Impact Assessment of VAT and Import Duty Exemptions for Stand-Alone Solar in Nigeria

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Africa Clean Energy
Catalysing Africa's Solar Markets

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Africa Clean Energy Technical Assistance Facility

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ABBREVIATIONS AND ACRONYMS

Acronym	Definition
ACE	Africa Clean Energy
ACE TAF	Africa Clean Energy Technical Assistance Facility
CET	Common External Tariff
EAC CMA	East African Community Customs Management Act
ECOWAS	Economic Community of West African States
ECREEE	Ecowas Centre for Renewable Energy and Energy Efficiency
FCDO	Foreign Commonwealth and Development Office
FGN	Federal Government of Nigeria
FIRS	Federal Inland Revenue Service
FMFBNP	Federal Ministry of Finance, Budget, and National Planning
FMP	Federal Ministry of Power
FTE	Full-time equivalent
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HS	Harmonized System
IDEC	Import Duty Exemption Certificate
IMF	International Monetary Fund
MW	Megawatt
₦	Nigerian Naira
NCS	Nigeria Customs Service
NEP	Nigeria Electrification Project
NSW	National Single Window
OGS	Off Grid Solar
PAYGo	Pay As You Go
REA	Rural Electrification Agency
REAN	Renewable Energy Association of Nigeria
REF	Rural Electrification Fund
RISE	Regulatory Indicators for Sustainable Energy
SAS	Stand-alone Solar
SDG	Sustainable Development Goal
SEforALL	Sustainable Energy for All
SHS	Solar Home System
VAT	Value Added Tax

EXECUTIVE SUMMARY

Context and objectives

Stand-alone solar (SAS) products play a critical role in delivering electricity access for all, especially for hard-to-reach, low-income Nigerian households. Out of a total population of 201 million, 77 million still lack access to electricity, and even those who are connected to the main grid experience frequent – and costly – outages. Households often spend more on generator fuel and kerosene for lighting than on consumption from the grid, resulting in an inefficient, costly, and environmentally damaging energy sector. In this context, the Federal Government of Nigeria (FGN) aims to reach 5% of households with stand-alone solar technologies by 2040, and recently launched an ambitious plan to connect 5 million un-electrified households in the country through solar home systems (SHS) and mini-grids by 2023.

While the SAS sector in Nigeria ranks among the top ten markets worldwide in terms of annual sales, it will need to accelerate growth to deliver on the government's energy access ambitions. Sales will need to rise from around 300,000 units each year in 2019 and 2020, to more than 1 million units per year by 2025.

VAT and import duty exemptions are a crucial part of an enabling environment to support achievement of these ambitious energy access targets. While there are VAT and import duty exemptions being put in place by the government, it is imperative to note that the scope of the VAT and import duty exemptions needs to be expanded and effectively applied to achieve the FGN's set targets for 2023 and 2040 as stated above. Tax exemptions make two critical contributions to support the growth of the stand-alone solar industry: first by reducing end user prices and making sure energy access technologies are more affordable – especially for the most vulnerable communities – thus supporting the federal government to meet its electrification targets. Second, by providing a clear commitment from the government, and when implemented efficiently and effectively, help reduce non-tariff barriers to trade. This second "indirect" effect is especially important while the market is still relatively young and at an early point of its growth trajectory.

This report presents an assessment of the impact of VAT, import duties and proposed comprehensive waivers for household access to SAS products in Nigeria over the next five years.

Findings

Under a reasonable but ambitious growth scenario, 2.75 million households could be using an SAS product by 2025, if VAT and import duty exemptions are in place and implemented effectively. Without the exemptions, the sector would likely survive but will struggle to grow to its potential, at a cost of around 700,000 fewer households gaining access to SAS technologies in the next five years.

Fully implementing both VAT and import duty exemptions would imply the government foregoing up to ₦ 1.8 billion in annual tax receipts at today's sales volumes. However, this is a short-term loss, for long term gains. In particular, if the SAS industry grows in line with its potential described above, the potential for VAT and income taxes could rise rapidly, worth up to ₦ 6.8 billion annually by 2025, and this could also contribute around ₦ 4.5 billion and ₦ 2.3 billion annually in corporation tax and employee income taxes respectively. Even in the short-term, VAT and import duty exemptions could make a significant contribution to reducing federal fuel subsidies, with the tax exemptions potentially reducing fuel subsidy by ₦ 5 billion each year, which alone offsets the tax revenue foregone.

> The Federal Government of Nigeria (FGN) aims to electrify 5% of households with stand-alone solar technologies by 2040, and recently launched an ambitious plan to connect 5 million un-electrified households in the country through solar home systems and mini-grids by 2023.

The key pillars of the case for exemptions are (i) the potential to deliver significant economic benefits; and (ii) addressing the limitations that the existing exemptions have in assisting the FGN achieve the SAS target, estimated revenue targets, as well as the fuel subsidy savings. The SAS industry is positioned to support up to 10,000 full-time equivalent jobs by 2025, providing salaries estimated at ₦ 20 billion including in communities that need jobs the most. Without the tax exemptions fully implemented, over 3,000 of these jobs would be lost worth ₦ 8 billion each year by 2025. Furthermore, some households will use their SAS products for income-generating activities, which could drive rural productivity and income-generating activities worth around ₦ 54 billion each year. Beyond these monetizable gains, there will also be substantial social and environmental gains linked to the exemptions. In particular, an extra two study hours each day for up to 1.4 million children in additional households gaining access to SAS technologies due to the exemptions, and an additional 33,000 tonnes of CO_2 emissions abated by replacing gasoline gensets and kerosene.

Recommendations

To make best use of tax policy to support the achievement of the Federal Government of Nigeria's ambitious energy access targets of reaching five million household through solar connections by 2021, there are three main recommendations that should be implemented:

1. Ensure clear definition of the scope of, and effective and efficient implementation of import duty and VAT exemptions to quality-verified SAS systems and components.
2. Set-up a Technical Working Group led by the Ministry of Finance, Budget and National Planning to develop a plan and support the implementation of the exemptions for identified solar products, facilitate government cross-agency cooperation and government – private sector coordination, and ensure that tax exemptions are effective in making sure quality SAS products reach underserved populations.
3. Improve the importation process for solar products by resolving issues such as HS code classification that cause delays and add associated costs such as demurrage that are passed on to the end user. This also includes the effective implementation of the Ministerial Directive on Import Duty and VAT Modification Order for solar products.

1. INTRODUCTION

The objective of this study is to understand the impact of VAT and import duties for stand-alone solar (SAS) products on the attainment of the government's national electrification target via SAS, the growth of the SAS sector, its contributions to key policy objectives, and to socioeconomic development outcomes.

The Federal Government of Nigeria (FGN) aims to achieve 100% rural electrification by 2040 with 5% through SAS solutions. The government has developed several energy access policies that promote off-grid energy electrification and recognises the importance of SAS in achieving the national electrification target, and has recently launched an ambitious plan **to connect 5 million un-electrified households in the country through solar home systems and mini-grids by 2023.**

There is a rich international literature and evidence base on the importance of access to energy to drive improvement in livelihoods and economic activities, and a supportive enabling environment is key to ensuring the SAS sector reaches its full potential and meets government electrification targets.

This assignment is delivered through ACE TAF and builds on a range of complementary studies on responsible taxation for the SAS sector. In particular, it builds on the ACE TAF Responsible Taxation report and quantitative tool piloted in Malawi, Rwanda and Sierra Leone. This study deepens the analysis in the tool and customizes it to the Nigerian context, to estimate the impact of VAT and import duty regimes in achieving the government's electrification target via SAS, solar sector development and a range of fiscal, socio-economic and environmental outcomes delivered.

This report is structured as follows:

- **Section 2** summarises the energy access context, including the government's ambitious plan to reach 5 million Nigerian households with solar home systems and mini-grids by 2023 through the Solar Power Naija Programme.
- **Section 3** describes the broad national revenue and fiscal context, and how taxation of SAS products in Nigeria has evolved in recent years.
- **Section 4** summarises the stakeholder engagements conducted which informs the analysis presented in this assignment.
- **Section 5** provides an overview of the quantitative tool used in this assignment and sets out the key assumptions and sources used.
- **Section 6** describes the results of the assessment and underlines the benefits delivered by tax exemptions for SAS products across a range of monetised and non-monetised impacts.
- **Section 7** concludes with recommendations for a way forward for the sector, including applying tax exemptions in the short-term, but with a clear understanding of a route map to reach sector maturity and understand when it may become appropriate to revisit the conditions for such exemptions in future.

