

ALL ON NIGERIA

OFF GRID ENERGY BUSINESS REPORT

All ON
Nextier

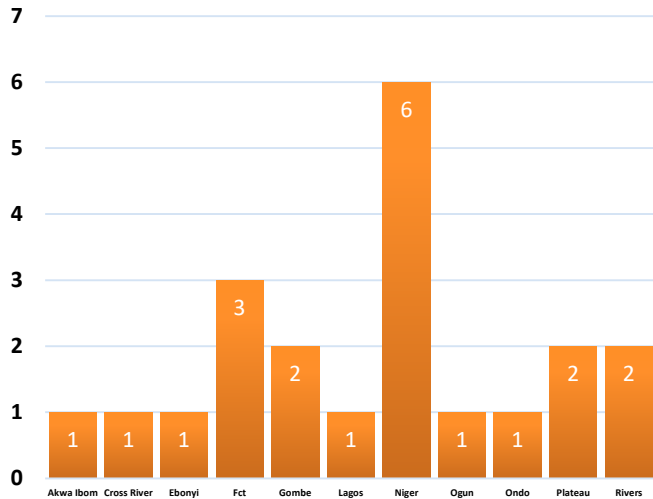


| Content Summary

- Executive Summary
- Report Objectives, Scope & Methodology
- Nigeria Energy Sector
- Field Survey Results
- Estimation of Off Grid Electricity market size in Nigeria and Projections
- Constraints and opportunities for growth and development of the off-grid market in Nigeria
- Policy Recommendations
- Conclusion
- References

Executive Summary

The mini-grids visited were in **21 communities**, and were spread across the **11 states** in Nigeria.



A total of **246 Responders** were interviewed.

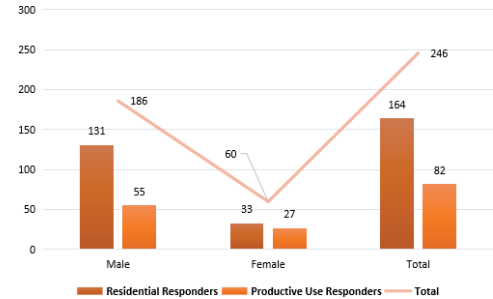


186 out of these 246 Responders were males



while **60** were Female

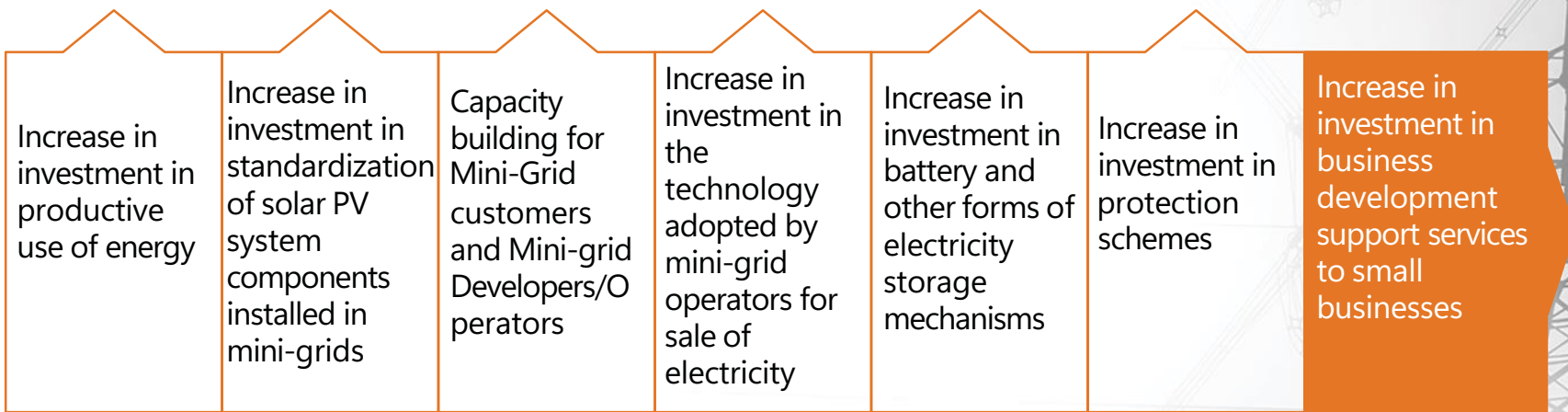
Meanwhile, only 82 out of the 246 Responders were productive users, while the remaining 164 were residential users.



The total installed mini-grid power capacity across the 21 mini-grids visited was 2.192MW, and the total population across all 21 communities being supplied power by these mini-grids was about 95,000 people.

This translates to a power capacity of 23W per person

Executive Summary



Summary of investment opportunities in off-grid market space

Nigeria Energy Sector



Nigeria has the largest population and largest economy in sub-Saharan Africa but suffers from limitations in the power sector which constrain the economic growth of the country.



Nigeria is endowed with large oil, gas, hydro, and solar resources, and has the potential to generate **12,522MW of electric power** from existing plants, not including off-grid generation.



On most days, however, it is only able to dispatch around **4,000MW**, which is insufficient for a country of over **195 million people**.

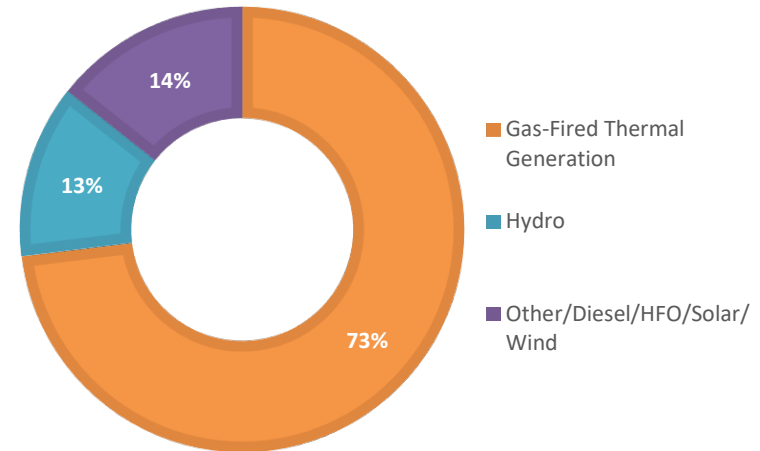
Installed Generation Capacity and Electricity Generation Mix



Nigeria has a total installed power generation capacity of 16,384MW. Power generation in Nigeria is mainly from hydro and gas-fired thermal power plants, with the hydro plants providing 2,062MW and the gas-fired 11,972MW. Solar, wind, and other sources such as diesel and Heavy Fuel Oil (HFO) constitute the remainder with 2,350MW.



Despite the figures above, Nigeria continues to struggle in dispatching at full capacity. On the 28th of February, 2021, the country recorded the highest ever dispatch power of 5,615.40MW, which was 22MW higher than, and came just three days after the previous peak of 5,593.40MW was recorded. This is very dismal for a country with an estimated energy demand of more than 98,000MW.



Power Generation Mix in Nigeria

Electricity Access in Nigeria

Nigeria is home to nearly 200 million people as of 2022 and is projected to have a population of about 400 million people by 2050.

This significantly large and increasingly growing population should ordinarily delight manufacturers because of the potentially large addressable market. However, grid power supply in Nigeria remains inadequate and unreliable, despite the vast gas reserves the country possesses.

The World Energy Outlook 2020 database as published by the International Energy Agency (IEA) placed electricity access in Nigeria at 61.6% as at 2019, with 77 million people without power supply. Electricity access for the urban population was placed at 91.4%, while that of the rural population was placed at 30.4%, an approximately 6-point decline from 36% recorded in 2018.

Source: The Economist: <https://www.economist.com/special-report/2020/03/26/africas-population-will-double-by-2050>
World Energy Outlook 2020 Database. Accessed at: <https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity>

Tracking SDG7: The Energy Progress Report 2021 – World bank

According to the Tracking SDG7:

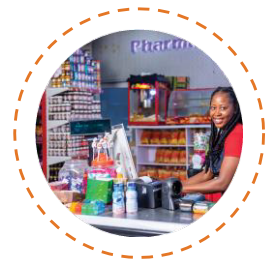
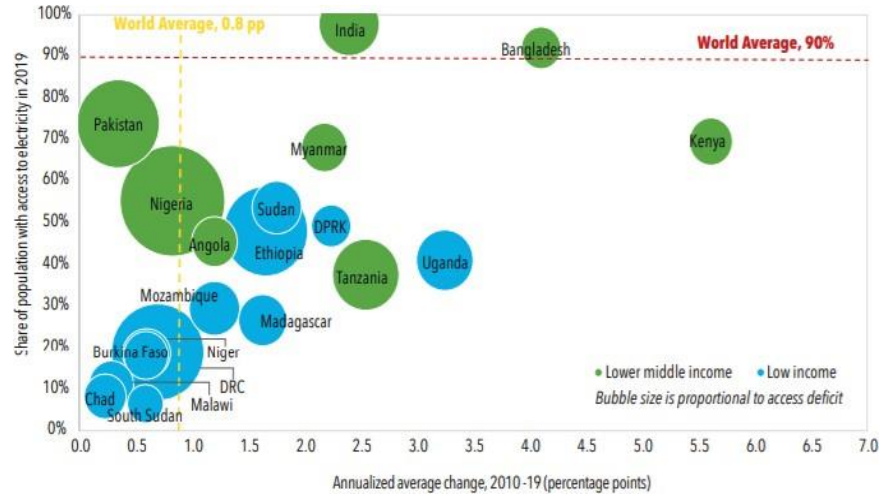
The Energy progress Report 2021 published by The World Bank (WB), the IEA, the International Renewable Energy Agency (IRENA), the United Nations (UN), and the World Health Organization (WHO), Nigeria was ranked as the world's worst country with regards to access to electricity with about 90 million of the total population without power supply.

This number corresponds to about 46% of the total population.

Where the grid is available, which corresponds to 55% of the total population, consumers experience frequent power cuts ranging from 4 to 15 hours per day.

This represents a huge gap which Nigerians fill with other, often less clean, and more expensive stop-gap measures.





Nigerian businesses are estimated to spend almost

\$14 billion
(₦5 trillion)

annually on inefficient generation that is expensive

(\$0.40/kWh or ₦140/kWh or more),

of poor quality, noisy, and polluting,

whereas developing off-grid alternatives to complement the grid creates a **\$9.2B/year** (₦3.2T/year) market opportunity for mini-grids and solar home systems that will save **\$4.4B/year** (₦1.5T/year) for Nigerian homes and businesses.



Nigeria has nearly

14,000MW

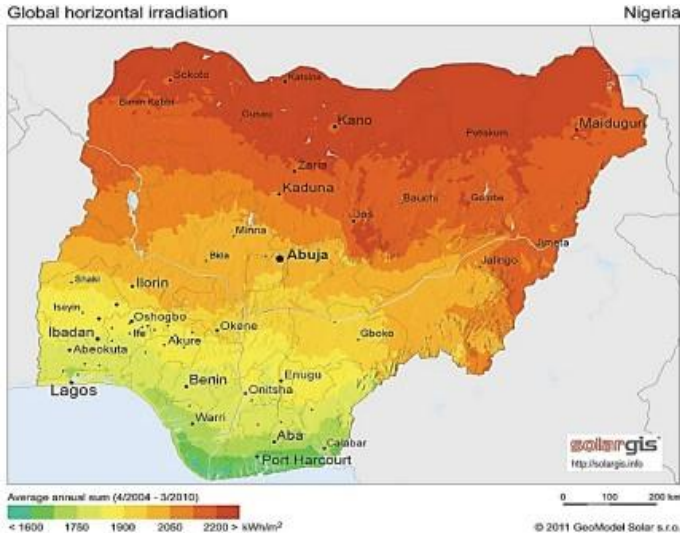
installed electricity generation capacity but much of that capacity is constrained due to technical challenges associated with the overall network/power system.

Electricity Access in top 20 access deficit countries

Source: Rural Electrification Agency: The Off-Grid Opportunity in Nigeria
Tracking SDG7: The Energy Progress Report 2021

Main sources of Power Generation in Nigeria: Focus on Off Grid Sector

Solar



Solar Irradiation Potential of Nigeria

Source: Awogbemi, O. and Komolafe, C.A. 2011. Potential for sustainable renewable energy development in Nigeria. Pacific Journal of Science and Technology 10(1): 161-169
 USAID, Nigeria Off-grid Energy Market Intelligence Report, April 2019
 The Solar Report Nigeria. Commissioned by the Netherlands Enterprise Agency

Nigeria is one of the world's tropical countries, which lies between 40 and 130 with a landmass of 9.24×10^5 km² and enjoys average daily sunshine hours, ranging from 3.15 hours at the coastal areas to 9.0 hours at the northern boundary. Nigeria receives about 4.851×10^{12} kWh of energy per day from the sun.

Based on the land area of the country and an average of 5.535 kWh/m²/day, Nigeria has an average of 1.804×10^{15} kWh of incident solar energy annually. This annual solar energy insolation value is about 27 times the nation's total conventional energy resources in energy units. This means Nigeria has boundless opportunities to tap from the power of the sun for energy.

The Renewable Energy Master plan targets 500MW installed capacity for solar PV in 2025. The assumed potential for concentrated solar power and photovoltaic generation is around 427,000MW.

The revenue potential from SHS in Nigeria is estimated to be **\$2 billion per year.**



Hydropower

- Nigeria is bestowed with large rivers and natural falls and an estimated 1,800 m³ per capita per year of renewable water resources available.
- The main water resources that provide rich hydropower potential are the Niger River, Benue River, and the Lake Chad basin.
- Currently, the total installed capacity of hydropower is 2,062MW. Research estimates put the total exploitable potential of hydropower at over 14,120 MW, amounting to more than 50,800 GWh of electricity annually.
- Ministry of Power and Ministry of Water Resources established a partnership that is targeted towards rehabilitating several existing hydropower plants. These plants include: the Gurara 1 (30MW), the Tiga (10MW), Oyan (10MW), the Challawa (8MW), and the 6MW Ikere plant, not leaving out the 700MW Zungeru and 40MW Kashimbila hydropower plants currently under construction.
- Nigeria has six hydropower stations although not all of them are fully operational. Three major plants are in operation – Kainji (760MW), Jebba (578MW), Shiroro (600MW). There is also the Mambilla Power project which is expected to have an installed capacity of 3,050 MW when completed.

Sources: <https://www.hydropower.org/country-profiles/nigeria>
Renewable Energy Potential in Nigeria, available at <https://pubs.iied.org/sites/default/files/pdfs/migrate/G03512.pdf>



Wind

In Nigeria, the average wind speed is estimated at 4-5 metres per second at 30 metres (implying 5-6m/s at 80 metres height).

While the potential for large-scale wind power generation might be restricted to a few locations, the off-grid potential of wind power, especially in isolated areas, particularly in the coastal part of the Niger Delta, has not been explored.

For over a decade, the Wind Farm located in Katsina State, which was conceived in June 2009, is yet to be commissioned after a security incident in 2012. According to the ECOWAS Observatory for Renewable Energy and Energy Efficiency, the Katsina Wind Farm would consist of 37 GEV MP 275kW in Northern Nigeria.



Diesel Generators

Due to unreliable access to electricity supply from the national grid, Nigerians have been forced to spend about \$14 billion annually on the generation of electric power using small petrol or diesel generators, which are quite expensive and release harmful emissions into the atmosphere.

In 2021, 20GW of small diesel-powered generators were used in daily operation. This amount is recorded to be five (5) times the capacity of the on-grid generation supply.

Approximately 60 million people in Nigeria use diesel generators to generate electricity, making it the most used source of non-grid power generation. Further research also notes that 8,000 to 14,000MW of decentralized diesel generator capacity is currently installed in the country.

It was estimated in 2018 that Nigerians often pay more than \$0.71 per kWh for local diesel generation, compared to mini-grid electricity, which costs \$0.60 to \$1.00 per kWh.

Source: USAID, PA-NPSP Off-grid Market Intelligence Report, 2021, available at https://pdf.usaid.gov/pdf_docs/PA00ZB5X.pdf
USAID, Nigeria Off-grid Energy Market Intelligence Report, April 2019, available at https://pdf.usaid.gov/pdf_docs/PA00XGH7.pdf
Rocky Mountain Institute (RMI), 2018 available at https://pdf.usaid.gov/pdf_docs/PA00XGH7.pdf
<https://www.bioenergyconsult.com/biomass-energy-in-nigeria/>



Biomass

Nigeria has a substantial biomass potential of about 144 million tonnes annually.

Biomass accounts for about 80% of Nigeria's total primary energy consumed. Most of these go towards heating, lighting, and cooking in rural areas.

In November 2016, the Ebonyi State Government took over the United Nations Industrial Development Organisation (UNIDO) demonstration biomass gasifier power plant located at the UNIDO Mini-industrial cluster in Ekwashi Ngbo in Ohaukwu Local Government Area of the State. The power plant is to generate 5.5 Megawatt energy using rice husk.



