (provides market intelligence to private sector)
  - TA and capital grants to private sector for mini-grid development
  - TA to financiers and investors interested in investing in the mini-grid sector

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WHAT IS A MINI-GRID?

- **Definition:** Any electricity supply system with its **own power generation capacity** supplying electricity to **more than one customer** connected via a low or medium voltage distribution grid and which **can operate in isolation from the main grid**. **Interconnected mini-grids** are also possible.

- **Three major components:**
  - **Production:** Generation (renewable energy and diesel genset - for backup), Storage (batteries and charge controller), Converters (e.g. inverter), system management (IT equipment) and bus bar (wiring connecting for all production equipment)
  - **Distribution:** subsystem distributing the produced electricity to the users consisting of wiring (DC/AC and single or three phase and overhead or underground)
  - **Load:** all the equipment on the end-user side (e.g. meters/load limiters, internal wiring, grounding and the electric appliances)

- **Link to Renewable Energies:** Mini-grids can be powered with conventional energy systems such as diesel generators. However, technology development in the renewable energy sector and the resulting drop in the price of RE components has led to the progressive replacement of diesel generators as main the power generation source for mini-grids.

Source: ARE, 2011, “Hybrid mini-grids for rural electrification: lessons learned”

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EXAMPLE OF A SOLAR MINI-GRID – POWERSTATION