1. *The Africa Clean Energy Technical Assistance Facility*

2. NIGERIA'S ENERGY ACCESS CONTEXT

2.1 Summary of Energy Access Priorities

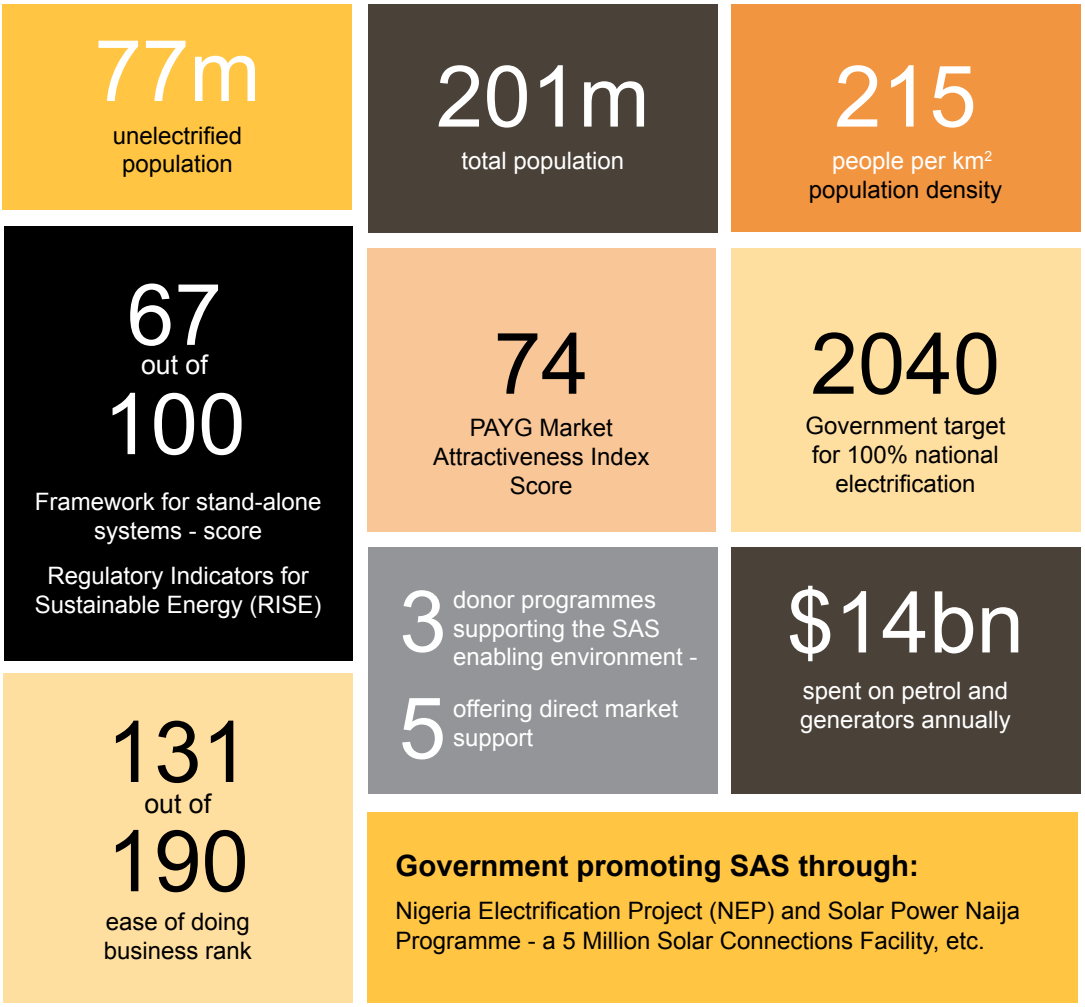

Figure 1: Nigeria off-grid solar context – at a glance

Source: ACE TAF (2021) Stand-alone Solar (SAS) Market Update

Out of a total population of over 201 million, 77 million still lack access to electricity. Nationwide this represents over 40% of households, and about 60% in rural areas. Even among those who do have connections, the majority are connected to an unreliable main grid with frequent – and costly – outages.[2] Households often spend more on generator fuel and kerosene for lighting than on consumption from the grid, resulting in an inefficient, costly, and environmentally-damaging energy sector. The opportunity for clean and reliable SAS energy technologies in this context is vast.

In order to achieve its energy access targets, Nigeria will need to provide electricity to more than 1 million households per year and add roughly 25 GW to its power generation capacity. This will require the government

2. *Energy and Economic Growth (2020) "Moving beyond energy access – the challenge and impact of unreliable electricity in emerging economies"*

to utilise a range of solutions beyond grid extension. Nigeria's off-grid market is unique due to the enormous deficit of centrally generated power vis-a-vis actual demand. The increase in installed capacity and generation in recent years falls well short of the growth in the population's demand for power.

Nigeria's energy access priorities include expanding energy access to rural communities not connected to the national grid through development of mini grids and distribution of SAS systems. It also supports the roll out of solutions for urban centres with bad grid to power schools, hospitals, households, and commercial facilities. The Nigeria Electrification Project (NEP) is another key initiative in the off-grid sector. The NEP is a USD 550 million program co-funded by the World Bank (USD 350m) and AfDB (USD 200m), and administered by REA that aims to leverage private sector investments in solar mini-grids and solar home systems. The Rural Electrification Fund (REF) of the REA also employs the same model by providing grant subsidies to SAS providers and solar mini-grid developers for the deployment of solar home systems and solar mini-grids across rural communities in the country. Both the NEP and REF when combined have deployed over 350,000 Solar Home Systems (SHS) under their SHS components.

To address the electrification deficit, the government aims to achieve 100% rural electrification by 2040 with 5% coming through SAS solutions. The Nigerian market is already one of the largest in terms of global unit sales with an estimated investment opportunity of around US$ 9.2 billion per year.[3] As seen in Figure 2, these off-grid and underserved markets exist all over Nigeria and across economic status

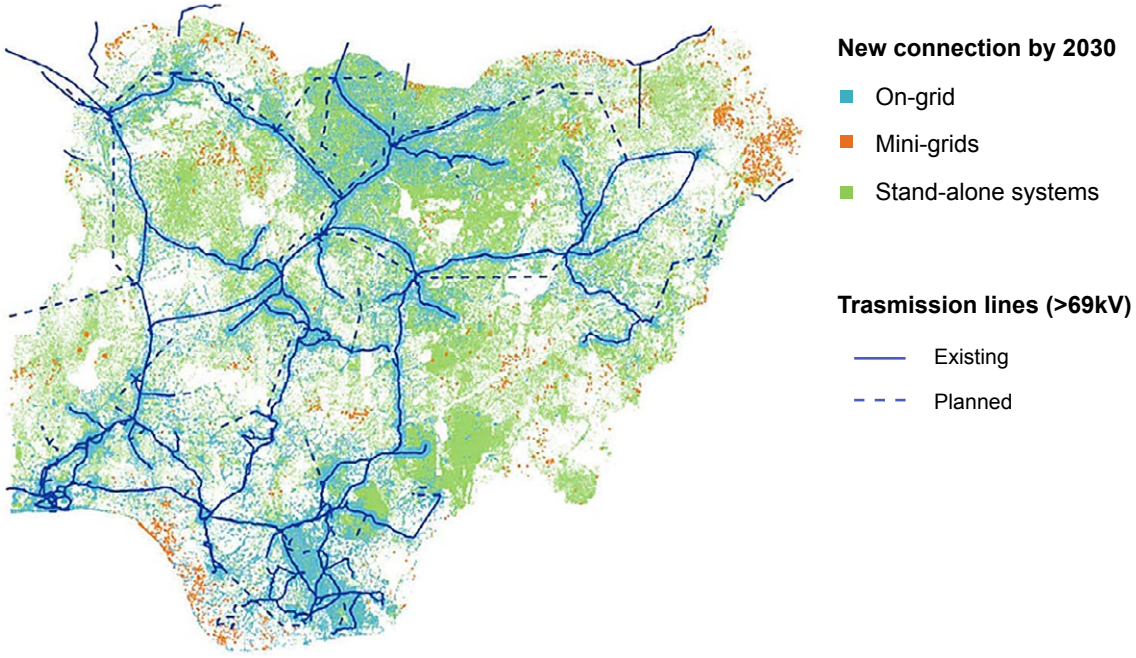

Figure 2: Nigeria Energy Access by 2030, by technology

Source: IEA Nigeria Energy Outlook

Despite progress made, achieving the government's Solar Power Naija 5 million solar connections target and national electrification target requires a step-change in the pace of rollout of solar products. A strong enabling environment will need to be in place to attract investment at the scale required. This enabling environment includes the ability to efficiently import (or manufacture locally) at sufficient scale and at a competitive cost; the ability to fast track imports through customs (while building local manufacturing capacity), and competitive customs tariff rates for SHS[4]. The products also need to be affordable for the target population - particularly rural and relatively low-income households. In this context, VAT and customs duties pose a risk to the attainment of the electrification targets as their added cost significantly increases the retail price of SAS products making them more expensive and most times out of the reach of consumers.

3. *ACE TAF (2021) "Stand-alone Solar Investment Map – Nigeria". Link*
4. *BCG (2020) Scale-up of Solar Home Systems in Nigeria*

Under its Nationally Determined Contribution (NDC), the government is working towards off-grid solar PV deployment of 13GW by 2030 as part of its CO_2 reduction measures. Electrification via SAS significantly contributes towards meeting the national climate target. Nigerian households have one of the highest usage rates of generators worldwide.[5] Indeed household spending on fuel for small gasoline and diesel gensets exceeds expenditure on electricity from the main grid, and costs businesses around USD 14 billion dollars each year.[6] The installed generating capacity of gensets exceeds the installed capacity of the electricity grid many times over – with an estimated 42 GW of capacity, compared to just over 5 GW of grid-tied generating capacity. This is an expensive, inefficient, and polluting way of generating electricity at scale, and represents a significant market opportunity for distributed renewable energy technologies such as SAS.

