



Bundesministerium  
für Wirtschaft  
und Energie



MITTELSTAND  
**GLOBAL**  
EXPORTINITIATIVE ENERGIE

# INFORMATION EVENT NIGERIA

## PHOTOVOLTAICS FOR OFF-GRID APPLICATIONS IN NIGERIA

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Delegation der Deutschen  
Wirtschaft in Nigeria  
Delegation of German Industry  
and Commerce in Nigeria



Deutsche Gesellschaft  
für Internationale  
Zusammenarbeit (GIZ) GmbH



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# Who we Are

We are an engineering firm that undertakes DESIGN, SUPPLY , INSTALLATIONS & MAINTENANCE of renewable energy based power solution packages for the various sectors of our nation's economy.

We are entirely Nigerian with technical assistance (when necessary) from Solar23 GmbH, Germany, Outback Power, USA, Magnum Energy, USA, Selectronic Australia Pty, Australia, Schneider Electric Solar Inverters, Nigeria/USA, African Energy, USA, SMA Sunbelt, Germany, Victron Energy B.V, The Netherlands, GreenOne Tech, Austria and TellCo Europe, Switzerland.

# INTRODUCTION

Electricity access continues to be a challenge in Nigeria. Approximately 55% of Nigeria's population lacks access to electricity; a rate that has not improved over the last five years.

Meanwhile, Nigeria's average daily generating capacity of 4 GW is insufficient to meet the country's energy demands, and delivers electricity at a highly regulated tariff ranging between ₦4 (€0.01) and ₦50 (€0.12) per kWh that is neither cost-reflective nor sustainable.

As a result of an inadequate supply of electricity, domestic and commercial consumers spend an estimated ₦4.9 trillion (US\$14 billion) annually to power 14 GW of small-scale diesel and petrol generating sets.

## **GENERATION CAPACITY**

Installed Capacity: 12,522 MW

Thermal: 10,142 MW

Hydro: 2,380 MW

## **CONNECTIONS**

Current Access Rate: 45%

Rural: 36% Urban: 55%

Households without Power: 20 million

Current installed capacity is 12.5 GW, but less than half of this is typically available at any given time.

Presently hydroelectric power and gas-fired systems take precedence in Nigeria's current energy mix.

The predominant RE sources in Nigeria are wind, solar, small-hydro and biomass energy, these energy sources have been gravely under-utilized due to heavy reliance on fossil fuel power generation.

The Nigerian government has developed the National Renewable Energy and Energy Efficiency Policy with the accompanying Vision 30:30:30 which aims at achieving 30,000MW of electricity by the year 2030 with renewable energy contributing 30 per cent of the energy mix.

A 2018 World Bank Data puts Nigeria's un-electrified population at 75 million people.

According to the Global Off-Grid Lighting Association (GOGLA), Nigeria has the second largest potential off-grid market in the world after India with 8 percent of the global off-grid household population of 434 million households.

The Rural Electrification Agency (REA) of Nigeria plan to deploy 10,000 mini-grids across the country and yet estimates that installing 100kW each per mini-grid will only meet 30 percent of anticipated demand in the country.

# ELECTRICITY VISION 30-30-30

## ENERGY MIX CHART

30GW BY 2030 WITH 30% RE			
	2017	2019	2030
<b>On Grid</b>			
Fossil Fuel			
Gas	3913	4259	13000
Coal	0	255	3200
Nuclear	0	0	2000
Renewable Energy			
LHP	1650	2200	4700
SMHP	125	285	1200
Solar PV	500	1600	5000
Solar Thermal	0	0	1000
Wind	50	130	800
Biomass	50	240	1100
Geothermal	0	0	0
<b>OFF GRID</b>			
Mini Grid	50	150	5314
SHS + Street Light	100	300	2786

2017	2019	2030
650	2050	13100



# PV OFF-GRID APPLICATIONS

- Mini-Grid
- Captive Power
- Solar Home Systems
- Solar Street lights

# MINI GRID

Minigrids are stand-alone power generation systems of up to 1 MW capacity that provide electricity to multiple consumers through a distribution network.

One GIZ assessment of the minigrid opportunity suggests that over 26 million Nigerians can be most effectively provided with electricity via nearly 8,000 isolated minigrid systems providing 4.4 GWh per year.

Although today's minigrid tariffs are high relative to distribution companies and the central grid, they fall within the ability and willingness of customers to pay for electricity.