Geothermal Energy

Geothermal energy refers to energy tapped from deep below the earth's surface.

It is extracted in the form of steam or hot water and is used to power geothermal plants' turbines on the surface to generate electricity.

In Nigeria, geothermal energy remains largely untapped; as of 2018, the level of consumption for geothermal energy was recorded to be 0 in terms of the level of consumption as opposed to capacity.

At present, there are no installed geothermal plants in Nigeria.

Mini-Grids

- Mini-grids are independent electricity distribution networks that provide power to multiple individuals or businesses in small communities using integrated renewable or hybrid energy systems.
- At the end of August 2021, the market for mini-grids in Nigeria was estimated to have an installed capacity of 3.2 MW with 62 mini-grids serving rural communities. This exponential growth in the deployment of mini-grids is attributed to the numerous national funding programs, and the developing regulatory environment. Green Village Electricity (GVE) remains the largest industry player with a total installed capacity of 4.54 MW and total operational mini-grids of over 15 plants.
- REA has estimated that even if the country implements 10,000 mini-grids of 100 kW each, it would only be able to meet 30% of the existing energy demand.
- Most mini-grid projects today are situated in densely populated agrarian communities, typically with a population of around 2,500 distributed among 300–500 households.
- Only two interconnected mini-grids are currently operational in Nigeria: The Mokoloki mini-grid in Ogun State and The Toto mini-grid in Nasarawa State.
- The main economic activities in audited communities are farming and fishing, and income is primarily obtained through the sale of cash and food crops like maize, millet, sorghum, yam, cocoa, and cocoyam. Other common commercial activities include retail, welding, grain milling, and barbing.

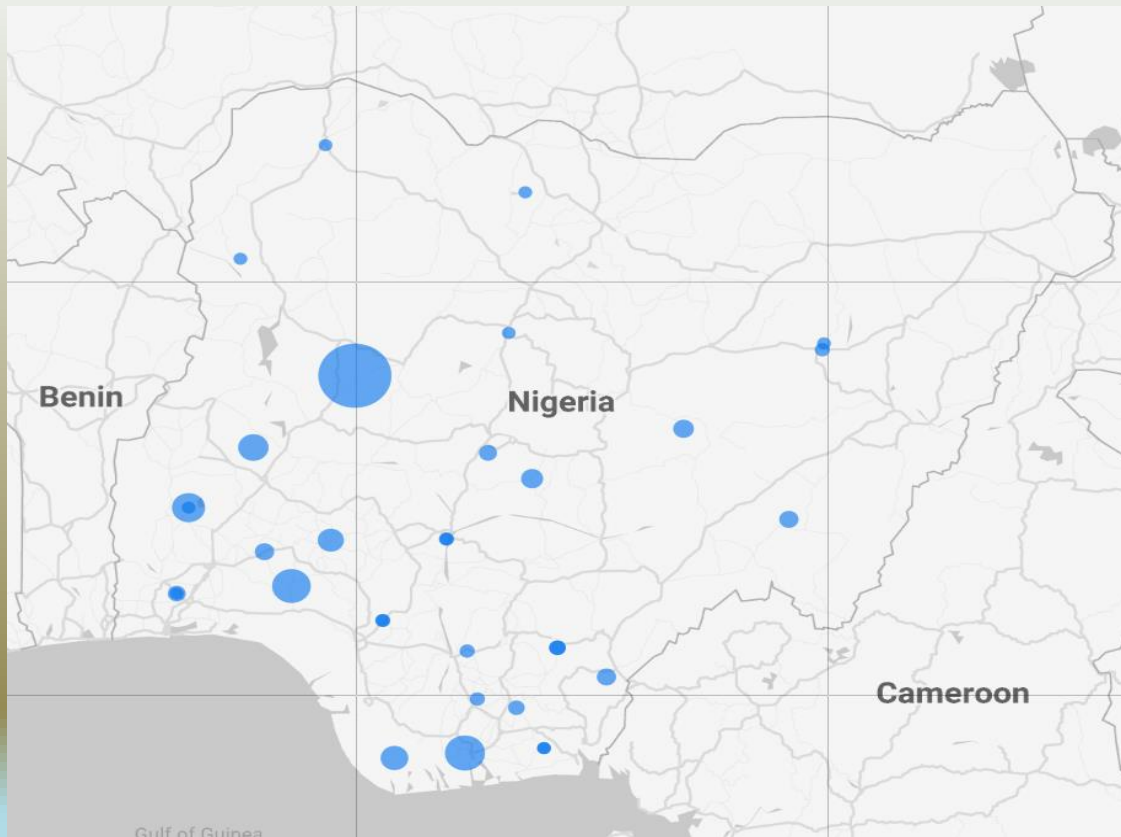
Source: Rural Electrification Agency, 2023

USAID, Nigeria Off-grid Energy Market Intelligence Report, April 2019, available at

https://pdf.usaid.gov/pdf_docs/PA00XGH7.pdf

USAID, PA-NPSP Off-grid Market Intelligence Report, 2021, available at https://pdf.usaid.gov/pdf_docs/PA00ZB5X.pdf

Mini-Grid Map of Nigeria



**Operational/Non-operational
Mini-grids as of June 2022**

Source: <https://datastudio.google.com/s/tpP2eWBfgc8>

Key Trends in the Nigeria Off-Grid Energy market



Business Development
for Off-Grid Firms



Development of Quality
Standards



Improved transactions
in Payment Option



Increased access to
funding

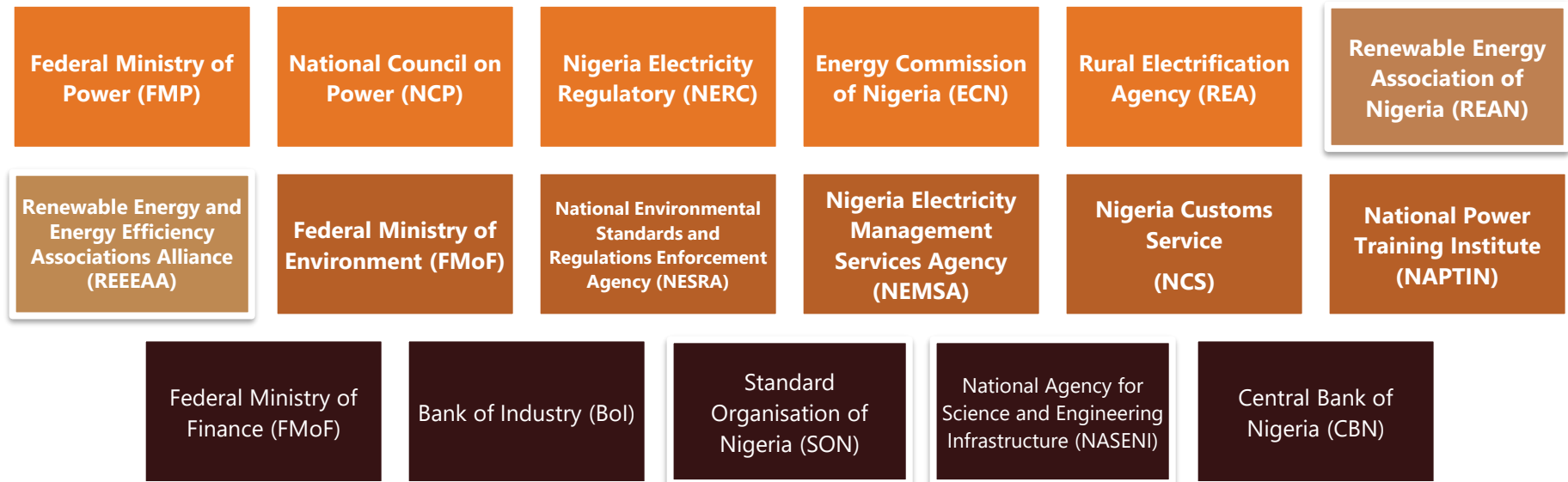


Renewed interest in the
14 Solar IPPs

Off-Grid Projects in Nigeria

- Solar Power Naija (SPN)
 - Africa Minigrid Programme (AMP)
 - Nigeria Electrification Project (NEP)
 - EU investment in renewable energy
 - The Ashama 200MW/HR Solar PV Farm
 - CBN Solar Intervention Fund
 - Energizing Education Programme (EEP)
- Energizing Economies Initiative (EEI)
 - Energizing Agriculture Programme (EAP)
 - Africa Clean Energy – Technical Assistance Facility (ACE-TAF)
 - Nigeria Energy Support Program (NESP):
 - All On Partnerships for Energy Access Limited (All On) activities
 - Solar stand-alone solutions

Key Stakeholders in the Off Grid Market in Nigeria



Major companies into Solar home systems, stand-alone systems, and pico-solar lanterns



Major players in the Mini-grid space



NEP SHS Data in Rivers State

NEP COMPONENT 2 - STANDALONE SOLAR HOME SYSTEMS

Output Based Fund – 4th July 2022

SHS Deployments in Rivers State



Total **Connections** deployed in Rivers State is **7,155**



Total **Households** connected under the OBF is **6,950**



Total **MSMEs** connected under the OBF is **127**



Total **PV Capacity** deployed in Rivers State is **388.4kW**

- The SHS product range deployed in Rivers State falls between **6Wp** and **9,360Wp**.
- The customer category includes Residential, Commercial, Productive Use and Public.
- The list of companies on the left are SHS companies under the SHS OBF that have deployed SHS to Rivers State.

S/No	SHS Companies
1	Greenlight Planet Ltd
2	Lumos Global
3	Beebeejump Int'l Ltd
4	Solar Energy by D.Light Ltd
5	Oolu Energy Nigeria Ltd
6	Smarter Grid Int'l Ltd
7	Salpha Energy
8	Solar Sister Entrepreneur Ltd
9	A4&T Power Solutions
10	Creeds Energy
11	Fenix International
12	Arnegy Solar Ltd
13	Cloud Energy Photielectric Ltd
14	SOSAI Renewable Energies

Existing Energy Positive Business models in Nigeria and within Africa

The Facilitator model

- This model is led by a market enabler that educates the entrepreneurs on the benefits of using productive use appliances. Then, this market enabler connects the entrepreneurs to the financing bodies who then provide the funding for the purchase of the equipment needed.
- This model is analogous with an incubation programme, where the facilitator helps bridge the knowledge gap needed to make the incubatees sustainable and linking them up with financing bodies for funds.
- Clean Technology Hub's Off-Grid Renewable Energy Enterprise Development Programme through the support of All On train start-ups and provide grants to qualified entrepreneurs at the end of the training.

The Processing Center Model

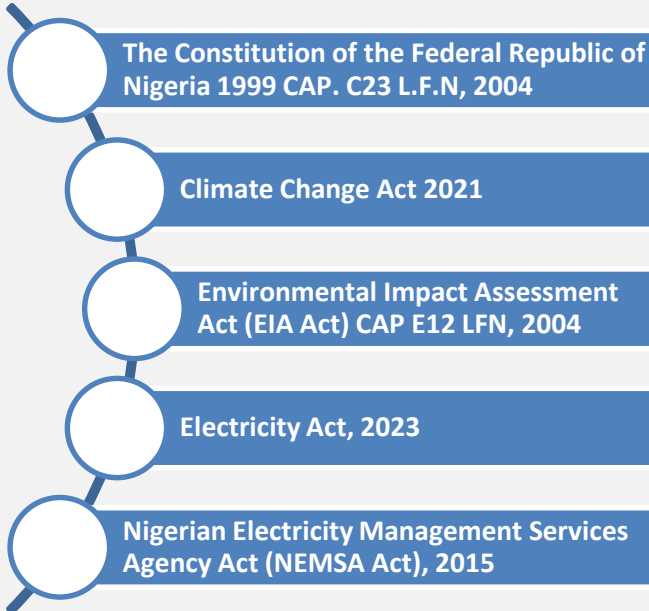
- This model is designed such that the mini-grid developer seeks funding to develop or acquire productive-use appliances that the existing entrepreneurs cannot afford.
- The developer then charges the local entrepreneurs for the usage of the appliance.

Legal, Policy and Regulatory Framework for Off-Grid Energy in Nigeria

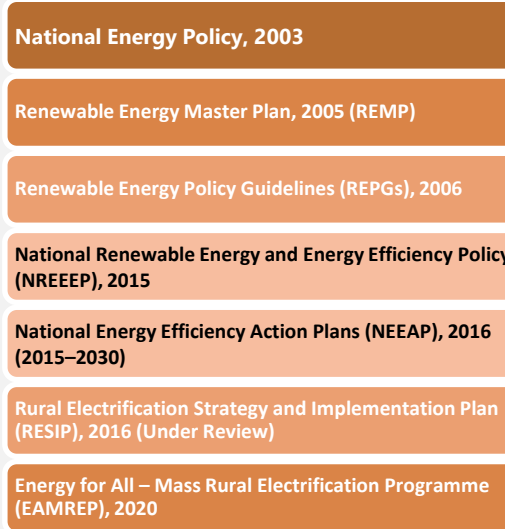
- The policy direction and strategies of the government towards the diversification of Nigeria's energy mix and building a vibrant off-grid sector have been largely progressive.
- Some of these policies include the National Electric Power Policy (2001), Renewable Energy Master Plan (2005), Renewable Energy Policy Guidelines (2006), Renewable Electricity Action Programme (2006), National Renewable Energy and Energy Efficiency Policy (2015), Renewable Energy Feed-in Tariff regulations (2015 - under review), NERC Mini-grid regulation of 2017, NERC mini-grid regulation, 2023 and the Eligible Customer Regulations 2017.
- Other more recent legislative actions include the federal government-issued VAT (Modification Order) 2020, in which renewable energy equipment, such as wind-powered generators, solar-powered generators, and solar cells, were listed as items exempted from the application of VAT.
- Additionally, the *National Renewable Energy and Energy Efficiency Policy (NREEEP)* proposes free customs duty for two years on the importation of equipment and materials used in renewable energy and energy efficiency projects, and the National Renewable Energy Action Plans (2015–2030) also proposed incentives to encourage participation in the renewable energy sector.

Laws, Policies and Regulations

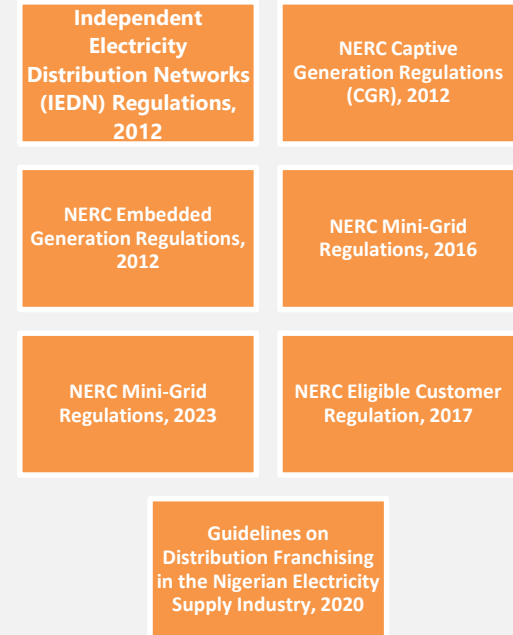
Laws



Policies



Regulations



Financing Options for Off-Grid Power Projects



Tariffs and Incentives for Off-Grid Power Projects

Tax Based Incentives

S/N	CATEGORIES
1	100% WHT exemption from interests on foreign loans granted to the company where such loans are for at least 7 years with a 2-year moratorium
2	5% duty application on solar panels. There is an exemption on solar cells and other components used in manufacturing or assembling solar modules.
3	Investment Tax Relief for expenditure on electricity, water, tarred road or telephone for the purpose of trade or business for a period of 3 years.
4	Allowance for 100% foreign ownership of electricity plants
5	Pioneer Status incentive (Tax holiday) for an initial three years, and renewable for the next two years
6	20% tax credit on qualifying expenditure for companies and other organizations engaged in research and development activities for commercialisation
7	10% Investment Allowance eligibility for incurring plant and equipment expenditure
	Additional allowance for providing amenities such as electricity, water, or tarred roads for trade and business purposes.

Efforts to boost investments in the renewable energy and energy efficiency (RE/EE) market in Nigeria have been evident in various stages of Nigeria's electrification policies. The Federal Government has consistently sought to improve the environment for renewable integration in the energy mix through a series of policies and regulations to de-risk the off-grid market for optimum private sector involvement. In addition, international development agencies, donors, investors, and impact investment organizations have invested profoundly in the off-grid market to bridge the energy access gap and promote sustainable development. As a result, the Nigerian off-grid sector has seen significant growth in recent years.

However, despite the upward growth trend of the market, a significant factor affecting the penetration of off-grid energy is market uncertainty and the unavailability of market intelligence in the sector. The high risk of investment for off-grid energy companies is often an offshoot of market uncertainties related to commercial viability, financing, security of investments, and technical viability of the projects. Therefore, promoting RE investments in Nigeria requires an in-depth understanding of the niche market's potential, challenges, and barriers by the relevant stakeholders and investors

In order to understand these factors militating against penetration of renewable energy in the off-grid market in Nigeria and provide market intelligence in the sector, this study was commissioned.