2.2 Overview of the Stand-alone Solar Sector

The stand-alone solar sector in Nigeria has expanded quickly over the last five years but is still far short of the growth trajectory needed to reach energy access targets. The last five years have seen important successes for the off-grid solar sector and SAS, with a well-developed and active Rural Electrification Agency (REA), an active industry association – the Renewable Energy Association of Nigeria (REAN), and growth in sales supported by significant donor support such as the UK DFID 'Solar Nigeria' programme and private sector participation. However, these gains are still slow-paced especially compared to the government's 5 million solar household connections target under the Solar Power Naija Programme and national electrification target. The sector will need continued support from a supportive policy and regulation framework, including through fiscal and tax incentives.

The Nigeria SAS sector has witnessed significant growth with 303,914 sales recorded in 2020 – relatively similar to the sales volume in 2019, and up from negligible sales five years earlier.[7] Nigeria ranked fifth globally in sales volume for key OGS markets in 2019 with the OGS market opportunity estimated at $9.2 billion per year.The market has received support in the form of technical assistance and grants from donors, development

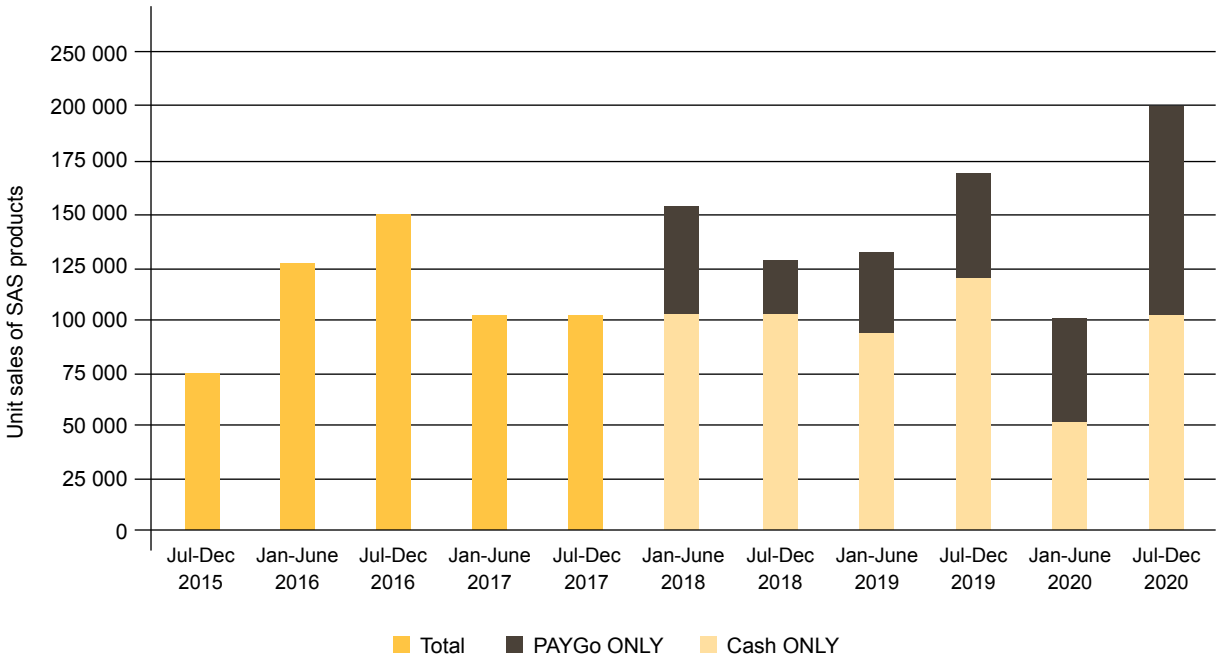

Figure 3: Sales of SAS products have reached over 300,000 per year in the last couple of years

Source: ACE TAF analysis of GOGLA half-yearly sales reports

5. *IFC (2019) "The Dirty Footprint of the Broken Grid". Link*
6. *REA (2017) Nigeria Mini-Grid Investment Brief". Link*
7. *GOGLA (2020) "Global Off-Grid Market Solar Report". Link*

finance development finance institutions and private sector actors, which has supported its early-stage growth. However, challenges still exist in addressing finance, supply, demand, and regulatory barriers. Nigeria has a below average overall RISE[8] score of 30 (out of 100). A key indicator in calculating the overall RISE score includes an assessment of the country's policy and regulatory environment for stand-alone solar where Nigeria has an average score of 56.

The stand-alone solar (SAS) sector in Nigeria has seen increasing private sector traction. As of 2019, ~1.8M SAS products—including solar home systems pico solar, and productive use products powered by stand-alone solar—were currently in use in the market. Further, it is estimated that over 23 million households in Nigeria will be suitable for SAS solutions in meeting their electrification needs by 2023. At least 61 SAS companies have set up operations in the country to address the demand for energy solutions, including international companies that have ongoing operations in other parts of the continent and many local companies with substantial market knowledge.

To meet the significant market need, the SAS sector has attracted ~USD 227 million from a wide range of investors. Currently, about 20 million households in Nigeria lack access to power and many connected households also rely on gasoline and diesel backup, and kerosene lighting, given the poor power quality of the grid. As a result, the SAS sector has stepped in to close the gap with strong investor backing. Development Finance Institutions (DFIs), development partners, and government programs have contributed the most investment to the SAS sector, up to 54% of the total investment inflows. Early-stage impact firms, specialized debt investors, and strategic corporates also invested heavily, largely in international SAS companies with proven traction. Commercial bank investment remains elusive because many companies are still small and unable to service commercial rate financing. Hard currency dominates investment, as companies struggle to access affordable local currency financing. Attention is also shifting towards developing a local content for the sector, learning from the experience of the oil and gas industry that has a framework in place. Some SAS providers are already assembling components locally including solar panels and installation accessories, but these remain a very insignificant portion of market demand.

Several donor programmes have provided and are still providing technical assistance and grants in addressing the sector's finance, supply, demand, and regulatory barriers. Under the UK FCDO funded Africa Clean Energy Technical Assistance Facility (ACE TAF), standards for SAS have been adopted in-country, a Guide for SAS E-waste management developed, and state governments supported in off-grid solar rural electrification. Programmes such as the USAID Nigeria Power Sector Programme, GIZ Nigeria Energy Support Programme (NESP), UK Nigeria Infrastructure Advisory Facility (UK NIAF), the Nigeria Off-Grid Market Acceleration Programme (NOMAP), and Sustainable Energy for All (SEforAll) are providing technical assistance to improve the enabling environment for off-grid solar in the country. The industry association, REAN, also plays an active role in representing the private sector in the country.

2.3 Barriers to Stand-alone Solar Sector development

However, despite this progress, several bottlenecks are still present in the Nigerian off-grid sector. These include affordability (the cost of systems compared to the ability and willingness to pay for those systems), and various policy and regulatory implementation challenges:

- **High import tariff for solar components and kits.** This can add between between 15% - 40% of end user retail prices to the consumer[9], hampering ability to reach all households in remote and low-income regions as these systems become beyond their purchasing power.
- **Ability to pay.** As described in the modelling results in Section 6 below, while many households may be able to afford a medium size solar home system using PAYG or other forms of consumer finance, a significant proportion of the population will still struggle to afford SAS products. An ACE TAF Deep Dive Market Research

8. *RISE is a set of indicators to help compare national policy and regulatory frameworks for sustainable energy. It assesses countries' policy and regulatory support for each of the three pillars of sustainable energy—access to modern energy, energy efficiency, and renewable energy. Countries are scored between 0 (poor) and 100 (excellent) across several focal areas which are weighted equally to reach an overall score for the country*
9. *Findings from consultations with local OGS Providers, with the wide range a result of inconsistent application of VAT and import duties*

Report in 10 states across the geo-political region of the country already highlights affordability, amongst other factors, as a major determinant for consumer choice to purchase SAS products.[10]

