STAND-ALONE SOLAR MARKET STUDY

PRIVATE SECTOR AND INVESTOR INSIGHTS: A RAPIDLY GROWING MARKET

Nigeria

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Africa Clean Energy
Catalysing Africa's Solar Markets

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CONTENTS

List of Tables

List of Figures

1. INTRODUCTION

1.1 Nigeria's Electricity Gap Means Millions lack Basic Services

Nigeria's population is estimated at 201 million,[1] of which 77 million do not have access to any electricity source,[2] which is an essential driver of economic growth.

Nigeria's national grid will not provide universal coverage within the next decade based on current grid electrification rates, and hence a large part of the country will need off-grid solutions such as mini-grids and stand-alone solar systems to meet the country's electrification target (Figure 1).

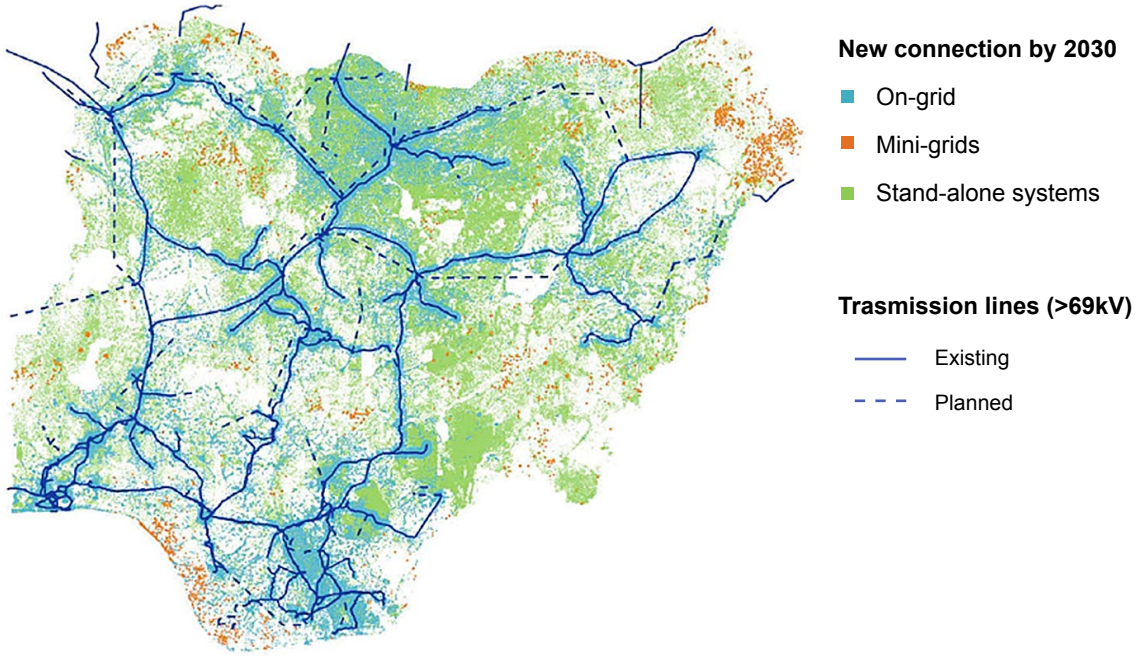

Figure 1: Nigeria Energy Outlook in 2030

Source: International Enargy Agency - Nigeria Energy Outlook

It is not only off-grid communities that need alternative solutions. Among the grid-connected population, just 25% of households and businesses receive four or more hours of power per day; an estimated 80% of them supplement unreliable electricity with costly, polluting alternatives such as kerosene, diesel or petrol generators.[3] Nigerians spend an estimated $14 billion on these power sources annually.[4]

These off-grid and underserved markets exist all over Nigeria and across economic status. Recognising this, the Government of Nigeria (GoN) has targeted reaching 5% of the population through stand-alone solar (SAS) as part of achieving 100% access by 2040. SAS products are a cost-effective, clean power source that come in sizes attractive to all income brackets and with power for most electricity needs – including income generating activities.