Objectives and Methodology



Report Objectives

The objective of this project is to carry out and publish research that will provide qualitative and quantitative estimates of the potential growth of Nigeria's off-grid industry over a defined timeframe. This report will outline the current value chain and potential growth trajectories for the industry. Key elements of the value chain trajectories that will be analyzed are the value chain components and their economics, including players, participation requirements, challenge, contribution to power supply capacities, contributions to Nigeria's gross domestic product, investment, and job market sizes and opportunities, etc.



Report Methodology

A mixed-method model of both qualitative and quantitative data collections methodology was adopted. The report presents a range of information collected from both individual interviews and available literature and policy documents on the off-grid clean energy landscape in Nigeria. This report contains the outcome of the field visit study that was conducted across 21 Communities covering 11 States in Nigeria.

3 sets of Questionnaires were used in obtaining information from the respective communities visited. The Questionnaires which were developed using the kobo tool are as follows:

1 Questionnaire for Mini-Grid Location: comprising of a total of 36 Questions

2 Questionnaire for Residential customers in Mini-Grid Community: comprising of a total of 39 Questions

3 Questionnaire for Productive Users in Mini-Grid Communities: comprising of a total of 31 Questions

- The Questionnaires were designed to cover the entire objectives of the Study.
- The data entered by the field personnel were validated real time from the backend of the kobo tool by Data validation team from home office.
- Thereafter, an assessment of the collected data was carried out, and deductions and projections were made on the current market status, current and future off-grid market size, constraints to growth & development, and opportunities for expansion and investments in off-grid space in Nigeria.

Field Survey Results



Federal Capital Territory



Plateau State



Gombe State



Ogun State



Rivers State



Lagos State



Niger State



Ebonyi State



Akwa Ibom State



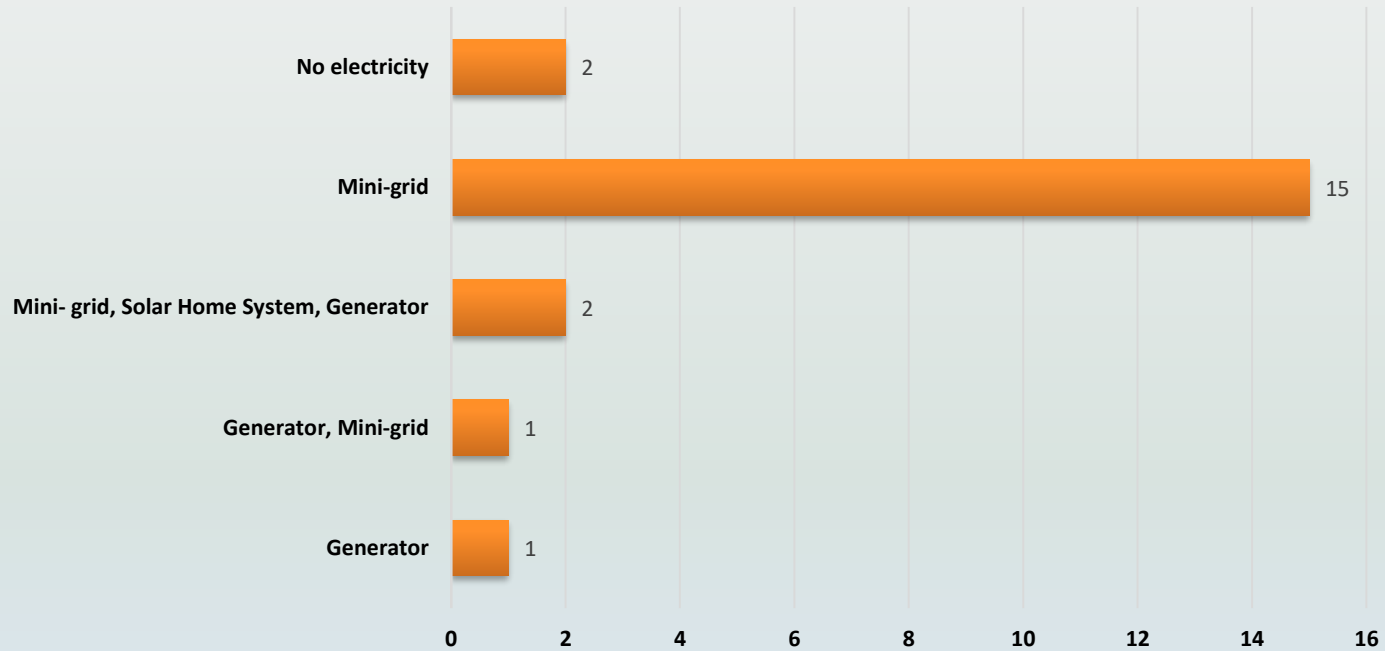
Cross River State



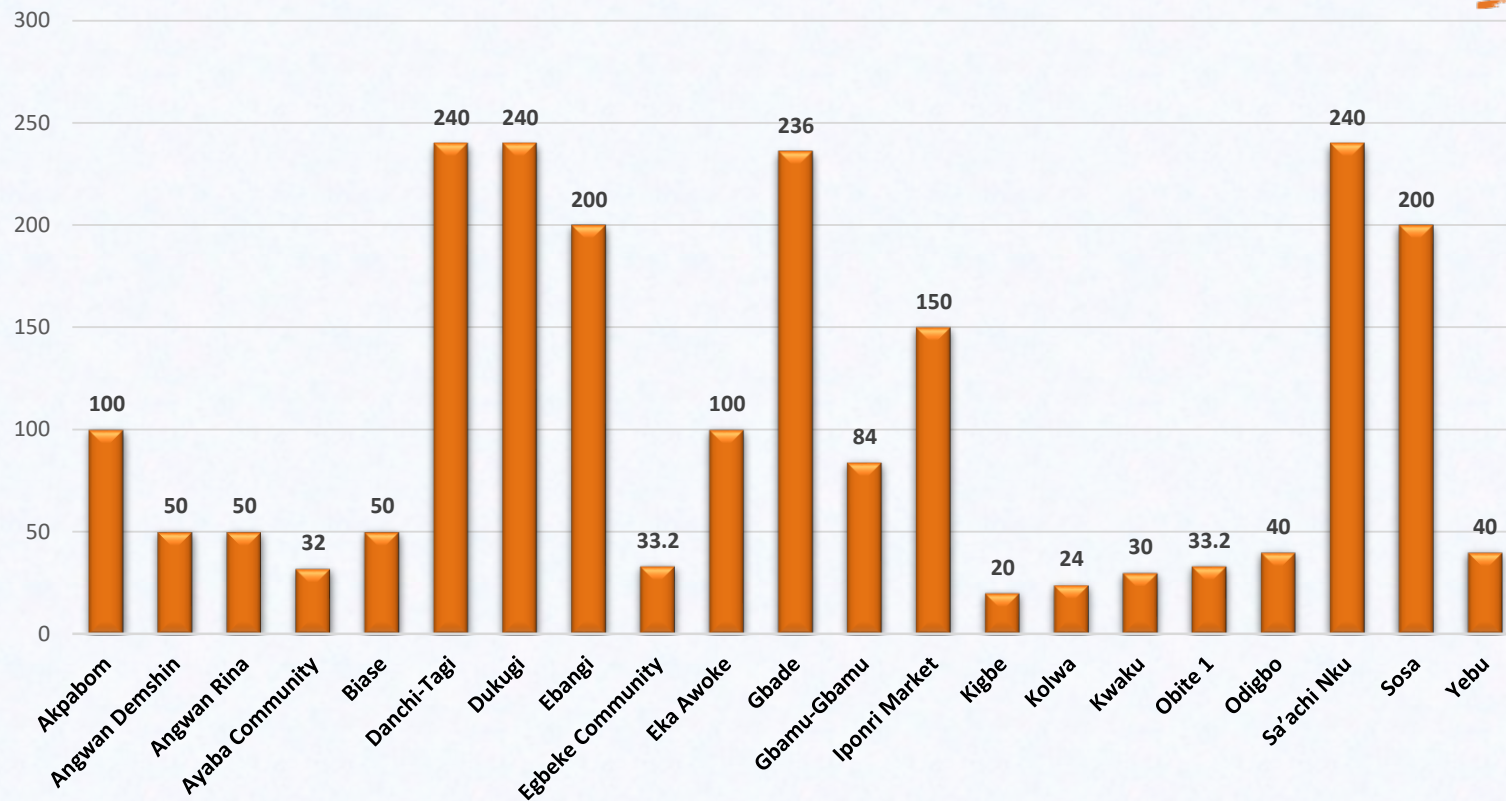
Ondo State

Sites Visited

Assessment of current market status of mini-grids in Nigeria

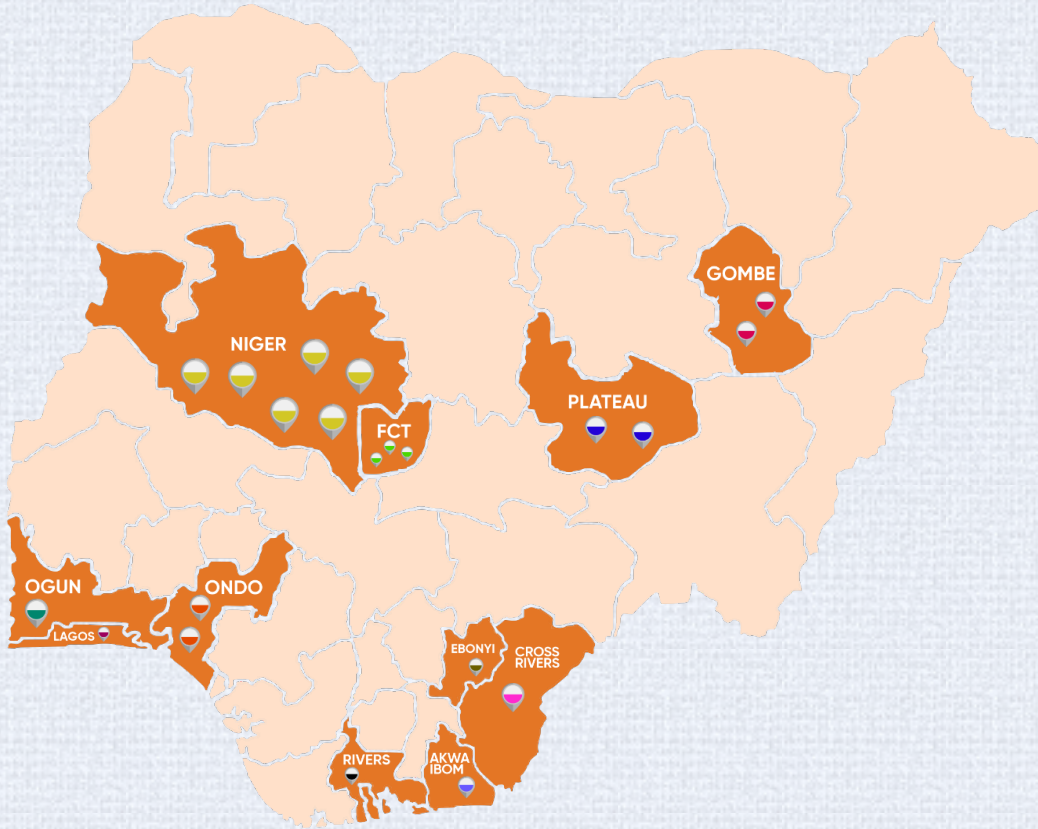













Distribution of major source of power supply across 21 Communities surveyed



Distribution of the installed mini-grid capacity in kW across 21 communities

Mini-Grid Map of Sites Visited



-  Kigbe, Kwaku and Yebu
-  Danchi-Tagi, Dukugi, Ebangi, Gbade, Sosa and Sa'achi Nku
-  Angwan Demshin and Angwan Rina
-  Obite 1 and Odigbo
-  Ayaba Community and Kolwa
-  Iponri Market
-  Gbamu-Gbamu
-  Eka Awoke
-  Akpabom
-  Biase
-  Egbeke Community

Residential uses of electricity

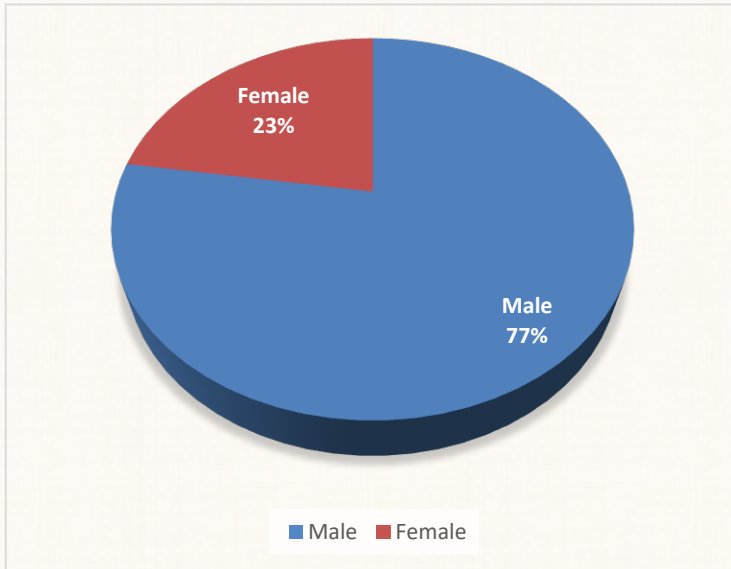
- **Lighting**
- **Fan**
- **Electronics (Radio and TV mostly)**
- **Fridge**

Productive uses of electricity

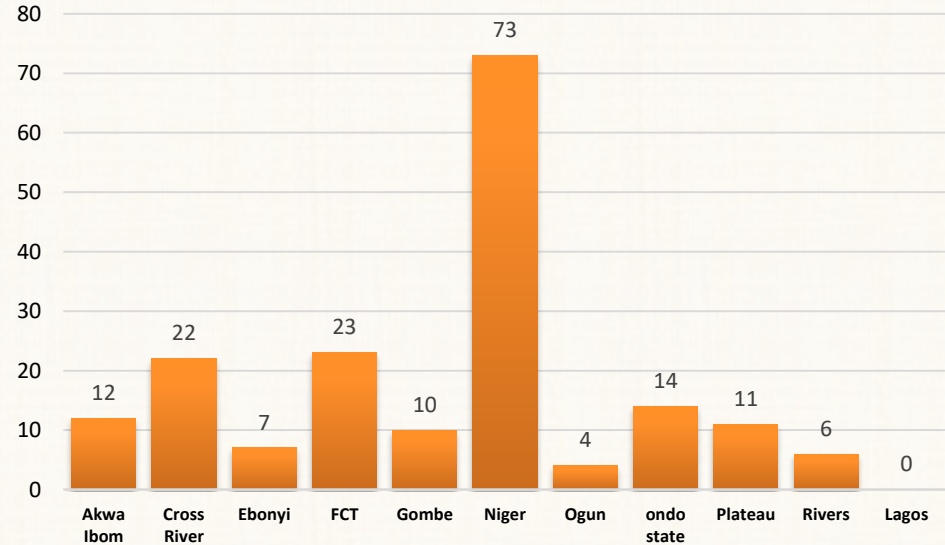
- **Welding (welding machine mainly)**
- **Barbing/Beauty Saloon (Hair drying machine, Light, and Fans)**
- **Retail Shop (Lighting, Fridge and Fans mostly)**
- **Hotel (Lights, Fans and handful of AC)**
- **TV viewing centre/Game House (TV, Lights, and Fans mainly)**
- **Medicine shop (Light and Fan mostly, sometimes Fridge)**
- **Tailoring (Lights, Fans and sewing machine)**
- **Pub (Lights and Fans)**
- **Phone charging Business (Light and socket points to connect many phones)**
- **Laundry (Pressing Iron, Light, and Fans mostly)**
- **Computer services (Computer, Lights, and Fans mostly)**
- **Popcorn machine (Light, Fan, & Popcorn machine)**
- **Electronic shop (Lights, TV, and Fans mainly)**
- **Betting shop (TV, Lights and Fans)**
- **Printing Press (Printing machines, Lights and Fans)**
- **Agric Processing (Cassava, Maize, etc., Grinding machine mostly)**