- **SAS product quality.** The energy needs and aspirations of Nigerian households are high, and there is often a perception of SAS products as providing a lower quality of service (compared to the main grid for example) due to a high prevalence of poor-quality products in the country. A crucial factor in catalysing the market to achieve its full potential will be ensuring customers get access to high-quality, and where affordable relatively larger solar home systems that can meet their needs. There is moderate to high presence of SAS product counterfeits in the country particularly in trade channels, with traders and consumers generally unable to identify quality SAS products.[11]
- **Lack of coordination of fiscal incentives hinders implementation of existing waivers.** Coordination gaps, and sometimes conflicting perspectives on the eligibility and application of import duty and VAT exemptions for SAS products among key government institutions such as the Federal Ministry of Finance, Budget, and National Planning (FMFBNP); FIRS; and Nigeria Customs Service. The result is that while there is often reassurance that waivers or exemptions are in place, these are not always implemented smoothly resulting either in most products paying duties, or a lengthy delay to receive the waiver/exemption (see below).
- **Inconsistent interpretation of HS Codes and application of tariffs** for solar technologies often leading to delays and high demurrage costs which are eventually passed on to consumers. Companies have experienced lack of clarity and ambiguity in what HS Codes apply to solar panels with diodes and those without diodes. In some instances, customs do apply HS Codes that attract duty as against what the companies completed on the importation documents.
- **Access to finance across the value chain remains a major constraint to the growth of the sector particularly for indigenous companies.** Even with existing investment in the sector, meeting the electrification targets will require significant scale up in investment for the sector. It is estimated that at least $675 million additional capital is required to meet the government's 5 million household solar connection target under the Solar Power Naija programme[12]. The financing gap is even more prevalent in trade channels where just 4% of SAS traders have secured any form of supply finance (debt).[13]
- **Poor policy implementation by government has also been a key bottleneck for the sector** despite provisions made to improve the enabling environment for OGS in various government energy access documents such as National Renewable Energy and Energy Efficiency Policy (NREEEP 2015), and SE4ALL Action Plan Agenda. Implementing policy provisions such as the application of tax incentives for the sector hit a brick wall at the point of implementation especially at the ports when dealing with Customs.
- **Fluctuating and depreciating local currency has created an uncertain price market** as products are not guaranteed stable prices which at times makes the financial model of companies unrealistic. Access to foreign exchange through the CBN window can be a long process with delays that ultimately affect product availability.
- **The complexity and time required for the importation process still poses a major headache for SAS providers.** Even where import duty and VAT waivers are in place, the process is often complex and lengthy which raises both financial and time costs for SAS providers. This is true even with the Import Duty Exemption Certificate (IDEC) process which should be an easier and faster process, judging from the experience of SAS providers who have tried obtaining the certificates.

10. ACE TAF (2021) Nigeria Market Research Deep Dive Research.
11. ibid
12. BCG (2020) Scale-up of Solar Home Systems in Nigeria
13. ACE TAF (2021) Nigeria Market Research Deep Dive Research.

3. NATIONAL REVENUE AND TAX CONTEXT FOR THE SAS INDUSTRY

3.1 Value Added Tax (VAT)[14]

Nigerian VAT is a consumption tax that is levied at the rate of 7.5% on the supply of all goods and services, except for those specifically exempted. Exemptions are defined under the VAT Act (Part I and II of the First Schedule) as amended. Section 38(b) of the VAT Act as amended gives the Minister of Finance the power to make an order which shall be published in the Gazette amending, varying or modifying the lists of exempted goods and services that are set out in the First Schedule to the VAT Act. In the exercise of this power, the Minister of Finance on 3rd February 2020 issued a VAT Modification Order titled "Value Added Tax Act (Modification Order), 2020" (the "Order") modifying the list of exempted goods and services in the First Schedule to the VAT Act and expanding the list of VAT exempted items in Nigeria.

The goods exempted from VAT under the Order include renewable energy equipment that come under the Common External Tariff (CET) Code 85. This includes wind-powered generators; solar powered generators; solar cells whether or not in modules or made up into panels; other photosensitive semiconductor devices; solar DC generators of an output not exceeding 750W; solar DC generators of an output exceeding 750W but not exceeding 75kW; solar DC generators of an output exceeding 75 kW but not exceeding 375 kW and Solar DC generators of an output exceeding 375 kW. Batteries which are key components of renewable energy projects that have significant impact on the cost of implementing such projects were however not included in the exemption list. Also, it needs to be emphasized that the provision of services in relation to all the VAT exempt goods that are listed in the Order (particularly in the renewable energy sector) are still liable to VAT because the services are not specifically exempted by the Order. As such, all services provided to a client in relation to the sale of these exempted items, the sale of electricity as a service and the rental of these exempted items are all VATable. All suppliers and service providers, therefore, continue to issue VAT invoices on these non-exempt services.

However, following the issuance of this Order by the Minister of Finance, the Federal Inland Revenue Service (FIRS) issued a Public Notice titled "the Value Added Tax Act (Modification Order), 2020: Items not Exempted from VAT" ("FIRS Notice" or "Notice") to provide clarification with respect to items that are not exempted from VAT under the Order. In this notice, it listed items included in the Order as issued by the Minister of Finance that according to the FIRS are not VAT exempt and will continue to attract 7.5% VAT which included renewable energy equipment. The issue here seems to be a technical one with regards to the provision and description of renewable energy components as contained in the Order – presumably listed under the explanatory notes and not under the exemption list, as clarified by the FIRS.

The Order is currently being updated by the FMFBNP with the FIRS and Ministry of Power to address these issues and ensure effective implementation of the Order. This report will provide further fact-based evidence to the government on the justification for VAT exemptions - as well as import duty – for more comprehensive waiver; recommendations and guidance on implementation in the short, medium and long term towards meeting government's electrification goals; development of the SAS sector; and socio-economic development.

3.2 Import Duties

The ECOWAS Common External Tariff (CET) defines the import duties applicable for good imported into Nigeria including solar technologies. The actual implementation of the ECOWAS CET is the obligation of the Member States.

14. *For the year 2020, the total VAT contribution to National GDP is N1,154,409,332,385.60, broken down as follows: Q1 is N324,579,124,652.33. Q2 is N327,195,289,088.00. Q3 is N424,708,184,453.88. Q4 is N454,688,211,726.06.. Information is not readily available for how much of the total VAT comes from the electricity sector but it is expected that it amounts to a negligible fraction of the total VAT generated when compared to the N842.090 bn generated in Q3, September 2020.*

The CET covers almost 6,000 tariff lines allocated to five tariff bands:[15]

- Zero-rating for essential social goods, which applies to just under 100 tariff lines deemed essential social goods.
- 5% on goods of primary necessity, applying to over 2,000 tariff lines for primary necessity, raw materials and specific inputs.
- 10% on inputs and intermediate goods, for over 1,000 tariff lines for input and intermediary goods.
- 20% on final consumption goods, which is the largest category comprising over 2,000 tariff lines for final consumption goods.
- 35% for over 100 tariff lines on specific good for economic development.

SAS products and components which typically consists of solar cells and other apparatus used for the installation of solar equipment and solar powered equipment are within and below the 10% tariff under the CET. Specifically, solar panels depending on whether they are equipped or not with elements such as diodes attract either zero rating or 5%. Additionally, equipment like solar water heaters and solar powered generators are accessed at 5% thereby falling under the goods of primary necessity.

Notwithstanding the foregoing, it is important to note the challenge constantly faced with respect to the interpretation of the HS Codes based on the ECOWAS CET for solar technologies in Nigeria. Prior to 2018, solar panels imported into the country were import duty exempt. However, in 2018, the Nigeria Customs Service (NCS) re-classified solar panels from its previous classification under Heading 85.41 to Heading 85.01. According to the NCS, solar panels used for electricity generation fall under Heading 8501 as they possess diodes and other elements used for electricity generation. As defined under the explanatory notes to Heading 85.01 (XVI-8501-3), "photovoltaic generators consisting of panels of photocells combined with other apparatus, like storage batteries and electronic controls (voltage regulator, inverter, etc.). It also covers panels or modules equipped with elements, however simple (for example diodes to control the direction of the current), which supply the power directly to, for example, a motor, an electrolyser, etc." This is different from the exclusion notes under the Explanatory Note on Heading 85.41 (Vol.5, P – XVI-8541-3) which states that, "the Heading does not cover panels or modules equipped with elements, however simple (for example, diodes to control the direction of the current)".

The distinguishing factor by the NCS between Headings 85.01 and 85.41 is that the former relates to solar panels having bypass-diodes permitting for use in power generation purposes, and the latter to solar modules used for functions other than the generation of useful power. As such solar panels imported for electricity generation are subject to 5% import duty.

In addition, it is instructive to note that on the 16th of January, 2019, the FMFBNP issued a circular titled "Clarification on the Fiscal Policy Measures for the Power Sector as it Relates to Importation of Machinery and Equipment for Solar Energy" (the "Import Duty Ministerial Directive"). According to the Import Duty Ministerial Directive, the FMFBNP issued clarifications that the import duty payable on solar items attract different rates. Specifically, all solar cells, modules, and panels that are not equipped with any element, e.g. diodes, transistors or resistors under Heading 85.41 will attract zero percent (0%) rate of import duty. However, solar panels with diodes, which have capacity to generate power under Heading 85.01 attract 5% rate of import duty. The aim of this is to encourage the local production of solar energy components and to protect local assemblers/manufacturers by enabling them to add value and generate employment opportunities thereby ensuring technological transfer.

The challenge is that local assembly and manufacturing for solar products is still at a very nascent stage and requires more tailored support beyond the application of import duties on solar components to develop. At its current stage, it is unable to meet the short-term electricity demand and government's electrification targets. Various studies have been carried out by stakeholders such as SEforALL, ACE TAF, and McKinsey in proposing a roadmap for the development of the local assembly and manufacturing sector for solar products in the country.