Photo: INENSUS GmbH

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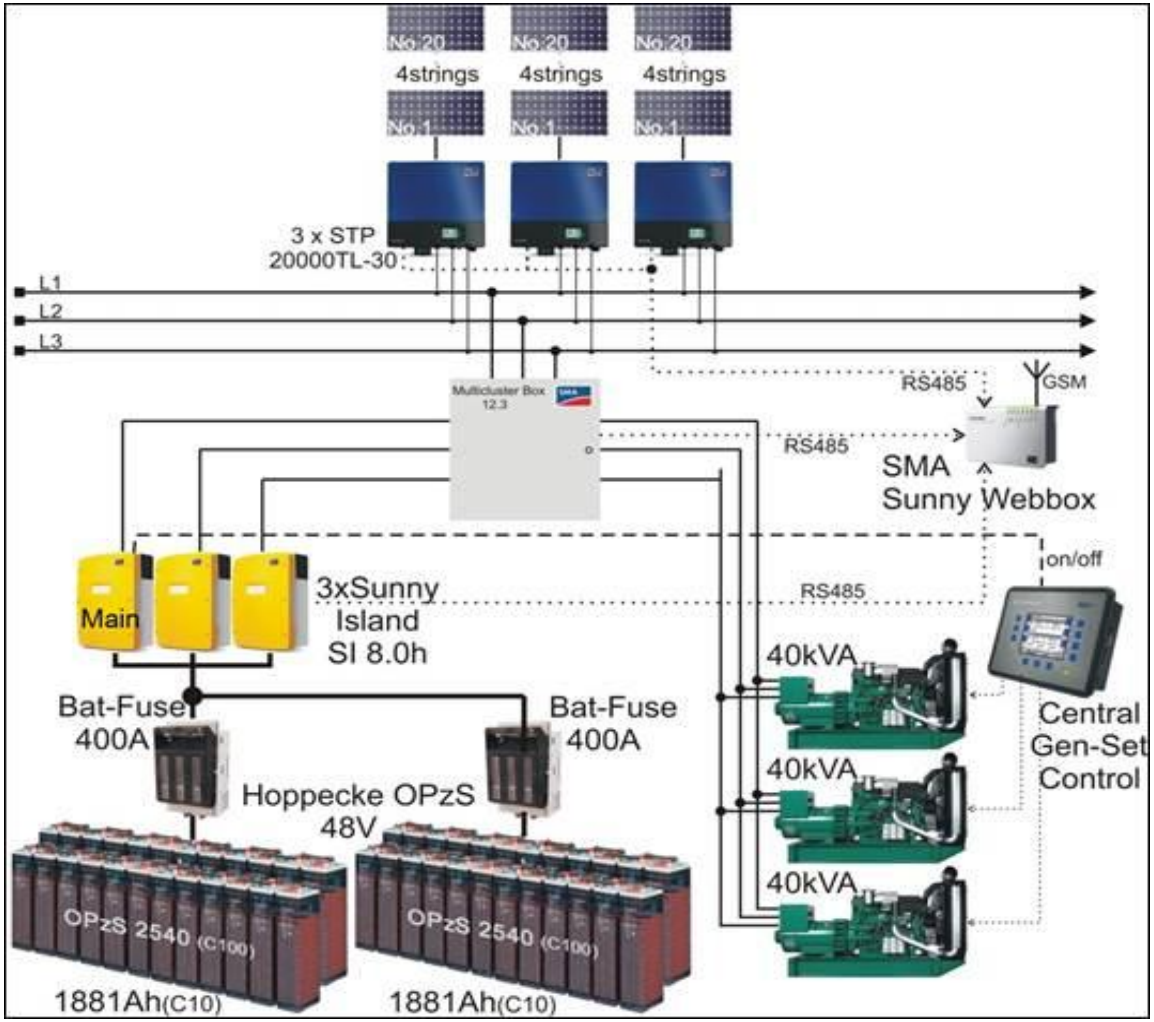
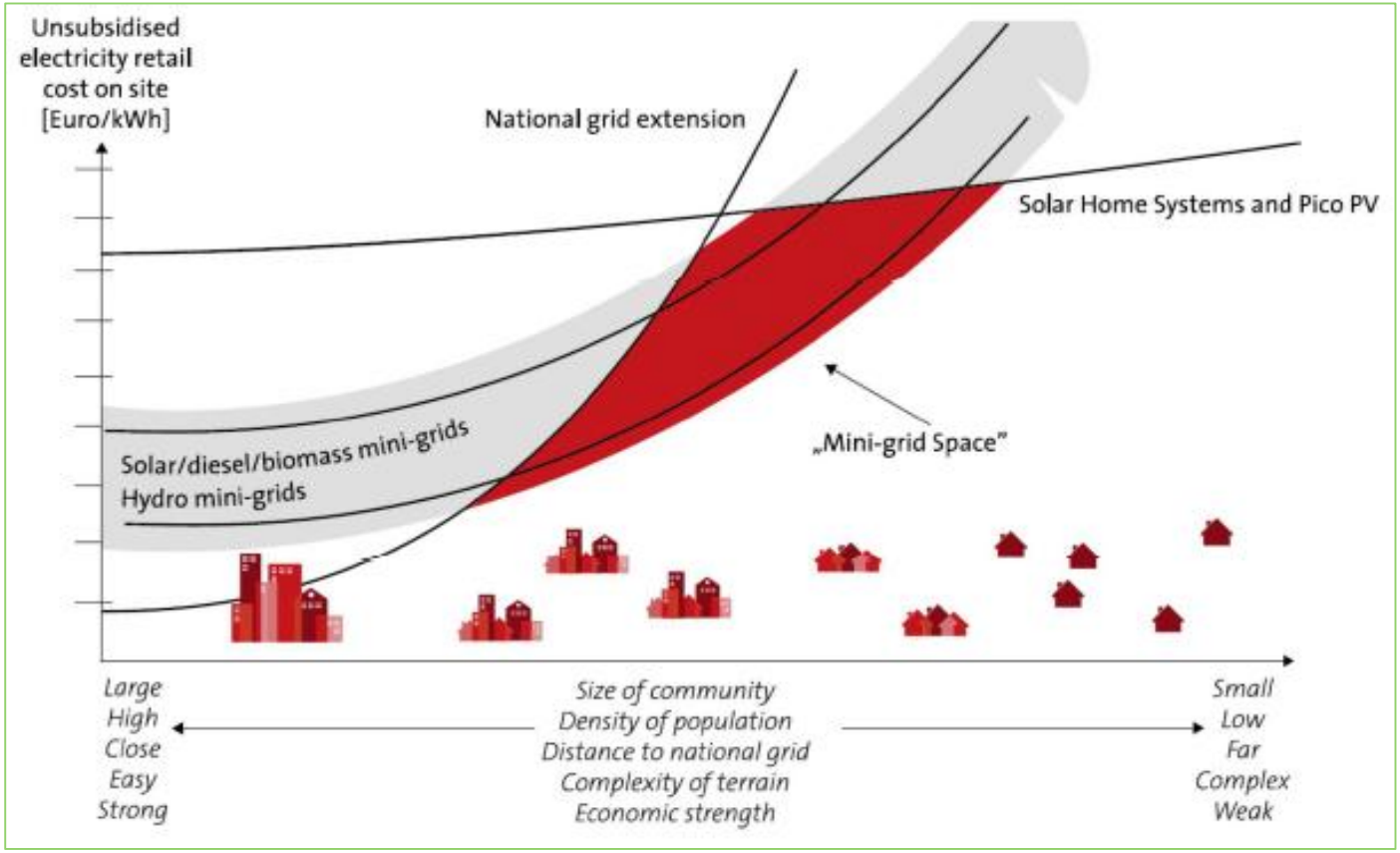