Overview of uses of electricity from the mini-grids

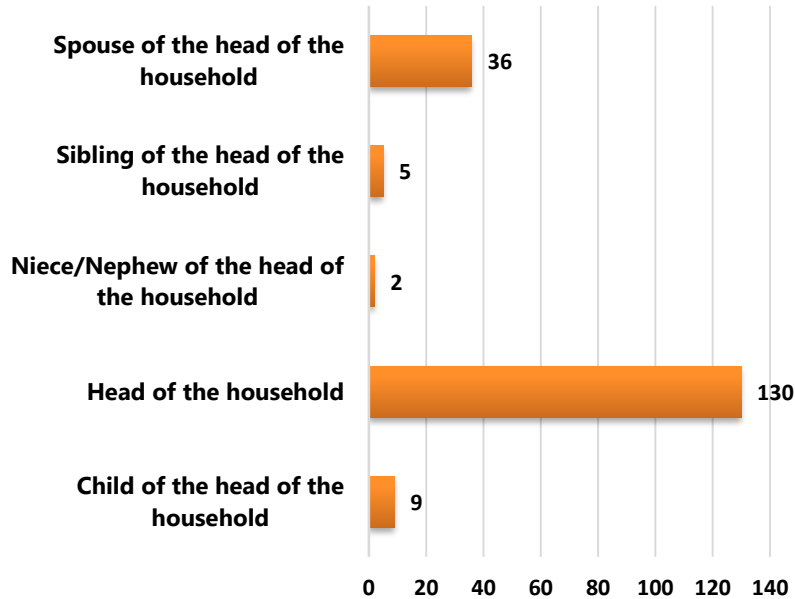
Outcome Of The Engagement With Residential Users



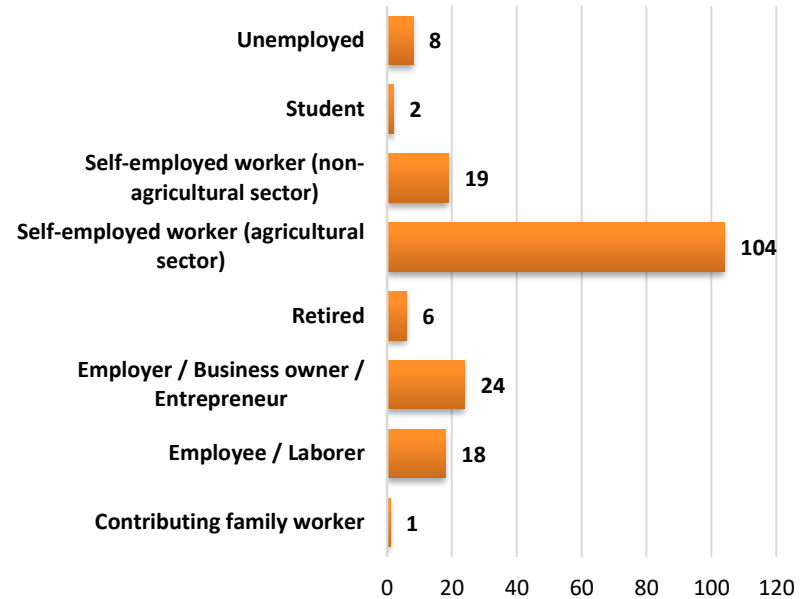
Distribution of Gender of Residential Customers interviews



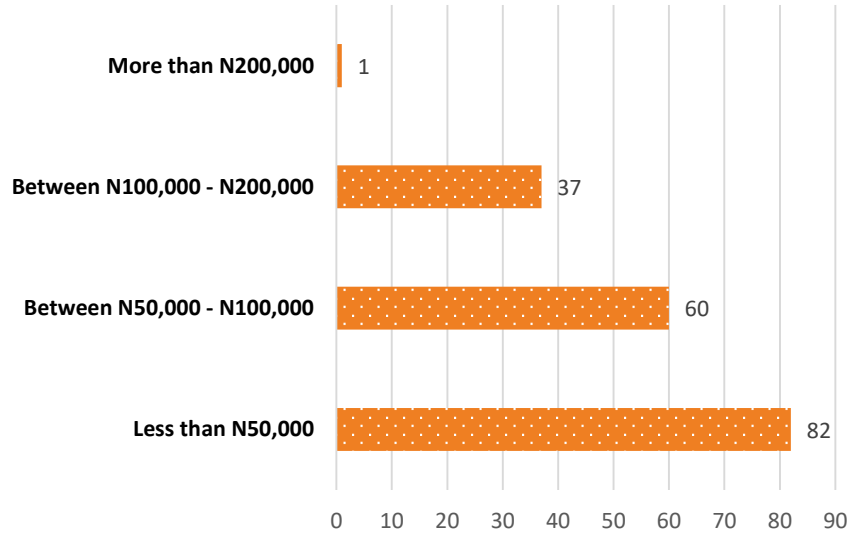
Distribution of Residential Customers by State



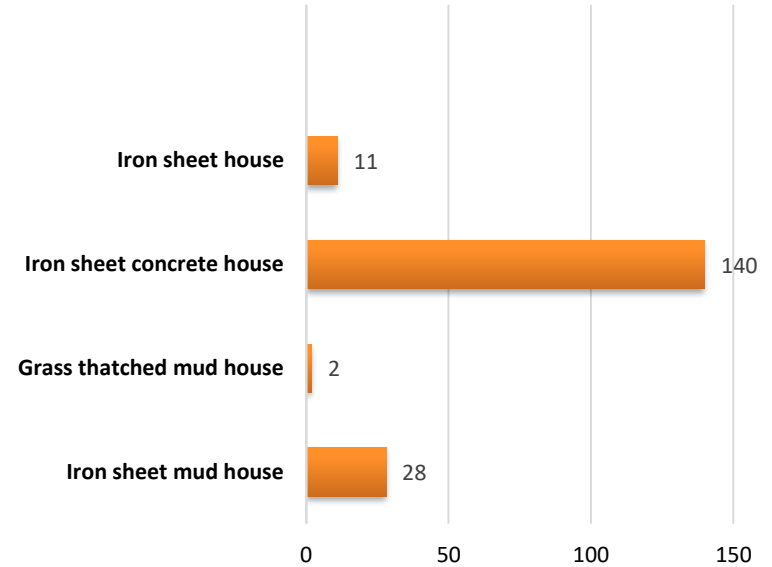
Status of Respondents in their respective Households



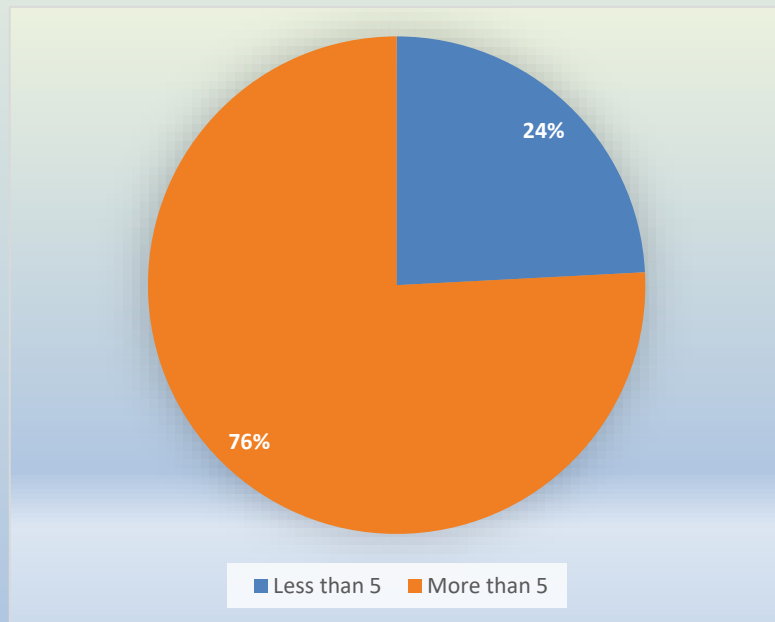
Employment status of Residential Customers interviewed



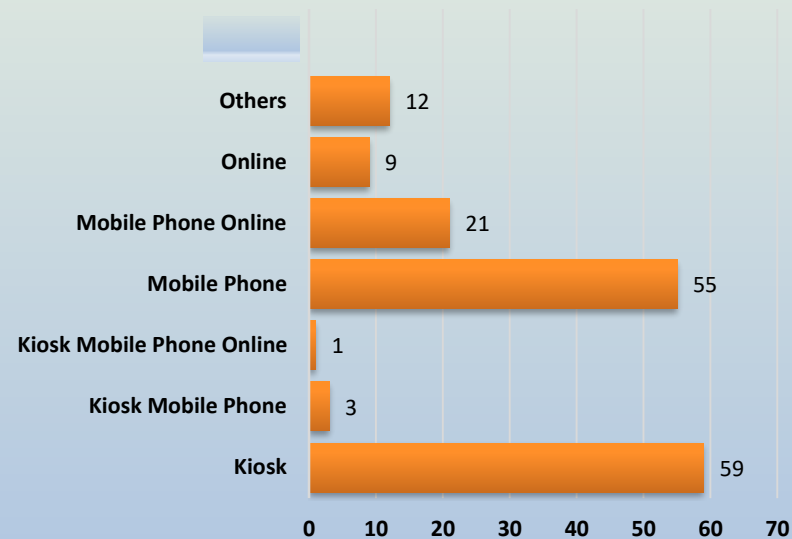
Range of monthly income of residential customers interviewed



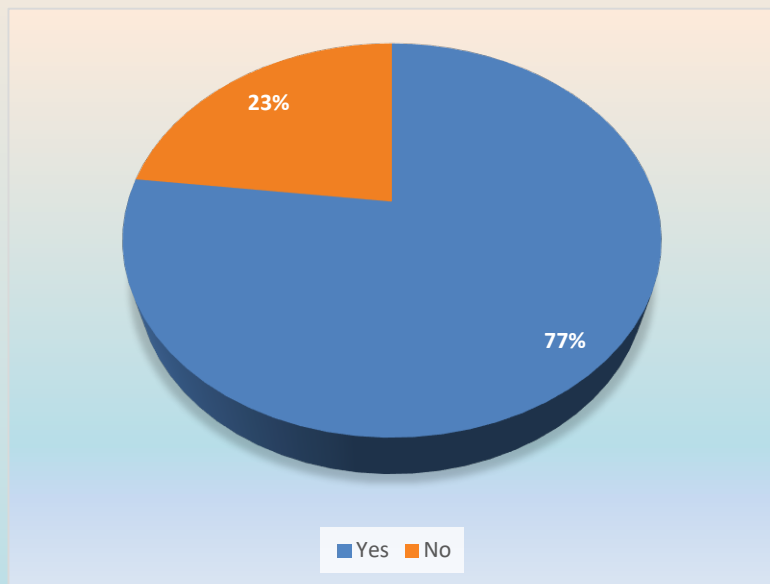
Type of house residential customers interviewed live in



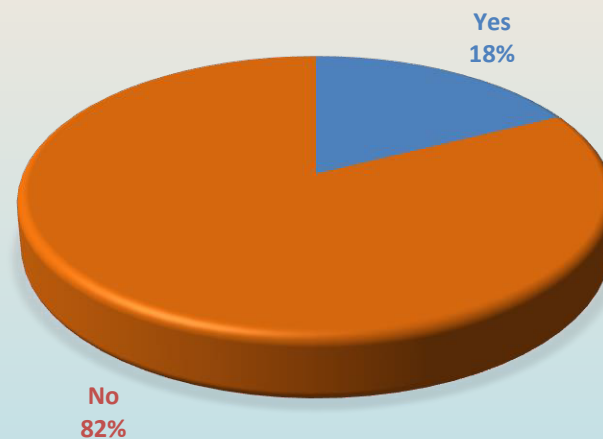
Number of People in a household



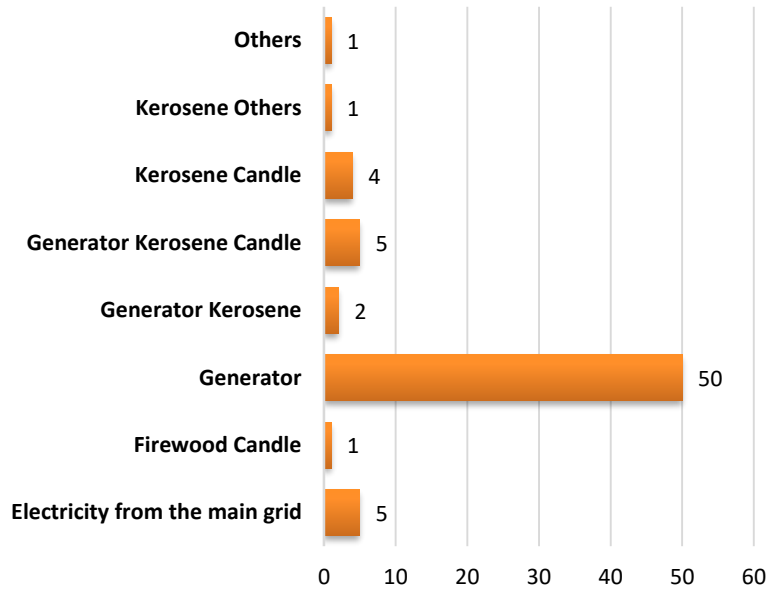
Mode of Purchase of electricity



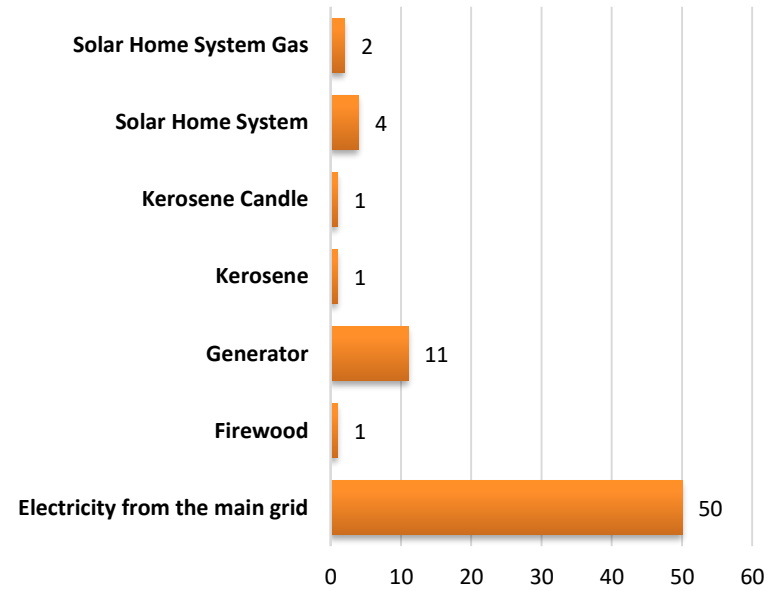
**Usage of Generators before
Mini-grid was deployed**



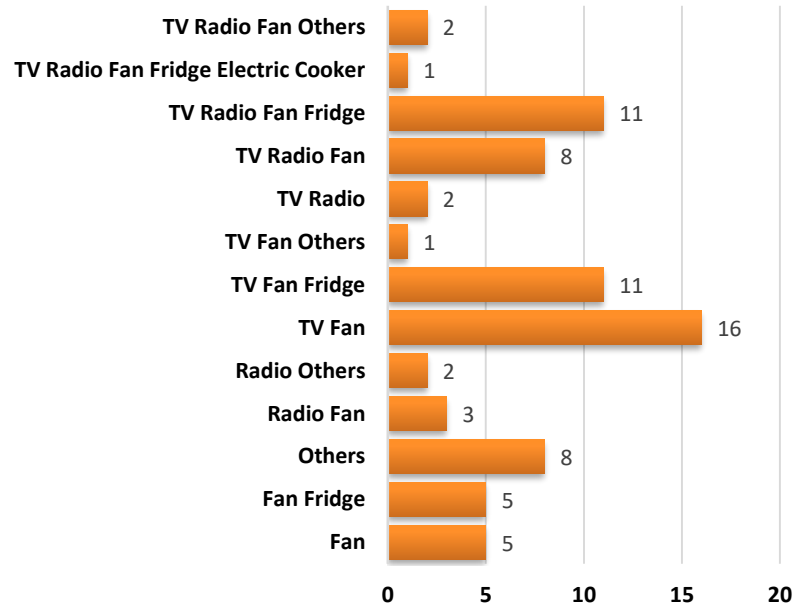
**Usage of Generators after Mini-
grid was deployed**



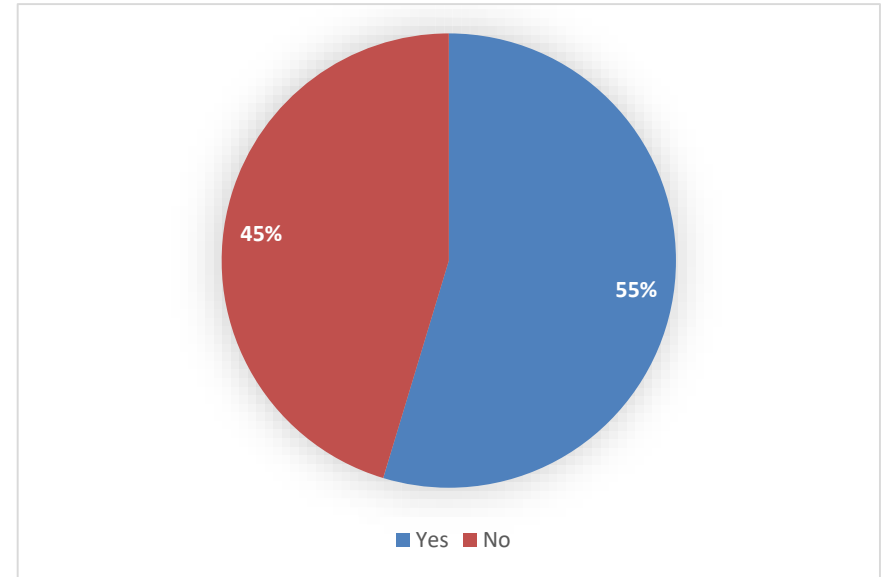
Source of Lighting before mini-grid was installed