15. *Henrich Böll Stiftung (2019) "Policy Research on the imposition of 10% Tarrif Duties on Solar Components: Making a way for Solar in Nigeria". Link*

There is the issue of conflicting policy directives as it relates to import duties for solar products which makes it confusing not just for the solar companies, but also for customs officials at the ports who quote varying policy and fiscal provisions when applying import duties. The Import Duty Ministerial Directive goes further to state that for items which are multi-purpose solar power related accessories and which could be used for purposes other than solar power generation, solar companies shall be required to pay the stipulated import duty rate as set out in the Import Duty Ministerial Directive. Despite the Import Duty Ministerial Directive applying 5% import duties to solar panels under Heading 85.01, the Customs further issued a memo in March 2020 stating that solar panels under the same Heading attracts a 10% import duty. It is not clear if this memo is meant to override the Import Duty Ministerial Directive of 2019 or even has the legal backing to do so, however SAS providers and solar developers are reportedly paying 10% import duty for imported solar panels, despite the Ministerial Directive. Attempts to push back on this with reference to the Ministerial Directive when clearing their SAS products results in delays which can eventually lead to paying high demurrage fees, and so most SAS importers end up paying the 10% import duty.

Box 1: ACE TAF Importation Guide for Solar PV Products and Technologies in Nigeria

In 2019, ACE TAF developed a **Nigeria Solar Importation Guide** to provide clarity on the importation process and act as a baseline importer guide for SAS providers. It aims to clarify the ambiguity and complexity in the solar importation process in Nigeria. The key areas covered include an overview of solar energy technologies, the Harmonized Commodity Description and Coding Systems (HS Code) for solar energy technologies, quality standards, step-by-step importation process for solar energy technologies, and stakeholder mapping across the importation chain. Also covered are applicable import incentives for solar energy technologies.

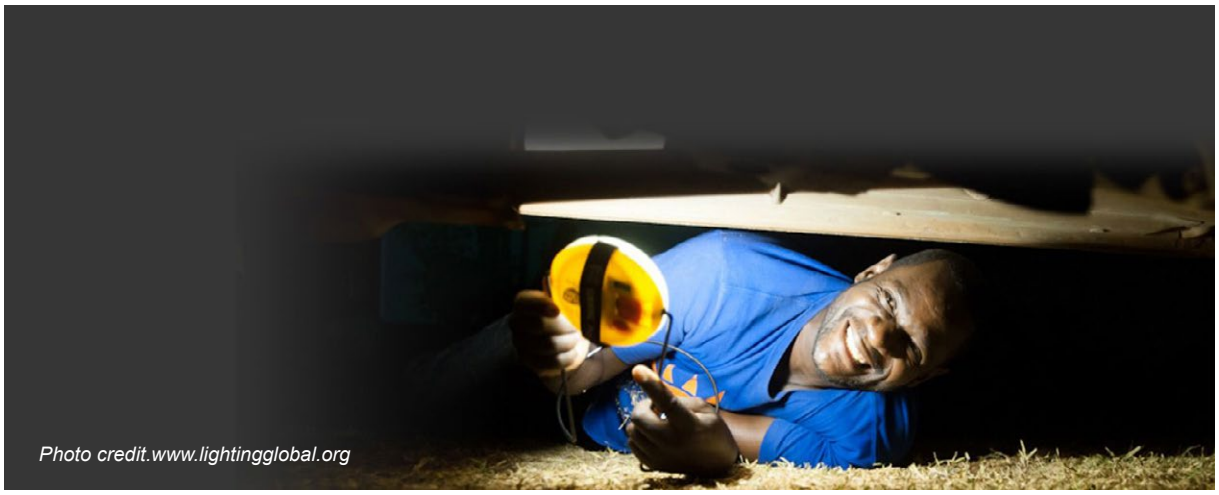

Photo credit.www.lightingglobal.org

4. SUMMARY OF STAKEHOLDER ENGAGEMENT

As part of this study, targeted engagements were carried out with 12 public and private sector stakeholders including relevant government institutions, sector support stakeholders, and SAS providers. The full list of stakeholders consulted is provided in Annex 1. The interviews were used to inform and test modelling assumptions for the quantitative analysis described below in Section 5 and Section 6.

Summary of Key Learnings from the Stakeholder Engagements

- **SAS providers pay VAT, import duties, and other levies on imported renewable energy equipment** which raises retail prices of SAS products between 15% - 40%[16] as these costs are passed down to consumers. Similarly, these providers have paid – and continue to pay – VAT even after the VAT Modification Order of 2020 that grants exemption from VAT for certain renewable energy equipment. They also pay higher import duty on solar products such as the recent 10% import duty on solar panels despite the Import Duty Ministerial Directive.
- **Efforts to obtain this exemption or any sort of waivers, or pay lower import duty result in significant time delays which in turn mean SAS providers have to pay demurrage costs**, as their products stay longer than envisaged at the ports. These costs are inevitably passed on as additional costs in the retail price of the SAS product to the consumer. **From the foregoing, the Import Duty Ministerial Directive of 2019 as well as the VAT Modification Order of 2020 appear to have no effect and are not enforced by the NCS and FIRS.**

  NCS officials at the ports are also known to impose the highest import duty (as high as 20%) on SHS kits and other integrated solar products that have multiple components such as batteries, solar panels, charge controllers, and others. With such products, the component having the highest import duty is selected and the import duty applied on the product regardless of the applicable import duties of the other associated components which are lesser or in some instances exempt.
- **Extending exemptions to other solar components such as batteries will improve affordability significantly.** A common request from stakeholders in the private sector is that the list of VAT exempt items as well as items exempt from import duty should include batteries which are necessary for SAS products and comprise a significant percentage of product cost, as well as other associated solar technologies for productive uses. However, government and customs officials may need capacity building to reduce concerns around "leakage" – that is the risk of exemptions being applied to a broader range of products than intended, and in particular "dual use" type products for which it is not always easy to identify where they would be used as part of a solar home system, or put to another purpose.

  While there are legitimate concerns around "leakage" of exemptions granted to solar components and technologies, specification around the technology and capacity of batteries and other technologies that are exempt can be made, and reinforced through capacity building provided to Customs official in recognising these technologies to ensure appropriate enforcement – and have been successfully adopted in other countries. For example, batteries suitable for use as part of a solar home system which serve predominantly rural consumers can be identified by their technology type which would not be suitable for use in cars or other applications. These can also be properly defined through updates to the HS code classification to indicate their specific use for solar electricity applications, and clarity for exemptions. This will also ensure that the exemptions target the unelectrified rural population whom the exemptions are designed to benefit.
- **Effective co-ordination between key government institutions is required for the effective implementation of exemptions and ensuring it benefits target beneficiaries.** There are co-ordination challenges between key government institutions – the Ministry of Finance, Budget, and National Planning; NCS; and FIRS – on the application of exemptions for solar products. For example, the FIRS reversed the Ministerial Directive and VAT Modification Order gazetted by Federal Ministry of Finance, Budget and National Planning which granted VAT

16. *Findings from consultations with local OGS Providers, with the wide range a result of inconsistent application of VAT and import duties*

exemptions to solar components; while the Customs Service issued a memo on the application of 10% import duty on solar panels despite its classification as 5% by the Ministry of Finance, Budget and National Planning. These highlight some of the coordination challenges. There is also limited understanding of solar technologies by these government institutions particularly Customs officials at the ports leading to the inconsistent interpretation of HS Codes and application of tariffs for solar technologies. Effective co-ordination between the FMFBNP, NCS, and FIRS, on an effective tariff exemption regime which is properly understood by relevant officials of the government institutions particularly FIRS and NCS is necessary for seamless implementation of the VAT exemptions.

- **A simplified and efficient importation process which incorporates the use of technology and less face-to-face interaction will facilitate a speedy and effective importation experience for stakeholders.** The introduction of Import Duty Exemption Certificates (IDEC) issued by the FMFBNP for import duty exemptions on specific products or items should provide import duty reliefs on specific solar products as described by the FMFBNP. According to the Ministry, a solar company can apply to it for IDEC ahead of importing the solar products on which import duty exemptions are requested and obtain the IDEC which can be used while clearing the products at the ports. All SAS providers require a letter of support from the Ministry of Power to the FMFBNP before an IDEC can be issued. This process, now online, is designed as an alternative means of getting import duty exemptions on goods that provide certain socio-economic benefits and include solar products.

  Currently however, the process of obtaining the IDEC is complex and lengthy as shown from the experience of SAS providers, creating delays in clearing products and additional costs. This has resulted in some SAS providers prefering to pay duties than go through the IDEC process due to its complexity, thus defeating its purpose. Many SAS providers are unaware of the IDEC process.

- **A speedy and efficient importation process will eliminate the additional costs currently incurred by SAS providers due to delays and which are passed on to end users.** As described above, issues with obtaining import duty or VAT exemptions, or the inconsistent HS Code classification of solar products, cause significant time delays which in turn mean SAS providers have to pay demurrage costs as their products stay longer than envisaged at the ports. These costs which significantly increase the cost of doing business in Nigeria are inevitably passed on as part of the SAS product retail price to the consumer.

- **Aligning quality standards with import duty and VAT exemptions on solar products will curtail the influx of sub-standard products and protect consumers.** Applying exemptions to quality verified solar products and components that meet the national IEC standards for solar technologies as set by the Standards Organisation of Nigeria (SON) will incentivise and ensure that only quality solar products get to the consumer, and prevent market spoilage caused by poor-quality solar products in the country. The exemptions will make quality products more affordable and reduce consumer patronage of poor-quality products that are usually cheaper and prevalent in the market. This will protect the limited purchasing power of consumers, particularly rural consumers, and ensure value for money.

