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# **NIGERIA POWER SECTOR PROGRAM**

## **NIGERIA OFF-GRID ENERGY MARKET INTELLIGENCE REPORT**

April 2019

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# NIGERIA POWER SECTOR PROGRAM (NPSP)

## NIGERIA OFF-GRID ENERGY MARKET INTELLIGENCE REPORT

IDIQ Contract No. 720-674-18-D-00003 Power Africa Extension (PAE)

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## ACRONYMS

Acronym	Definition
<b>AfDB</b>	African Development Bank
<b>AMDA</b>	African Mini Grid Developers Association
<b>B2B</b>	Business-to-Business
<b>B2C</b>	Business-to-Consumer
<b>BTG</b>	Beyond the Grid
<b>C&amp;I</b>	Commercial and Industrial
<b>CAC</b>	Corporate Affairs Commission
<b>CAPEX</b>	Capital Expenditure
<b>CET</b>	Common External Tariff
<b>DFI</b>	Development Finance Institutions
<b>DFID</b>	Department for International Development
<b>DISCO</b>	Distribution Company
<b>EPSRA</b>	Electric Power Sector Reform Act
<b>EU</b>	European Union
<b>EUR</b>	Euro
<b>FCMB</b>	First City Monument Bank
<b>FIRS</b>	Federal Inland Revenue Service
<b>GDP</b>	Gross Domestic Product
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit
<b>GMG</b>	Green Mini Grid
<b>GVE</b>	Green Village Electricity
<b>ICT</b>	Information and Communication Technology
<b>IEC</b>	International Electrotechnical Commission
<b>IFC</b>	International Finance Corporation
<b>IPP</b>	Independent Power Producer
<b>IRR</b>	Internal Rate of Return
<b>IsDB</b>	Islamic Development Bank
<b>kW</b>	Kilowatt
<b>kWh</b>	Kilowatt Hour
<b>LAPO</b>	Lift Above Poverty Organization
<b>LGA</b>	Local Government Area
<b>MEMART</b>	Memorandum and Articles of Association
<b>MSME</b>	Micro, Small, and Medium Enterprises
<b>MW</b>	Megawatt
<b>MYTO</b>	Multi Year Tariff Order
<b>NCIC</b>	Nigeria Climate Innovation Center
<b>NEP</b>	Nigeria Electrification Project
<b>NERC</b>	Nigerian Electricity Regulatory Commission
<b>NESP</b>	Nigeria Energy Support Programme
<b>NESREA</b>	National Environmental Standards and Regulations Enforcement Agency
<b>NIPC</b>	Nigerian Investment Promotion Commission
<b>NPSP</b>	Nigeria Power Sector Program
<b>NREL</b>	National Renewable Energy Laboratory
<b>PATRP</b>	Power Africa Transactions and Reforms Program
<b>PAYG</b>	Pay-As-You-Go
<b>PE</b>	Private Equity
<b>PPA</b>	Power Purchase Agreement
<b>PRG</b>	Partial Risk Guarantee
<b>PV</b>	Photovoltaic
<b>REA</b>	Rural Electrification Agency
<b>REEEP</b>	Renewable Energy and Energy Efficiency Project
<b>RMI</b>	Rocky Mountain Institute

<b>Acronym</b>	<b>Definition</b>
<b>SEED</b>	Sustainable Energy for Economic Development
<b>SGD</b>	Single Good Declaration
<b>SHS</b>	Solar Home System
<b>SME</b>	Small and Medium-Sized Enterprises
<b>SON</b>	Standards Organization of Nigeria
<b>SONCAP</b>	SON Conformity Assessment Programme
<b>TET</b>	Tertiary Education Trust Fund
<b>UBA</b>	United Bank for Africa
<b>US</b>	United States
<b>USADF</b>	United States African Development Foundation
<b>USAID</b>	United States Agency for International Development
<b>USD</b>	United States Dollar
<b>USSD</b>	Unstructured Supplementary Service Data
<b>USTDA</b>	United States Trade and Development Agency
<b>VAT</b>	Value Added Tax

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## EXECUTIVE SUMMARY

The purpose of this report is to provide high-level information on the landscape of Nigeria's off-grid market for local and international off-grid companies interested in entering or expanding in the market. As the largest economy, and most populous country, in sub-Saharan Africa, Nigeria represents one of the largest off-grid investment opportunities in the world. The Nigerian Rural Electrification Agency (REA) estimates that off-grid alternatives to on-grid electricity create a market opportunity of approximately USD9.2 billion annually.<sup>1</sup> The demand for electricity in Nigeria and the scale of the opportunity outstrips the ability of local developers to supply off-grid solutions. Meeting the significant level of demand requires the participation of international developers, financiers, and technology firms.

The Nigeria Power Sector (NPSP) team understands that for existing and new off-grid energy companies to be able to deliver a range of energy services to potential off-grid customers throughout Nigeria, they require access to relevant market intelligence and information on the market's potential, possible business models, and existing market actors. To strengthen this knowledge base, a detailed review of publicly available market information relating to the off-grid energy sector in Nigeria was carried out. During the market intelligence review, a range of key stakeholders in the Nigeria energy sector identified as key informants were interviewed in addition to a review of identified relevant literature.

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<sup>1</sup> Rural Electrification Agency, *Nigeria's Annual Mini Grid Electricity Investment Opportunities Reach \$9.2bn*, <http://rea.gov.ng/rea-nigerias-annual-mini-grid-electricity-investment-opportunities-reach-9-2bn/>

## INTRODUCTION

USAID's Nigeria Power Sector Program is a five-year reform effort that aims to address, and help overcome, Nigeria's systemic liquidity and supply chain constraints through targeted interventions from gas supply for generation to distribution of power to end consumers. NPSP will use a flexible approach to develop, deploy, evaluate, and sustain a variety of interventions and activities to respond to the critical needs and the economic, political, and social developments of the sector. To improve and promote sustainable electricity access, NPSP recognizes the need to focus on critical enabling environment reforms to help stimulate new private sector participation in the energy sector while contributing to Power Africa's overall goal of increasing electricity supply and access, and delivering the following:

- **10,000 MWs** of newly available power generation capacity
- **3 million** new connections

NPSP will increase electricity availability, access, and reliability throughout Nigeria, while measuring objective progress across four program outcomes:

- **Outcome 1 (OC1):** Increase Private Sector Investment in Gas Supply, Power Generation, and Transmission
- **Outcome 2 (OC2):** Facilitate New Off-grid Connections to Cleaner Power Supply
- **Outcome 3 (OC3):** Improve the Enabling Environment for Private Sector Participation in Power Sector
- **Outcome 4 (OC4):** Promote Improved Liquidity throughout the Energy Sector

Recognizing that Power Africa cannot achieve energy access goals through the use of large grid extension projects alone, the U.S. Government launched the Beyond the Grid (BTG) initiative, focused exclusively on unlocking investment and growth for off-grid and small-scale energy solutions on the African continent. BTG unlocks investment and growth for private sector off-grid energy solutions. BTG will enable 25-30 million new off-grid energy connections by 2030 by accelerating household-level (solar home system) and community-level (micro-/mini-grids) electrification solutions. To achieve this goal, BTG:

- Supports private sector off-grid companies to promote innovative products and services, enhance management skills, and successfully scale-up and grow their businesses through market and business intelligence;
- Ensures enabling environments are supportive through regulatory and policy regimes, tailored to each country's environment and market dynamics, to facilitate private sector success; and
- Facilitates access to finance for off-grid companies.

In this capacity, NPSP is supporting Nigeria's off-grid energy sector through a combination of enabling environment activities, direct support to project developers, energy technology and service provider companies, investors, donors, and financiers, and collaboration with other major stakeholders and programs operating in-country.

NPSP understands that to enable existing and new off-grid energy companies to deliver a range of energy services to potential off-grid customers throughout Nigeria access to relevant and detailed market intelligence must be provided. Although multiple studies have already been carried out, it is currently not clear to many companies what information has been collected and where it can be accessed. It is therefore important that the current knowledge gap regarding the solar photovoltaic (PV) off-grid market in Nigeria is filled.

## REPORT OBJECTIVES

This report was developed for the benefit of international off-grid energy companies interested in entering the Nigerian market and local companies interested in expanding their existing market presence. Nigeria is at a point of inflection, where demand for electricity has generated the need for multiple actors to enter the market to facilitate the degree of generation capacity and customer engagement required to meet demand. This report aims to provide information that is also relevant for international off-grid companies who are interested in establishing new businesses in Nigeria, as well as motivate those companies who still lack critical information about the Nigerian market.

To provide assistance and consolidate relevant information available on the Nigerian off-grid power sector, NPSP produced this report with the following specific objectives to provide information about:

- The overall landscape of the off-grid energy market in Nigeria, including information about existing customer demographics and demand.
- Summary areas of the off-grid energy landscape in Nigeria, including existing actors for both SHS and mini-grids.
- Nigeria's business environment, including ease of doing business and the identification of a few relevant regulatory processes off-grid companies may be required to engage in.



## **METHODOLOGY**

This report presents a range of information which was collected across the off-grid landscape covering demand, regulations and supply chains. This information was collected through the following primary activities:

### **Key Stakeholders Interviews**

The key informants were relevant stakeholders in the Nigeria energy sector. These include persons from relevant government agencies, off-grid companies, and international development partners through face-to-face meetings as well as phone conversations.

### **Review of Existing Literature/Policy Documents/NPSP Assessments**

An extensive search and consultation with relevant stakeholders was carried out to gather data from a range of literature for this report. The collection of literature covered the three categories of information the literature review was intended to focus on. The collection of literature included reports on previous market studies conducted, reports on previous mini-grids and off-grid lighting projects, existing policies and regulatory framework on how to invest in Nigeria, renewable energy technology and financing, as well as reviews of statistics on the country demographics, etc., from reports and websites.

# I. OFF-GRID MARKET LANDSCAPE

Nigeria's market for off-grid electricity generation represents an attractive power sector investment and one of the largest investment opportunities in Africa. Historically, Nigeria's power sector has been challenged by structural inefficiencies which contribute to end users realizing, at times, only 25% of installed generation capacity.<sup>2</sup> While power supply has improved, with Nigeria privatizing large segments of the generation and distribution segments of the power sector value chain in 2005, there continues to be a deficit between the amount of power generated and demand.<sup>3</sup> This is exacerbated by the degree of technical losses Nigeria experiences across its on-grid power sector value chain, creating a significant need for alternative, off-grid solutions to fill the power supply and electricity access gap.

## I.1. OFF-GRID MARKET POTENTIAL

Off-grid electricity is typically small-scale generation and storage, often coupled with lighting and appliances, and is independent of on-grid generation or distribution companies. Off-grid solutions typically comprise one of three categories:

- **Solar Home System (SHS):** Offers up to 5 kW of power via solar photovoltaic equipment and a battery, often with lighting and appliances, installed at an individual's home or business
- **Mini-grid:** An independent electricity distribution network that provides power to multiple individuals or businesses in small communities using integrated renewable or hybrid energy systems
- **Diesel generator:** Traditional fossil-fuel generation

Given Nigeria's relatively high degree of solar radiation, particularly in the northern states that are most affected by limited access to electricity, the primary renewable technologies for supplying power to off-grid locations are SHS and solar-powered mini-grids. These platforms have only recently reached a point of price competitiveness with more traditional off-grid generation options.<sup>4</sup> Solar home systems provide cost effective generation at an individual household and business level while mini-grids provide community-scale electricity.

Mini-grids and SHS are likely the most viable options for expanding electricity access to off-grid consumers in Nigeria and there is a limited availability of locally-manufactured solar technologies. Due to the lack of in-country manufacturing, employment opportunities in the SHS sector are mostly tied to the sale and service of SHS units. As SHS expands into the market, particularly with the increased use of Pay-As-You-Go (PAYG) systems, the employment profile may change to include more technically proficient jobs including software engineering and customer support.<sup>5</sup> The profile of mini-grid development is more complex, with many technologically-advanced components within the generation, management, and storage segments of the mini-grid value chain requiring external companies and partners to supply, with opportunities for local companies to engage in development of the project and support in implementation.