Source: Rubitec Utilities, Solar Hybrid Mini-Grid in Ogun, 2016

Mini-grid space

Most reliable solution (24/7) for large villages far away from main grid with productive users, but development is resource intensive leading to high tariffs.



Source: EUEI-PDF, Mini-grid policy toolkit, 2014

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Off grid systems supports many levels of energy need

Africa progress panel	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Energy service		Task lightning, phone Charge	General lightning, TV and fan	Tier 2 and medium powered appliances	Tier 3 and high powered appliances	Tier 4 and very high powered appliances
Capacity		< 12 Wh	< 200 Wh	< 1 kWh	< 3,4 kWh	< 8,3 kWh
Solar product	Solar lantern	Solar lantern + charger	Small SHS	Large SHS	Larger SHS	Larger SHS
Mini Grid			Mini grid	Mini grid	Mini grid	Mini grid

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Comparison of rural electrification technologies

	MAIN GRID	MINI-GRID	STAND-ALONE
ADVANTAGES	• Cheapest solution (near urban areas) • CAN provide unlimited power supply • Most scalable option	• Flexibility in technical design and operational models • Reliable power supply • Scalable • Can power productive users (tier 4 and 5) • Cheap in rural areas • Technology advancing rapidly (lower cost/kWh)	• Independent solution • Easy to install and replicate • Can be deployed on a purely commercial basis
DISADVANTAGES	• Expensive in the rural areas • Not a target area for DisCos (slow expansion) • Depends on the backbones from DisCo, TSP and GenCo	• Resource intensive projects • Dependent on regulation (agreements between partners) • Need subsidies • Limited power supply (Mgt. of demand) • Higher tariffs than main grid	• Provides a very limited power supply • Most expensive solution (at least in Nigeria)

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Advantages and disadvantages of mini-grid models

Africa progress panel	Advantages	Disadvantages
Utility model	• Experience • Access to policymakers • Uniform tariff • Scalable	• Lack incentives • Inefficient • Public finance only
Private model	• Good competences • Market driven • Decentralized mgt. • Can attract priv. finance	• Upfront finance • Sector lacks experience • Tariffs and relations • Policy and reg. framework
Community model	• Community buy-in • Meet the demand • Empower local people	• Lack of technical experience • Lack of management skills • Decision-making slow
Public-private model	• Combines advantages • Responsibilities optimized	• Difference in management sys. • Strong framework required

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What is the demand

- IEA estimates that 140 M people in Africa will gain access to mini-grids in Africa. Requiring installation of 4000 – 8000 mini-grids a year in 25 years!
- Nigeria: 4000 sites – 13 Million people (GIZ mapping on GIS)
- Benchmark in Nigeria: Euro 572/house hold connection
- Investment need in Nigeria: 2 billion Euro
- Capacity: 1,8 GWp

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Productive loads key to scale

INTEGRATION

- Productive loads allow for economies to scale
- This in turn improves the profitability

CHALLENGES

- Social
  - Change of habits
- Economic
  - Productive tariffs need to compete against diesel
  - Investment hurdle related to mechanization
- Technical
  - Load/Demand management, e.g. avoid pumps and/or mills etc. running on batteries