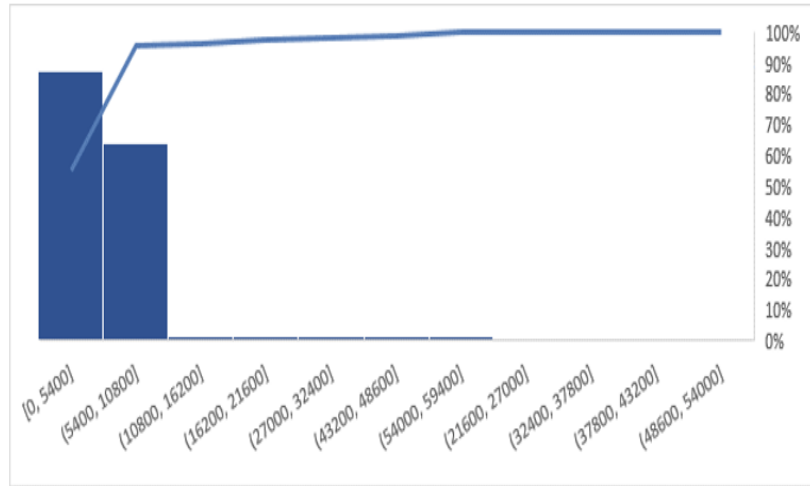
Source of Lighting after mini-grid was installed



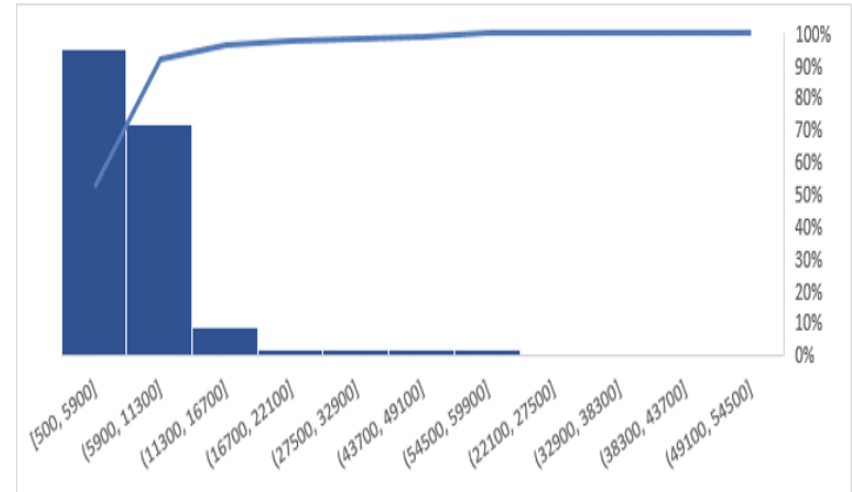
Old electrical appliances before Mini-grid



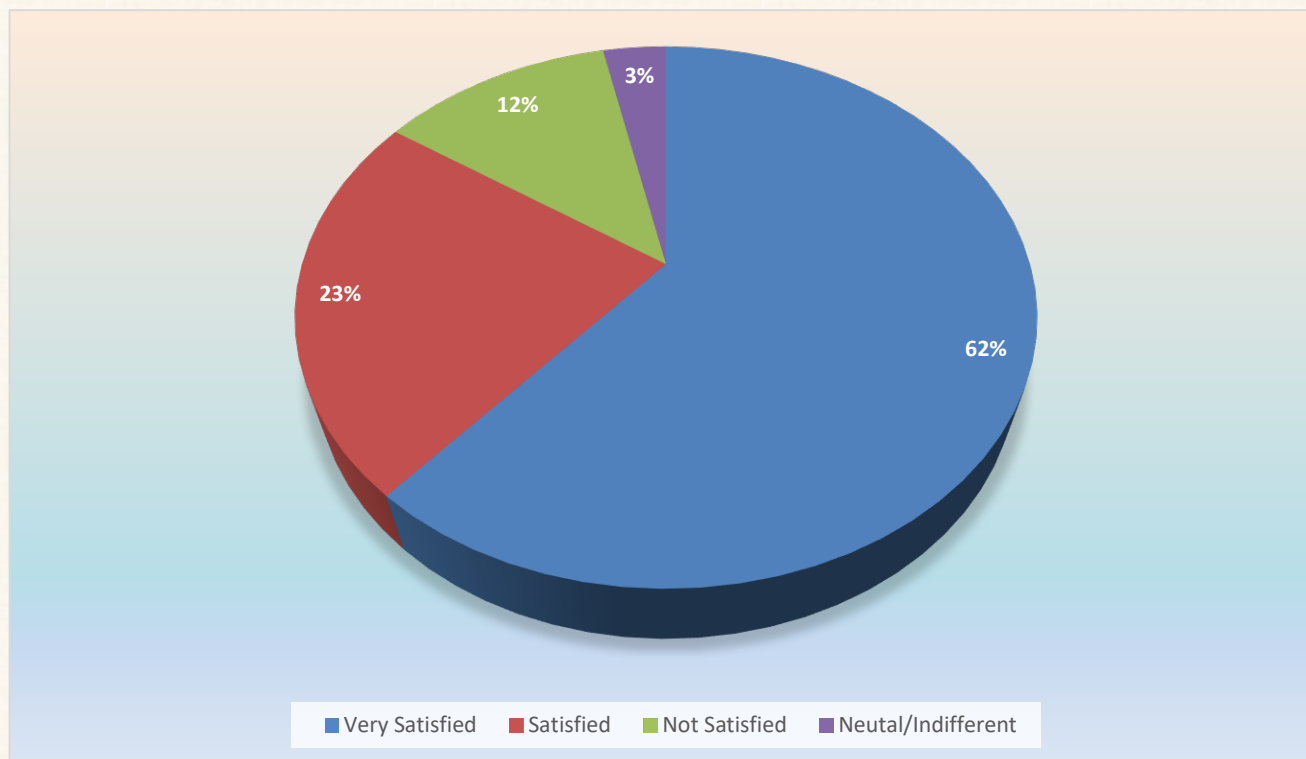
New electrical appliances after Mini-Grid was installed



Monthly Expenses in Electricity provided by Mini Grid

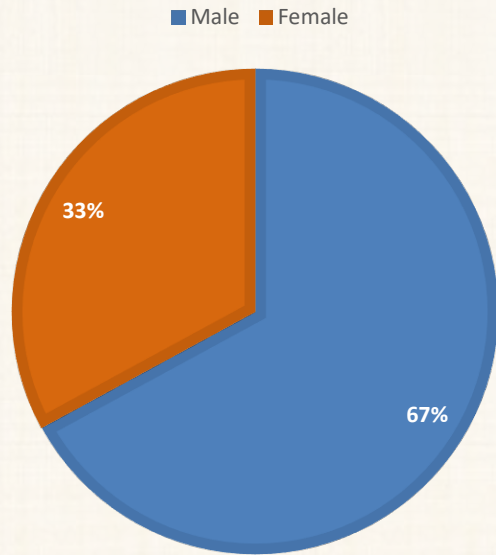


Current total Monthly Expenses on Electricity

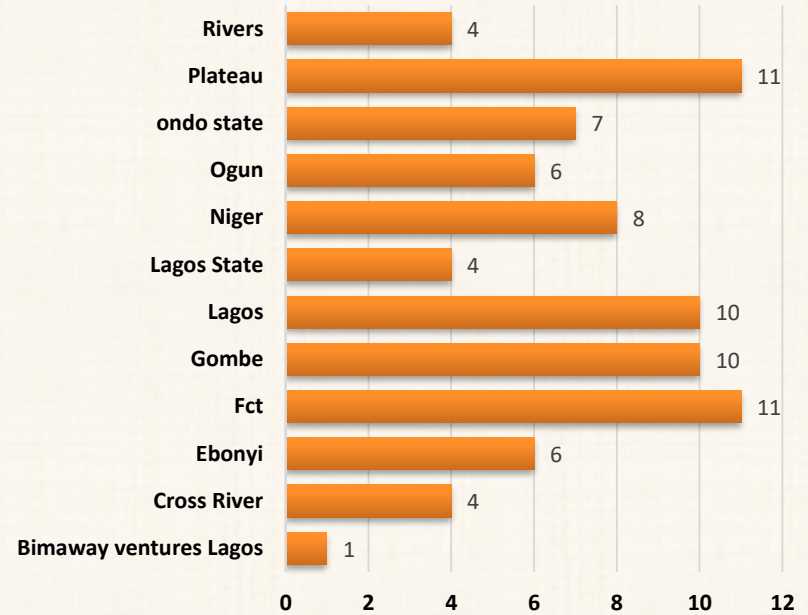


Level of satisfaction with Mini-grid supply

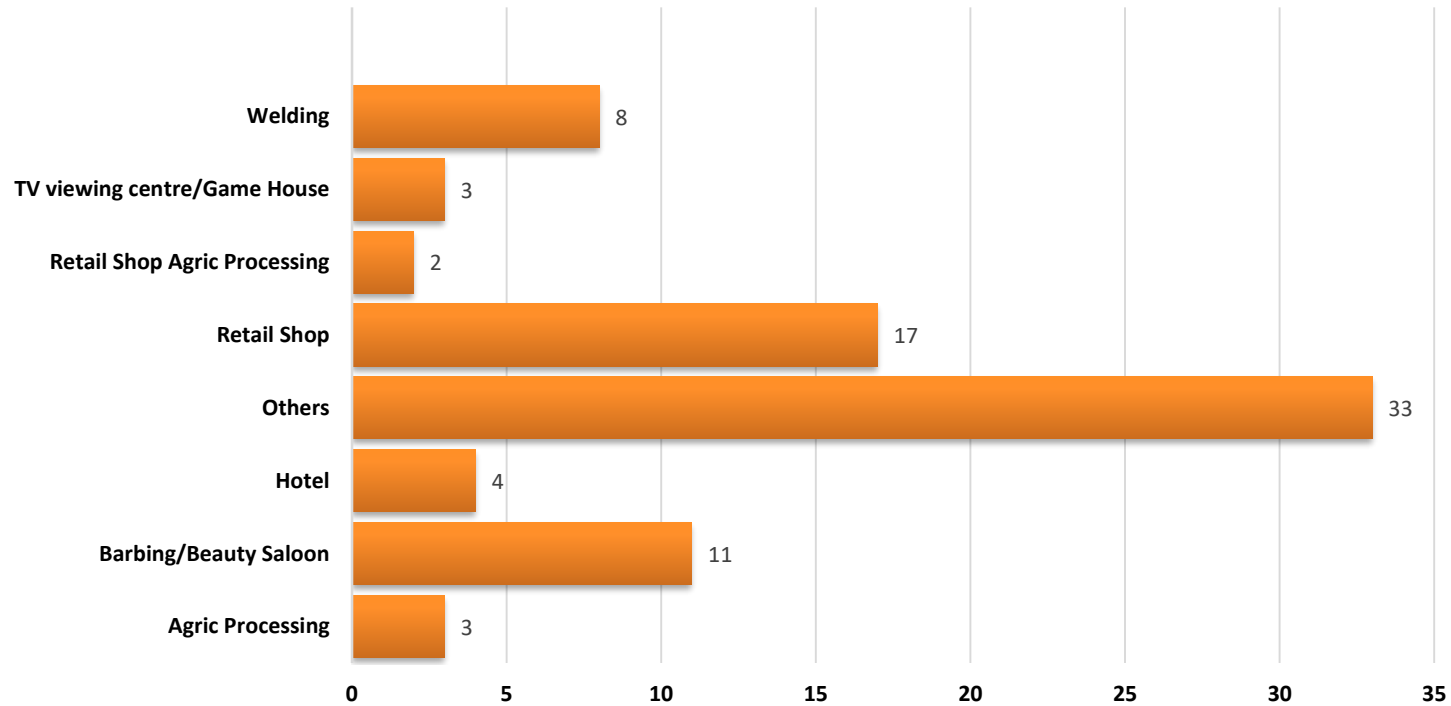
Outcome Of The Engagement With Productive Users