1. *World Bank (2018)*
2. *International Energy Agency (2020) World Energy Outlook*
3. *Power for All (2018) Research Summary: Nigeria Finance*
4. *Nairametrics (2020) Nigerians spend $14 billion on generators, fuel*

1.2 The Growth of Stand-Alone Solar (SAS) and Government Support to the Sector

The use of SAS in Nigeria has grown significantly in the last five years, as customers become more familiar with the technology and experience the benefits. In response to the growing demand, solar companies are increasing their product range, consumer financing options and expanding their distribution reach. Foreign and local investors are increasingly interested in the market opportunity which by one estimate can be up to USD 9.2 billion annually[5], and government and development partners have been ramping up their support.

The Government of Nigeria (GoN) has been promoting SAS through various initiatives of the Rural Electrification Agency (REA) such as the Nigeria Electrification Project (NEP), the Rural Electrification Fund (REF), as well as the Solar Naija programme, which plans to deploy 5 million solar connections via solar home systems (SHS) and solar mini-grids by 2023. To put the government targets in context, 303,914 quality verified[6] SAS products were sold in 2020 – a major increase from negligible sales five years earlier, but still not close to meeting off-grid and underserved-grid customers' electricity needs. According to BCG, there is the opportunity to distribute SAS solutions to an estimated 3.2 million unelectrified households through SAS solutions, but the market needs an injection of $750 million to achieve this.[7]

In 2020, the regulatory environment for the off-grid sector was further boosted.

- The GoN adopted quality standards for SAS in June 2020 and continues to work on the enforcement of those standards.
- The repeal and re-enactment of the Companies and Allied Matters Act, 1990 ('CAMA') as CAMA 2020 which eliminates requirements for companies to denominate their authorised share capital in Naira, and as such enables foreign investors to shield their capital from local inflation.
- The revised guidelines for Payment Service Banks (PSBs), should substantively enhance the availability of deposit and payment/remittance services for small businesses and low-income households despite only 3 providers having been issued a license to date, due to high minimum capital requirements of around $130 million[8].

An estimated 3.2 million unelectrified households could afford financed SAS (through pay-as-you-go – see below) but the market needs an injection of $750 million to achieve this.[9] There is a major opportunity here – although for SAS companies in Nigeria it is not without its challenges.

1.3 Market Research to Evaluate Rural Access to SAS Products

The UK-funded Africa Clean Energy Technical Assistance Facility (ACE TAF) commissioned a nationwide study to assess the extent to which vulnerable communities have access to SAS. It looked at trade and consumer segments in rural, peri-urban, and urban areas across 10 states (Abia, Ado Ekiti, Bauchi, Cross Rivers, Ebonyi, Edo, Kano, Kogi, Oyo and Plateau) in the country's six geo-political regions. This study was carried out between June and September 2020 during the covid-19 pandemic, and also assessed the impact of the pandemic on traders and end users of SAS products.

5. *Africa Clean Energy Technical Assistance Facility (2021) Stand-Alone Solar Investment Map, Nigeria*
6. *There is a glut of low-quality solar in the Nigerian market – as in all countries. This sales figure includes only SAS product that meets an international standard from Lighting Global / VeraSol. Quality SAS probably constitutes less than half the total solar market.*
7. *BCG (2020) Scale Up of Solar Home Systems: Preliminary Perspective, October 2020*
8. *ACE TAF (2021) Stand-alone Solar Investment Map – Nigeria*
9. *BCG (2020) Scale Up of Solar Home Systems: Preliminary Perspective, October 2020*
10. *Stand-alone solar (SAS) products can be grouped into 3 categories: lanterns, which are portable devices with a single light and maybe a phone charger; solar home systems (SHS), which are plug-and-play 'kits' that include solar panels, battery, multiple lights, and sometimes appliances such as a TV or fan; and solar panels, which are bought alongside other components (battery, inverter, cables, etc.) to form a system. Each has its pros and cons in terms of cost, capacity and convenience.*

The researchers interviewed traders, end users, and other stakeholders assessing how many sell or use SAS products, which products are available and preferred[10], the end-user experience and benefits, and other important aspects of the SAS market including quality, affordability, and after-sales support. The full report is available on the ACE TAF website and can be accessed here[11].