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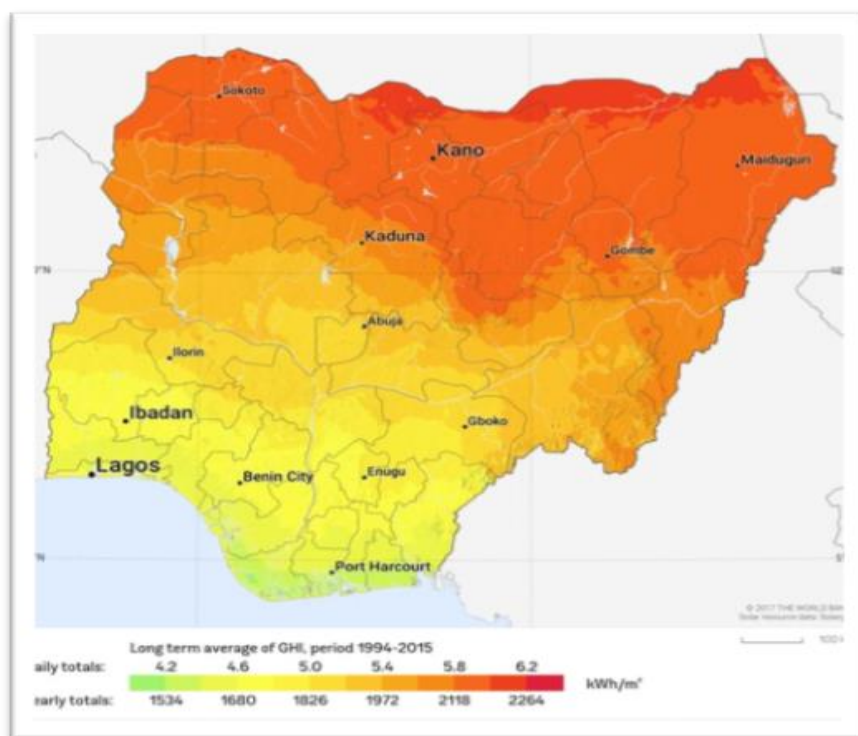
<sup>2</sup> The Advisory Power Team, Office of the Vice President, Federal Government of Nigeria, *Nigeria Power Baseline Report*, 2015 (Nigeria Power Baseline Report, 2015)

<sup>3</sup> Nigeria Investment Promotion Commission, <https://www.nipc.gov.ng/power/>

<sup>4</sup> Rocky Mountain Institute, *Nigeria Mini-grid Investment Report*, 2018, [https://www.rmi.org/wp-content/uploads/2018/08/RMI\\_Nigeria\\_Mini-grid\\_Investment\\_Report\\_2018.pdf](https://www.rmi.org/wp-content/uploads/2018/08/RMI_Nigeria_Mini-grid_Investment_Report_2018.pdf) (RMI, Mini-grid Investment Report)

<sup>5</sup> GOGLA, [https://www.gogla.org/sites/default/files/resource\\_docs/job\\_creation\\_in\\_the\\_og\\_sector\\_-\\_policy\\_note\\_1.pdf](https://www.gogla.org/sites/default/files/resource_docs/job_creation_in_the_og_sector_-_policy_note_1.pdf)

Figure 1. Nigeria's Solar Radiation Exposure



Source: World Bank ESMAP

### 1.1.1. The Scale of the Off-Grid Market

Compared to its East African counterparts, Nigeria represents a wholly different market scale, in both size of the demand – with approximately 120 million Nigerians having little to no access to electricity – and the vast portions of the country where on-grid solutions are not always practicable.<sup>6</sup> This population, with approximately 81 million un-served<sup>7</sup> and 40 million under-served<sup>8</sup>, is larger than any single national non-Nigerian population on the continent. Developing off-grid capacity in Nigeria is key to sustaining economic growth and meeting market demand and presents a large market opportunity for both mini-grid and SHS investment. The potential for developing at scale is also substantial, the Nigerian Rural Electrification Agency (REA) estimates that even if 10,000 mini-grids of 100 kW each were installed in the next few years it would only meet 30% of existing demand.<sup>9</sup> Further, to meet ambitious energy targets such as providing universal electricity access by 2030, Nigeria would have to connect between 500,000 and 800,000 households annually, a scale that necessitates rapid growth in the off-grid market.<sup>10</sup>

### 1.1.2. Recent Changes Accelerating the Off-Grid Market

#### Increased Number of Payment Options

In addition to the generation technologies available for meeting Nigerian consumer demand, there are a variety of payment and funding options available. Payment for the power consumed, and purchasing

<sup>6</sup> World Bank Group, Nigeria, in Lighting Global, <https://www.lightingafrica.org/country/nigeria/> (World Bank, Nigeria)

<sup>7</sup> World Bank, *Power Sector Recovery Program Final Report*, <http://documents.worldbank.org/curated/en/814321517496088129/pdf/124160-ESSA-PI64001-PUBLIC.pdf> (World Bank, PSRP Final Report)

<sup>8</sup> World Bank, Nigeria

<sup>9</sup> REA, *Off-Grid Opportunity Nigeria*, <http://rea.gov.ng/off-grid-opportunity-nigeria/>

<sup>10</sup> World Bank, PSRP Final Report

of the SHS unit itself, have traditionally been hurdles to developing the off-grid commercial model. Microfinance Institutions (MFIs) and their small-scale consumer loans are relatively new in the Nigerian energy market, but actors are emerging and beginning to connect with solar developers. LAPO, one of the largest MFIs in Nigeria, has more than 400 branches across the country and has partnered with d.light, a SHS company, to expand the number and scale of loans made to SHS customers. This effort alone has financed thousands of SHS purchases per month throughout Nigeria.

Expanding the use of PAYG and electronic payment systems is complicated by a cash-dominant Nigerian economy. While Nigerian customers' historically-preferred payment method of choice for most goods is cash, there are signs that new technologies such as mobile money remains in its nascent stages and a constraint on the market, while PAYG is slowly gaining traction among electricity consumers. Airtime payment options, which utilize the mobile phone carrier's Global System for Mobile Communication mechanism that customers use to purchase minutes, has seen success as a preferred subsidiary of PAYG technology. This progress is often geographically splintered, however, with certain economic areas preferring cash to electronic forms of payment, while other economic areas have adopted electronic payment options with enthusiasm. Several payment service providers (e.g., Interswitch, Swifta, Paga) have a physical network of collection agents, while commercial banks have also embarked upon expansions of their agent networks through a program called Shared Agent Network Expansion Fund, to increase the accessibility of payment systems throughout Nigeria.

### **Development of Quality Standards**

The proposed influx of donor-funded financing is expected to catalyze the number of interested and active mini-grid developers and SHS companies. To build consumer confidence and propel SHS purchases, organizations have begun to implement quality assurance standards. The World Bank and International Finance Corporation (IFC) have supported the Lighting Global Quality Test Methodology since 2009 to vet the stream of off-grid solar products coming to market. Globally, this process has evaluated and approved more than 245 solar products.<sup>11</sup> This global standard allows off-grid consumers to make educated decisions on by establishing a common framework that can be applied across multiple markets. Industry benefits by having a singular global standard to qualify against, instead of being required to adapt to different standards in each market they operate, with separate globally-applicable standards for both smaller-scale Pico-PV and full SHS. While Lighting Global focuses on SHS development quality assurance, the United States National Renewable Energy Laboratory (NREL) created a quality assurance framework for mini-grids. This framework provides a "common way to reference levels of service" and rests on the two pillars of (1) defining the levels of service and (2) defining an accountability framework.<sup>12</sup>

### **Increased Access to Funding**

In recent years, the Nigerian government has seized on the need to drive supply to meet demand and has begun providing power sector development incentives. This has been catalyzed by proposed funding from the World Bank through its Nigeria Electrification Project (NEP), envisaged to invest USD350 million across mini-grids, SHS, power systems for universities, and technical assistance.<sup>13</sup> For mini-grids alone, the amount of public financing coming available exceeds USD230 million across multiple publicly funded donor programs.

Further, REA has analyzed and identified hundreds of possible mini-grid sites for developers – estimating that developers can derive a return on investment for a medium scale, approximately 200 kW solar home system in three years.<sup>14</sup> Further, the federal government has made a concerted effort

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<sup>11</sup> IFC, Lighting Global, <https://www.lightingglobal.org/quality-assurance-program/product-testing-data/>

<sup>12</sup> NREL, *Quality Assurance Framework for Mini-grids*, 2017, <https://www.nrel.gov/docs/fy17osti/68414.pdf>

<sup>13</sup> REA, *World Bank Approves USD350m for REAs Solar Power Projects in Schools*, <http://rea.gov.ng/wbank-approves-350m-for-reas-solar-power-projects-in-schools-others/>

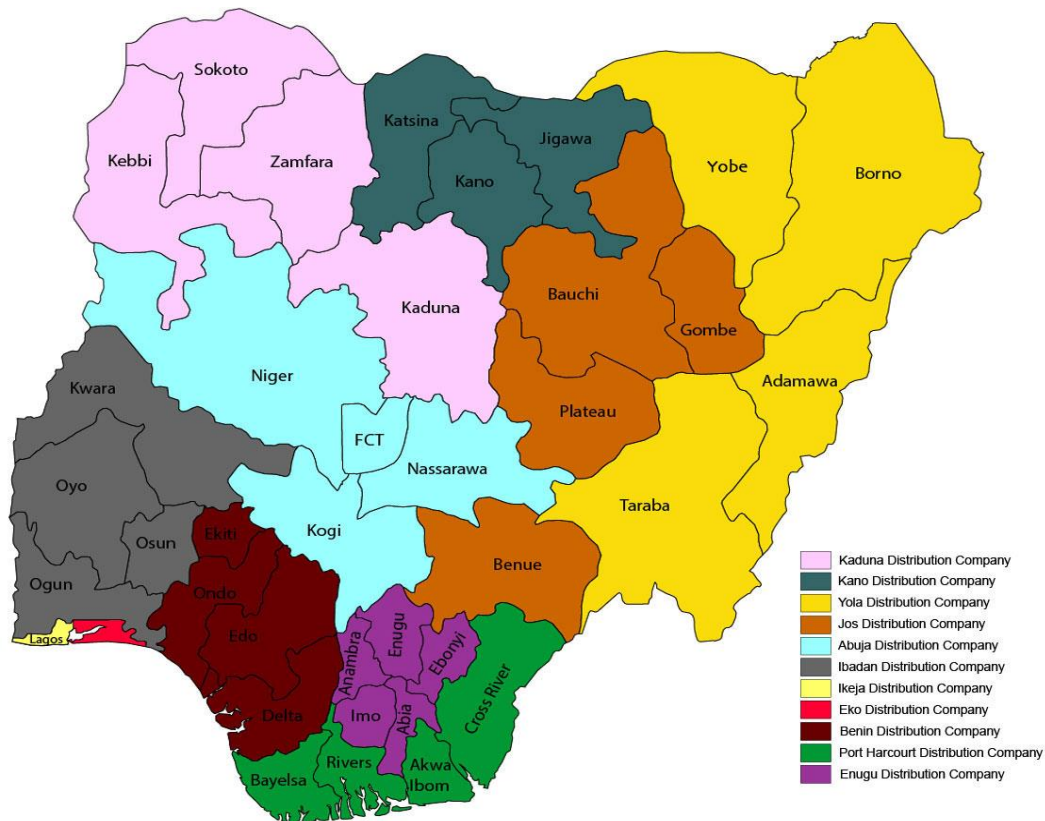
<sup>14</sup> REA, *Off-Grid Opportunity Nigeria*, <http://rea.gov.ng/off-grid-opportunity-nigeria/>

to create an enabling environment for power sector investment and has implemented a variety of tax, tariff, and other financial incentives to encourage investment.

## 1.2. OFF-GRID ENERGY DEMAND

Understanding the framework within which the off-grid sector operates is integral to understanding the impetus for off-grid demand. The current electricity distribution network stretches across the six geopolitical zones of the federation and there are 11 distribution companies (DISCOs) operating within the network in regions allocated to them.<sup>15</sup> These regions are outlined below.

Figure 2: DISCO Coverage in Nigeria



Source: NERC

The distribution grid currently serves approximately 8 million customers (with connections in terms of residential households, commercial, etc.) and the rate of urban electrification with the grid is 84% while the rural area is 39%.<sup>16</sup> On-grid electricity is unreliable, with approximately 40%<sup>17</sup> of on-grid customers experiencing service below their demand, often receiving less than 12 hours per day from the grid. The unreliable on-grid supply and the high incidence of “weak grid” suggests there may be strong demand for off-grid solutions, particularly SHS, even in areas that are connected to the grid. Table I below provides summary information of how many average hours of electricity supply are available across Nigeria’s distribution companies.

<sup>15</sup> Nigeria Power Baseline Report, 2015

<sup>16</sup> World Bank, PSRP Final Report

<sup>17</sup> World Bank, Nigeria

Table 1: Average Daily Power Availability to Major Cities by DISCO

Distribution Company	States / Coverage Area	Average Hours of Supply Availability
Abuja Electricity Distribution	Abuja Federal Capital Territory, Kogi, Nasarawa, Niger	15.60
Benin Electricity Distribution	Delta, Edo, Ekiti, Ondo	11.10
Eko Electricity Distribution	Lagos South	8.50
Enugu Electricity Distribution	Abia, Anambra, Ebonyi, Enugu, Imo	19.40
Ibadan Electricity Distribution	Kwara, Ogun, Osun, Oyo	6.10
Ikeja Electricity Distribution	Lagos North	10.20
Jos Electricity Distribution	Bauchi, Benue, Gombe, Plateau	13.20
Kaduna Electricity Distribution	Kaduna, Kebbi, Sokoto, Zamfara	22.50
Kano Electricity Distribution	Abuja Federal Capital Territory, Adamawa, Anambra, Bauchi, Benue, Borno, Cross River	8.20
Port Harcourt Electricity Distribution	Akwa Ibom, Bayelsa, Cross River, Rivers	22.50
Yola Electricity Distribution	Adamawa, Borno, Taraba, Yobe	5.20