Gender of Customer

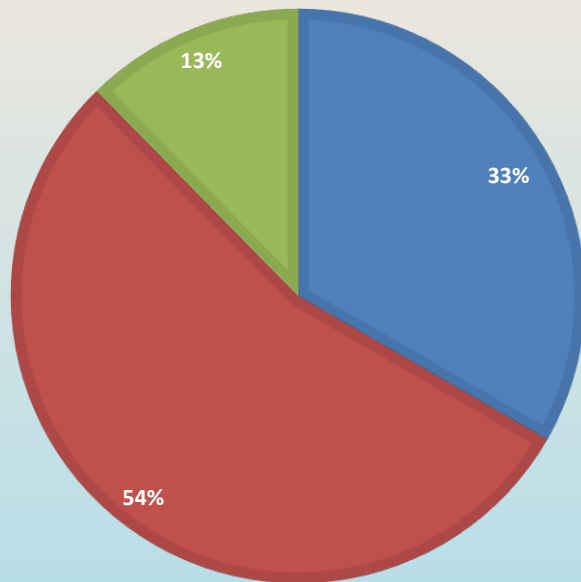


State Customer's Business is located

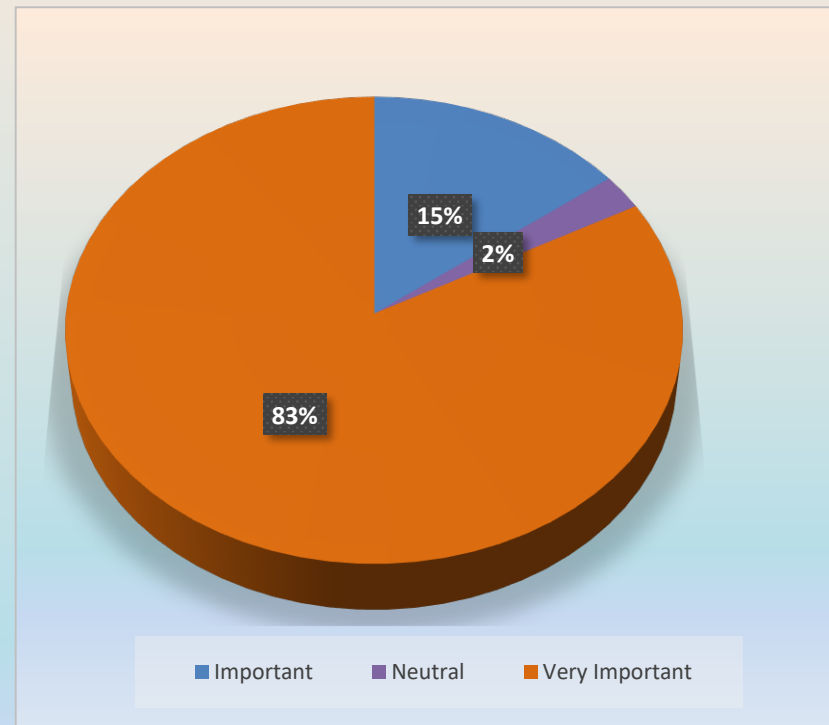


Nature of Customer's Business

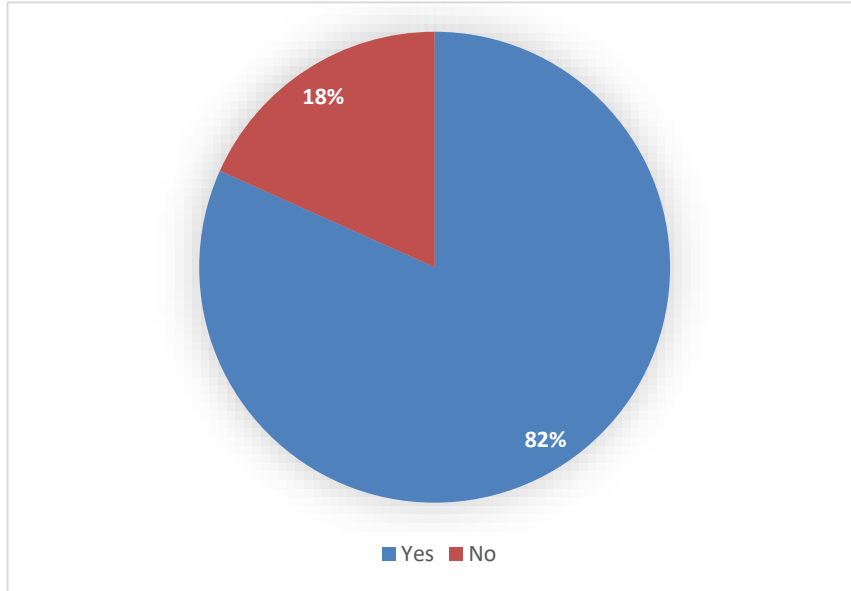
■ Women ■ Men ■ Both men and women



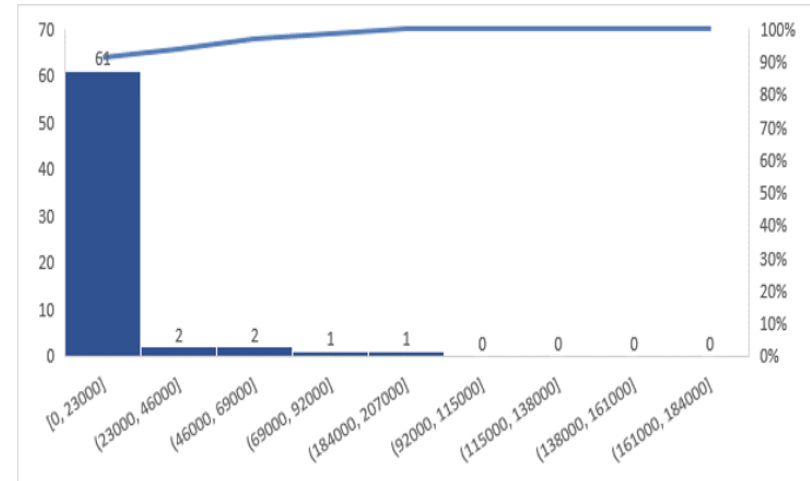
Business owned/led by gender



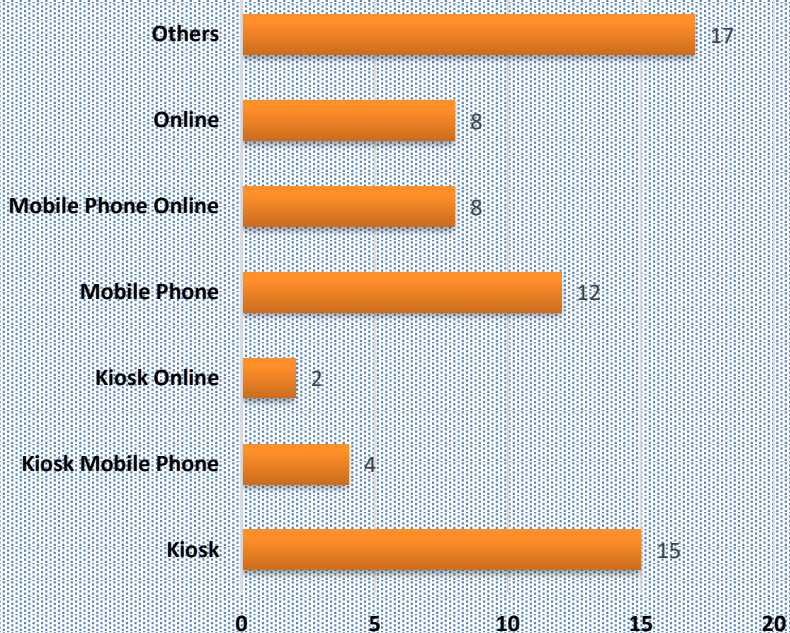
Importance of electricity for Customer's Business



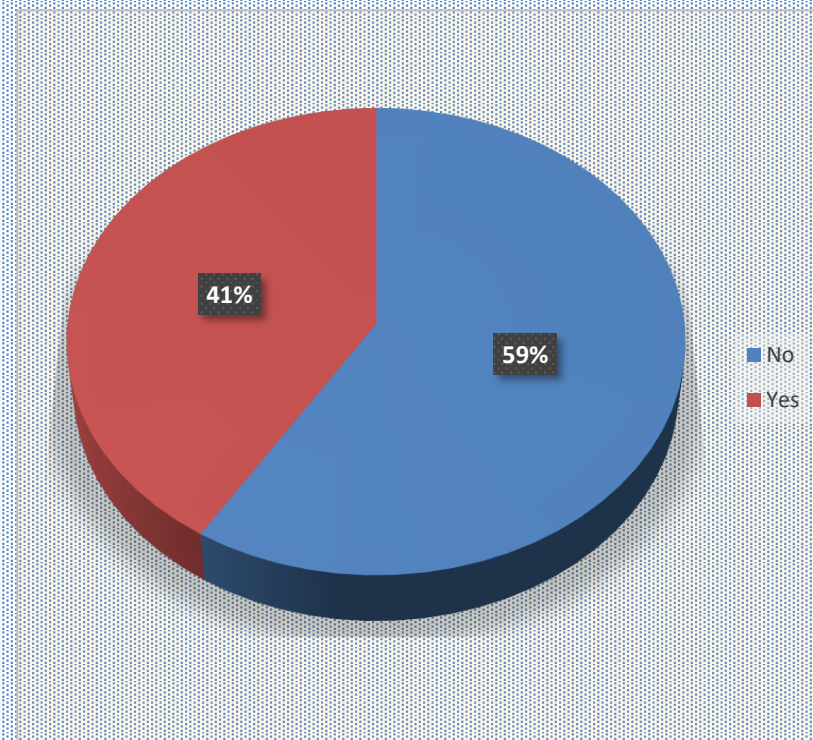
Have your business been receiving electricity from the mini-grid electricity?



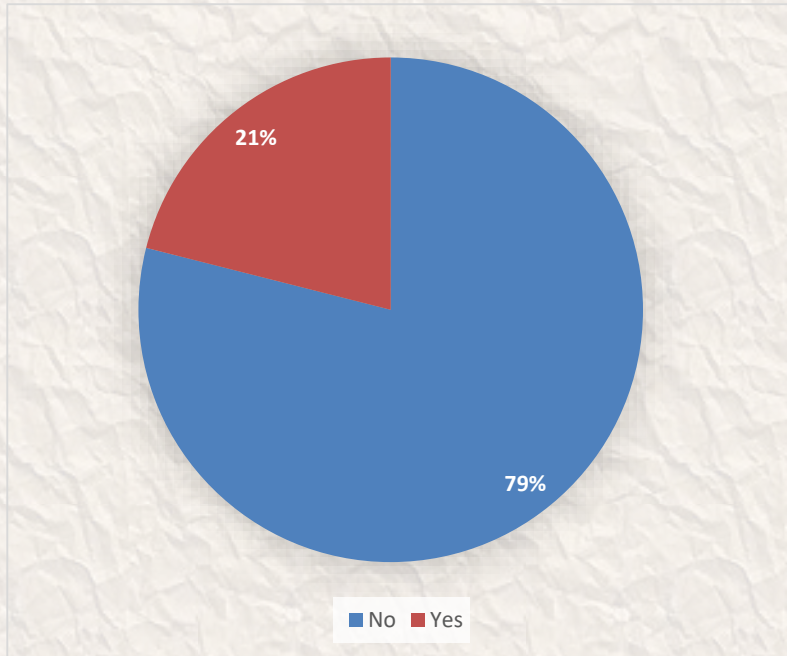
How much do you spend on the electricity provided by the mini-grid on monthly basis?



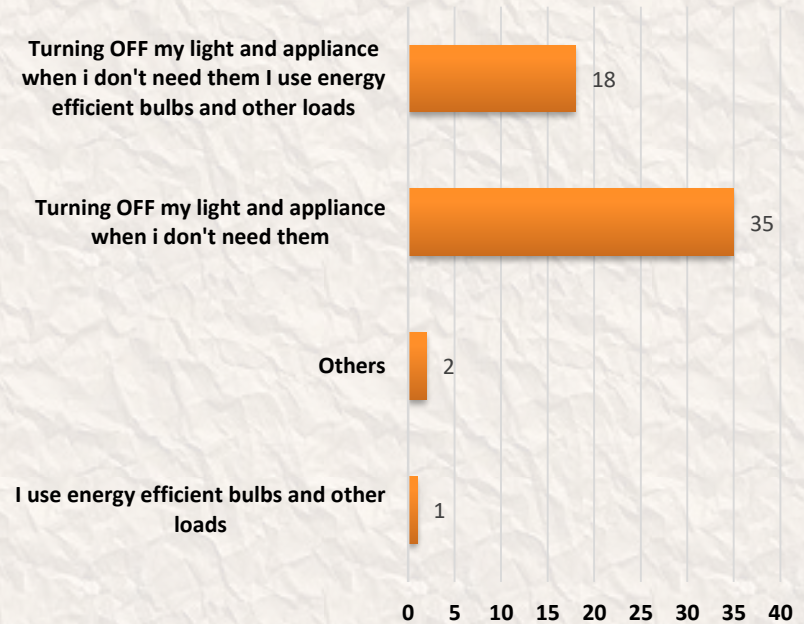
How do you purchase electricity from the mini-grid?



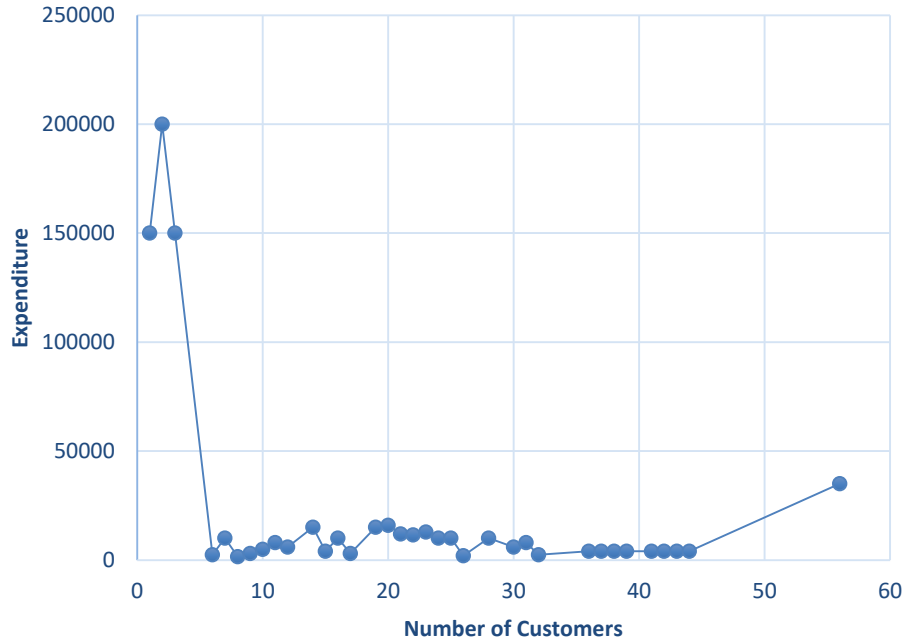
Do you still use Generator since the deployment of the mini-grid?



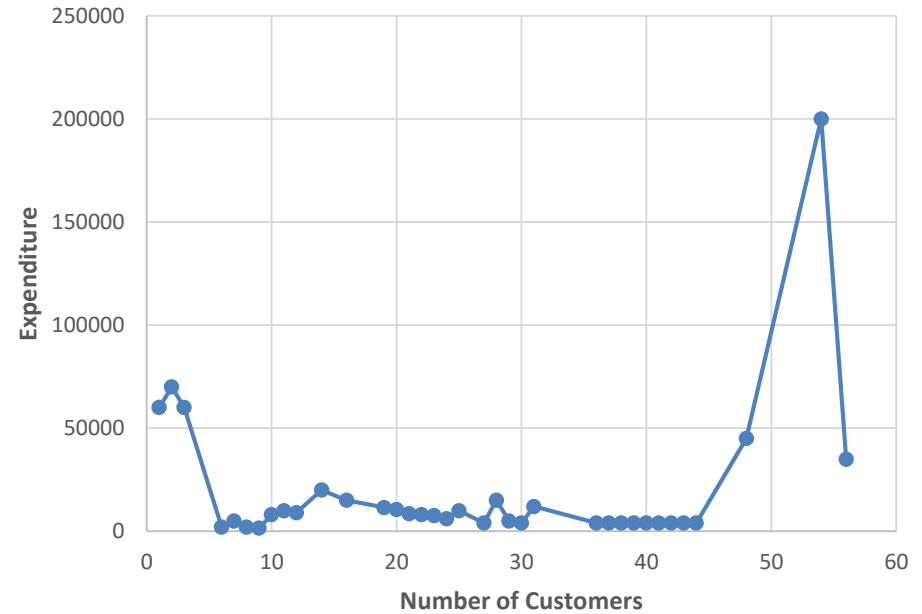
Have you purchased more electricity consuming devices after you were connected to the mini grid?



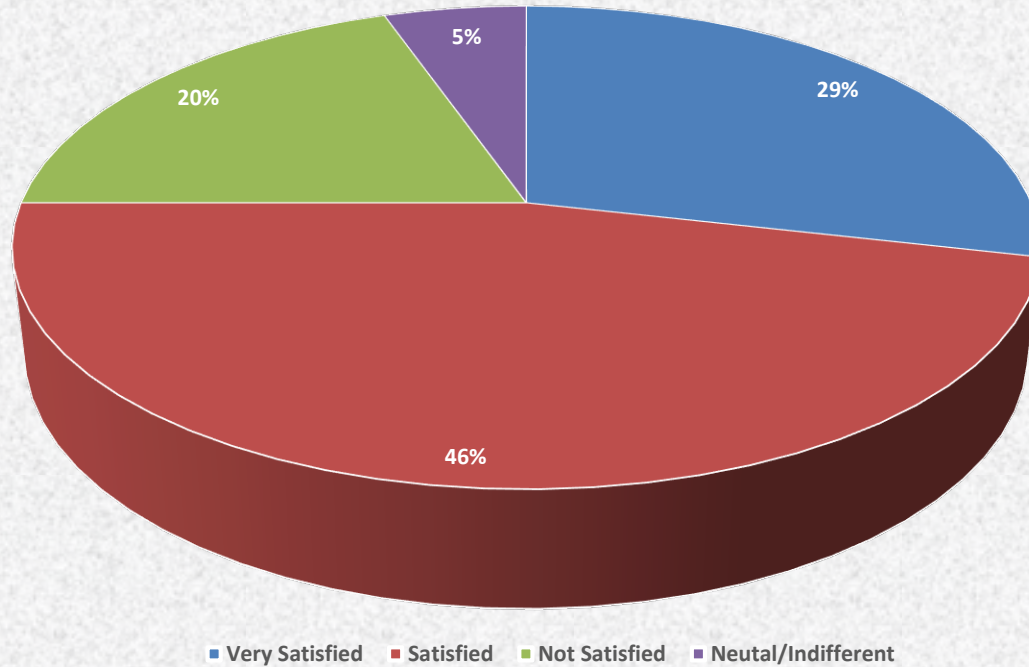
Energy conservation measures every month



Monthly expenditure on generator/fuelling + electricity from Grid before mini-grid was deployed



Monthly expenditure on generator/fuelling + electricity from the Mini-grid and main grid



Level of satisfaction with the mini-grid with respect to quality and availability of power supply from it

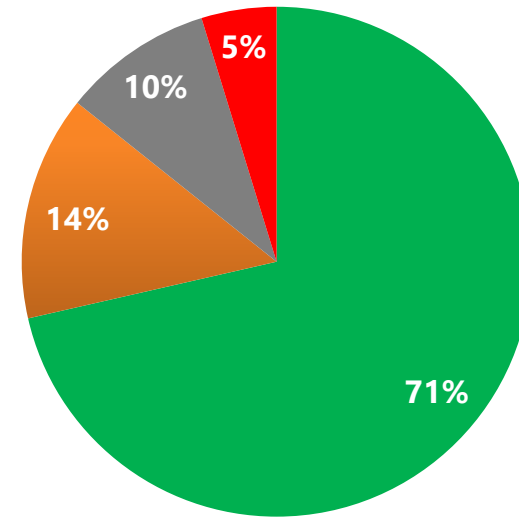
Operational status, technology utilized and technical issues with the Mini-grids

71% of the mini-grids

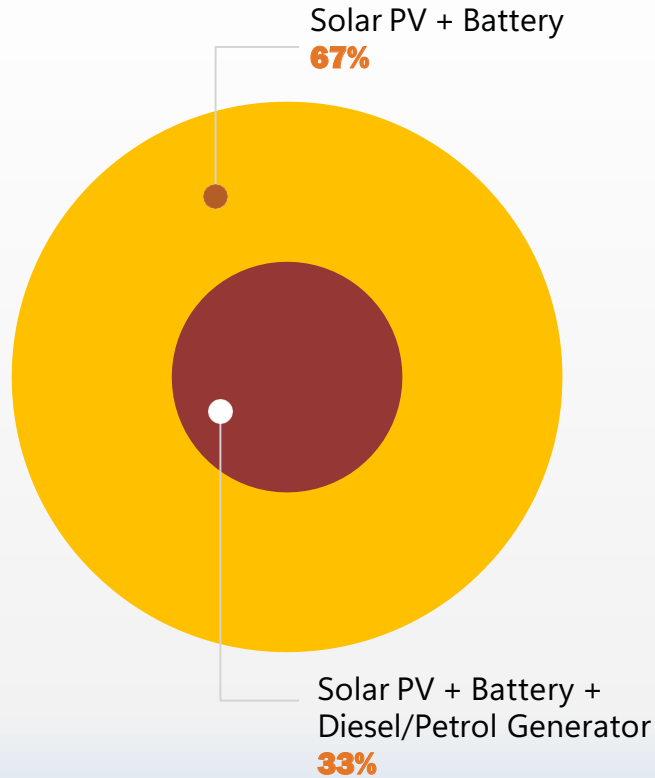
visited were fully operational with customers connected to them and are receiving electricity, while 14% were partially operational with customers connected to them, but with limited electricity being supplied from the mini-grid to connected customers owing to one form of technical fault or the other.