The following sections summarize key findings and recommendations on how governments can collaborate with and support the private sector and other stakeholders to ensure that SAS solutions are integrated into universal energy access plans.

1.4 Key Findings and Recommendations

1.4.1 There is a substantial untapped market opportunity for stand-alone solar companies to distribute through mainstream trade channels

Across Nigeria, SAS units found among end consumers (27 per cent) is double that in the trade (13.6 per cent). This could indicate that there is twice the demand and use of SAS products than available supply through trade channels. This discrepancy is likely due to latent demand, robust alternative (non-trade) supply channels, and a concentration of supply in a few shops in urban areas.

Solar is more commonly sold through the trade in peri-urban areas. It may be that traders in peri-urban and urban areas do not have the capacity or business appetite to carry solar to the "last mile". This is the opposite of what has been found in Kenya, Tanzania and Ethiopia, where there has been deliberate targeting of rural customers.[12]

It is three times more common to find solar in peri-urban homes than rural homes, and lesser to find SAS in urban homes (see Figure 2 below) – even as 80% of peri-urban solar owners are also connected to the main grid. It is clear that people are using solar as backup for an unreliable or expensive power supply such as gasoline or diesel generators. Nearly a third of SAS owners have generators. This may also be the result of the peri-urban population having more disposable income and nearer to sales outlets than their rural counterparts.

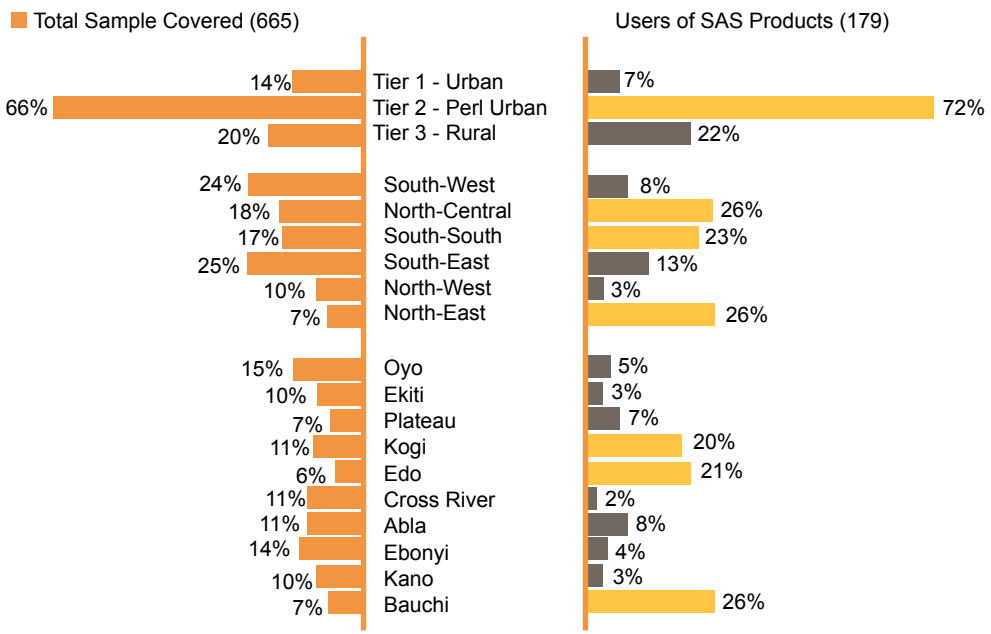

Figure 2 Profile of: SAS consumers by tier, zone and state

11. *ACE TAF (2021) Stand-Alone Off-Grid Solar Market Research – Nigeria. https://www.ace-taf.org/kb/stand-alone-off-grid-solar-market-research-nigeria-2/*
12. *Lighting Africa (2017-18) Off-Grid Solar Market Deep Dive reports (Kenya, Ethiopia & Tanzania)*

'Trade' and 'non-trade' are largely parallel markets. In Nigeria, products generally move through two types of supply chains. Products are distributed through the wholesale and retail trade, and some manufacturers move products through non-trade channels such as networks of brand agents, microfinance institutions (MFIs), franchises and other groups. Researchers found that a few brands are sold through both supply channels (e.g. d.light, and Greenlight Planet) and end-users can buy direct or source through both channels.