Source: Independent Energy Watch Initiative, December 2018

### 1.2.1. Economic Indicators of Off-Grid Customers

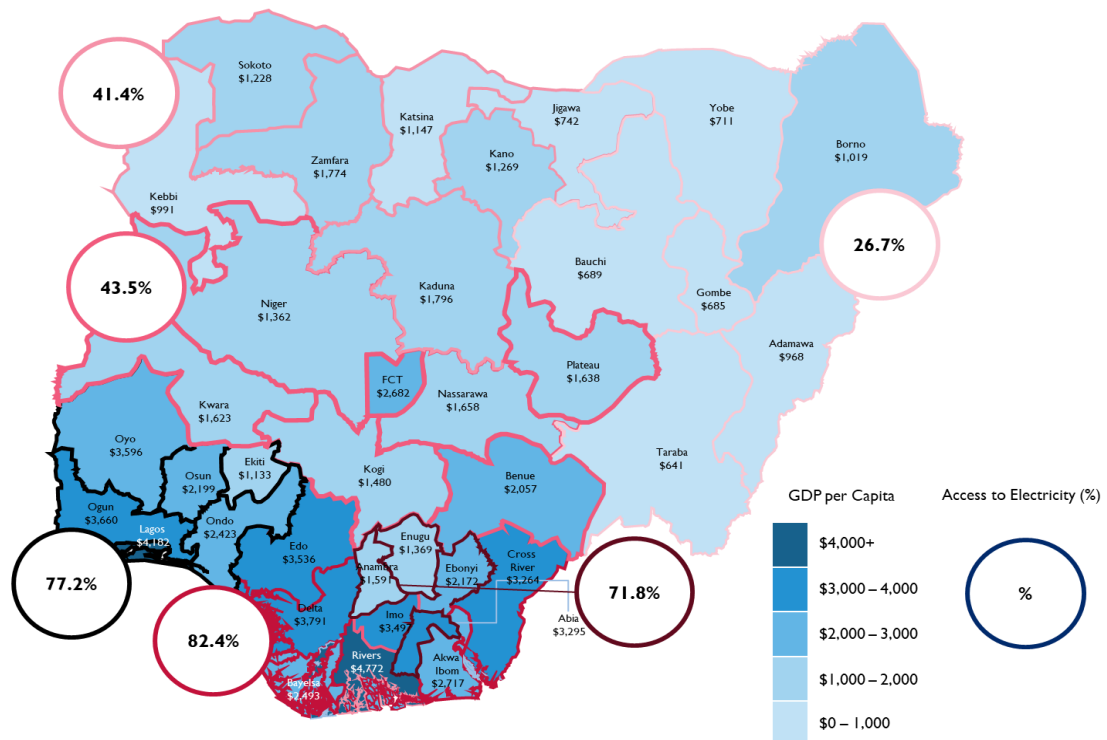
According to the World Bank, Nigeria's population density is approximately 210 persons per square kilometer, this is more than 2-times the population density of large off-grid markets in East Africa, including both Kenya and Tanzania. As of 2017, World Bank estimates placed the average GDP per capita in Nigeria at USD1,968.56, but this figure varies significantly across the country.<sup>18</sup> Available state-by-state data shows that Rivers state had the highest GDP per capita, with USD4,772, while Taraba state had the lowest GDP per capita USD641.<sup>19</sup> These demographics vary across Nigeria's 36 states, with GDP per capita clustered in the Southern states, often at 4-times the level of the northern states such as Jigawa, Yobe, or Sokoto and mirrors electricity access rates, which vary significantly from the country's southern region where access is near-universal, to the northern states, where access can hover around 25%, depending on the state.

When layering these two economic indicators, (1) GDP per capita and (2) electricity access rates across Nigeria's geopolitical territories, it becomes evident that areas of low GDP per capita often overlap with regions with comparatively low access to electricity. This is particularly noticeable in the divide between northern and southern Nigeria, where high-per-capita GDP statistics are clustered around the commercial and industrial centers of Lagos and Port Harcourt, while northern states that rely more on agrarian economies have lower earnings. Low access areas are also the areas for the most off-grid growth, signaling potentially large markets for SHS and mini-grid development.

<sup>18</sup> World Bank, <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=NG>

<sup>19</sup> Kingmakers Nigeria, <https://medium.com/kingmakers/how-we-projected-the-gdp-for-states-in-nigeria-5ccc5e2c85f7>

Figure 3: Summary of GDP Per Capita and Electricity Access Rates in Nigeria



Source: World Bank, Kingmakers Nigeria, NPSP Team Research

### 1.2.2. Ability of Customers to Pay for Off-Grid Products

The ability of customers to pay varies significantly by state and community. In 2018, Rocky Mountain Institute (RMI) estimated that customers in Nigeria often pay upwards of USD.71/kWh for local diesel generation.<sup>20</sup> Mini-grid electricity costs compare favorably, with RMI estimating that a mini-grid power can be produced in the range of USD0.60 to USD1.00 per kWh.<sup>21</sup> At times, this can be more expensive than on-grid electricity, but many customers are willing to pay the slightly higher rate due to the increase in reliability and immediate access a mini-grid affords. Further information on how much different consumer segments spend on electricity is outlined in the table below:

<sup>20</sup> Rocky Mountain Institute, *Reliable and Affordable Electricity for Nigeria: Growing the Minigrid Market*, <https://www.rmi.org/reliable-and-affordable-electricity-for-nigeria-growing-the-minigrid-market/>

<sup>21</sup> *Ibid.*

Table 2: Off-Grid Consumer Demographics

	Rural	Peri-urban	MSMEs	Urban	Commercial
Description	Sparsely populated, under developed villages and towns with limited infrastructure. Population demographic usually consists of farmers, petty traders, teachers and artisans	Consists of small and medium-sized villages /towns drawn into an urbanized fabric. Usually more densely populated rural areas. Population demographic usually consists of farmers, petty traders, drivers, civil servants	Micro, Small, and Medium Enterprises (MSMEs) account for more than 84% jobs in the country. They usually have less than 200 employees and include traders, artisans, small-scale businesses in key sectors	Densely populated settlement areas with infrastructure of built environment	Large-scale businesses in key sectors such as Agriculture, FMCG, Finance, ICT, Oil & Gas and Healthcare with over 200 employees located in commercial hubs including Lagos, Abuja, Kano, Port Harcourt and Aba
Income	USD 3 - 55/month	up to ~ USD 110/month	Variable	USD 480 - 645/month	Variable
Monthly Energy Consumption	<8 kWh/month	<20 kWh/month	20 – 110kWh/month	<50 kWh/month	>110 kWh/month
Energy Spend	~USD 6/month	>USD 11/month	USD 27- 55/month	~USD 48-65/ month	N/A

Source: NPSP Team Research

### 1.2.3. Types of Energy Uses

Energy use and cost vary by their end use. For mini-grids in particular the incorporation of productive loads – electricity loads tied to an economically productive use of electricity such as businesses or agricultural processing – significantly improve the economic viability of the site. Common energy uses in rural and peri-urban areas, and appliances or technologies associated with those uses, include the following:

- **Agricultural processing:** Crushing, grinding, processing, or drying of produce. Agricultural processing is typically a strong productive load.
- **Cooking and cooling:** Stove-tops and small refrigerator units for meal preparation and preservation.
- **Information access and entertainment:** Batteries, televisions, computers, mobile phones, tablets, and charging of appliances.
- **Lighting:** Kerosene, paraffin, battery-powered flashlight, palm oil lamps for day-to-day lighting needs. Can be a productive load if tied to larger-scale facilities such as educational institutions or health care centers.



For off-grid customers, much of this equipment is powered by small diesel generators. It is estimated that approximately 60 million people in Nigeria use diesel generators to generate electricity, making it the most commonly used type of non-grid power generation.<sup>22</sup> Research also suggests that between 8,000 and 14,000 MW of decentralized diesel generator capacity is currently installed in the country.<sup>23</sup> With the expansion of SHS and mini-grids, many of these more traditional electricity generation options can be replaced by more affordable, healthier electric alternatives.

### 1.3. CURRENT OPPORTUNITIES

Catalyzed by the potential size of the market and recent market accelerants, there is opportunity for multiple types of actors to enter the Nigerian market and achieve scale. This section organizes these actors into four broad categories:

- **Mini-Grid Developers:** Firms that develop, own, operate, and maintain mini-grids
- **SHS Companies:** Firms that sell solar home systems
- **Technology Suppliers:** Companies that sell technological components and services for both mini-grid and SHS systems
- **Financiers:** Entities that stand to invest capital (including through equity, debt, and grant instruments) in the Nigerian off-grid market

#### 1.3.1. Opportunities for Mini-Grid Developers

REA has set aggressive targets for both mini-grid development in Nigeria. By 2023, REA has targeted scaling 10,000 new mini-grid sites and has divided isolated mini-grid regulation into two primary categories, (1) mini-grids under 100kw and (2) mini-grids between 100kw and 1MW. REA further estimates that the Nigerian market could scale 10,000 mini-grids at 100kW per mini-grid over the course of a decade and only 30% of the anticipated national demand would be met.<sup>24</sup> As demonstrated in Figure 4, REA has already begun a site prioritization process for the 10,000 targeted mini-grid locations, attempting to de-risk initial investments by identifying the most promising sites based on a variety of factors. Adding to off-grid generation capacity using mini-grids can be completed from end to end by a single company but often, either due to the complexity of the site, the size of the demand, or other complicating factors, multiple parties are involved. A current trend is for new Nigeria market entrants to partner with local actors, utilizing their local expertise along with existing networks and supply chains. The most successful mini-grid projects can produce returns in the range of 15%-20%, while returns in the range of 13% are more typical, with a significant opportunity to include productive loads to improve the site economics.<sup>25</sup>

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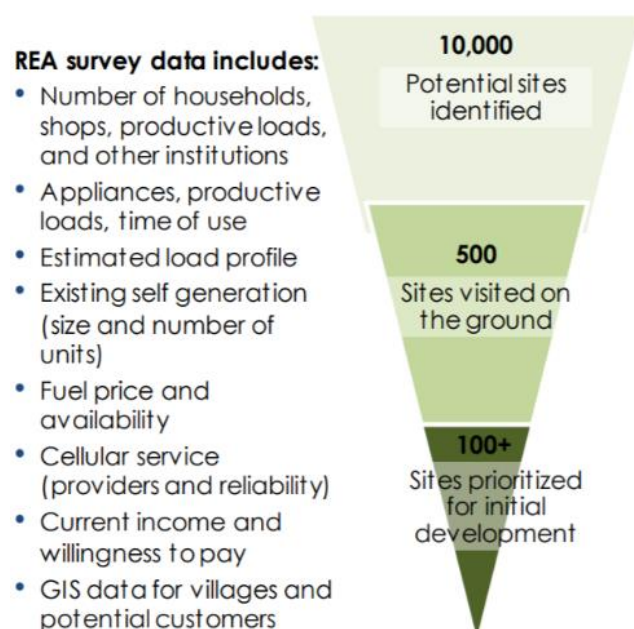
<sup>22</sup> Henrich Boll Stiftung, *Comparison of Costs of Electricity Generation in Nigeria*, [https://ng.boell.org/sites/default/files/true\\_cost\\_of\\_power\\_technical\\_report\\_final.pdf](https://ng.boell.org/sites/default/files/true_cost_of_power_technical_report_final.pdf)

<sup>23</sup> Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, *The Nigerian Energy Sector*, 2<sup>nd</sup> ed. (Abuja: Nigerian Energy Support Programme (NESP), 2015)

<sup>24</sup> REA, Nigeria Mini-grid Investment Brief, [https://rea.gov.ng/Nigeria\\_Mini-gridInvestmentBrief\\_171202-V2.pdf](https://rea.gov.ng/Nigeria_Mini-gridInvestmentBrief_171202-V2.pdf)

<sup>25</sup> RMI, Mini-Grid Investment Report

Figure 4: REA's Site Prioritization Process



Source: REA

This landscape is increasingly being supported by public entities. In 2017, the Rural Electrification Agency secured USD86 million in outside funding for power sector project development.<sup>26</sup> Since that time, REA has funded data collection activities for approximately 386 rural electrification projects, including mini-grid development.<sup>27</sup> Further, the World Bank is expected to extend a USD350M tender to implement off-grid and rural electrification under the Nigerian Electrification Project (NEP). It is expected that more than one third of this loan will be allocated to mini-grid development, with additional amounts allocated towards SHS, universities, and technical assistance.<sup>28</sup> The table below highlights additional upcoming public financing opportunities:

Table 3: Upcoming Tenders

Program	Awarding Entity	Focus	Amount
Energizing Economies Initiative (EEI) Phase 2 and 3	REA	Mini-grid	USD600m [estimated]
Nigeria Electrification Project	World Bank	Mini-grid	USD150m
Nigeria Electrification Project	World Bank	SHS	USD75m
Nigeria Electrification Project	World Bank	Public Universities / Teaching Hospitals	USD105m
Nigeria Electrification Project	World Bank	Technical Assistance	USD20m
Nigerian Energy Support Program II	GIZ	Mini-grid	EUR6m
Nigeria Electrification Project	AfDB	Mini-grid / SHS	USD200m

Source: NPSP Team Research

<sup>26</sup> Ibid.

<sup>27</sup> Ibid.

<sup>28</sup> Ibid.

Tenders such as these have increased the number of private companies developing mini-grids in Nigeria. These companies include those that specialize in mini-grids and specialize in multiple stages of the off-grid value chain, including firms that focus predominantly on distribution, installation, and integration of systems of varying sizes. RMI has identified that, while there are mini-grids throughout Nigeria, only approximately 10 current mini-grid sites are privately developed and financially sustainable.<sup>29</sup>

### **1.3.2. Opportunities for SHS Companies**

SHS companies have made significant strides in recent years, many building off positive experiences in the East African market or other, smaller, West African markets. At this stage, the market has largely been dominated by a few large actors, yet significant opportunities remain. Approximately 80% of electricity consumption in Nigeria is attributable to the residential market, a demographic most likely to be interested in SHS purchases.<sup>30</sup> Companies that can introduce new and innovative sales and distribution models may gain a competitive advantage in a market that, currently, relies heavily on peer recommendations and word-of-mouth. Further, introducing flexible payment technologies such as electronic payments and PAYG may enable companies to tap in to new customer bases. Current themes and market gaps associated with potential customer groups that could be targeted by SHS companies looking to enter the Nigerian market are outlined below.

Compared to local companies, international companies retain a slight competitive advantage in several of the internationally-focused aspects of the SHS market. Typically, international SHS companies have better access to international financing sources, production facilities for off-grid technologies, and research and development than some of their local competitors.