5. THEORY OF CHANGE AND APPROACH TO ASSESS THE IMPACT OF VAT AND IMPORT DUTIES

5.1 The Impact of Tax Exemptions on SAS Sector Development

The stand-alone solar sector is a crucial part of reaching universal access to energy as enshrined in SDG 7, and in several of the government's energy access documents. These include the National Renewable Energy and Energy Efficiency Policy (NREEEP), National Renewable Energy Action Plan (NREAP), National Energy Efficiency Action Plan (NEEAP), Rural Electrification Strategy and Implementation (RESIP), Nationally Determined Contribution (NDC), and Sustainable Energy for All – Action Agenda (SE4ALL AA). The government also prioritises SAS as part of its economic recovery plan under its 2020 Economic Sustainability Plan which sets out the framework for the Solar Power Naija Programme that aims to connect 5 million households to solar via SHS and mini grids. SAS technologies offer the most cost-effective electrification option for a significant proportion of Nigerian households, predominantly those in remote rural areas who are typically not only the hardest to reach, but also often the poorest and most vulnerable.

While achieving universal access to energy is a worthy goal, the benefits of access to SAS technologies are wide-ranging beyond meeting the government's electrification targets. As shown from the study findings, providing fiscal incentives in support of the SAS sector supports:

- Ensuring widespread access to SAS products which offer households and small businesses access to power for productive use in and outside the household, thus improving economic income and standard of living.
- Generating crucial high and low skilled jobs in rural areas.
- Reducing household expenditure on recurring purchases of other fossil-fuel-based and often harmful forms of energy, if the relatively higher cost of access to an SAS product can be overcome.
- Mitigating greenhouse gas emissions from traditional, fossil-fuel-based energy access products.
- Supporting the growth of what is still a relatively young sector to make sure businesses reach a path to maturity, reach all of their target customer base, and achieve stable profitability.
- Providing high-quality lighting and liberating time for children to spend on education at home and reducing damaging health impacts of burning fossil fuels in-doors.
- Creating a level-playing with other technologies which have historically benefited from significant public sector support and subsidies. Subsidies for both grid connection and consumption from the grid, and fuel subsidies for generators and kerosene usage.

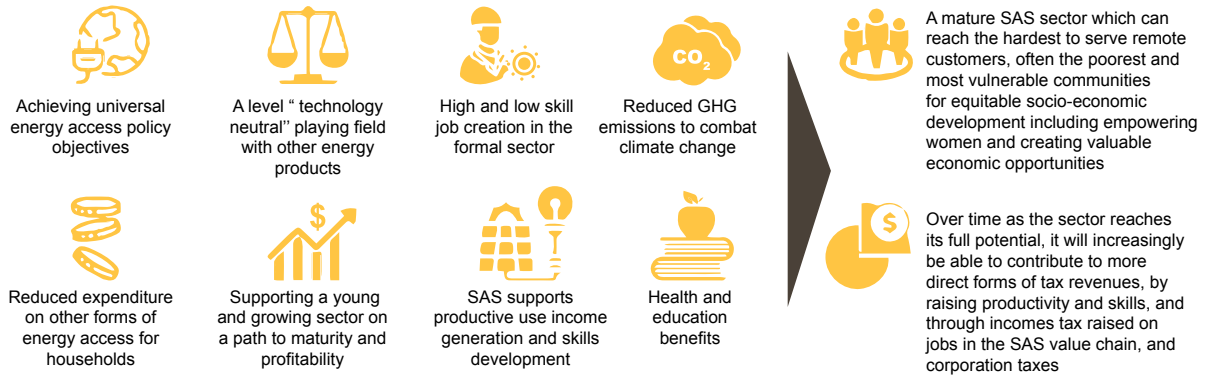

Figure 4: The SAS sector delivers a range of important policy, fiscal, and socioeconomic benefits that far outweigh any potential short-term gains in national revenue foregone from tax exemptions

Source: ACE TAF analysis

5.2 Recent Trends in VAT and Import Duty Policy for SAS Products

This assessment builds on and contributes to a growing body of evidence on the impact of fiscal incentives on the development of the SAS sector and delivery of socio-economic benefits. In particular, it builds on a series of national studies supported by UK DFID's Energy Africa campaign, for Mozambique,[17] Malawi,[18] Uganda,[19] Zambia,[20] and recent further studies including a Uganda Off-Grid Energy Market Accelerator analysis of fiscal,[21] and a Duke University study of the impact of tax on uptake of SAS in East Africa.[21] The approach taken and some key findings from these studies are described in Annex 2, and briefly summarized in the box below.

Box 2: Impact of tax changes to SAS sector as shown by other studies

Studies conducted on East Africa have found that introduction of import tariffs have a negative impact on uptake of SAS units, thus impacting the ability of governments to achieve their access targets. A Duke study of Kenya and Uganda found that a 20% import tariff would result in a decrease of 18% in the sales of solar kits without televisions. This reduced further to a 32% decrease in sales for kits with televisions.

Conversely, an ECA study on Mozambique found that setting import duties and VAT at 0% would increase projected sales of SAS to 500,000 over a 10-year period. This would result in 3.1 million people accessing power through solar PV by 2026 against a national access target of 4.1 million by 2030. Maintaining the current taxation regime would leave that number at 231,000 by 2030 (5% of the national access target).

VAT and import duty exemptions are a widely used – and highly successful in the right conditions – policy tool to foster development of the SAS industry. They are the most widely used fiscal tool due to their relative simplicity and low implementation cost compared to other fiscal policy tools - **of 38 countries surveyed, 23 provide duty exemptions and 14 provide VAT exemptions for SAS products.**[23] The world's leading off-grid solar markets have deployed tax exemptions consistently to develop their respective national markets – and indeed where taxes have been re-introduced, they have often been reversed quickly. For example:

- In Bangladesh, the National Board of Revenue reintroduced VAT exemptions for solar panels and modules at the end of 2018, only a few months after VAT had been introduced.[24] Bangladesh has one of the largest SAS markets worldwide, serving 16% of the population - over 5 million households - at its peak resulting from a contribution of factors including historical VAT exemptions, and financing models that benefit the target population.
- In Kenya, where annual sales of SHS and solar lanterns reach around 3 million each year, and serve 30% of the rural population, VAT and import duty exemptions have been a mainstay in supporting market growth. While VAT was introduced in the Finance Act 2020, the first reading of the Finance Bill 2021 reintroduced the exemptions for solar products due to its benefits.[25]

17. *Energy Africa (2016) "Energy Africa – Mozambique. Technical assistance to model and analyse the economic effects of VAT and tariffs on pico PV products, solar home systems, and improved cookstoves". Link*
18. *Energy Africa (2017) "Energy Africa – Malawi. Technical assistance to model and analyse the economic effects of VAT and tariffs on pico PV products, solar home systems, and improved cookstoves". Link*
19. *Energy Africa (2018) "Energy Africa – Uganda. Fiscal policy options for Solar Home Systems (SHS)". Link*
20. *Kuungana Advisory (2018) "Energy Africa – Zambia. Technical assistance to model and analyse the economic effects of fiscal policy options for off-grid technologies in Zambia". Link*
21. *UOMA (2018) "Fiscal Policy Analysis: An assessment of the tax and subsidy options to accelerate solar home systems in Uganda". Link*
22. *Fetter, Rob, and Jonathan Phillips (2019) "The True Cost of Solar Tariffs in East Africa". Link*
23. *BloombergNEF, Sub-Saharan Africa Market Outlook 2020: Reducing risk, opening opportunities across the world's fastest growing regions, Climatescope, 2020, Link*
24. *https://thefinancialexpress.com.bd/trade/nbr-exempts-solar-panels-from-vat-1534493051*
25. *KPMG (2021) "Finance Bill 2021 – a KPMG Analysis". Link*

- In Rwanda where SAS sales have grown quickly in the last few years, a consistent regime of VAT and import duty exemptions is one of the key policies cited by companies as supporting their market development. Exemptions are tagged to both high quality products and IEC test standards and must also comply with the Ministry of Infrastructure guidelines which set standards for minimum system size (amongst others).[26]

In West Africa, less favourable policy and regulatory environments, including taxes, are identified as a key constraint to the kind of SAS market growth that East Africa has delivered.[27] Nonetheless, some countries in the region are increasingly adopting favourable tax policies to support the sector. For example, in Senegal VAT exemptions were announced in 2018, and a defined product list subsequently developed which includes entry level solar lanterns and solar home systems, and solar irrigation equipment for productive use.[28] A Technical Working Group comprising the private sector, international development partners, and key government agencies is supporting implementation of the tax codes and exemptions