The practical differences in the ways SAS are reaching end-users have implications in terms of the trust between buyers and sellers; incentives (or lack thereof) to sell quality products; financing available; access to market intelligence; ability to reach vulnerable buyers; and more. Non-trade channels which have targeted sales networks tend to build better end-user relationships, stock more quality products, and provide additional services such as consumer finance and after-sales support better than trade channels, which improves end user trust. Trade channels tend to lack these or offer to a lesser degree which reduces end user trust, but then tend to have closer access to end users and market information on consumer preferences than non-trade channels.

Trade channels pose opportunities for growth. Given that SAS solutions were found in just 13.6% of shops and 62% of trade outlets not currently carrying solar expressed interest in doing so there is future potential for companies to distribute products via this channel. Quality SAS companies should explore trade channels as alternatives to complement their non-trade networks and scale the business. The industry association for example can contact trader groups and associations in target markets, and forge collaboration with credible retailers. Smaller traders may have difficulty scaling their sales without access to capital and/or credit. In addition, we found that market intelligence is not reaching non-specialist outlets such as electronics or hardware shops, particularly for higher quality products. **Electronics wholesalers present opportunities for partnerships with suppliers** since they have stronger capital bases and existing onward distribution networks.

The market opportunity may be particularly attractive in populous states that have low grid connectivity such as Bauchi and Plateau, or low solar product penetration, such as Oyo or Cross River. Refer to Table 2 for more solar penetration rates, grid connectivity percentage and population estimates by State.

Table 1: State by state comparison of SAS trade penetration, grid connectivity and population size

Zone	State	Solar trade penetration	Grid connectivity	Population estimate[13]
South West	Oyo	5.7%	67%	7,840,864
	Ekiti	13.0%	93%	3,270,798
South East	Abia	32.3%	82%	3,727,347
	Ebonyi	12.1%	39%	2,880,383
South South	Edo	11.8%	82%	4,235,595
	Plateau	13.9%	36%	4,200,442
North Central	Cross River	4.9%	57%	3,866,269
	Kogi	19.4%	63%	4,473,490
North West	Kano	17.3%	52%	13,076,892
North East	Bauchi	19.7%	29%	6,537,314
	Average	**13.6%**		

13. *World Population Review (2021) Rankings of Countries in Africa*

While solar lanterns and panels are widely available across different types of trade outlets, SHS are more often found in specialised shops dealing in electronics and hardware (Figure 3).