Today's cost-reflective minigrid tariffs are typically near ₦200/kWh (€0.47/kWh), which is less expensive than the cost to run a small diesel or petrol generator set. Although this cost reflects the small scale and risk of a nascent market, minigrid tariffs are expected to continue falling and can be reduced by 60% by 2020.

## Policies Supporting Off-grid Electrification



YEAR  
 POLICIES/PLANS  
 IMPACT ON OFF-GRID OR RURAL ELECTRIFICATION



YEAR	POLICIES/PLANS	IMPACT ON OFF-GRID OR RURAL ELECTRIFICATION
2001	<b>National Electric Power Policy (NEPP)</b>	<ul style="list-style-type: none"> <li>Provides for the structuring and privatisation of the electricity market</li> <li>Provides for a Rural Electrification Policy, and targets as well as the Rural Electrification Fund</li> <li>Promotes research and development in the power sector</li> </ul>
2005	<b>Electric Power Sector Reform Act (EPSRA)</b>	<ul style="list-style-type: none"> <li>Unbundles and privatises the Nigerian electricity market</li> <li>Develops a competitive electricity market</li> <li>Establishes the Nigerian Electricity Regulatory Commission; Rural Electrification Agency</li> <li>Consumer protection, licenses and tariffs</li> </ul>
2015	<b>Nigerian Renewable Energy and Energy Efficiency Policy (NREEEP)</b>	<ul style="list-style-type: none"> <li>Develops renewable energy and energy efficiency (RE &amp; EE) targets and action plans</li> <li>Power roadmap and support for electricity market reforms</li> <li>Promotes off-grid renewables development and financing</li> <li>Recommends additional regulations and economic instruments</li> <li>Research development and training</li> <li>Requires bilateral and regional cooperation</li> <li>Implements existing planning and policy</li> </ul>
2016	<b>Rural Electrification Strategy and Implementation Plan (RESIP)</b>	<ul style="list-style-type: none"> <li>Coordinates and implements Nigeria's rural electrification policies, target and strategies</li> <li>Administers the Rural Electrification Fund</li> <li>Promotes low-cost technologies and private sector participation</li> </ul>
2017	<b>Power Sector Recovery Programme (PSRP)</b>	<ul style="list-style-type: none"> <li>Increases electricity access by implementing off-grid renewable solutions</li> <li>Establishes data driven processes for decision making across the sector</li> <li>Develops and implements a foreign exchange policy for the power sector</li> <li>Makes electricity market contracts effective and ensures cost reflective tariffs</li> </ul>
2017	<b>Nigerian Electricity Regulatory Commission Mini-grid Regulation</b>	<ul style="list-style-type: none"> <li>Provides definition, registration and grant of permit for minigrid systems</li> <li>Develops contract templates and enforcement of electricity contracts between all parties concerned</li> <li>Describes operation of the minigrid including technical specifications</li> <li>Proposes commercial arrangement including tariff setting</li> <li>Establishes framework for investor and consumer protection</li> </ul>
2017	<b>Rural Electrification Fund Operational Guidelines (REFOG)</b>	<ul style="list-style-type: none"> <li>Provides capital subsidies/grants and technical support to developers of rural electrification projects</li> <li>Establishes the investor eligibility and the project selection criteria under REF</li> <li>Outlines the sources and allocation of REF resources</li> <li>Develops a database of possible locations to be targeted by the REF</li> <li>Outlines the REF grant award process, monitoring and evaluation of projects</li> </ul>

Table 3. Timeline of key policies and their impact on off-grid electrification

These policy frameworks, among other regulations and plans, are expected to increase access to inclusive, modern and clean energy services, improve energy security and climate objectives, and contribute to diversifying Nigeria's energy mix away from fossil fuels. Some of the policy documents contain a number of regulatory and economic incentives.

These incentives were designed to promote private sector participation in the sector by attracting local and foreign investment, increasing access to concessionary finance, reducing costs for project development, enforcing contracts, limiting exposure to foreign exchange volatility through local sourcing of components, eliminating import duty/tax, and fast-tracking customs clearance.

## OFF-GRID SOLAR MINI-GRIDS - MARKET STATUS AND POTENTIAL

Market still nascent, but maturing fast and with great potential

	Customers	No. mini-grids	Installed cap.	Market value
Status	6k	30*	1MW	Euro 6m
Potential	5m	8k	3.5GW	Euro 5b

\*One mini-grid in Nigeria powered by biomass. All other are solar

Source: ECREEE/ECOWREX and FMPWH

Entrepreneurial tissue:

10 companies operating mini-grids in Nigeria organized under AMDA

Large number of new companies (incl.. Large corporates) prospecting

Presentation in Lagos, 14<sup>th</sup> Nov. 2018 by Luis-Carlos Miro (GIZ)

As the minigrid sector in Nigeria grows, it offers both meaningful impact and exciting investment opportunities. In a matter of 12–24 months the number of commercial minigrid systems is expected to increase by a factor of ten, while project costs are falling and best practices are being implemented across the sector.