Further opportunities lie in co-delivering value-added goods and services in parallel with SHS distribution. When a family purchases a solar home system, the SHS transaction is often one of their first experiences in the market for high-technology goods. In addition to providing electricity that can catalyze the use of other technology goods such as phones, computers, and televisions, the SHS company engaged with that family also has a workable supply chain and a dedicated customer base with a defined ability and willingness to pay for goods and services. Providing additional goods and services beyond strictly SHS units may allow SHS companies to both diversify their business models and develop new, supplementary streams of revenue.

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<sup>29</sup> Rocky Mountain Institute, *Reliable and Affordable Electricity for Nigeria: Growing the Mini-grid Market*, <https://www.rmi.org/reliable-and-affordable-electricity-for-nigeria-growing-the-mini-grid-market/>

<sup>30</sup> Africa-EU RECP, *Captive Power in Nigeria* (2016)

Table 4: Off-Grid Customer Themes and Gaps

		Consumption Potential	
		Low (<50kWh/month)	Medium / high (>50kWh/month)
Current Status	User	<p><b>Common themes:</b></p> <ul style="list-style-type: none"> <li>• <b>Choice</b> to start using solar is almost entirely price driven</li> <li>• <b>Sales</b> driven by word-of-mouth or door-to-door</li> <li>• <b>Relationship between customer and agent</b> is critical to continued payment - mentioned agents being part of their community / friends - creates an accountability measure</li> </ul> <p><b>Common challenges:</b></p> <ul style="list-style-type: none"> <li>• <b>Batteries</b> stop holding charge after just 4 months</li> <li>• <b>Dust</b> accumulates on panels after 6 months, making them notably less effective</li> <li>• Low response rate on <b>customer service</b></li> </ul>	<p><b>Common themes:</b></p> <ul style="list-style-type: none"> <li>• <b>Sales</b> driven by word-of-mouth or door-to-door</li> <li>• <b>Relationship directly with company owner</b> (or associate) is key to building trust around maintenance and customer service</li> <li>• <b>Payment plans</b> often negotiated directly with company based on personal relationships</li> </ul> <p><b>Common challenges:</b></p> <ul style="list-style-type: none"> <li>• <b>Batteries</b> failed and needed to be replaced</li> <li>• <b>Dust</b> accumulates on panels after 6 months, making them notably less effective</li> </ul>
	Non-user	<p><b>Common themes:</b></p> <ul style="list-style-type: none"> <li>• General <b>excitement about growth</b> in availability of solar</li> <li>• <b>Strong awareness</b> of at least one friend, family member, or neighbor using SHS</li> </ul> <p><b>Reasons for non-use:</b></p> <ul style="list-style-type: none"> <li>• <b>Never exposed</b> to sales agents or marketing material in general</li> <li>• <b>Perception</b> of solar as an <b>expensive</b> option</li> <li>• Able to find lower cost (or no cost) <b>alternatives</b> for low energy use needs</li> </ul>	<p><b>Common themes:</b></p> <ul style="list-style-type: none"> <li>• Interest in renewable energy for <b>social and environmental</b> reasons</li> <li>• <b>High value placed on reliability</b></li> </ul> <p><b>Reasons for non-use:</b></p> <ul style="list-style-type: none"> <li>• <b>Concern about battery life</b> – high cost of battery replacement</li> <li>• <b>Sunk cost fallacy</b> – recent purchase of generator prevents transition</li> <li>• <b>Minimal exposure</b> to sales agents or marketing material in general</li> </ul>

Source: NPSP Team Research

### 1.3.3. Opportunities for Technology Suppliers

The rapid expansion of mini-grid and SHS opportunities in the Nigerian market not only creates opportunities for mini-grid developers and SHS companies, but also for engineering firms, technology firms, energy consultancies, and other purveyors of supporting technology and services. Firms that provide site survey and technical engineering review capabilities, edge devices, solar home system compatible appliances, and mini-grid components and maintenance parts, among others, all have an opportunity to successfully enter the Nigerian market and take advantage of the market's scale. Included in this category are those firms that specialize in financial technology (FinTech). A snapshot of FinTech-related systems that are currently, or could soon be, in use in the Nigerian power sector include:

- **Electronic Payment Services:** Payment services made from or via a mobile phone from an account linked to a mobile phone number
- **Mobile Apps and/or Online Web Portals:** Online payment via an app or payment gateway
- **Pay-as-you-go:** Payment made in a proportional amount to the amount of electricity used. Represents a flexible payment option for those with limited or unreliable incomes

Electronic payment platforms often operate on pre-paid credits that are paid wirelessly through telecommunications platforms, utilize technologies being pioneered by FinTech entrepreneurs. As the

scale of the off-grid generation and energy storage technologies increased in Nigeria, so too will the need for additional, innovative FinTech solutions to monitor electricity loads, provide flexible payment options, and facilitate financing.

### 1.3.4. Opportunities for Financiers

The Nigerian market also has significant opportunities for financial institutions looking to achieve a strong return or make a significant social impact. The NPSP Team estimates that level of investment will not keep pace with the demand for investment, resulting in a funding gap of more than USD8.2 billion, with approximately USD5.2 billion attributed SHS and USD3 billion for mini-grid development.<sup>31</sup> There is a strong need for development investors (donors, DFI's, etc.) to crowd-in commercial investors over time, which still view the Nigerian investment landscape as relatively high-risk, despite the scale of the market opportunity. The representative list below outlines prospective opportunities for financiers irrespective of their current level of engagement in Nigeria's off-grid market.

Table 5: Representative Off-Grid Investor Categories

Investor Class	Representative Investors	Opportunity
<b>Impact</b>	<ul style="list-style-type: none"> <li>Deutsche Bank Social Venture Fund</li> <li>GroFin</li> <li>All-On</li> <li>Acumen</li> </ul>	High potential for a social return in an underserved market. Approximately 120 million of the more than 190 million population has little to no access to reliable electricity. This restricts economic and educational advancement, along with access to healthcare, across a large portion of the country.
<b>Development Finance Institution (DFI)</b>	<ul style="list-style-type: none"> <li>Overseas Private Investment Corporation</li> <li>Dutch Development Bank</li> <li>Bank of Industry</li> <li>AfDB</li> </ul>	DFIs have played a dominant role in the Nigerian market thus far, proving some of the largest debt investment to-date. They benefit by gaining access to a market that can easily absorb rapid scale, and they have a key role in their ability to crowd in commercial investors.
<b>International Commercial Banks</b>	<ul style="list-style-type: none"> <li>Rand Merchant Bank</li> <li>Standard Chartered</li> </ul>	A strong opportunity for high return rates. However, commercial lenders are traditionally more risk-averse than DFIs or other development organizations. Continued DFI investment should drive down the level of risk to an acceptable level
<b>Local Commercial Banks</b>	<ul style="list-style-type: none"> <li>EcoBank Nigeria</li> <li>Sterling Bank</li> <li>FCMB</li> <li>UBA</li> </ul>	Opportunity for market inclusion and to develop an understanding of a sector that has not traditionally been a focus for these institutions due to general unfamiliarity with the off-grid sector, an inflexible lending model that only accepts physical assets as collateral, and a limited range of in-house experience, among other complications. Additional opportunity includes the ability to broaden their network beyond Nigerian markets by partnering with international finance institutions and other, global commercial banks.

<sup>31</sup> NPSP Team Research

Investor Class	Representative Investors	Opportunity
<b>Private Equity</b>	<ul style="list-style-type: none"> <li>• Enko Capital</li> <li>• Frontier Investment Management</li> </ul>	Significant opportunity for investment in large-scale SHS companies once SHS companies solidify their market position. Traditionally private equity firms look for more mature companies to invest and prioritize market returns over social impact returns.
<b>Foundations</b>	<ul style="list-style-type: none"> <li>• Shell Foundation</li> <li>• Rockefeller Foundation</li> </ul>	The market presents ample opportunity for multiple foundations and grant-providers to maximize social impact.

Source: NPSP Team Research

## 2. NIGERIA'S SOLAR HOME SYSTEM LANDSCAPE

The SHS market in Nigeria is dominated by a handful of primary companies, including; d.light, Lumos, and Greenlight Planet dominate SHS market share. However, more companies have moved in, with the majority of active SHS companies entering the Nigerian market between 2014 and 2018. According to NPSP Team research, the Nigerian market now has approximately 26 established SHS companies and mini-grid developers, with an additional 19 emerging market actors, with additional companies still in the scoping or piloting phases. The market continues to evolve, with local startups, international independents, emerging household names, and pioneer brands all sizing up the scale of the market opportunity. A summary of the most prominent SHS companies is provided below, with a more comprehensive list available in Appendix A:

Table 6: Summary of SHS Companies Operating in Nigeria

Market Actor	Estimated Units Sold	International / Local Company	Nigerian Locations Active
	100,000	International	Nationwide
	24,000	Local	14 Northern States
	10,000	International	Nationwide
	2,500	International	Kano, Kaduna
	1,200	Local	Abuja, Lagos, Edo, Osun
	150	International	Nationwide
	n/a	International	Nationwide

Source: NPSP Team Research

## 2.1. SUMMARY OF SHS BUSINESS MODELS

There are multiple business models that SHS companies use to engage their respective customer bases and facilitate sales. These include direct sales and purchase, credit sales, and power as service. Additional models may develop as the incidence of small scale consumer loans rise and technologies such as PAYG and electronic payment platforms, and mobile money proliferate. The table below illustrates prospective SHS business models and potential benefits and challenges of each model.

Table 7: SHS Business Models

Model	Description	Benefits for SHS Companies	Challenges for SHS Companies
<b>Direct Sales / Purchase</b>	A company completes the sale of a SHS in one transaction. No financing is required to facilitate the transaction.	<ul style="list-style-type: none"> <li>• Influx of working capital</li> <li>• Favors local actors who are familiar the market nuance</li> </ul>	<ul style="list-style-type: none"> <li>• Requires customer base with high ability to pay</li> </ul>
<b>Credit Sales</b>	Customers purchase a system on credit predicated on an agreement to repay over a set period. Includes both lease-to-own and end-user credit transactions. For end-user credit, a third party to the developer provides credit necessary to fund the purchase price.	<ul style="list-style-type: none"> <li>• Broadens the market for the developer, making the system available to those who cannot afford a direct purchase</li> <li>• Provides flexibility to both the end user and the developer</li> </ul>	<ul style="list-style-type: none"> <li>• The SHS unit may be used as collateral against the loan provided to the end use by the bank or microfinance institution</li> </ul>
<b>Power as Service</b>	The SHS system is not sold to the end users by the SHS company, instead, the company uses the system to generate power provided to the end user. The company is also in charge of operations and maintenance expenses.	<ul style="list-style-type: none"> <li>• A strong fit for commercial customer bases</li> </ul>	<ul style="list-style-type: none"> <li>• Requires companies to account for operation and maintenance expenses</li> </ul>

Source: NPSP Team Research

Beyond the typical business models for SHS companies, there are a range of potential distributor partnerships for off-grid technologies. Non-SHS companies with access to rural markets, such as those who sell farming implements and consumables, may be able to distribute solar equipment in parallel to their already well-established supply chains in the future. There are several large commodity suppliers that source from many political zones across the country. Companies such as this with a broad distribution network in rural areas could deliver SHS equipment or aftermarket services in partnership with SHS companies.

## 2.2. SUMMARY OF PAYMENT OPTIONS FOR SHS COMPANIES

Determining a payment structure has consistently been one of the most requested pieces of information for companies looking to enter the Nigerian SHS market. Payment options vary significantly based on the targeted customer demographic. Some of the available payment structures are outlined below:



Table 8: SHS Payment Models

Payment Option	Description	Advantages	Disadvantages
<b>Mobile Money</b>	Payment services made from or via a mobile phone from an account linked to a mobile phone number	<ul style="list-style-type: none"> <li>• Efficient and effective collections</li> <li>• Reduced cost of collections</li> </ul>	<ul style="list-style-type: none"> <li>• Poor network infrastructure and connectivity in rural areas</li> <li>• Extremely low levels of mobile money penetration (&lt;3%)</li> </ul>
<b>Mobile Apps or Online Web Portal</b>	Online payment via an app or payment gateway	<ul style="list-style-type: none"> <li>• Efficient and effective collections</li> <li>• Reduced cost of collections</li> </ul>	<ul style="list-style-type: none"> <li>• Poor network infrastructure and connectivity in rural areas</li> <li>• Most require Java plug-ins</li> </ul>
<b>Cash collections through stationary or door-to-door agents</b>	Manual collections through agents that collect cash at stationary kiosk or go door-to-door	<ul style="list-style-type: none"> <li>• Convenient for consumers - Rural and peri-urban communities are primarily cash based</li> </ul>	<ul style="list-style-type: none"> <li>• Increased cost of collections and data management process</li> </ul>
<b>Unstructured Supplementary Service Data (USSD) Codes</b>	Use of mobile phones to communicate with the network operator's computer to process energy payments when the user dials specific codes	<ul style="list-style-type: none"> <li>• No requirement for Java plug-ins or smart phones</li> <li>• More effective in areas with limited connectivity especially rural communities</li> </ul>	<ul style="list-style-type: none"> <li>• Customers need to be banked with Bank Verification Numbers to use USSD codes.</li> <li>• Extremely low rates of financial inclusion for the bottom of the pyramid</li> </ul>

Source: NPSP Team Research

### 2.3. SOLAR HOME SYSTEMS: LESSONS LEARNT

SHS lessons vary from mini-grid lessons largely due to the retail nature of the SHS business model and the logistical requirements of the system. SHS companies must focus more closely on developing a viable retail model, including retaining a robust distribution network, implementing a strategy for marketing and selling SHS units, and communicating with prospective and current SHS customers. A few high-level lessons for developing a successful and financially viable SHS sales and distribution model are comprised below into the following lessons:

- **Lesson 1:** Flexible Financing and Payment
- **Lesson 2:** Customer Education
- **Lesson 3:** Marketing and Communications

#### Lesson 1: Flexible Financing and Payment

- **Incorporate flexible and electronic payment technologies:** Incorporating electronic payment platforms or pay-as-you-go technology into the SHS offering creates more flexible payment options for customers. This particularly assists those customers with a high willingness to pay but a low ability to pay who may not otherwise be able to enter the SHS market.