KEY PRODUCTIVE USERS

Photos: GIZ India

ENABLING FRAMEWORK FOR PRIVATE MINI-GRIDS

- **Strong interest** on federal and state levels as concerns off-grid solutions
- **Deep understanding** of mini-grids at key MDAs (e.g. FMPWH or NERC)
- Conducive **legislative and policy frameworks** for private mini-grids
- Mini-grid **regulation** (supported by NESP) has been approved by NERC
  - Compensation for mini-grid operators in case of main-grid connection
  - Tariff calculation methodology allowing for reflective tariffs
- NESP partner states are developing mini-grid **PPP frameworks**
- **Financiers**, some supported by NESP, are lending (e.g. BoI, bettervest)

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MARKET HAS MATURED

- When NESP started
  - Privately-led **mini-grids in operation** (but 100% grant funded)
  - Technically and financially **capable local companies**
- In 2015, NESP carried out nationwide **Guided Idea Competition** to **pilot PPP model**
  - Out of 100+ companies, 8 were retained, **4 PPPs signed** and **5 pilots**
  - NESP provides **TA** and **grant** to offset ~40% of project's capital expenditure
  - Private partners contribute with their **manpower** as well as **debt/equity**
  - State Goverments contribute by covering **regulatory costs**
- Attracted by conducive framework, **international companies** now scouting market

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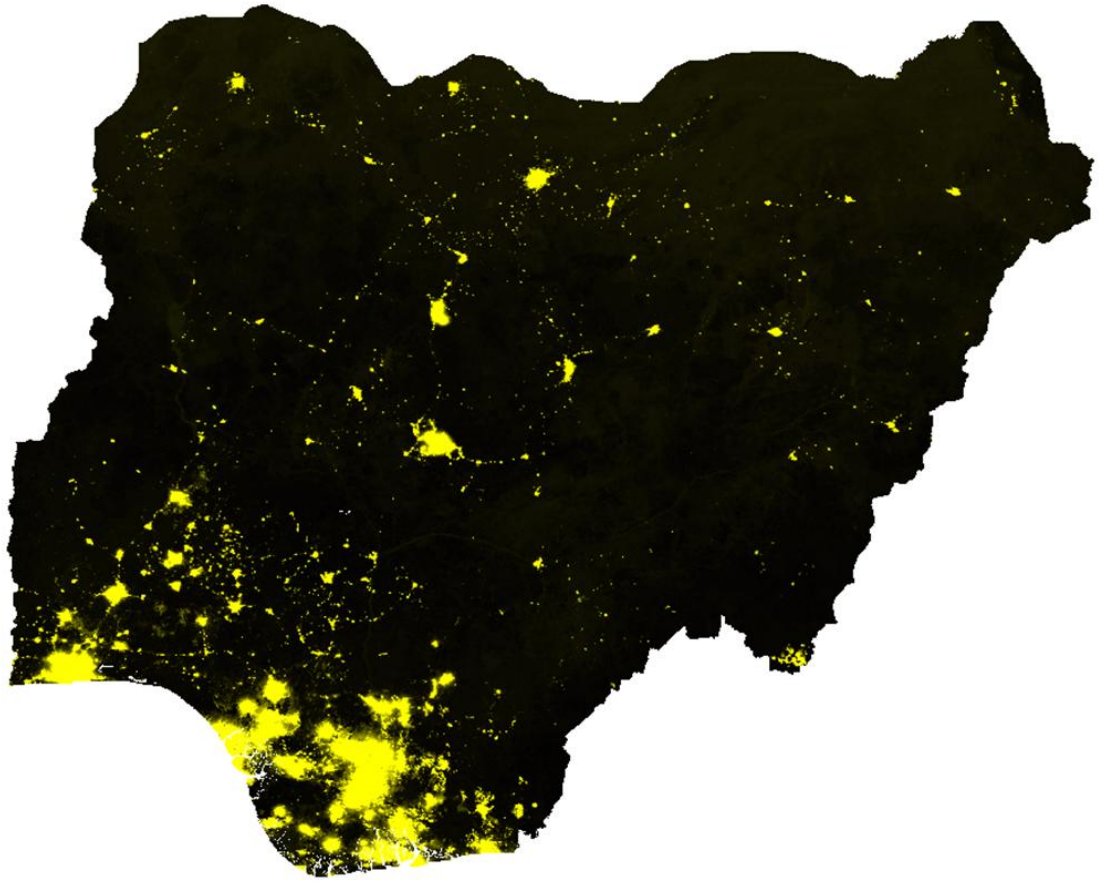
Light emission image of Nigeria