This progress can be further accelerated as new investors enter the market and stakeholders address opportunities for enabling growth.

Taken as a whole, the future is bright for the minigrid industry and the electrification of rural Nigeria.

# CAPTIVE POWER

The generation of off-grid electricity that is entirely consumed by the generating entity itself and has an installed capacity exceeding 1 MW, with no upper limit.



## **Use of generators in the manufacturing industry**

Nigeria's manufacturing sector is one of the major driving forces behind the country's economic growth. The manufacturing sector accounted for 9% of GDP (€ 40 billion) in 2013. Growth in the sector has been rapid at a pace of almost 18% per annum in the period 2011–2013, although it is hampered by supply bottlenecks, including disruptions in electricity supply.

Due to irregular power supply and the need for manufacturing industries to sustain production, Nigerian manufacturers have resorted to the use of diesel and gas for their energy needs.

Estimates suggest that between 8 and 14 GW of decentralised diesel generator capacity is currently installed in the country.

About 86% of the companies in Nigeria own or share a generator and about 48% of their total electricity demand is covered by these private generators.

With several millions of privately installed diesel generators, Nigeria leads Africa as a generator importer and is one of the highest importers worldwide.

Find in the next slide, a study, carried out by *Let's make solar work ( A Nigeria- German capacity building initiative)* focusing on the mid-sized power consumers in Nigeria, that is SMEs and social facilities.

The survey was carried out by Solarmate Engineering during September/December 2017 mainly within the Lagos metropolis and some parts of Kano and Kaduna.

We targeted more than 70 companies and social facilities.

A Nigerian-German  
know-how & technology  
transfer Initiative

develoPPP.de



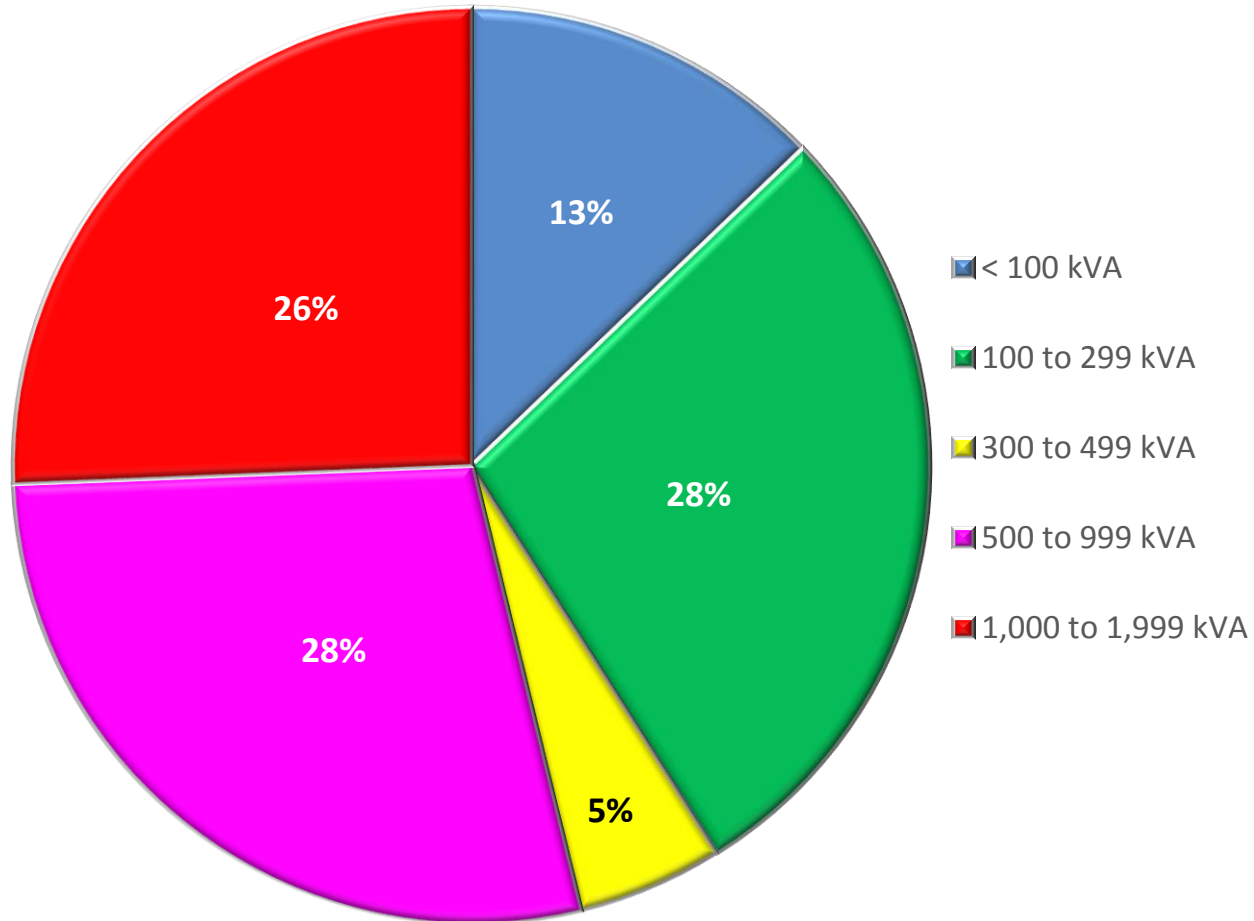
**Let's Make Solar Work is a capacity building initiative for EPCs and trainers.**