- **Provide financing for energy efficient equipment and appliances in the community:** Providing an affordable and local community financing option for consumers can increase uptake of mini-grid or SHS services. Further, providing small-scale and flexible loans for energy efficient appliances and SHS may increase overall demand for electricity and market attractiveness for investors.

## Lesson 2: Customer Education

- **Detail SHS options:** Highlighting the range of appliance options (fans, lights, mobile phone charging, etc.) that can support market penetration, particularly in those rural areas beyond the urban and peri-urban markets where SHS use has not yet solidified.
- **Outline SHS benefits:** The primary competitor for SHS is a diesel generator. Educating potential customers on the cost benefits of SHS as well as the health and safety improvements of using a clean electricity source, can increase sales and acceptance of SHS systems as a viable alternative.

## Lesson 3: Marketing and Communications

- **Invest in strategic approaches:** The majority of SHS companies operating in Nigeria do not have a concerted marketing effort, relying instead on peer-to-peer and word-of-mouth recommendations to market systems. Designing a marketing and communications strategy to target desired a desired customer base, particularly with hard to reach rural communities, may provide a competitive advantage in the market.
- **Deliver after sales support:** Delivering reliable after sales services and support is particularly important with lower income customers for whom the SHS unit may be one of their first large technology purchases. Large brands are placing new emphasis on training customer service representatives and creating networks of local field agents to service deployed SHS units and respond to customer questions and complaints.

### 3. NIGERIA'S MINI-GRID LANDSCAPE

REA's target of 10,000 additional mini-grids is an aggressive goal that will require an influx of international and local developers to scope, finance, construct and operate sites to achieve. Currently, the mini-grid landscape is dominated by systems less than 100 kW, as these have lower capital expenditure (CAPEX), higher returns, and do not require the Nigerian Electricity Regulatory Commission (NERC) permitting and Multi Year Tariff Order (MYTO) tariff calculations. The mini-grid landscape can be categorized into three different system sizes, each with a corresponding set of likely demographics and potential benefits and hurdles to profitability. These are outlined at a high-level below:

Table 9: Mini-Grid Landscape


Mini-Grid Size	Site Description	Profitability
<b>Small Mini-Grids (B2C)</b>	<ul style="list-style-type: none"> <li>Households</li> <li>&lt;1kW energy demand</li> <li>Rural, sparsely-populated communities (30-50 houses)</li> </ul>	<ul style="list-style-type: none"> <li>Low upfront cost for installation and maintenance</li> <li>Higher infrastructure and transmission cost from difficult terrain and low density</li> </ul>
<b>Medium Mini-Grids (B2C)</b>	<ul style="list-style-type: none"> <li>Communities</li> <li>~10kW energy demand</li> <li>Peri-urban, more densely populated communities (50-250 houses)</li> </ul>	<ul style="list-style-type: none"> <li>Higher upfront cost for installation and maintenance</li> <li>Increased economies of scales</li> </ul>
<b>Large Mini-Grids (Anchor B2B + Peripheral B2C)</b>	<ul style="list-style-type: none"> <li>SMEs + households</li> <li>~30-40kW+ energy demand</li> <li>Large densely populated areas with anchor commercial tenant and nearby residents and SMEs</li> </ul>	<ul style="list-style-type: none"> <li>Higher upfront cost for installation and maintenance</li> <li>High profit margin from anchor tenants due to stable revenues and cash flows</li> <li>Higher cost justified by higher demand density</li> </ul>

Source: All On, 2017

#### 3.1 SUMMARY OF MINI-GRID MARKET ACTORS

Mini-grids are often installed by solar developers, private companies that specialize in procuring, installing, and maintaining mini-grid technology and accompanying support systems. The majority of mini-grid companies operating in Nigeria are local firms. This is due to the benefit of having local context in the mini-grid market, which is of greater consequence than the SHS market, as mini-grids rely heavily on-site selection and community engagement. Some of the largest market actors are highlighted below, with a more comprehensive list available in Appendix A:

Table 10: Summary of Mini-Grid Companies Operating in Nigeria

Market Actor	Number of Mini-grids	Capacity (KW)	Locations
	5	98kW (6,9,9,34,34kW)	Rivers, Plateau, Gombe

Market Actor	Number of Mini-grids	Capacity (KW)	Locations
 GV Creating a Reliable Renewable Energy Future	3	48 kW (16 kW each)	Kaduna, Delta, Rivers
	2	62 kW (24 and 38KW)	Edo, Osun
	2	n/a	Kaduna
	2	40 kW (20 kW each)	Abuja
	1	100 kW	Niger
	1	85 kW	Ogun
	2	n/a	Kano, Lagos
<b>Ajima Farms:</b> <b>Waste 2 Watt</b>	1	20 kW	Abuja

Source: Shell Foundation, 2018; World Bank Group, 2017; NPSP Team Research

## 3.2 MINI-GRID BUSINESS MODELS

There are multiple types of mini-grid models, with smaller systems more likely to supply electricity on a business-to-consumer (B2C) basis and larger systems more targeted at Business-to-Business (B2B) electricity sales. Across all mini-grid development avenues, business model drivers often align to the mini-grid project development value chain, a high-level overview of which is outlined in Figure 5 below.

### 1. Site Identification and Assessment

This is a primary driver of mini-grid viability. Selecting the appropriate site requires taking note of the site logistics (access roads, remoteness, etc.), potential energy demand, the potential for anchor loads or productive uses (agricultural centers, telecommunications towers, etc.) and the proximity of the site to potential grid connection in the future.

### 2. Design and Planning

Determining the correct system size for the demographics and needs of the selected site is integral to achieving profitability.

### 3. Customer Acquisition

Implementing a community engagement plan is integral to achieving a sustainable business model for mini-grids in Nigeria. Explaining the value and process of mini-grid construction and electricity use, along with building community support from local leaders, can lead to a more sustainable economic model and reduce the likelihood that consumers will default on their electricity payments.

#### **4. Procurement**

The majority of the photovoltaic materials required for this phase are purchased through international suppliers, some construction material may be available through local vendors.

#### **5. System Installation**

As with system maintenance, many mini-grid developers form partnerships with technical or engineering firms to construct and install the mini-grid.

#### **6. Commissioning\***

Depending on the size and potential connectivity to the grid, a mini-grid may be officially commissioned by REA.

#### **7. Metering, Billing, and Collection**

Many mini-grid developers utilize similar payment systems as SHS companies, with a current emphasis on local collection agents and the recent emergence of PAYG and electronic payment platforms as potential additional options. Most mini-grid projects operate on a pre-paid billing system, usually operating in conjunction with a payment provider but having their own platform for metering and billing.

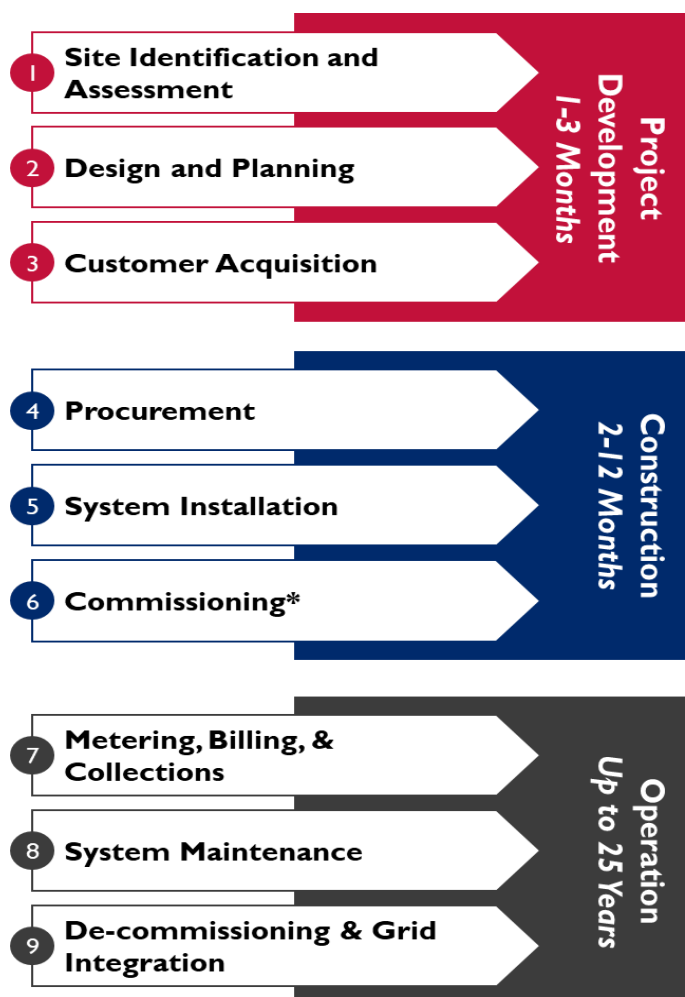
#### **8. System Maintenance**

Most developers partner with technical firms to operate and maintain the mini-grid.

#### **9. Decommissioning and Grid Integration**

The Nigerian market has yet to test this phase, as mini-grids are relatively new to the off-grid landscape and have not been decommissioned. NERC's mini-grid regulation does provide compensation for grid connection and overtake by a distribution company.

Figure 5: Mini-Grid Project Development Value Chain



\*Assumes grid-connectivity. If the mini-grid is not connected to the grid, commissioning may not be necessary

Source: RMI

### 3.3 NERC'S MINI-GRID REGULATION

NERC's mini-grid regulation defines a mini-grid as any electricity supply system with its own power generation capacity, supplying electricity to more than one customer and which can operate in isolation from or be connected to a Distribution Licensee's network. Within the regulations, the term *mini-grid* is used for any isolated or interconnected mini-grid between up to 1 MW of generation capacity.

- **Interconnected Mini-grid:** A mini-grid which is connected to a Distribution Licensee's network.
- **Isolated Mini-grid** is a mini-grid which is not connected to any Distribution Licensee's network.
- **A Distribution Licensee** is a holder of a Distribution License who operates a Distribution Network that is connected to the transmission system operated by the system operation Licensee.<sup>32</sup>

The regulation makes the allowance for a mini-grid operator to either obtain a license for more than 1 MW generation or a permit for less than 1 MW generation. A license is granted by the Nigeria

<sup>32</sup> NERC, *Regulations for Mini-Grids*, 2016.

Electricity Regulatory Commission (NERC) under the Electric Power Sector Reform Act of 2005. A permit is granted by NERC to an Isolated Mini-grid Operator who applies for the construction, operation and/or maintenance and, where applicable, ownership of a mini-grid.

NERC's mini-grid classifications vary based on the size of the mini-grid, with different regulatory processes for grids below 100kW and those between 100kW and 1MW.

Figure 6: NERC's Mini-Grid Classifications

Type	Isolated		Interconnected
Size	<100kW	100kW-1MW	<1MW
Location	Unserved (free to choose)	Unserved (confirmed against DISCO plans)	Underserved
Permitting/registration	Register only	Permit required	Permit & Interconnection agreement
Tariff setting methodology	Free to set	Required to use MYTO	Retail tariff required to use MYTO
NERC tariff approval	Not required	Required	Required
Link to apply for permit or registration: <a href="http://www.nercng.org/index.php/home/operators/mini-grid">http://www.nercng.org/index.php/home/operators/mini-grid</a>			

Source: RMI, Nigerian Economic Summit Group, NPSP Team Research

As outlined above, there are two primary categories of mini-grid and corresponding options for licensing, registration and permitting. Registration does not afford NERC legal protection, should a DISCO grid encroach on the operators site, there is no mechanism for compensation to the operator. However, a registered, but not permitted, site is not beholden to NERC regulations regarding site location or tariff structure.

Conversely, a permitted site must follow NERC guidelines and regulations, including justifying their tariff by using the NERC-produced MYTO model. In exchange, the mini-grid operator receives regulatory protection from NERC, including a compensation mechanism should the grid eventually extend to the mini-grid site.

Should MYTO be necessary, NERC provides the MYTO calculation tool on their website for download. A visual snapshot of the tool and some of its inputs is provided below and the direct link to the tool is provided in a footnote below.