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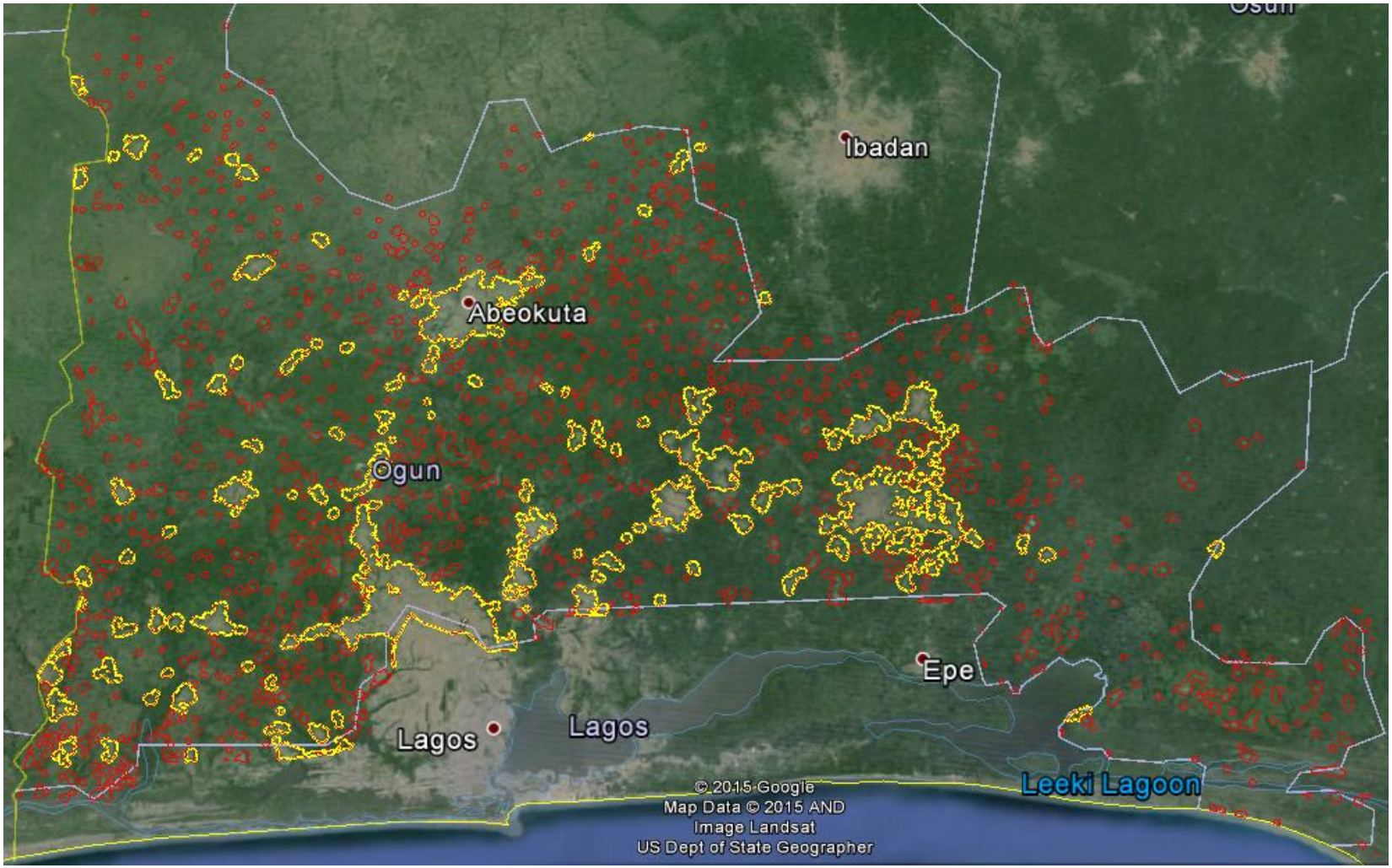
Clusters in Ogun State