**The program is funded up to 50% by develoPPP and the remaining 50% by the consortium partners.**

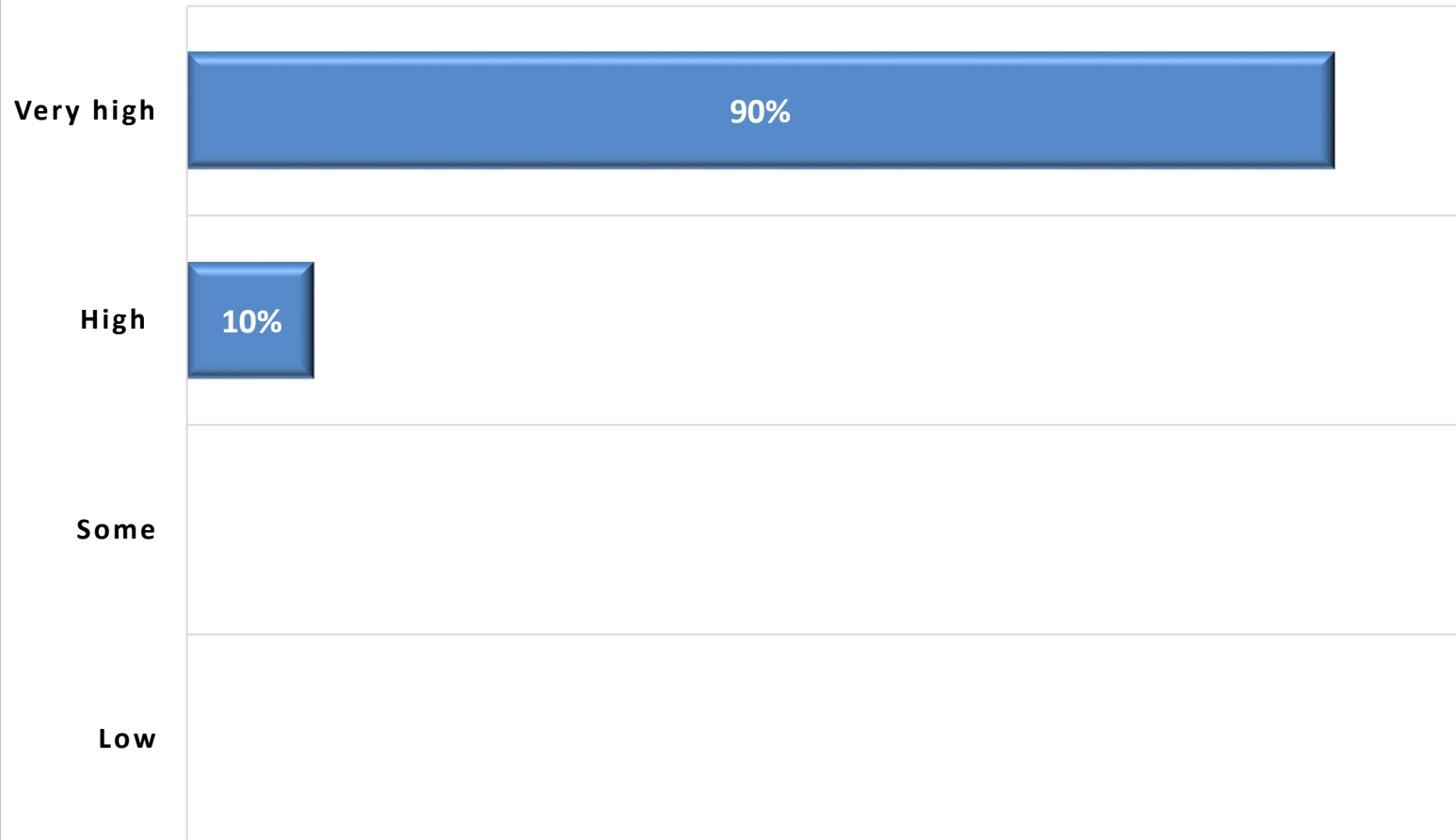
CAPTIVE POWER



## Capacities of diesel generators operated by mid-sized power consumers



## Interest of mid-sized power consumers to reduce their power bills



“Speaking on Monday (February 12, 2018), the Minister of Power, Works and Housing, Mr. Babatunde Fashola, who was represented at the February 2018 edition of the monthly power sector operators meeting at Katampe in Abuja by the Minister of State for Power, Works and Housing, Mr. Suleiman Hassan, explained that on the average, 300 million litres of diesel were consumed monthly to power these generating sets.”

For the substitution of diesel generators, or a diesel-solar hybrid power package, there is a relatively high potential for the use of renewable energy.

# SOLAR HOME SYSTEMS

SHSs capable of powering appliances such as TVs and fans are likely to capture an increasing market share. About 7 million off-grid households will use solar-powered fans and 15 million households will have a solar-powered TV in 2020, according to our estimates.- *Bloomberg New Energy Finance*

With high mobile coverage and a large un-electrified population, Nigeria's energy addressable market, defined as the number of people who have access to GSM coverage but do not have access to electricity, represents just under 70m people. In addition to completely off-grid communities, there is also a significant number of people who have only intermittent access to electricity. The rise of mobile-enabled pay-as-you-go (PAYG) solar solutions, notably solar home systems, as a response to underserved communities' lack of reliable and affordable lighting and charging solutions in East Africa, highlights the opportunity for the PAYG model to scale into West Africa and Nigeria specifically. - *GSMA*



## OFF-GRID INVESTMENT OPPORTUNITY

The goal of the Solar Home System component of the NEP (Nigeria Electrification Project) is to help 1.5 million Nigerian households and micro, small and medium enterprises (MSMEs) access better, yet affordable energy services via stand-alone solar home systems provided by the private sector. In addition, 1 million single solar lanterns are expected to be distributed during the course of the project. (*from REA website*)