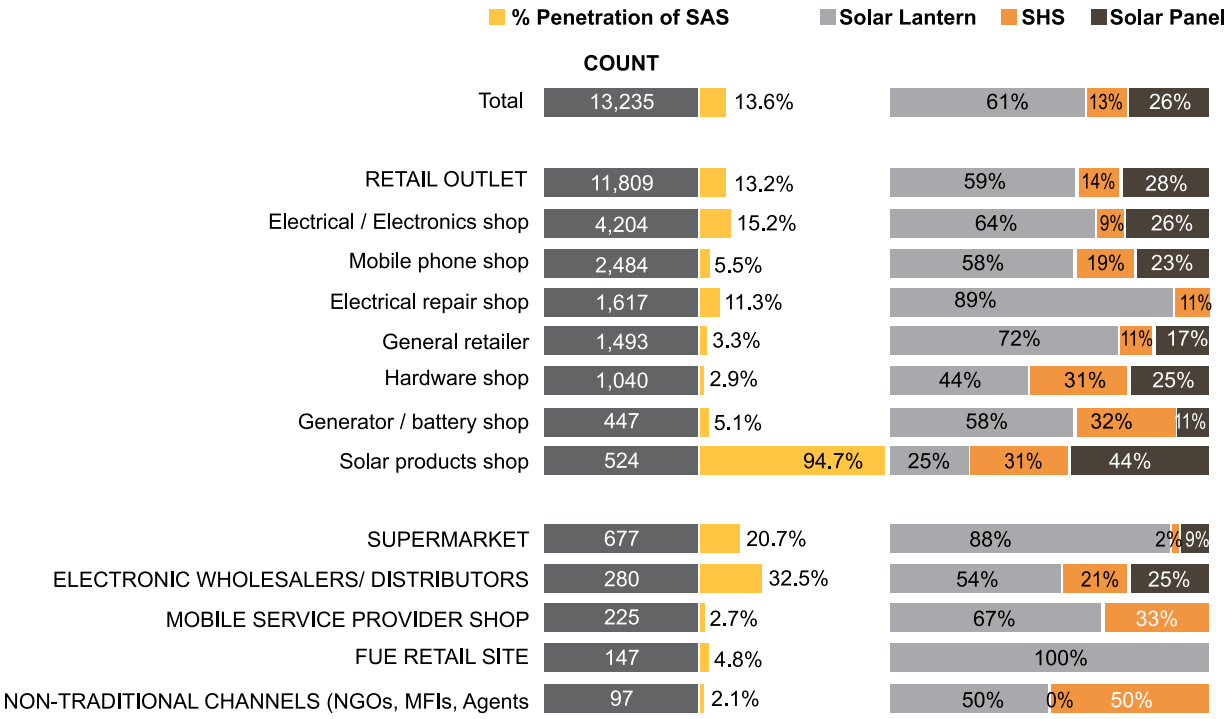

Figure 3: Types of trade outlets selling SAS

1.4.2 End user insights across Nigeria show SAS products are still predominantly a middle-income product

SAS users have slightly higher incomes than average, and many are in professional occupations. On average solar-owning households have six members living together, with two school-going children, in three-room homes. **Youth below the age of 25 had slightly higher rates of SAS usage than other age brackets, pointing to the appeal of SAS among the younger generation.**

The SHS market remains largely untapped. Just 2% of surveyed households have an SHS product, compared to 12% lanterns and 15% panels. Users with more than one product typically have a lantern and a larger capacity panel. Two thirds of households use their SAS product for purposes other than lighting – primarily phone charging, TV, and radio. Productive solar appliances[14] are still nascent, with less than 5% penetration at the trade level, and less than 2% usage at consumer level.

Forty-seven percent (**47%) of MSMEs had a SAS product on the premises, predominantly panel-based systems, with a higher prevalence in peri-urban areas**. Ninety-seven percent of MSMEs that owned solar panels bought them from trade outlets and 100% of MSMEs with SHS bought them from brand agents. Notably, **MSME SAS owners are using solar panels at higher rates than generators – an indication that solar may to some extent be replacing fuel power**.

Overall, the solar panel category has the highest product sales, followed by solar lanterns (with 170 unique brands found in stock), and SHS the least as shown in Figure 4 below. Popularity with the solar panel category - which consist of component-based systems designed to meet varying energy demands - highlights higher and varying energy needs of end users. It is possible that SHS systems may have increased consumer preference if they were more available in the trade channel than their current speciality status seeing as they meet the mid-range energy demand of end users.