15% of the mini-grids

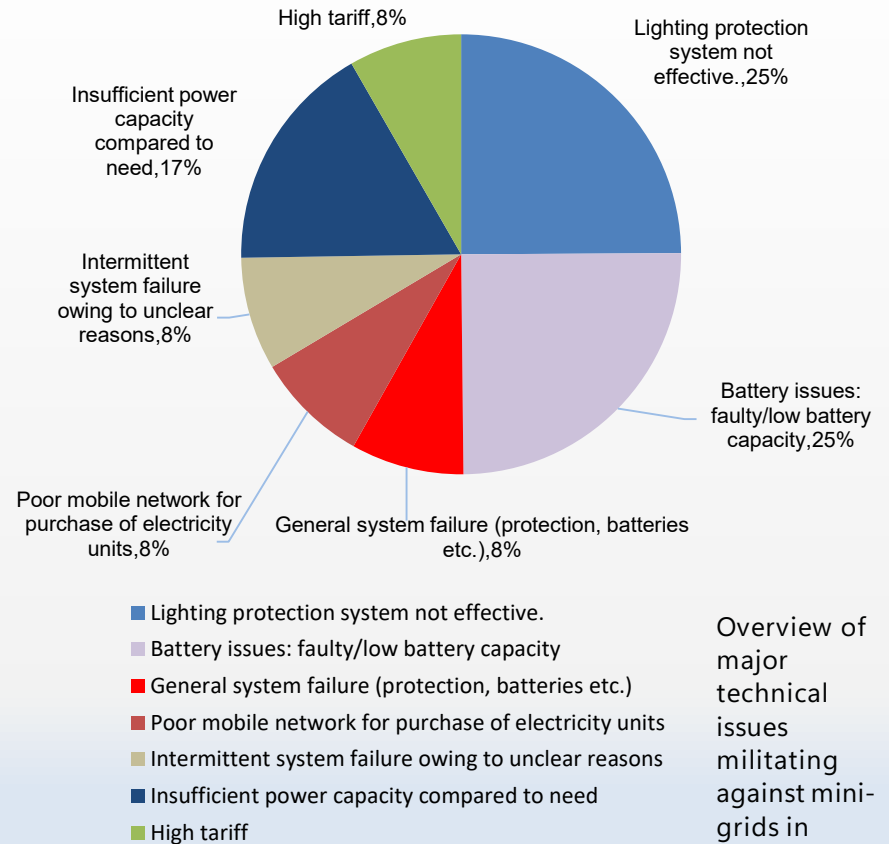
were completely not supplying power to connected customers; 10% were owing to fault and 5% was as a result of power plant being brand new and yet to be commissioned.



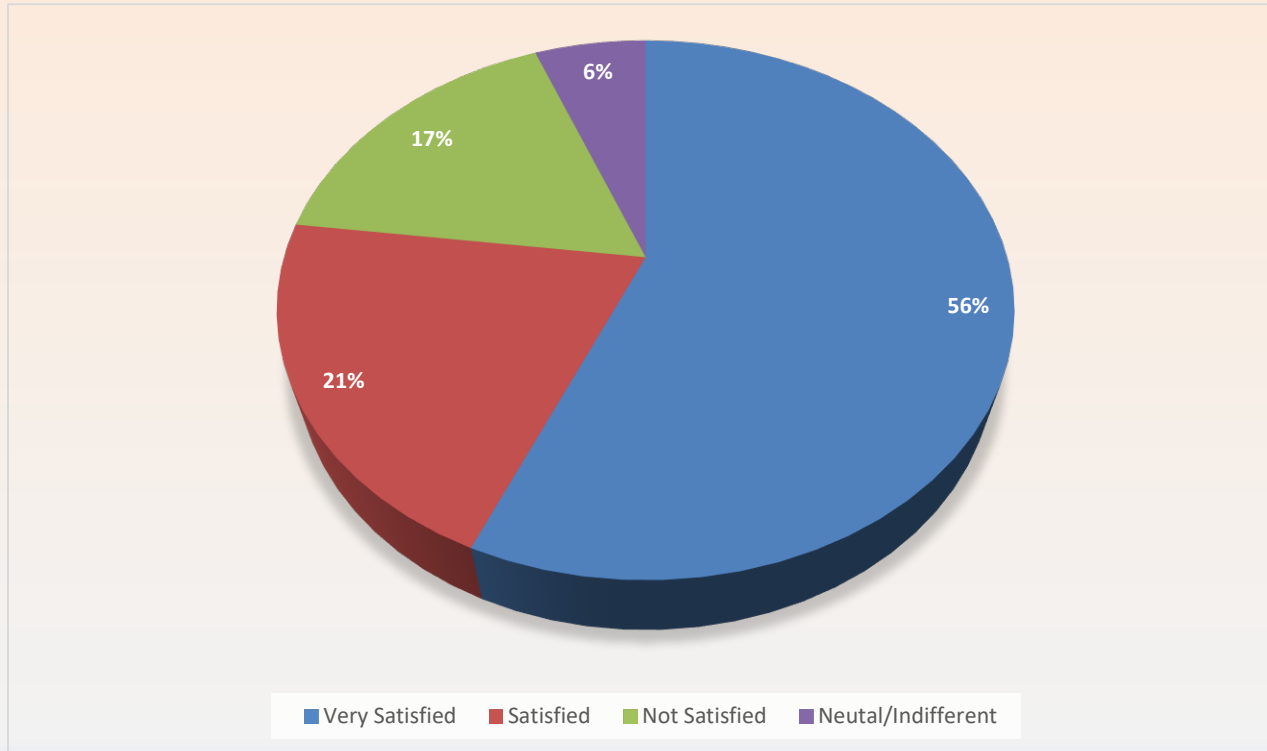
- Fully operational
- Partially operational (limited power output)
- Not operational (no power output)
- Not commissioned



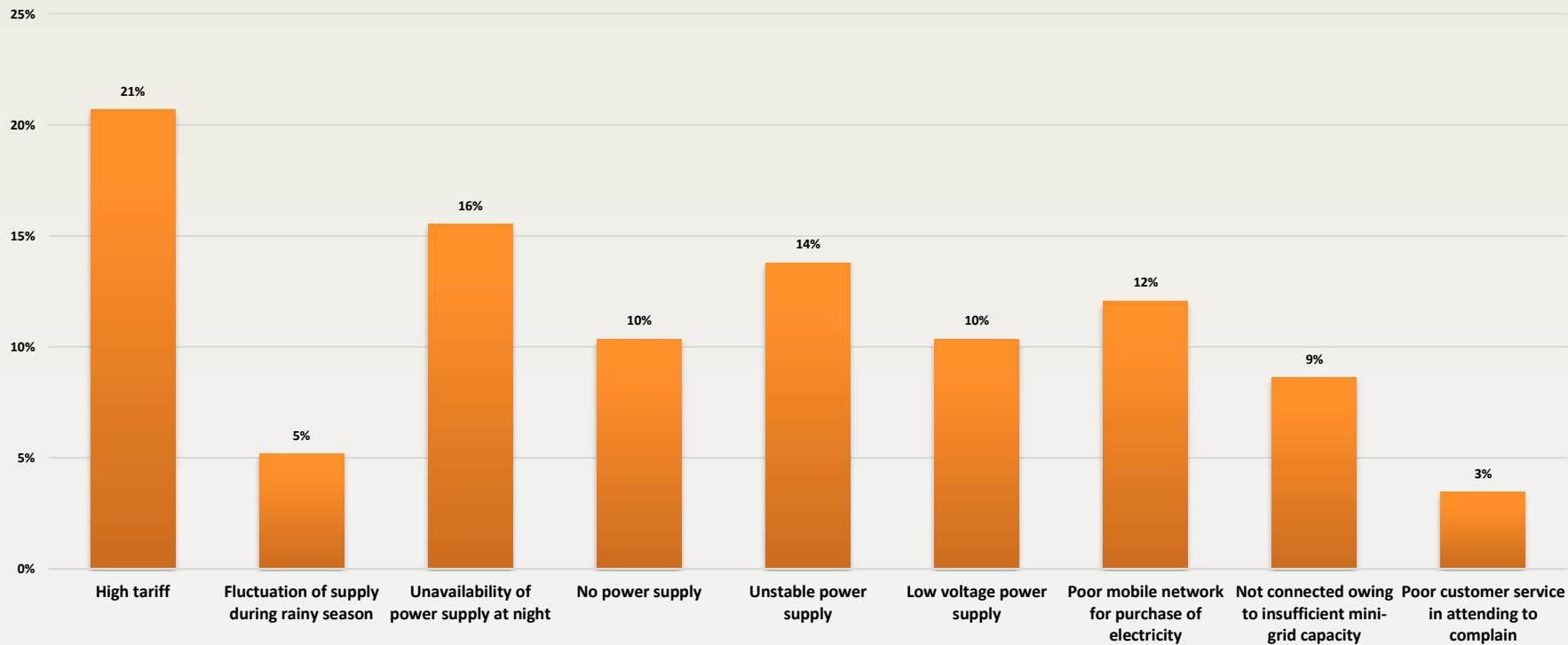
Overview of Power systems technology used across 21 mini-grid



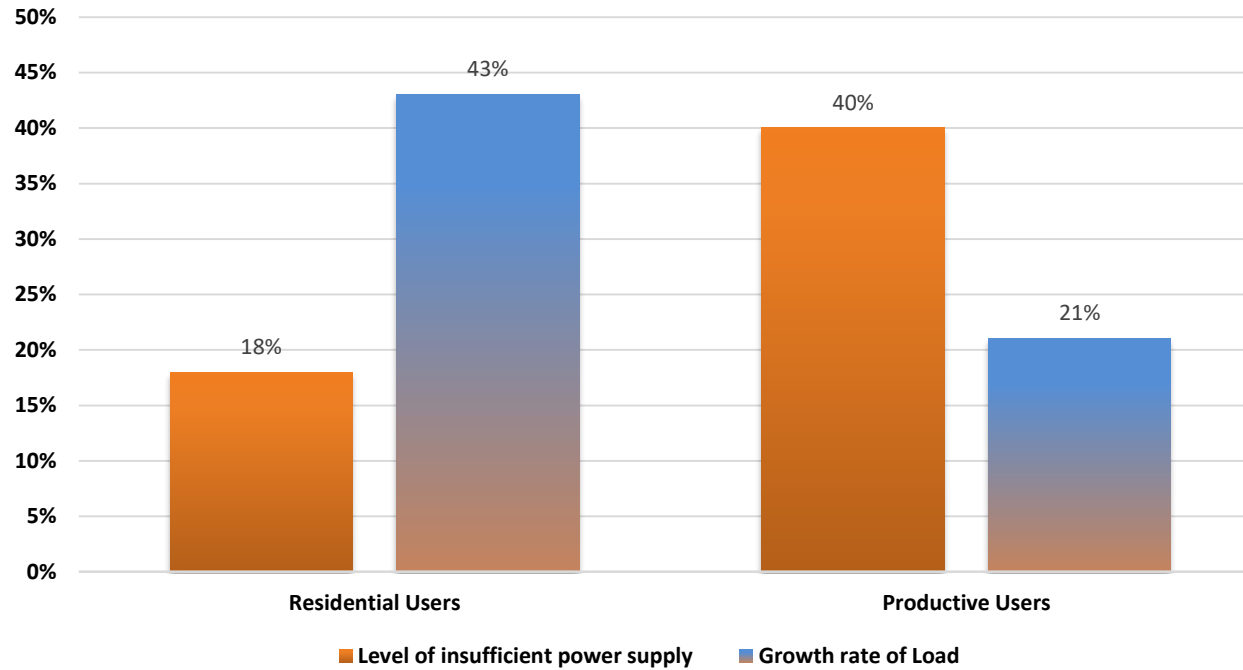
Overview of major technical issues militating against mini-grids in Nigeria



Level of satisfaction of both residential and productive users of electricity from the mini-grid