Figure 7: NERC MYTO Model Snapshot<sup>33</sup>

Investment GENERATION ASSETS						
Select the mini-grid / village :	MkniGrid_Yaba1		<a href="#">Return to Control Page</a>		<b>Insert Generation Assets</b>	
Select the year of the project :	2017					
Type of Assets	No of units	[Unit]		Unit Price	Total Price	Useful Years
Solar Panel [kWp]	100.7	[kWp]	X	138,188 NGN	13,915,481 NGN	25
Solar cables, connectors, support structure [kWp]	100.7	[kVA]	X	92,774 NGN	9,342,365 NGN	20
Deep cycle battery bank with racking system [kW]	349.92	[kWh C10]	X	53,686 NGN	18,785,721 NGN	8
Solar inverter [kW]	100	[kVA]	X	34,357 NGN	3,435,747 NGN	10
Battery inverter [kW]	48.87	[No.]	X	233,677 NGN	11,419,815 NGN	10
Sub distribution infrastructures including- cables, :	1	[No.]	X	5,552,377 NGN	5,552,377 NGN	15
Generation House [NGN] + Transport	1	[No.]	X	21,108,427 NGN	21,108,427 NGN	25
Installation/ Labour and logistics (transport equipm	1	[No.]	X	2,475,000 NGN	2,475,000 NGN	15
PH Costs : Installation/ Labour and logistics + install	1	[No.]	X	11,000,000 NGN	11,000,000 NGN	15
		[No.]	X	1,650,000 NGN	0 NGN	15

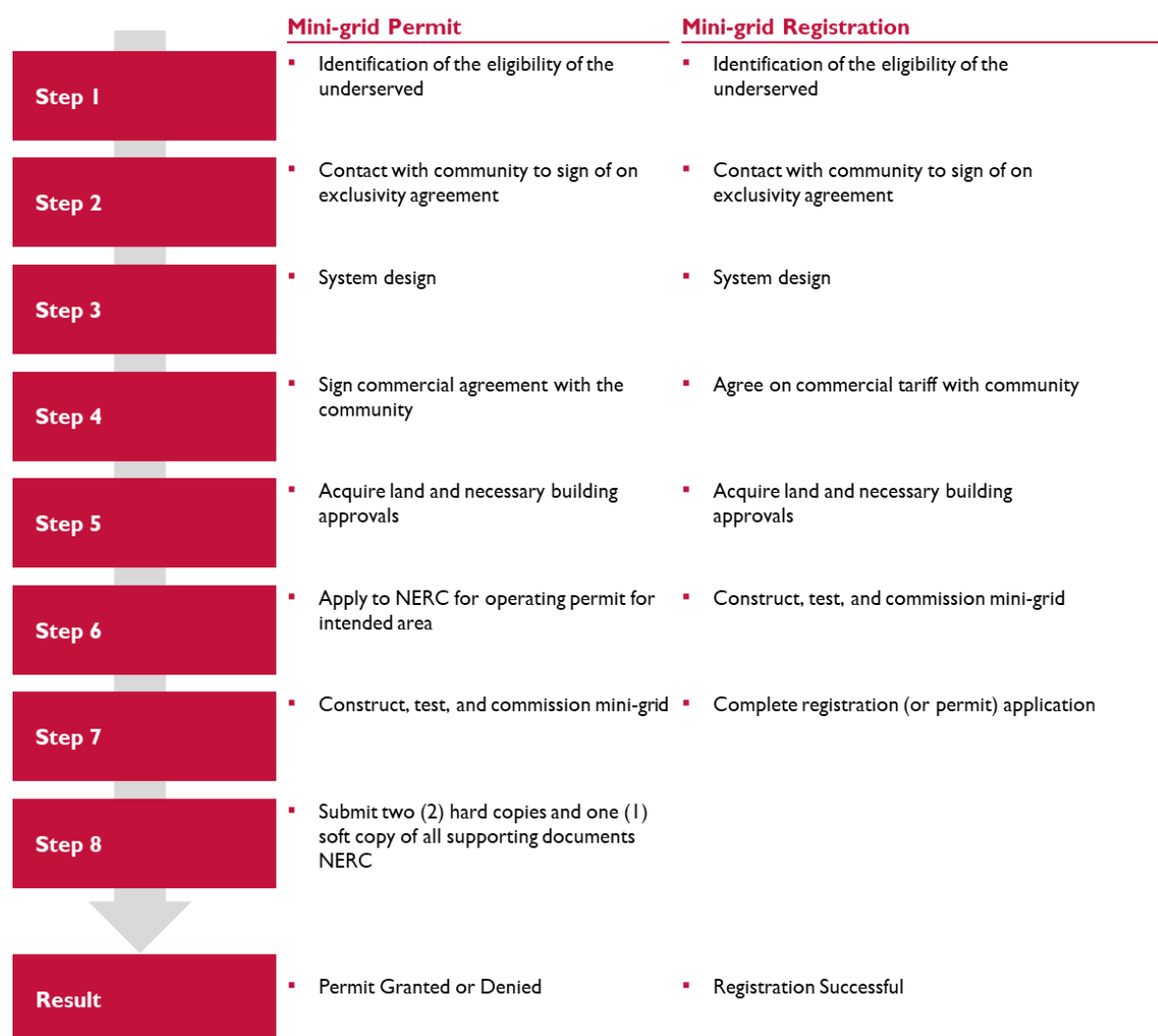
Source: NERC

As outlined above, NERC's 2016 mini-grid regulation breaks the licensing process into two distinct workstreams based on the size of the mini-grid – Permits and Registration. The process for applying for each of these designations is detailed below, as outlined by the Rural Electrification Agency.

<sup>33</sup> The full model can be accessed at <http://www.nercng.org/index.php/component/remository/Regulations/MYTO-Mini-Grid-Model/?Itemid=591>



Figure 8: Procedure for a NERC Mini-Grid Permit or Registration



Source: REA

### 3.4 EXISTING MINI-GRID PROJECTS

Mini-grid development in Nigeria has increased in recent years, providing stable solar electricity to hundreds of communities which had previously relied on gasoline and diesel for electricity generation and kerosene or paraffin for lighting. Nigeria is actively pursuing this opportunity and is trying to facilitate and encourage mini-grid site investment and development.

#### REA’s Energizing Economies Initiative

The Energizing Economies Initiative (EEI) is a Nigerian government initiative being implemented by the Rural Electrification Agency. EEI focuses on providing access to electricity for unserved and underserved economic clusters across the country. Four pilot mini-grid projects serving clusters of economic activity have been implemented to date, Ariaria Market in Abia State, Sabon Gari Market in Kano State, and Somolu Printing Community and Sura Shopping Complex, both in Lagos State. REA is seeking to launch 300+ off-grid projects across the country by 2022, in a phased approach, with the first phase covering 13 different markets in 6 states.<sup>34</sup>

<sup>34</sup> Rural Electrification Agency, *Energizing Economies Initiative*, <http://rea.gov.ng/energizing-economies/> (REA, EEI)

The model being adopted in the energizing economies (markets) initiative by REA shows a more positive approach which demonstrates the commercial viability of these sites/projects. This is made possible as the uptake from these markets is 100% productive load capacity. REA is currently in the execution of the first phase of the project to electrify over 13 economic clusters. Overall, EEI is expected to provide clean and reliable power supply to about 80,000 shops, empower more than 200,000 MSMEs, create over 2,500 jobs, and serve more than 7 million people.<sup>35</sup>

### Summary of Existing Mini-grid Projects

As the table below illustrates, while the location and size of existing mini-grid installations vary substantially, there are commonalities. Most sites are in tightly clustered agrarian communities with populations approximately 2,500 people and 300-500 households in an effort to supply electricity to a high number of people with as little transmission as possible.<sup>36</sup> While these only represent a handful of sites out of thousands of potential and current locations, these developed sites lay the foundation for additional off-grid generation facilities across the country.

Table 11: Representative Existing Mini-Grid Projects

State	Community	LGA	~Size (MW)	~Persons / Homes	Promoters	Developer	Project Sponsor
Sokoto	Kurdula	Gudu LGA	80	6000/500	Sokoto state Rural Devt Initiative	Gosolar	EU, NESP Program
Ogun	Gbamu	Ijebu East LGA	85	3000+/346	Niger state Rural Devt Initiative	Rubitec	EU, NESP Program
Niger	Tunga JIka	Magama LGA	100	2000+/202	Ogun state Rural Devt Initiative	Nayo Tropical	EU, NESP Program
Cross-River	Umon Island	Biase LGA	50	600/65	Cross-River State Rural Devt Initiative	Cross River state Govt	EU, NESP Program
Plateau	Angwan Rina	Shendam LGA	100	4000/536	Plateau state Rural Dev Initiative. Fed Min of Power and Housing	GVE	EU, NESP Program
	Demshin	Shendam LGA				GVE	EU, NESP Program

Source: NPSP Team Research, REA

While the opportunity for investment, return, and electrification is significant, there are also many challenges to developing off grid locations in Nigeria. Projects are not always economically viable, demand can be challenging to accurately forecast and the willingness of local populations to pay for electricity – and the operator’s ability to consistently enforce collection – are sometimes circumspect. Further, due to the level of investment required and relative remoteness of many off-grid locations, mini-grid installations are likely to become fixtures of the local communities for years, if not decades, presenting the challenge posed by sustaining the operational success over time. This longevity makes community buy-in an integral piece to both the long-term success of the site, both in terms of maintenance, operation, and sustained demand, as well as the project’s bankability.

<sup>35</sup> REA, EEI

<sup>36</sup> RMI, Mini-Grid Investment Report

To achieve this end there are a variety of lessons learned and best practices that have been identified from Nigeria, East Africa, and other countries or regions with developing mini-grid markets.

### 3.5 MINI-GRID LESSONS LEARNT

Compiled from NPSP team research and other independent reports, a few high-level lessons for developing a successful and financially viable mini-grid model are comprised below:<sup>37</sup>

- **Lesson 1:** Ensuring Economic Viability
- **Lesson 2:** Driving Community Engagement
- **Lesson 3:** Achieving Sustainable Financing
- **Lesson 4:** Achieving Regulatory Understanding

#### Lesson 1: Ensuring Economic Viability

Financially viable mini-grids can be achieved using a portfolio approach and taking advantage of the potential to integrate productive loads, i.e., electricity loads that power economically productive activities. There is often a mixed understanding of mini-grid technologies, payment strategies, and fluctuating local demand for services:

- **Locate sites in densely populated areas:** Locations with stable and long-standing populations are more likely to provide a sustained demand for electricity.
- **Incorporate productive uses:** A productive use of energy (i.e., productive load) is energy used by small business for an economically productive activity.<sup>38</sup> Incorporating this type of customer makes mini-grid economics more viable due to their consistent use of energy and larger load, compared to residential, non-productive customers.
- **Geographically cluster sites to take advantage of economies of scale:** Achieving scale in an intentional manner can reduce long-term operational costs and short-term development costs by taking advantage of economies of scale.
- **Run demand simulations across a variety of scenarios:** Understanding the high and low demand scenarios for mini-grid locations and allow a developer to understand the requirements for achieving a financially viable result. Factor in ramping up of the loads over time.
- **Maintain compatibility:** Constructing mini-grids in a modular or grid-compatible manner will give the developer the option of either expanding the operation should it prove successful or moving on-grid should the grid be extended during the life of the site.

#### Lesson 2: Driving Community Engagement

A successful community engagement strategy is key to securing and building long-term demand for off-grid technology and the electricity it provides:

- **Engage the community throughout the life of the project:** It is important to establish a customer agreement to set a foundation for community buy-in well before project development takes place.<sup>39</sup> An agreement can include a variety of documents, but the basic intent of the agreement serves to educate a potential customer base on plans, potential,

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<sup>37</sup> NPSP Team Research

<sup>38</sup> NREL, *Productive Use of Energy in African Micro-Grids: Technical and Business Considerations*, <https://www.nrel.gov/docs/fy18osti/71663.pdf>

<sup>39</sup> NREL, *Customer Agreement Considerations for Micro-Grids in Sub-Saharan Africa*, <https://www.nrel.gov/docs/fy18osti/70777.pdf>

pricing, roles and responsibilities of parties involved, reliability of the system, and potential safety concerns. Fostering community participation, ownership, and understanding of the function of a mini-grid can translate to faster uptake of services and sustained demand.

- **Co-locating operational and maintenance functions within the community:** Co-location both reduces logistical costs associated with operation, increases local ownership and the possibility of knock-on economic impact and, potentially, increases reliability of service by reducing wait time for maintenance.

### Lesson 3: Achieving Sustainable Financing

Utilizing affordable and flexible financing options is a key step towards securing a long-term customer base:

- **Utilize debt and equity financing preferentially to grant financing:** While grant funding may be compulsory for some extremely rural mini-grid developments to compensate for longer payback periods than more densely populated areas. Further, the typical blend of debt and equity (70:30) with a variable grant component allows for more flexibility in executing off-grid development. However, it is challenging to raise debt for greenfield projects and a developer may consider deploying in phases, in such a manner that the cash flows from the first phase are established before seeking debt for subsequent phases.

### Lesson 4: Achieving Regulatory Understanding

Power-sector regulations play a significant role in the success or failure of mini-grid projects, particularly in Nigeria, where the regulatory landscape changes swiftly and, on occasion, with little notice:

- **Clearly identify relevant regulations:** The regulatory landscape of Nigeria, including tariff structures such as national utility tariffs and deregulated cost-reflective tariffs, can be a complex environment with limited ability to enforce at the local level.<sup>40</sup> This will vary significantly by the locality in question but can hinder, or assist, in making the case for a successful mini-grid site.