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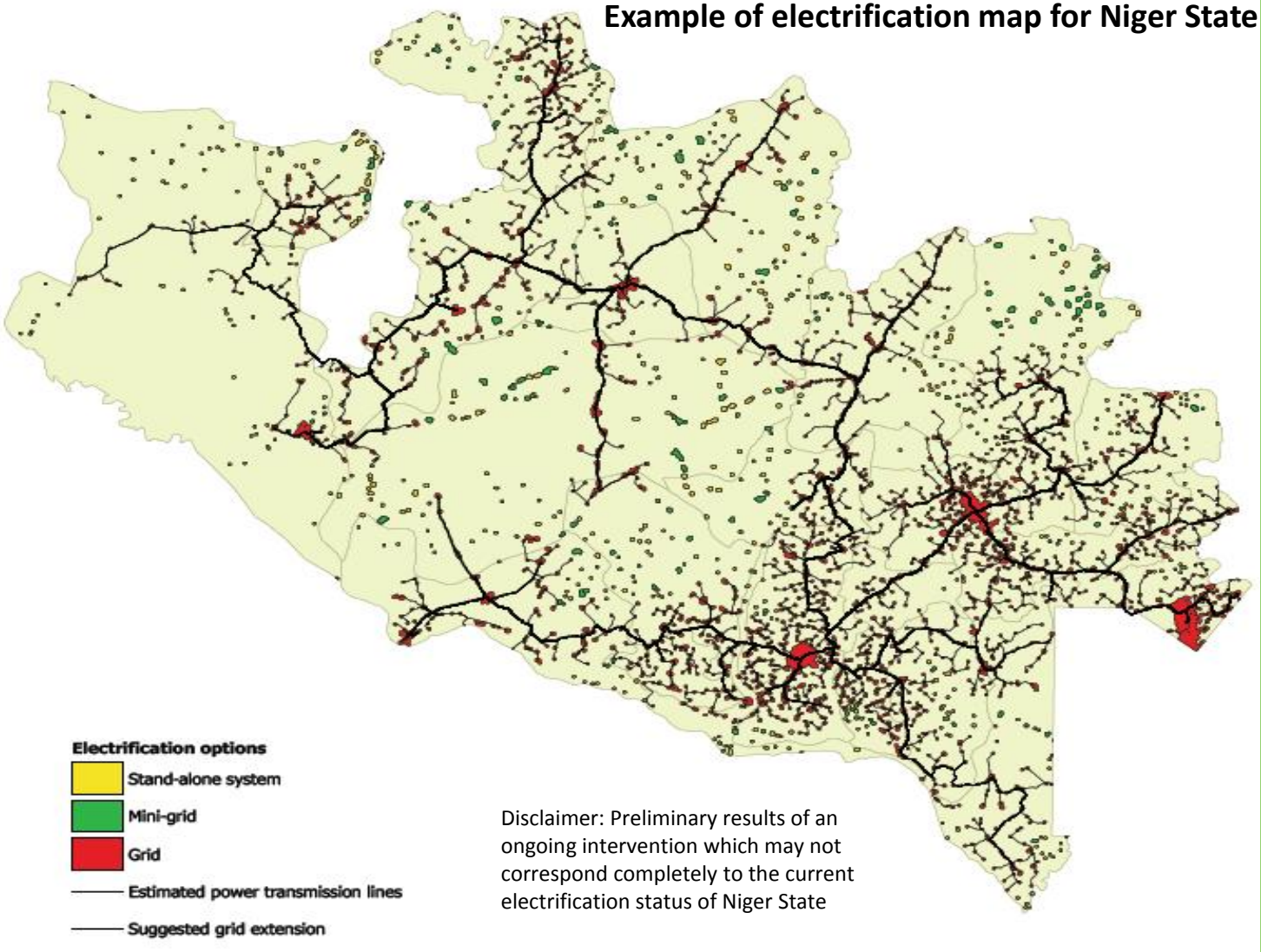
Electrification maps

Example of electrification map for Niger State



Disclaimer: Preliminary results of an ongoing intervention which may not correspond completely to the current electrification status of Niger State