14. Appliances with income generating potential.

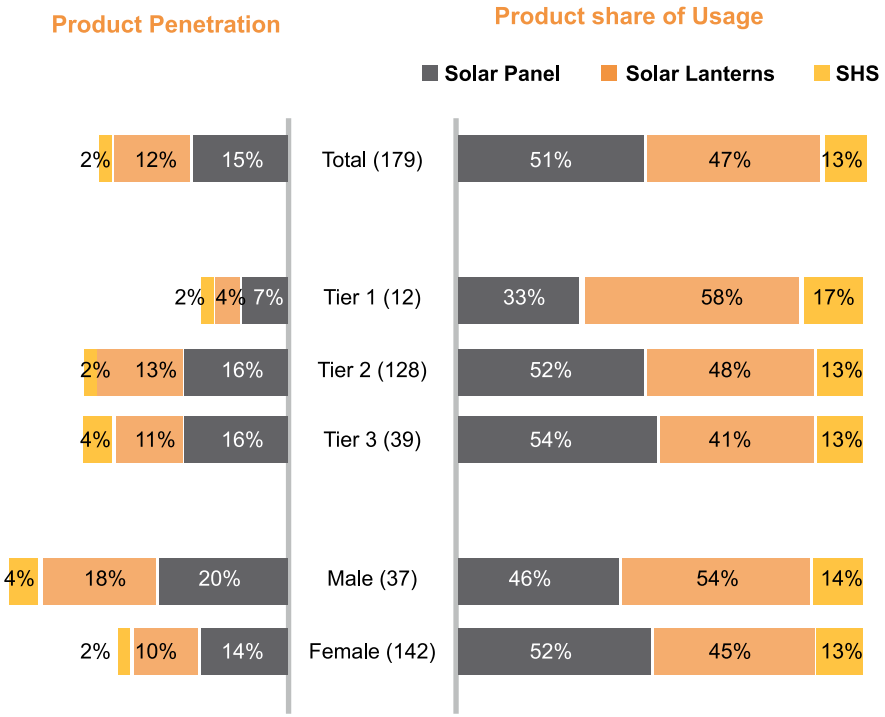

Figure 4: Relative popularity of different SAS categories

When end users decide to purchase SAS products, traders see their SAS product choices as driven by safety and accessibility. Households and MSMEs interviewed gave a range of priorities, shown in Figure 5.

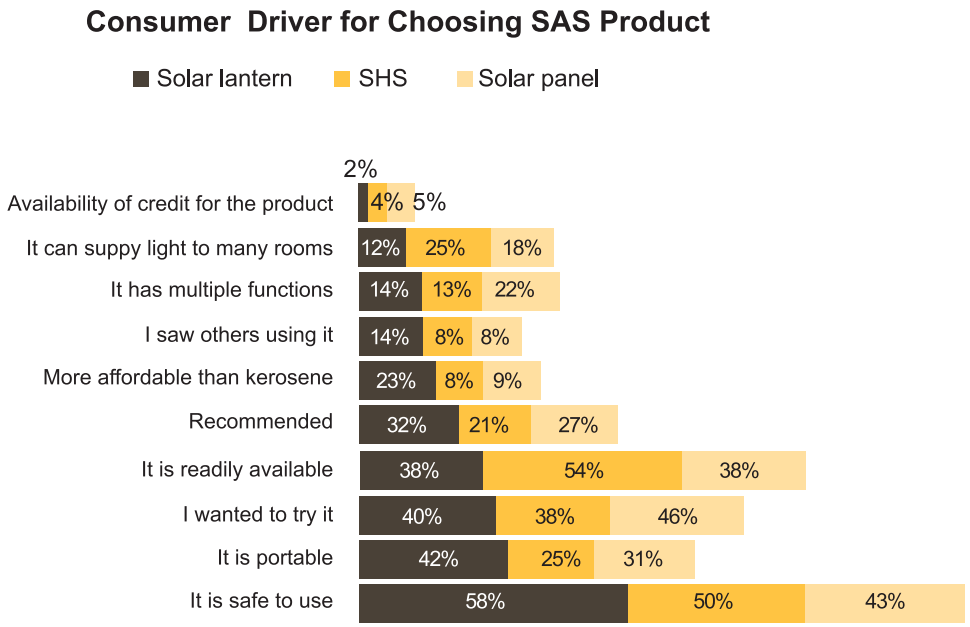

Figure 5: Consumer priorities in buying SAS

1.4.3 Cost remains a barrier for traders and customers alike. Credit constraints along the supply chain present a major limitation on the solar market in the country

In Nigeria, the trade in SAS is conducted almost exclusively in cash, not credit. International brands, many of which offer PAYG, account for 93% of the estimated $227 million invested in the SAS market.[15] However, the majority of mainstream traders' self-finance their businesses or raise funds through friends and family. Only 4% have received formal financing, mainly through MFIs and SACCOs and of the remaining 96%, one third are not aware of loan facilities available. Only 17% have received credit from their suppliers.

Among the 4% of traders that were able to secure a loan, o**ver 80% were micro-borrowers of between 50,000 - 1,000,000 NGN**. Repayment periods varied depending on the loan amount, with smaller loans due within 2 years, while medium and large loans repaid over 5 years. Only 5% of loans allowed for more than 5 years for repayment. All formal lenders require collateral, which is usually a title deed or product inventory.