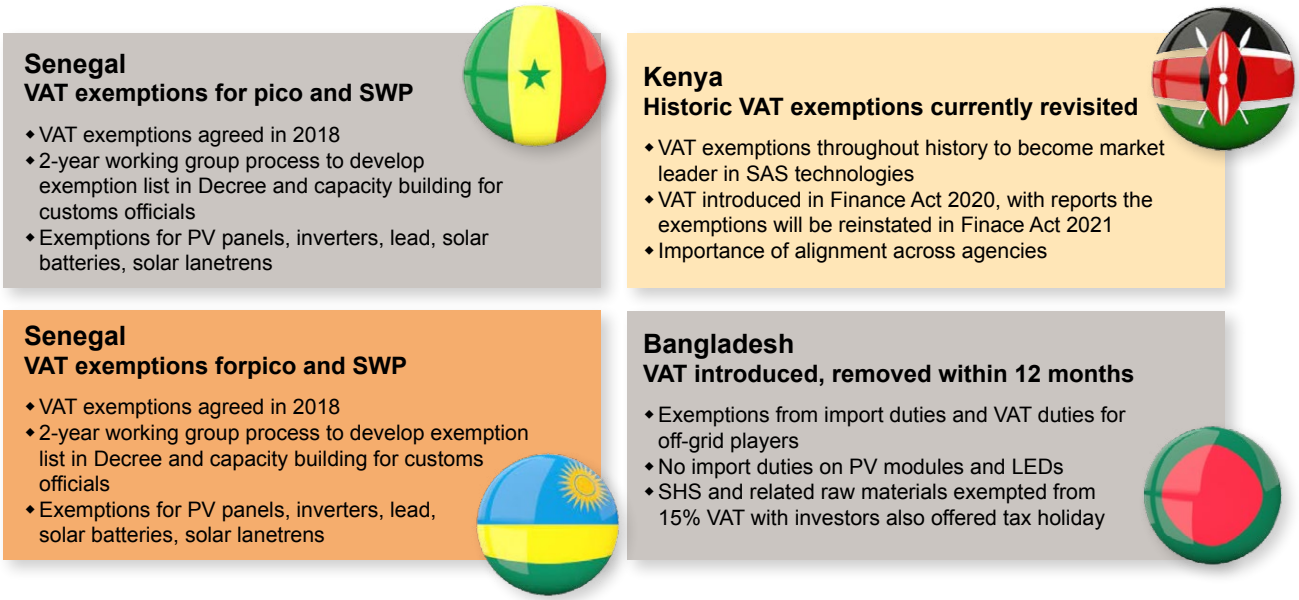

Figure 5: Tax exemptions have been a mainstay in the fastest growing SAS markets worldwide and are a widely used policy tool by governments

Source: ACE TAF analysis

5.3 Model Structure and Key Assumptions

The quantitative approach used for this assignment is built around the multi-country responsible taxation tool developed by ACE TAF in 2020.[29] The flow of calculations is shown in Figure 6. The tool models a range of VAT and import duty scenarios, taking as its starting point a scenario with exemptions and then looking sequentially at the impact of adding VAT and/or import duties separately, and then both combined. Alongside these scenarios, the tool incorporates data from a range of sources on the affordability of SAS products, the price sensitivity of demand to changes in end user prices (as a result of tax changes), and a wide range of estimates of the impact of access to SAS products. These are described further in the paragraphs below. The study also leveraged on the economic model was developed by Sustainable Energy for All (SEforALL) and All On to illustrate the potential for localising the assembly or manufacturing of solar home systems and mini-grids in Nigeria.

27. *Lighting Global (2020) "Off Grid Solar Market Trends Report 2020". Link*
28. *Government of Senegal (2020) "Arrêté interministériel fixant la liste des matériels destinés à la production d'énergies renouvelables exonérés de la taxe sur la valeur ajoutée." Link*
29. *ACE TAF (2021) "Impact of Tax Incentives on Access to Stand-Alone Solar Policy recommendations from analysis in Malawi, Rwanda, and Sierra Leone". Link*

The tool was then further modified to reflect the Nigerian context, as described in the bullets below.

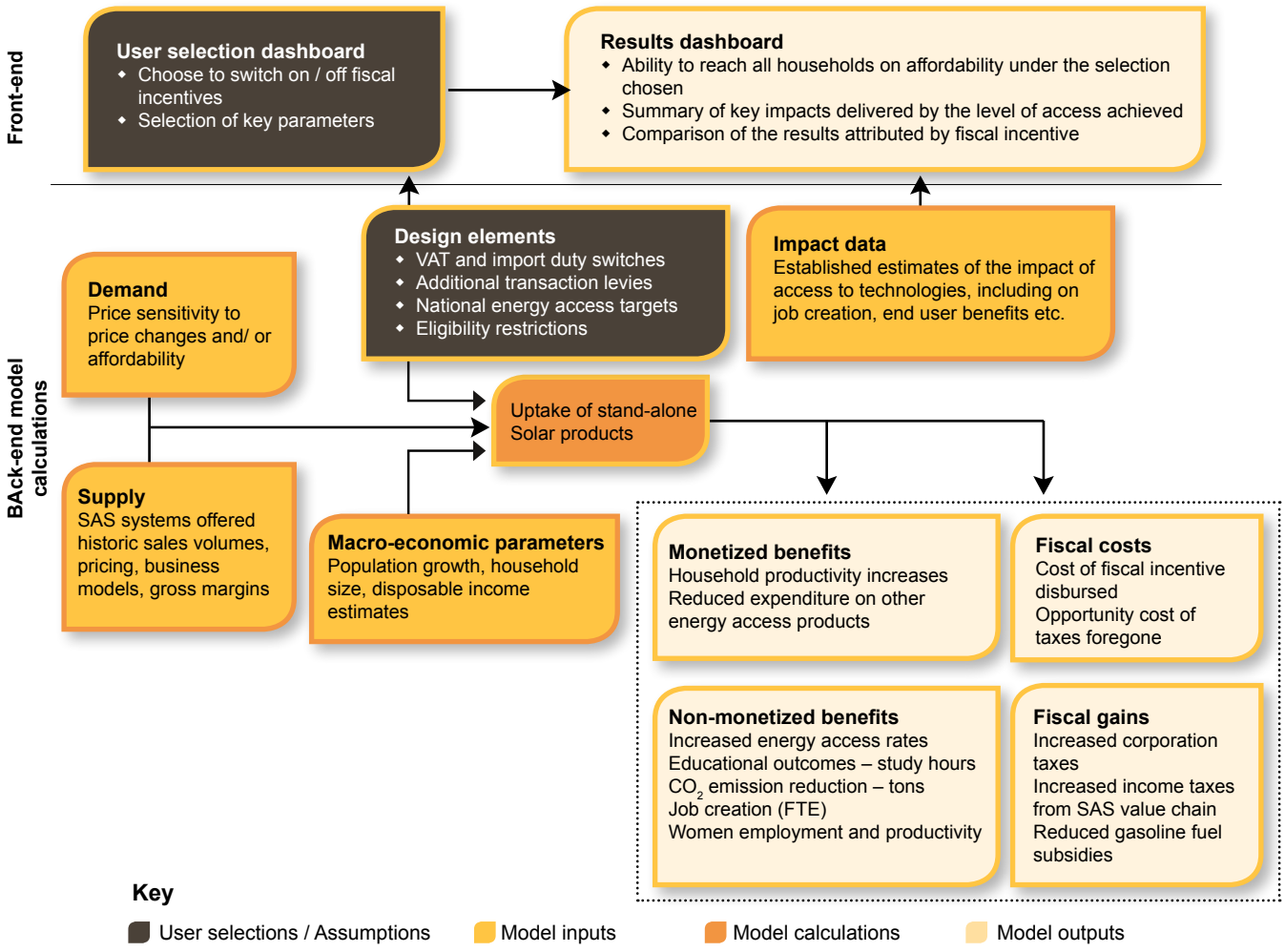

Figure 6: Tool structure to assess the impact of VAT and import duties on the SAS sector

Source: ACE TAF analysis

5.4 Key Economic and Demographic Assumptions and Data

We use the following data and assumptions on key macroeconomic parameters:

- **Population size and potential demand (households).** Starting from a population estimate of 201 million in 2019, we project this forward using the UN population growth forecast of 2.48% each year between 2020 and 2025. We assume household size stays constant at 4.9 people per household, so that by 2025 there will be around 48 million households nationwide.
- **Ability to pay**. We estimate affordability across the population based on a combination of (1) a shape of a "proxy" demand curve, which is based on the PovcalNet database (latest available 2018), and (2) income per capita.[30] As PovcalNet represents consumption expenditure from a fitted household consumption bundle – not disposable income – the shape of this demand curve is then fitted using the latest available GNI per capita data, which is just over USD 2,000. As a benchmark for affordability we then estimate the proportion of the population that would be able to afford the monthly payments for a PAYGo system allocating 5% of monthly expenditure to fuel / lighting, in line with the latest data on consumption expenditure from the Nigerian Bureau of Statistics.[31]

30. *World Bank PovcalNet tool. Link*
31. *Nigeria Bureau of Statistics (2020), "Consumption Expenditure Pattern in Nigeria – 2019". Link*

- **SAS sales trajectory.** We model a baseline sales trajectory that represents a significant acceleration in the growth of the SAS sector – growing at 30% year on year for each of the next five years. This would mean that the SAS sector would reach close to 3.5 million households by 2025. This growth trajectory is used as a middle ground between the last few years of sales which have remained relatively constant, and the higher sales trajectory needed to meet the 5 million solar homes target, which will require additional incentives beyond the tax exemptions examined in this assessment.
- **Change in uptake of SAS solutions.** The main model result presents the resulting change in sales volumes from a simple 'price elasticity of demand' (PED) approach based on estimates from previous studies.[32] The model uses a single elasticity of -0.9, which means that for a 10% increase in price, sales would be expected to fall by 9%. The model also calculates an "affordability" response, as a function of ability to pay and product prices based solely on data from Nigeria (as described above), as an alternative to this single PED estimate.