**Nigeria's Solar Home system Market is estimated at \$2 Billion A Year .**

# SOLAR STREET LIGHTS

There are estimated over 100,000 solar street lighting in Nigeria and we believe a potential for over a million more in the next few years.

## OTHER APPLICATIONS

- Water pumping
- Telecommunications
- Solar powered CCTV
- Remote lighting
- Cathodic Protection
- Etc.

## CURRENT PROJECTS

- **Mini-Grid and SHS**

Rural Electrification Agency initiatives

- **Captive Power**

Federal Educational institutions and hospitals

Factories/Industries

Economic Cities

Central Bank

- **Street Lights**

MDA and State Governments

## 2.35MW Captive Power PV Hybrid Power Plant in Ogun State



CURRENT PROJECTS



# TENDER PROCESS

## Government Tenders

### **Pre-qualification requirements**

Evidence of Incorporation/Registration with Corporate Affairs Commission (CAC); Tax Clearance Certificate for the last three years; Pension Compliance Certificate; Industrial Training Fund (ITF) Certificate; National Social Insurance Trust Fund (NSITF) ECS Clearance Certificate; National Database of Contractors Registration; Article and Memorandum of Association; Evidence of similar jobs; Evidence of up to date Annual returns with CAC; Company audited accounts for the last three years; Current reference letter from bank and bank statement of the company.

## Private Company Tenders

Private companies tender process are a lot less stringent than for Government and MDAs.

# FEDERAL TENDERS



The Official Listing  
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TENDER PROCESS

  
*Solar*mate  
ENGINEERING LIMITED

## Work with a Local partner:

In nearly every sector, and for both market entry and development, working with a local partner will greatly facilitate the processes.

Working through credible industry association (e.g. REAN, Renewable Energy Association of Nigeria, AMDA – Africa Mini grid developers Association Nigeria) will also greatly help in finding and choosing the right partner.



THANK YOU FOR LISTENING!

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