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<sup>40</sup> NREL, *Tariff Considerations for Micro-Grids in Sub-Saharan Africa*, <https://www.nrel.gov/docs/fy18osti/69044.pdf>

## 4. SUMMARY OF FINANCE OPTIONS FOR OFF-GRID ENERGY COMPANIES

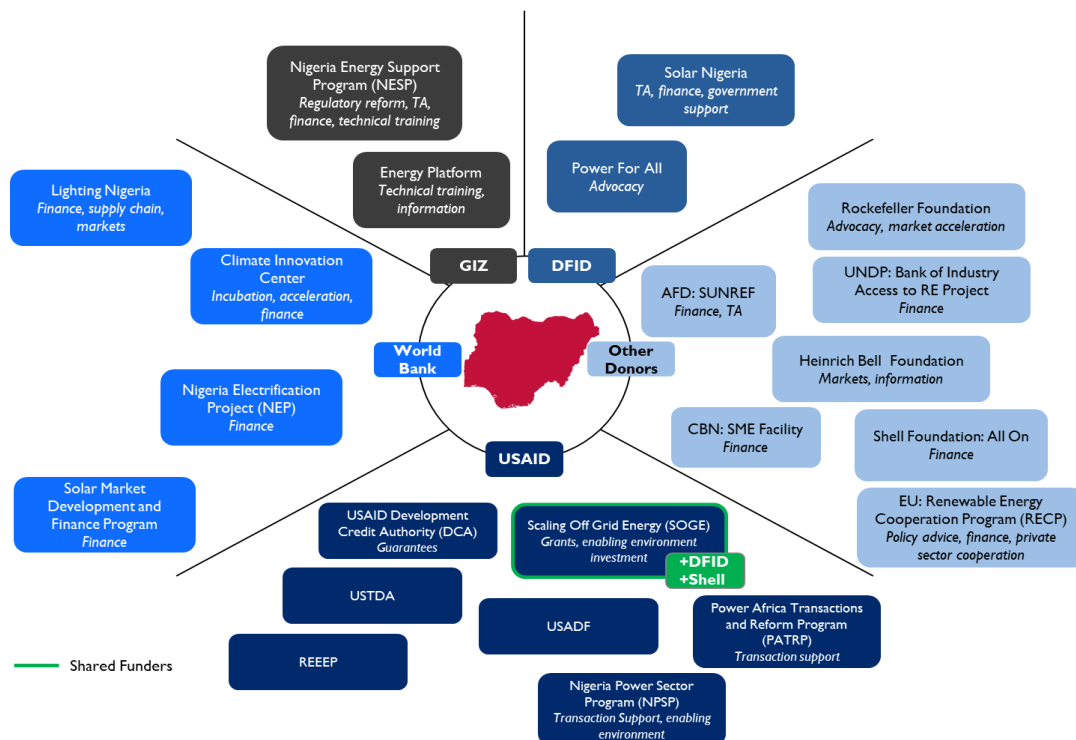
For both mini-grid developers and SHS companies, local investment in the sector has been thus far limited due to the relative newness of off-grid companies entering Nigeria and the high cost of capital. This challenge is particularly acute for mini-grid developers. For the purpose of this section, financing sources that are more active in the off-grid market have been classified into the following categories. This does not include some financier categories outlined earlier in the report, instead focusing more on international actors who have been more active in the sector than local entities, but does include the following entities:

- Development Finance Institutions
- Foundations
- Impact Investors
- Equity Investors
- Market Rate Lenders

### I. Development Finance Institutions

The DFI investor landscape has increased over the last few years in Nigeria, with hundreds of millions of dollars, in the form of primarily debt and grant financing, flowing into the country. DFI investment has increased steadily since 2012. Some of these programs are highlighted below, with a more comprehensive list available in the Appendix B.

Figure 9: Nigeria's Development Investor Landscape<sup>41</sup>



Source: REA, NPSP Team Research

<sup>41</sup> Includes both Development Finance Institutions and Foundations

## **World Bank NEP**

The World Bank is planning to tender USD350m through its Nigeria Electrification Project (NEP), with much of the loan targeted at off-grid development, including USD150m for mini-grid development and USD75m for SHS.

## **DFID Solar Nigeria**

Targeted to support commercial and private sector entities in Nigeria, including supporting qualified and experienced solar developers with a match of up to 30% funding for selected projects. For this program, the period for application of grants is coming to an end.

## **EU/GIZ-NESP II**

Grants of EUR6m has been budgeted for the NESP II under the Mini-grid Assistance Program (MAP). Approximately 6 sites are identified as a part of the first grant funding call. The grant will be in kind, by way of distribution equipment to be procured and supplied by GIZ.

## **AfDB**

The AfDB recently approved USD200 million loan to the Federal Government of Nigeria to support rural electrification efforts. This comprises a USD150 million sovereign loan and a USD50 million loan from the Africa Growing Together Fund.

## **2. Foundations**

At times in coordination with DFIs, foundations and other grant-providing organizations are active in the Nigerian off-grid market, some of the larger actors are outlined in above. The grant landscape has been particularly impactful for mini-grid developers, which have been able to rely on grants for up to 30% of their investment costs.<sup>42</sup> DFI grant programs are outlined in the Development Finance Institution section above.

## **3. Impact Investors**

Impact equity investors have been among the most active investors in the Nigerian market, albeit with smaller ticket sizes in the range of USD2-USD5 million. The majority of SHS companies in Nigeria and West Africa (compared to East Africa) remain relatively nascent and a more appropriate match for impact investors willing and able to provide seed capital compared to a large commercial equity injection.

## **4. Commercial Equity Investors**

Thus far, equity injection has been the primary financial instrument for off-grid investors, including relatively large ticket sizes between USD10 and USD40 million for late-stage companies with proven business models. While this has been a more active sector of the investment landscape, some estimates place 67% of equity investment in the off-grid market has been invested in only four companies, leaving smaller ticket sizes for a large portion of the market.<sup>43</sup> Commercial equity investors tend to have high return expectations, often above 25% internal rate of return.

## **5. Market Rate Lenders**

Commercial bank investment in the off-grid sector is limited, with little locally-provided debt currently available to SHS companies and mini-grid developers. Market rate tenors, the amount of time remaining to repay the loan, are often as short as 4 years. This is often not long enough for many mini-grid developers. Further, commercial interest rates can be untenably high, between 13% and 23% for local and international firms.

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<sup>42</sup> AfDB, *Green Mini-Grids in Sub-Saharan Africa*, <https://www.energy4impact.org/file/1818/download?token=j67HKZEy>

<sup>43</sup> Acumen, *Accelerating the role of patient capital*, 2018

## **6. Incentives in Renewable Energy Investment**

The National Renewable Energy and Energy Efficiency Policy (NREEEP) approved by the Federal Executive Council of Nigeria for the electricity sector in 2015, states that the government shall provide some incentives to boost the development of renewable energy and technology in the country. Other potential incentives that can facilitate the flow of capital are loan guarantees and political risk insurance. At a high level, the NREEEP incentives include, but are not limited to the following provisions:

- Tax incentives for renewable technology manufacturers
- Tax holidays
- Customs duty exemptions
- Land grants
- Tax credits for energy efficient appliances and lighting

## 5. OFF-GRID BUSINESS PROCESSES<sup>44</sup>

The following sections are aimed at providing information requested by both international off-grid energy companies currently considering expanding their businesses to Nigeria, as well as local off-grid companies already established in Nigeria seeking to scale up their businesses.

Nigeria is currently ranked 146 out of 190 economies on the ease of starting a business.<sup>45</sup> The highest-ranked country in the world is New Zealand and the lowest ranked country is Somalia. The rating is based on a set of indicators including procedures of registration, timeframe, cost of registration, and required minimum capital. Nigeria's ranking is a result of the bureaucratic and legal steps that an entrepreneur must complete to incorporate and register a new firm in Nigeria.<sup>46</sup>

According to World Bank statistics, starting a business in Nigeria generally involves approximately nine procedures and takes an average 10.9 days. The duration of registration varies from city to city within Nigeria.<sup>47</sup> The World Bank's "Doing Business in Nigeria" report found Abuja, the nation's capital, as the easiest place to start a business in Nigeria, with approximately 7 procedures taking a total of 10 days.<sup>48</sup> In Lagos state the World Bank determined that, for men, it takes approximately 10 days to complete full registration process, involving 8 procedures, while in Kano it will take about 14 days to complete full registration process, involving 10 procedural stages.<sup>49</sup>

### 5.1. REGISTERING A BUSINESS IN NIGERIA

There are multiple steps for successfully registering a business in Nigeria, the precise ordering of which is often lacking clarity. Some of these procedures, and the respective government entities that oversee them, are detailed below but may vary based on the size and type of the business venture. This selection of processes and procedures does not represent the full suite of business processes off-grid companies are likely to be required to engage in in order to successfully operate in Nigeria.

#### 5.1.1. Incorporation with the Corporate Affairs Commission (CAC)<sup>50</sup>

Extracted from CAC website, the registration process for both public and private companies to register with the CAC includes the following steps:<sup>51</sup>

- Check for availability of proposed company name. Read more about name reservation and Reserve a new Name
- Complete pre-registration form – CAC1.1
- Pay filing and Stamp duty fees Check the Fees for Services (Steps 1-3 can be completed on Company Registration Portal)
  - Prepare the signed scan copy of your pre-registration documents for upload as follows:
  - Form CAC1.1

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<sup>44</sup> A licensed accountant or attorney knowledgeable in Nigerian off-grid business processes should be consulted prior to engaging in, or making decisions based on, business practices, processes, and/or procedures described in this report

<sup>45</sup> World Bank, *Rankings & Ease of Doing Business Score*, <http://www.doingbusiness.org/en/rankings>

<sup>46</sup> World Bank, *Doing Business in Nigeria*, 2018

<sup>47</sup> *Ibid.*

<sup>48</sup> *Ibid.*

<sup>49</sup> *Ibid.*

<sup>50</sup> Excerpted directly from the Corporate Affairs Commission

<sup>51</sup> Corporate Affairs Commission, <http://new.cac.gov.ng/home/registration-steps/#>



- o Memorandum and Article of Association (MEMART)
- Recognized form of identification for Director(s)/Subscriber(s) and Secretary
- Provide evidence of payment to CAC
- Upload the scanned documents for processing.
- Submit the original copies of the documents uploaded at step 6 (Form CAC1.1, MEMART, etc.) to the CAC office you had selected in exchange for your certificate and the Certified True copies of the documents.

### **5.1.2. Registration with the Nigerian Investment Promotion Commission (NIPC)<sup>52</sup>**

Business Registration process requires:

- Duly completed NIPC Form I
- Memorandum & Articles of Association
- Evidence of Incorporation
- CAC Form 2.1 (or CAC Forms CO2 and CO7 for old companies)
- Power of Attorney/ Letter of Authority (where applicable)
- Evidence of Payment of Processing fee
- Registration with Federal Inland Revenue Service (FIRS) and Obtain First Tax Clearance Certificate.
- Application for Business Permit and Expatriate Quota.
- Obtain Residence Permits for Expatriate Staff.

### **5.1.3. Employment of Non-Nigerian Staff**

Due to the talent gap in Nigeria's workforce related to some aspects of the off-grid market, a summary of potential permits and processes related to employing expatriate staff is highlighted below:

- **Temporary Work Permits** may be required for foreign workers wishing to work in Nigeria for short-term assignments.
- **Expatriate Residence Permit and Aliens Card** may be required for non-Nigerian staff members who wish to work or reside in Nigeria in the long-term.
- **Expatriate Quota** establishes the maximum number of expatriate staff members that a company may hire.

### **5.1.4. Non-Nigerian Company Ownership/Licenses Required**

The Companies and Allied Matters Act provides stipulations on how businesses are formed and operated in Nigeria, and may require, depending on company circumstances, a company to incorporate with a local subsidiary. Exemptions to this act are available and are provided below:<sup>53</sup>

- Foreign companies invited to Nigeria by or with the approval of the Federal Government to execute any specified individual project;
- Foreign companies which are in Nigeria for the execution of specific individual loan projects on behalf of a donor country or international organization;

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<sup>52</sup> Excerpted directly from the Corporate Affairs Commission

<sup>53</sup> Excerpted directly from the Companies and Allied Matters Act

- Foreign government-owned companies engaged solely in export promotion activities; and
- Engineering consultants and technical experts engaged on any individual specialist project under contract with any of the governments in the Federation or any of their agencies or with any other body or person, where such contract has been approved by the Federal Government.

## 5.2. THE STANDARDS ORGANIZATION OF NIGERIA

The Standards Organization of Nigeria (SON) oversees the development of standards for importing goods into Nigeria to monitor and enforce quality standards. This includes solar technology used in off-grid energy equipment. SON has adopted the International Electrotechnical Commission (IEC) standards for solar panels, batteries, inverters and other off-grid energy equipment in Nigeria, and these standards are enforced by SON through the SON Conformity Assessment Programme (SONCAP) certificate, a sample of which is referenced below.

Figure 10: SONCAP Certificate Example

STANDARDS ORGANISATION OF NIGERIA CONFORMITY ASSESSMENT PROGRAMME		SONCAP Certificate	
Exporter's Name: Address:	WUXI HUIZHONG POWER CO., LTD. 2-2, XIANGJIANG ROAD, NEW ZONE, WUXI, JIANGSU, CHINA	Importer's Name: Address:	17971032-0001
Destination Port: NGTIN	Country of Supply: CN	SONCO Ref. No.: NGC06010054	Invoice No: HZB20170330
SON Country Office: CCIC INSP.	Country of Origin: CN	BL or AWB No.: COSU6150434990	Carrier: -
#	Product code	Product description	Reference
1	85414090	SOLAR ACCESSORIES	IEC 61056-1:2012
2	85414090	SOLAR ACCESSORIES	IEC 61056-1:2012
3	85414090	SOLAR ACCESSORIES	IEC 61056-1:2012

Source: SON

SONCAP is a pre-shipment verification of conformity to Standards process used to verify that products to be imported into Nigeria are in conformity with approved quality standards. The SON has defined three routes for product testing, determined by the type of product, the potential health and safety risk to consumers, and the need for environmental protection, that maybe applied as appropriate conformity assessment procedures for product(s) subject to SONCAP.<sup>54</sup> These routes have varied procedures depending on whether the product is unregistered, previously registered, or licensed.