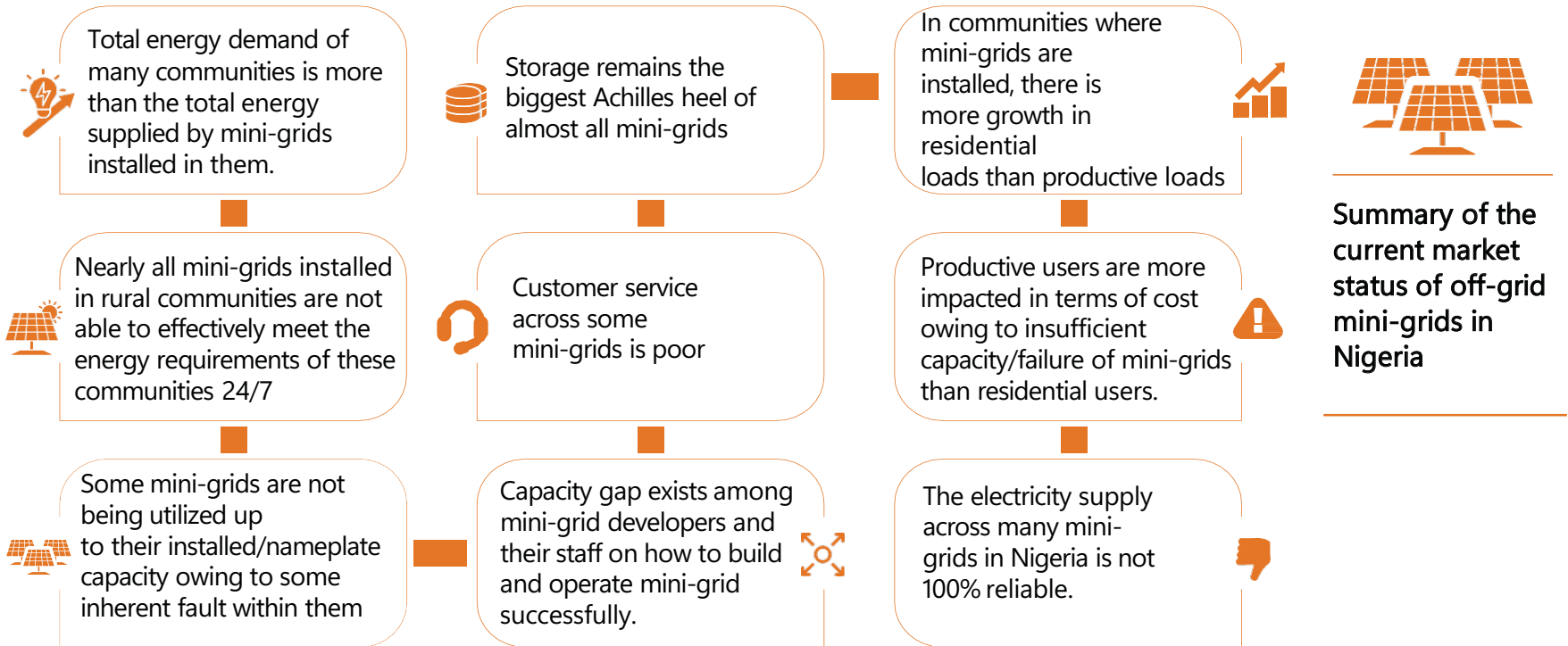


Category of complaints by mini-grid customers surveyed

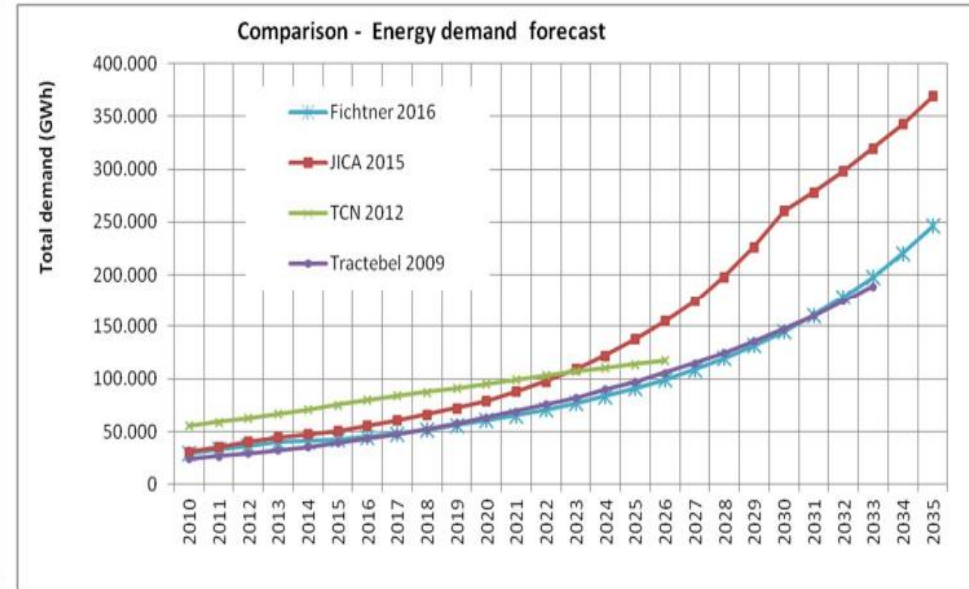
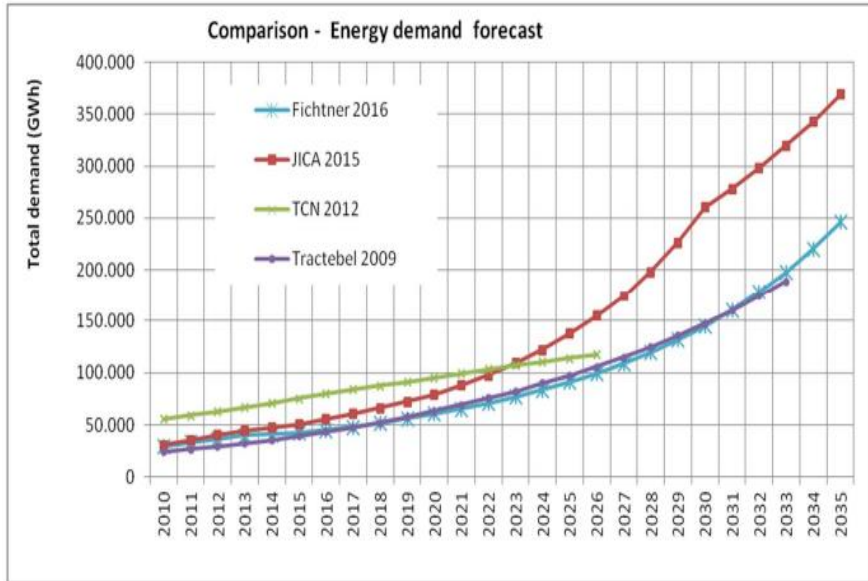


Level of insufficient power supply and growth rate of Load across Residential and productive users of electricity of mini-grid

Status Of The Current Off-grid Mini-grid Electricity Market From The Assessment



Nigeria Power (Load) Demand Forecast until 2035

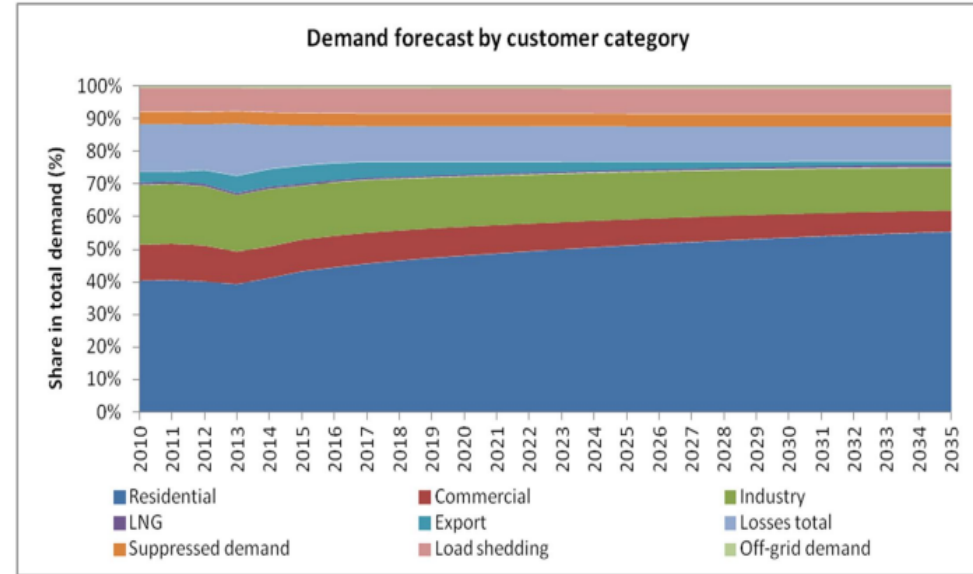


Source: Fitchner (2017), Nigeria Electricity and Gas Improvement Project: Transmission Expansion Plan Development of Power System Master Plan for the Transmission Company of Nigeria

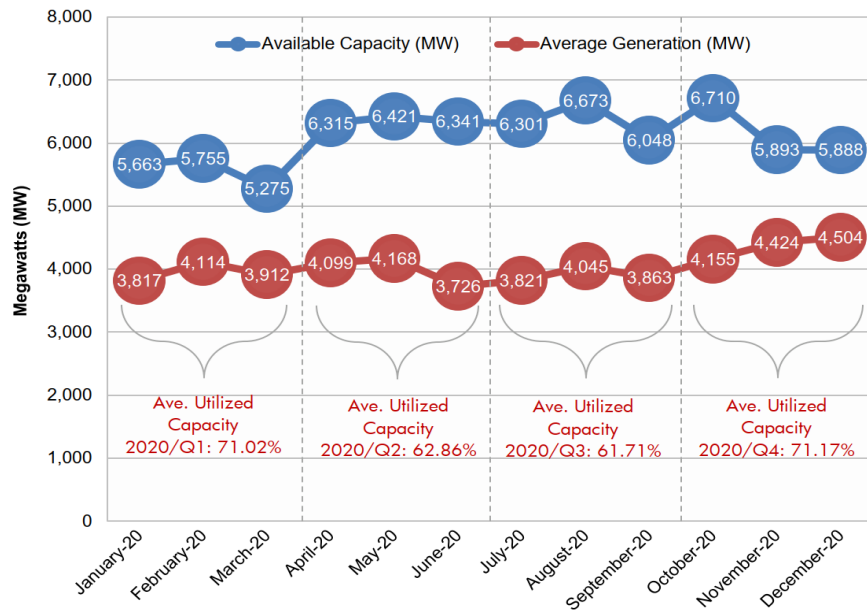
DISCO	DisCo	2020	Increase 2020-2025	2025	Increase 2025-2030	2030	Increase 2030-2035	2035
IKEDC	1-Ikeja	1250	16.08%	1451	39.57%	2025	13.66%	2302
IBEDC	2-Ibadan	1225	45.31%	1780	50.28%	2675	23.94%	3315
AEDC	3-Abuja	745	35.70%	1011	66.92%	1688	49.86%	2529
BEDC	4-Benin	1273	37.47%	1750	39.98%	2450	16.54%	2855
KAEDCO	5-Kaduna	590	78.31%	1052	93.96%	2040	21.82%	2486
JEDC	6-Jos	442	48.64%	657	86.06%	1222	10.40%	1350
EEDC	7-Enugu	1090	22.29%	1333	25.22%	1669	11.36%	1859
PHEDC	8-Port Harcourt	946	55.39%	1470	43.42%	2108	17.70%	2481
EKEDC	9-Eko	1320	25.08%	1651	35.51%	2237	13.38%	2537
KEDCO	10-Kano	705	34.04%	945	59.22%	1505	31.23%	1975
YOLA	11-Yola	309	99.03%	615	83.14%	1126	51.78%	1710
Total MW		9895	38.61%	13715	51.26%	20746	22.42%	25397
Export MW		387		1540		1831		2000
Total load MW		10282		15255		22577		27397

Forecasted Load demand per DisCo

Source:Fitchner (2017), Nigeria Electricity and Gas Improvement Project: Transmission Expansion Plan Development of Power System Master Plan for the Transmission Company of Nigeria



Power Supply Forecast And Estimated Demand-supply Gap In 2030



- The current average on-grid power supply in Nigeria hovers around 3.8GW and 4.5GW, as shown in the figure below, with installed and available capacities being 13.3GW and 6.7GW respectively.
- This means that the current on-grid supply (averagely 4GW) falls short of the demand (i.e. 10GW) by 60%; a gap of 6GW.
- This represents a total of nearly 6GW suppressed demands that is being sourced by electricity customers in Nigeria, through different forms of off-grid power arrangements.

Available Daily Generation and Available Capacity 2020/Q1-2020/Q4

Current Off-grid Electricity Market Capacity In 2020 And In 2030

Estimated Off-Grid electricity Market in
2020 = **6,000MW**

Estimated Off-Grid electricity Market in
2030 = **9,740MW**

Electricity demand
in 2020

Average On-grid
Electricity supply
in 2020

Electricity demand
in 2030

Average On-grid
electricity supply
in 2030

10,000MW

4,000MW

20,740MW

11,000MW

Constraints And Opportunities For Growth And Development Of The Off-grid Market In Nigeria

Poor economy/low income or purchasing power of off-takers of electricity

Insecurity/vandalization

Low Literacy Level

Gaps in other essential infrastructure in the state

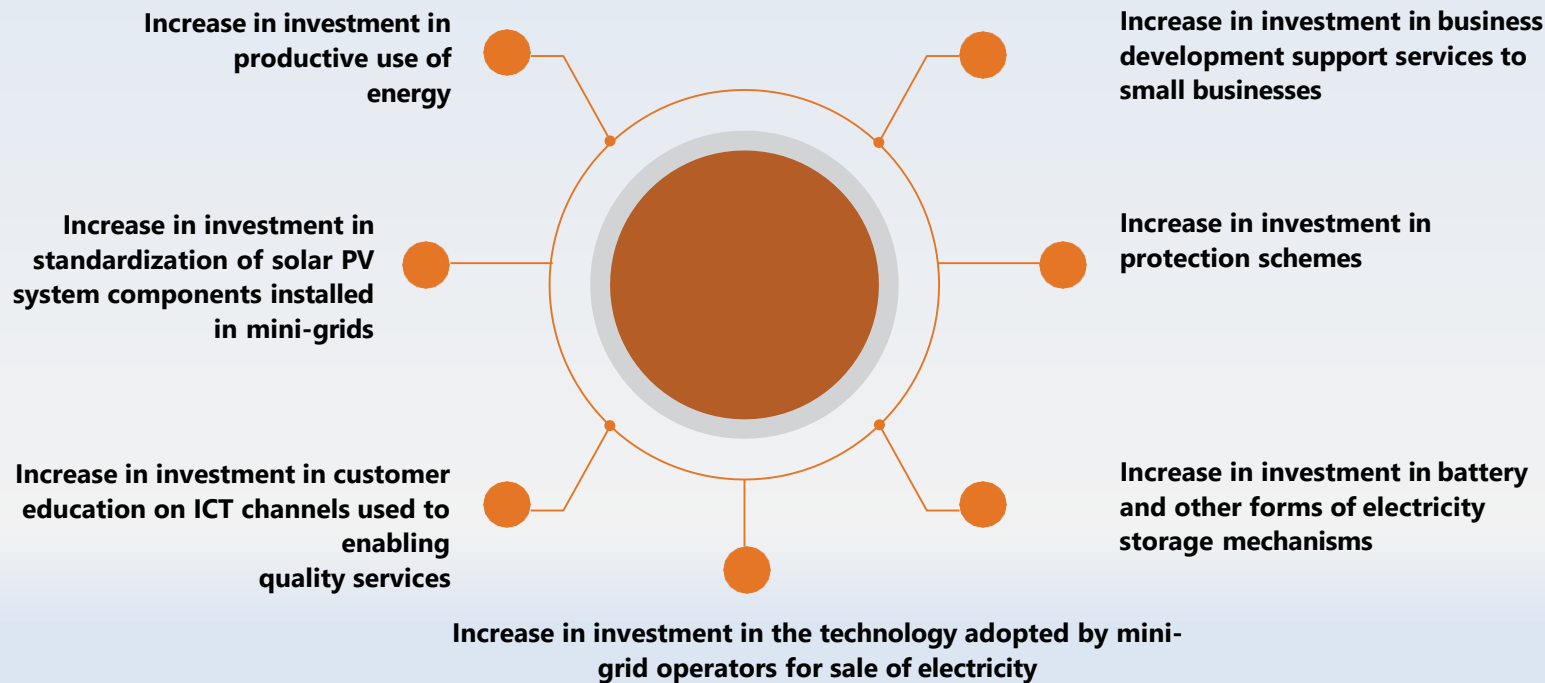
Use of substandard component in the construction of the mini-grid

Capacity building requirements

High tariff

Access to capital by small businesses

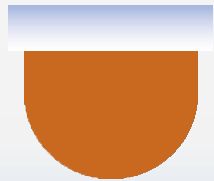
Opportunities For Expansion And Investment In The Off Grid Market In Nigeria



Policy Recommendations for Off-Grid Energy Scaling and Deployment in Nigeria



Policy Review and Harmonisation



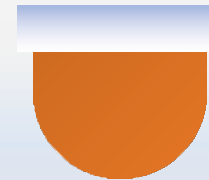
Incentives for Renewable Energy and Off-grid technology Adoption and Eliminating Investment Bottlenecks



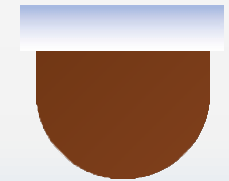
Involvement of the FGN in supporting Off-Grid Power Projects



Cross-Sectoral Policies to boost power affordability for end-users



Meeting the FGN's Climate Change Obligations



Conclusion and Recommendations

- The study shows that the electricity demand from rural communities is low. Many communities where mini-grids are installed and are needed are in rural areas, located at varying distances from the main grid and often in clusters, thus making it not economically attractive for DisCos to make the needed investment to electrify these communities.
- The interventions and investment made thus far to achieve the current level of mini-grid penetration in Nigeria by different actors is in the right direction and should be shored up. However, some aspects of the investment in these markets must be spent to obtain an in-depth understanding and address the identified obstacles militating against the smooth operations and sustainability of these mini-grids today.
- The recommended strategy to electrify these communities will remain via Decentralized Energy Systems (DES) if there is ever going to be any hope of attaining the 7th UN sustainable development goal in Nigeria.
- Another option is via the provision of a combination of Solar Home Systems (SHS), Solar Street Lights (SSL), and specific innovative energy solutions for productive usage to be used by the community on a pay-as-you-go basis, such as solar boreholes, solar refrigerator, solar dryers etc.

References

- Intellecap, Mapping the Off-grid Solar Market in Nigeria, available at <https://www.assets.signify.com/is/content/Signify/Assets/signify/global/20201105-mapping-the-off-grid-solar-market-in-nigeria-2019.pdf>
- IRENA, Energy Profile: Nigeria, available at https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Nigeria_Africa_RE_SP.pdf
- National Energy Policy 2003. Available at http://rea.gov.ng/wp-content/uploads/2017/09/National_Energy_Policy_Nigeria.pdf
- NERC Mini-Grid Regulations, 2016, available at <https://nep.nerc.gov.ng/docs/NERC%20Regulation%20For%20Mini%20Grids%202016.pdf>
- Nigerian Electricity Regulatory Commission (NERC) Quarterly Report for Q2 2021.
- Punch Nigeria, Nigeria's Off-grid solar market among fastest-growing in Africa, available at <https://punchng.com/nigerian-off-grid-solar-market-among-fastest-growing-in-africa-report/#:~:text=The%20Nigerian%20off%2Dgrid%20solar,Shell%2Dfunded%20impact%20investment%20company>.
- REA: Solar Power Naija Project <https://rea.gov.ng/solar-power-naija/>
- Renewable Energy Potential in Nigeria, available at <https://pubs.iied.org/sites/default/files/pdfs/migrate/G03512.pdf>
- Rocky Mountain Institute (RMI), 2018, available at https://pdf.usaid.gov/pdf_docs/PA00XGH7.pdf
- Rural Electrification Agency (REA), The Off-grid Opportunity in Nigeria, available at https://www.esmap.org/sites/default/files/Presentations/REA_Damilola-Off-Grid%20Opportunity_03122017_web.pdf
- Shell Foundation (2018), "Nigerian Off-Grid Market Acceleration Program: Mapping the Market."
- The Electricity and Power Sector Reform Act of 2005.
- The Electricity Act, 2023.
- The World Bank, 'Off-Grid Solar Market Trends Report' (2020).
- USAID, PA-NPSP Off-grid Market Intelligence Report, 2021, available at https://pdf.usaid.gov/pdf_docs/PA00ZB5X.pdf
- USAID, Nigeria Off-grid Energy Market Intelligence Report, April 2019, available at https://pdf.usaid.gov/pdf_docs/PA00XGH7.pdf

AllON | Nextier