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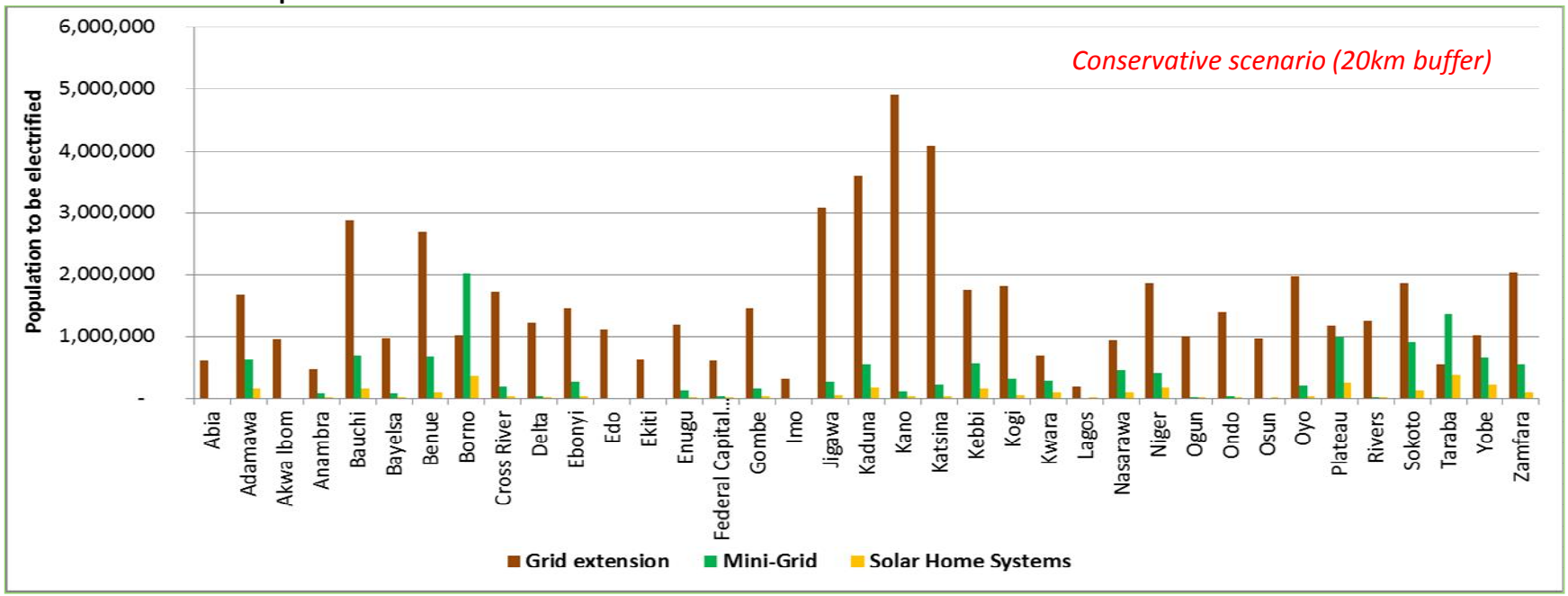
OFF-GRID PV MINI-GRID MARKET POTENTIAL

Figures included in slide are estimates based on NESP/FMPWH pre-planning. NESP also carried out advanced planning with its partner states.

- Now that market is m**ature**, we need to concentrate on **scale**!!!!
- **13M Nigerians** living in areas viable for off-grid PV mini-grids
- Potential for nearly **4000 mini-grids** with a PV capacity of **1.8 GWp**
- Potential capital investment estimated at **2 billion Euros**



Source: NESP, "Preliminary analysis for off-grid PV capacities for the whole of Nigeria", 2015

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NESP plans for roll out phase

- Support preparation of **replication strategies**
  - Up to 10 projects per private partner – ~50 projects in total
  - Total investment portfolio = 25M EUR
- Support **20 new projects** with 40% capital grant and TA
- Seek **collaborations with investors** to match-make them with its private partners
- Provide **technical, financial and legal advice** to investors

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Thank you!

Nigerian Energy Support Programme (NESP)

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