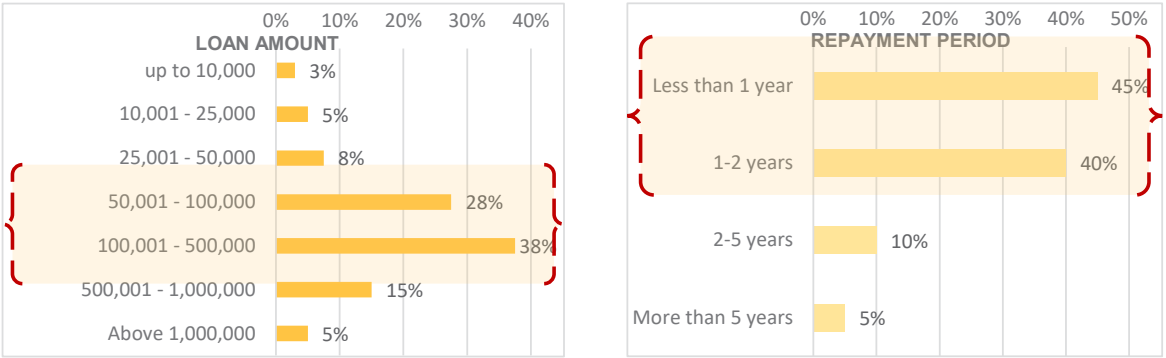

Figure 6: Borrowing by SAS traders

SAS customers are mostly paying cash up front and just 5% have been given credit from the shop where they bought the products. However, 24% of traders reported offering credit to select customers. When available, consumer financing is via PAYG or MFIs which supply solar finance directly to their customers. It appears that customers are unlikely to obtain a micro-loan and take the borrowed money to a trade outlet to purchase a solar product. There is an opportunity for solar companies to explore alternative consumer financing models to increase SAS product sales. This includes both digital and traditional cash-based models that are based on consumer preferences. Figure 8 summarizes how different solar products are being financed.

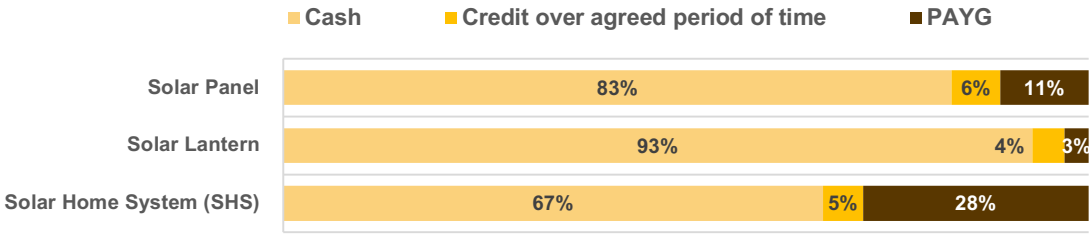

Figure 7: Payment methods for SAS consumers

15. *ACE TAF (2020) Nigeria Stand-alone Solar Investment Map*

MFIs that are in partnership with solar companies sell their solar products to individuals or organised groups such as SACCOs, out of branches predominantly in larger cities. At LAPO Microfinance, for example, s**olar loans are typically given at 6, 9 or 12-month terms** depending on the cost of the product, **charging interest of 3.2% monthly plus a 10% processing fee/deposit** and insurance in case of default or breakage.

1.4.4 Deep retail networks and latent demand signal significant investment opportunity in trade.

Investors typically fund solar companies working through non-trade channels, as they may be better capitalized than trade counterparts, and offer long-term consumer data and up-selling opportunities. Significant market opportunity however exists in trade channels who have established retail networks and are closer to consumers. S**ome traders, particularly distributors, possess an under-utilised, high-potential opportunity for the private sector to scale with proper structure and financing**. Development partners could provide capacity building support to improve local trade channel companies structure and make them better positioned for loans and relevant financing instruments, as well as integrating quality SAS products in their product delivery.