<sup>54</sup> Standard Organization of Nigeria, [http://son.gov.ng/soncap\\_service](http://son.gov.ng/soncap_service)

### 5.3. CUSTOMS DUTIES

Nigeria is in the process of integrating a National Trade Platform (also referred to as a National Single Window) into its overall customs structure with a goal of having the platform fully operational by 2020.<sup>55</sup> Once finalized, the national single window may streamline import/export processes by having all necessary information on a single platform, providing developers and technology suppliers a simplified process for compiling and processing customs documents. Currently, customs duties are assessed against a variety of off-grid technology components. A summary of the most common duties assessed is outlined below.

Table 12: Customs Duties for Off-Grid Components<sup>56</sup>

Category	Duty Assessed
<i>Most Relevant to Mini-Grids</i>	
PV Modules	0%
PV System	5%
PV Generator	5%
<i>Most Relevant to SHS</i>	
Lithium Batteries	20%
Others (potentially multiple)	5%-20%

Source: Nigerian Customs Administration

This list does not reflect a current controversy surrounding the importation of PV Modules, or “solar cells whether or not in modules or made up into panels” as defined under CET Code 8541.4010.00. While the customs code does not formally impose a customs duty or VAT, Nigerian customs officials have routinely levied a 5% VAT and 5% customs duty against PV modules.<sup>57</sup>

It is possible that customs officials may interpret components of integrated SHS units under different customs classifications. SHS wiring, lighting systems, and housings may be categorized under a variety of CET codes that include customs duties of between 5% and 20% and VAT of 5%.

Documentation required for importing off-grid technologies may vary depending on the method of transport (port vs. road) and the types of technologies contained in the shipment. Currently, the national single window platform<sup>58</sup> provides some high-level information, including the list of some documentation that may be required for importing solar cells (Customs CET Code 8541.4010.00). This list of required documents, and the agency responsible for processing that document, is included in Table 13 below.

<sup>55</sup> Sulaimon Salau, 2017, The Guardian, *Nigeria jostles to join 20 other nations on single window platform*, <https://guardian.ng/business-services/nigeria-jostles-to-join-20-other-nations-on-single-window-platform/>

<sup>56</sup> As officially designated by the Nigerian Customs Administration. Application may vary. <https://www.customs.gov.ng/Tariff/index.php>

<sup>57</sup> Olanrewaju Odunowo, 2018, Tech Cabal, *Despite Increase In Tariffs, Nigeria’s Solar Industry Remains Resilient*, <https://techcabal.com/2018/11/07/despite-increase-in-tariffs-nigerias-solar-industry-remains-resilient/>

<sup>58</sup> National Single Trade Window, <https://www.trade.gov.ng/>

Table 13: Representative Documents Required for Importing Solar Cells

No.	Document Name	Point of Contact
1	Bill of Lading	Seller
2	Invoice	Seller
3	Packing List	Seller
4	Risk Assessment Report	Nigeria Customs Administration
5	Single Good Declaration	Nigeria Customs Administration
6	Form "M"	Central Bank of Nigeria
7	Standards Organization of Nigeria Conformity Assessment Program	Standards Organization of Nigeria
8	Product Certificate	Standards Organization of Nigeria
9	NESREA Certificate	National Environmental Standards and Regulations Enforcement Agency

Source: National Single Window

## CONCLUSION

The Nigerian off-grid market is characterized by the size of the market opportunity, ability to scale rapidly, and the favorable conditions relating to consumer demand and demographics. This report compiles high-level market intelligence from a wide range of sources, in a range of highly relevant areas, to help international companies interested in jump-starting off-grid business in Nigeria and catalyze the market footprint of existing local off-grid companies. As demonstrated, there is large market potential for off-grid electrification business in Nigeria, as DISCOs currently operating Nigeria's grid are struggling to meet the increasing energy demand of consumers in urban centers and are unlikely to meet the needs of the populations in rural areas.

The opportunity for social and financial return is high, with more off-grid mini-grid developers, SHS companies, and technology companies entering the market every year. The market can support more developers, financiers, technology suppliers than are currently involved, needing additional capital and off-grid developers and companies to close the substantial gap between electricity supply and demand.

### **Engaging USAID's Nigeria Power Sector Program**

International SHS companies and mini-grid developers require significant growth in operational and market knowledge. NPSP can support them by undertaking tailored market research or commercial feasibility studies. As these actors seek to raise more equity or debt funding, NPSP can provide support by facilitating connections to financial institutions and potential donor programs.

### **Nigeria Power Sector Program**

[info@powerafrica-npsp.org](mailto:info@powerafrica-npsp.org)

## APPENDIX A – ESTABLISHED & EMERGING COMPANIES

Table 14: List of Established SHS and Mini-Grid Companies in the Nigerian Off-Grid Market

S/N	Company	Technology Solution
1	A4&T Solar	SHS
2	ACOB Lighting	Mini-Grids
3	Ajima Farms	Mini-Grids
4	Arnergy	Standalone Systems/C&I
5	Asolar	SHS
6	Asteven International Company Limited	SHS
7	Azuri	SHS
8	Black Bit Solar (BBSolar)	SHS/Standalone Systems
9	Blue Camel Energy	Standalone Systems/C&I
10	Creeds Energy	SHS/Standalone Systems
11	d.light	SHS
12	Emel Solar Solutions	SHS
13	GoSolar	C&I/Mini-Grids
14	Greenlight Planet	Pico/SHS
15	GVE Group	Mini-Grids
16	Havenhill Synergy	Mini-Grids
17	Lumos	SHS
18	Nayo Tropical Technology Ltd	Mini-Grids
19	Pan Africa Solar (PAS BBOX)	SHS
20	Rensource	Mini-Grids
21	Rubitec Solar	Mini-Grids
22	Solar Sisters	Pico/SHS
23	Solynta	Standalone Systems/C&I
24	Sosai Renewable Energy	SHS/Mini-Grids
25	Total Solar	SHS
26	Villageboom	SHS

Source: NPSP Team Research

Table 15: List of Emerging SHS and Mini-Grid Companies in the Nigerian Off-Grid Market

S/N	Company	Technology Solution
27	Aerodev Solutions Limited	Standalone Systems/C&I
28	Ashdam Solar Company LTD.	Standalone Systems/C&I
29	Aspire Power Solutions	Pico/SHS
30	Astrum Energy	C&I
31	Auxano Solar	Standalone Systems/C&I
32	Blue Ocean Nigeria	C&I
33	Cloud Energy	SHS
34	Consistent Energy	SHS
35	EM-ONE Energy Solutions Limited	Standalone Systems/C&I
36	ICE Commercial	C&I
37	Inlaks	Standalone Systems/C&I
38	Jua Energy Company Limited	SHS
39	Owena Hydro	Mini-Grids
40	PriVida Power Limited	C&I
41	Quintas Renewable Energy Solutions	Mini-Grids
42	Smarter Grid International	SHS
43	Solar Force Nigeria	C&I/Mini-Grids
44	Solar Kobo	Standalone Systems/C&I
45	Solarcentric	C&I

Source: NPSP Team Research

## APPENDIX B – DONOR ORGANIZATIONS

Program Name	Donor	Link
Nigeria Electricity Support Program (NESP)	European Union/GIZ	<a href="https://www.giz.de/en/worldwide/26374.html">https://www.giz.de/en/worldwide/26374.html</a>
Main Objective		Support provided
The program works on improving the conditions for the application of and investments in renewable energy, energy efficiency and rural electrification		Technical assistance, fundraising support, and policy reform

Program Name	Donor	Link
Power Africa Transactions and Reforms Program (PATRP)	USAID	N/A
Main Objective		Support provided
USAID funded program that aimed to increase supply of, and access to reliable and affordable energy through providing support to energy companies. As of November 2017, PATRP had facilitated the financial close of more than 1,800 MW of power generation projects.		Technical assistance, capacity building, and transaction support

Program Name	Donor	Link
Renewable Energy and Energy Efficiency Partnership (REEEP)	USAID/GIZ/European Commission/Rockefeller	<a href="https://www.reeep.org/programme-people">https://www.reeep.org/programme-people</a>
Main Objective		Support provided
The Renewable Energy and Energy Efficiency Partnership develops innovative, efficient financing mechanisms to strengthen markets for clean energy services in low- and middle-income countries, for the benefit of vulnerable populations.		Technical assistance



Program Name	Donor	Link
Global facility on Mini-grids of ESMAP	World Bank	<a href="https://www.esmap.org/node/22">https://www.esmap.org/node/22</a>
Main Objective		Support provided
The World Bank ESMAP program works to assist low and middle-income countries to increase know-how and institutional capacity to achieve environmentally sustainable solutions		Capacity building, policy reform

Program Name	Donor	Link
Nigeria Electrification Program (NEP)	World Bank	<a href="http://projects.worldbank.org/PI61885?lang=en">http://projects.worldbank.org/PI61885?lang=en</a>
Main Objective		Support provided
Nigeria Electrification Project (NEP) is a USD350m Rural Electrification Program supported by the World Bank to provide a pipeline of potential local investments and financial incentives to catalyze the Nigerian off grid market, through the provision of detailed Market Data, Grant Funding and Technical Assistance		Financial assistance for the development of rural mini-grids, technical assistance

Program Name	Donor	Link
Lighting Nigeria	IFC	<a href="https://www.lightingafrica.org/country/nigeria/">https://www.lightingafrica.org/country/nigeria/</a>
Main Objective		Support provided
Lighting Nigeria works in collaboration with manufacturers, distributors, retailers, financial institutions, government agencies, consumers and other stakeholders to develop markets and tackle the barriers to the adoption of cleaner energy sources		Consumer education, business development support, policy reform

Program Name	Donor	Link
Solar Nigeria	DFID	<a href="https://www.solar-ng.com/">https://www.solar-ng.com/</a>
Main Objective		Support provided
Solar Nigeria works with the solar industry in Nigeria to grow the market by providing facilities for affordable consumer credit, grants and technical assistance to companies that are already in the Nigerian solar market, or that seek to enter the market		Technical assistance, grant funding, consumer financing

Program Name	Donor	Link
Nigeria Renewable Energy Roundtable	Heinrich Boll	<a href="https://nesgroup.org/nigeria-renewable-energy-roundtable/">https://nesgroup.org/nigeria-renewable-energy-roundtable/</a>
Main Objective		Support provided
Nigeria Renewable Energy Roundtable is a partnership of government ministries, development agencies and private sector organizations that seeks to resolve issues and bottlenecks that limit the expansion of the off-grid and on-grid market in Nigeria		Advocacy, training, information on access to finance

Program Name	Donor	Link
Sustainable Energy for Economic Development (SEED)	Rockefeller/RMI	<a href="https://rmi.org/our-work/global-energy-transitions/seed/">https://rmi.org/our-work/global-energy-transitions/seed/</a>
Main Objective		Support provided
The SEED program is implemented by the Rocky Mountain Institute (RMI) which provides impartial technical, policy and financial advice on energy system development, and collaborates with the government and other donors to ensure successful implementation of the recommendations that they come up with		Technical, policy, financial advice and policy advocacy

Program Name	Donor	Link
Green Mini-grid Market Development Program	African Development Bank (AfDB)/SEforALL	<a href="https://www.se4allafrica.org/seforall-in-africa/regional-initiatives/green-mini-grids/">https://www.se4allafrica.org/seforall-in-africa/regional-initiatives/green-mini-grids/</a>
Main Objective		Support provided
The Green Mini-Grid Market Development Program supports the scale-up of investments in commercially viable Green Mini Grid (GMG) projects through a broad range of interventions to improve the enabling environment		Market intelligence, business development support, policy and regulatory support, quality assurance, financing

Program Name	Donor	Link
Nigeria Climate Innovation Center	World Bank	<a href="https://www.nigeriacic.org/">https://www.nigeriacic.org/</a>
Main Objective		Support provided
NCIC provides incubation, capacity building services and financing to Nigerian entrepreneurs that are developing innovative solutions in the off-grid sector		Capacity building, financing support

Program Name	Donor	Link
Co-Financing Africa Renewable Energy Projects	AfDB/Islamic Development Bank (IsDB)	<a href="http://www.financialnigeria.com/afdb-islamic-development-bank-sign-2-billion-deal-to-fund-smes-energy-projects-sustainable-880.html">http://www.financialnigeria.com/afdb-islamic-development-bank-sign-2-billion-deal-to-fund-smes-energy-projects-sustainable-880.html</a>
Main Objective		Support provided
The AfDB and IsDB signed an agreement in 2017 to jointly pull together USD2bn over the next three years to finance projects in various sectors, including renewable energy		Financing

Program Name	Donor	Link
Partial Risk Guarantee Program (PRG) in Support of the power sector	AfDB	<a href="https://www.afdb.org/en/projects-and-operations/project-portfolio/p-ng-fa0-006/">https://www.afdb.org/en/projects-and-operations/project-portfolio/p-ng-fa0-006/</a>
Main Objective		Support provided
The Project aims at increasing electricity production and thereby relieving the population of polluting diesel-powered generators. The ADF PRGs will protect the private investors and/or lenders against the risk of NBET not fulfilling its contractual obligations under the PPAs to be concluded with each nominated IPP		Financing (guarantees)

Program Name	Donor	Link
Association of Mini-grid Developers Association (AMDA)	Shell Foundation/ World Bank/DFID	<a href="http://africamda.org/">http://africamda.org/</a>
Main Objective		Support provided
AMDA is an industry association that serves as the voice of the mini-grid development industry in Nigeria and collaborates with various stakeholders in the industry to advocate for optimal policies and efficient capital deployment		Advocacy, coordination, industry intelligence (market data)