MFIs are currently more active financiers in the trade channels providing both consumer and supply finance, though on a lesser level with the latter. Typically, MFIs have more experience and understanding of trade channels than mainstream investors and partnerships. Partnerships between both through blended finance models could be an avenue towards providing increased financing for traders. Already some solar companies are in formal partnerships with MFIs as distribution and consumer financing partners. Investors can also get to benefit from the consumer financing provided by MFIs to consumers, increasing the viability of their investments particularly for quality-verified products.

1.4.5 A glut of poor product quality and minimal after-sales service offerings may undermine the customer experience

Lighting Global quality verified (QV)[16] lantern brands comprise a quarter of the brands in the market and are carried by half of traders; with penetration of QV SHS at 60% on par with Kenya. That said, major variations in price for what appear to be the same product (particularly among lanterns) point to a high likelihood of counterfeiting.[17]

The market appears to be flooded with sub-standard products. Compounding the concerns of finding a high percentage of non-verified products in the market, 64 per cent of traders have the impression that there is a moderate to high presence of counterfeits in the market, mainly in urban areas and in the high-volume North-West and North-East zones of Nigeria. In addition, less than half of traders, and just 12% of SAS customers, say they can identify a quality product.

Understanding of product quality is poor among traders and end users, with a product perceived as a quality product based on certain parameters such as having a warranty, instruction manual, or by pricing – more expensive products deemed as higher quality. Yet, under 10% of customers reported getting a warranty. Nearly half (44%) of traders have no knowledge of any quality certification for SAS products and of those who did, 40% mentioned the ISO standard, 10% IEC and 11% Lighting Global.

The prevalence of poor-quality products poses a challenge to solar companies due to their lower cost and high prevalence in the market. Ultimately, this negatively impacts consumer confidence in SAS products due to the negative experience using poor quality products. The private sector through the industry association, donor programmes, and NGOs need to increase advocacy and create more awareness in recognising quality SAS

16. *In July 2020, Lighting Global Quality Standards transitioned to global IEC Standards and have been adopted as mandatory national standards in Nigeria.*
17. *It is likely that the pervasiveness of counterfeits, and their indistinguishability from quality brand products, skews the data toward an over-reporting of QV in the market. The exclusion of some popular brands from QV status due to lack of testing (as opposed to lack of quality), potentially skews the data toward an under-reporting of quality product in the market.*

products, as well as self-regulation to increase the distribution of quality products into trade channels. Government organisations including the Standards Organisation of Nigeria, Rural Electrification Agency, Federal Competition and Consumer Protection Commission, Ministry of Information and Culture, National Orientation Agency also have a role to play in public sensitisation and quality standard enforcement.

Just 25% of solar traders offer installation, maintenance or repair services – and most are in urban areas, far from their customers. **Electrical technicians operating from their own premises are responsible for most of the installation and repair in the market**, and most are self-taught or have learned their trade through apprenticeship. **Just 21 per cent have formal training in SAS solutions**. Apprenticeship and on-the-job experience, of course, are legitimate ways of learning a skill, and are likely also the way most TV, refrigerator, mobile phone, or generator technicians learned their trades, however, in interviews some report a lack of appropriate tools and insufficient training on solar products.

1.4.6 Trade channels offer an under-utilised, high-potential opportunity for the private sector to scale SAS product delivery

Trade channels are usually the first point of call for consumers looking to purchase solar products. Their robust retail network, experience with different SAS brands, and knowledge of consumer product preference provide opportunities that can be leveraged by solar suppliers to scale SAS product distribution. Consumers will buy what is readily available in retail shops considering their preference and budget, and will typically take recommendation from traders. Exploring opportunities with trade channels has benefits for the suppliers to increase sales, and benefits the trade channels by improving product quality, technical skills, and investment.

Brand owners and SAS companies should explore partnerships with larger traders and distributors -

- The industry association such as the Renewable Energy Association of Nigeria (REAN) can facilitate engagements with counterpart trader associations across the country.
- An identified apex national trade association that can provide localised advice to brand owners on franchising and brand placement opportunities.
- Market development organisations and geospatial data providers can provide granular trade data to help REAN members identify target expansion opportunities.
- Donor partners and multilateral finance institutions could design results-based financing (RBF) or other grant funding tools that specifically incentivises development of trade relationships alongside targeted technical assistance programmes to improve awareness of quality or investor readiness support.

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