5.5 Technical Modelling Assumptions and Sources

The key sources of assumptions and sources used to generate the quantitative results are:

- **Corporation tax:** It is assumed that the average SAS company makes a fairly modest pre-tax gross margin of 16%.[33] Note that this is an assumption – and indeed is intended to represent where the sector could get to in the next five years under the right enabling conditions. Most companies are still on the path to profitability and are yet to achieve positive margins.

  Low margins means that any cost increases as a result of taxes levied would likely be fully passed on to end users – the supply curve has very limited ability to absorb these costs, with products typically provided close to an 'at-cost' basis. For the purpose of estimating potential corporation tax contributions, we apply the current Companies Income Tax Rate of 30% on profits.[34]

- **Employment in the SAS value chain.** The tool estimates the number of jobs created in the SAS value chain to deliver the annual sales in each tax scenario, based primarily on the GOGLA 'Growth Engine for Jobs' study, which provides a comprehensive review of the literature on job creation associated with SAS technologies worldwide.[34] To estimate income tax contributions from workers in the SAS value chain it is assumed that the average managerial position earns around ₦ 10 million each year, and faces an average tax rate of 20%. Other workers in the SAS value chain are assumed to earn ₦ 2 million each year in taxable earnings, with an average tax rate on these earnings of 10% to reflect the much lower share of earnings that will fall within income tax bands.[36] The employment estimates presented in this assessment are also broadly in line with the Power for All 'Powering Jobs' report.[37]
- **Potential savings in federal fuel subsidies.** Similar to the potential reduction in household spending on other energy access products (described below), access to SAS products may also reduce any remaining government subsidies on gasoline. Following the methodology described in the A2EI 2019 "Putting an End to Nigeria's Generator Crisis", we estimate the potential reduction in gasoline fuel subsidies based on a ₦ 35 subsidy per litre of gasoline used in small gensets.[38]
- **Benefits to users of SAS products.** A share of SAS products are expected to both (1) take up new jobs and start new businesses, and (2) become more productive and spend longer in their current jobs. The share of SAS users that use their system to generate additional income is based on the GOGLA 'Powering Opportunity West Africa' report, which in summary estimates that 14% of solar home system users generate an average additional income of USD 31 per month.[39] As we expect that much of this extra income will be generated from

32. *For example, Duke (2019) "The True Cost of Solar Tariffs in East Africa". Link*
33. *ACE TAF (2020) "Understanding the Impact of Distribution Costs on Uptake of OGS Products in Select SSA Countries". Link*
34. *FIRS (2020) "TAXES/LEVIES COLLECTED BY FIRS". Link*
35. *GOGLA (2019) "Off-Grid Solar: A Growth Engine for Jobs". Link*
36. *Salary levels based on engagement with sector stakeholders, consultant team review of available salary data in Nigeria. These salaries are intended to indicate a reasonable industry average benchmark and do not represent any specific company.*
37. *Power for All (2019) "Powering Jobs Census 2019 – the Energy Access Workforce". Link*
38. *A2EI (2019) "Putting an End to Nigeria's Generator Crisis: The Path Forward". Link*

low-wage jobs, often in the informal sector, we do not include any increase in tax revenues associated with this increase in economic activity. However, this is a conservative assumption as some of these micro-business activities may begin to generate formal, tax-paying jobs, and the additional income earned may also be spent in the marketplace on goods which generate VAT.

We also estimate the potential avoided expenditure on other sources of energy access. This is a "gross" saving and represents a reduction in expenditure on other energy products, but does not compare this to the expenditure on SAS products. The reason for this is that SAS technologies can offer a very different type and level of services – and in some instances expenditure may indeed increase, not only on the solar generation components but also on the range of appliances that can be powered by access to SAS technologies. For avoided expenditure, the main source used is the average household consumption of gasoline for gensets.[40] This also generates a potential saving in gasoline for government, which has historically subsidised around 20% of the cost of gasoline.

- **Educational outcomes.** The model assumes that the average SAS end user household has two children of school age and gains an extra two hours of light put to education each evening.
- **Climate mitigation benefits.** We estimate the reduction in CO_2 equivalent emissions from a reduction in kerosene and gasoline use. We assume 50% of households use kerosene, while 25% use gensets. For those households, at an average monthly usage of 2 litre of kerosene per household, and 4 litres of gasoline for gensets, we estimate CO_2 emissions on the basis of 2.5 kilogrammes of CO_2 emissions per litre of kerosene consumed, and 2.1 CO_2 emissions per litre of gasoline. These emissions are valued at a global social cost of carbon of USD 50 per tonne.
- **Finally, we assume the mix of SAS products in use stays in line with current products and prices.** The product mix shows that most stand-alone systems in Nigeria are relatively large – with as much as 45% being medium sized solar home systems above 50 Wp.[41] As for pricing, there is a wide range of products available on the market – the prices presented in Table 2 are based on the results from our stakeholder engagement, products available on the Jumia marketplace, findings from a Market Research Deep Dive survey carried out by ACE TAF in 2020[42] , and our consortium's experience working with the private sector.

Table 1: Indicative prices and shares of systems of different sizes in Nigeria

	Plug-n-play		Component based	
Product type	**Average price (USD)**	**Share of sales**	**Average price**	**Share of sales**
0 – 3 Watt single lighting systems	-	-		
3 – 11 Watt multi-light systems	45	20%		
11 – 50 Watt small SHS	150	35%	200	35%
50 Watt + medium SHS	400	45%	475	50%
50+ Watt large SHS			650	15%

40. A2EI (2019) "Putting an End to Nigeria's Generator Crisis: The Path Forward". Link
41. ACE TAF (2021) "Stand Alone Solar (SAS) – Market Update Nigeria". Link
42. ACE TAF (2021) "Stand Alone Off-Grid Solar Market Research: Nigeria". Link

6. KEY FINDINGS

6.1 Overview of the Socioeconomic Impact of VAT and Import Duty Exemptions

The section below presents the key results from the quantitative analysis carried out for this assessment – on the economic case for full implementation and expansion of VAT and import duty exemptions. It sets out and where possible monetizes the costs and benefits of tax exemptions, to provide a better understanding of the trade-offs of different outcomes, including fiscal, employment, household income and wider social benefits, and environmental outcomes.

Box 3: Nigeria's national revenue context and impact of covid-19

Nigeria is facing increasing pressure on national revenue in response to a confluence of global and local factors, among which include the dual pressures of the COVID-19 pandemic. Volatility in the oil markets, an unstable foreign exchange rate, and rising inflation have led to dwindling national revenues and increased costs of living across the country. These problems have been exacerbated by the COVID-19 pandemic that has crippled the world's economy and impacted Nigeria's revenue, with the country only just coming out of a recession.

The impact of COVID-19 has been far-reaching on national revenue, poverty (which will reduce ability to pay for SAS products) and on SAS supply chains. This has led the government to seek for new sources of income generation and maximize already existing sources (including import tariffs). On the other hand, consumers are constrained by weakening purchasing power. Weakening purchasing power of consumers ultimately leads to low patronage for solar companies and their products. There is no doubt that a population with weak purchasing power and dwindling sources of income does not provide a good business case for investors in Nigeria.

Overall, there is a clear rationale for implementing tax exemptions - although there is a trade-off between maximizing fiscal revenue today versus achieving better outcomes (including fiscal) in future. As shown in Figure 7, VAT and import duties applied at the standard rates could already generate up to ₦ 1.8 billion in annual tax receipts. However, if the SAS market grows in line with its potential in the next five years – which to a large extent relies on tax exemptions today – the future potential to collect VAT and income taxes increases significantly, worth up to ₦ 6.8 billion annually by 2025. Furthermore, a strong SAS industry could also be contributing ₦ 4.5 billion each year, and ₦ 2.3 billion each year in corporation tax and employee income taxes respectively by 2025. It is clear that the immediate priority even from a fiscal perspective must be to support growth and maturity of the sector, and then potentially reconsider how best the industry can make a fair contribution to national revenue.

Even in the short-term, VAT and import duty exemptions could make a significant contribution to reducing federal fuel subsidies. By 2025, access to SAS technologies could displace usage of small household gensets, reducing government expenditure on fuel subsidies by around ₦ 20 billion each year. The contribution of VAT and import duty exemptions in accelerating the growth of the SAS industry could account for around ₦ 5 billion of this total each year, which alone offsets most of the foregone VAT and import duty revenue that could be collected (as shown in Figure 7).

The tax revenue foregone is vastly inferior to the value of the socio-economic benefits delivered – making tax exemptions for the SAS industry a very effective use of public funds. On top of what are likely to turn out to be net fiscal benefits as described in the paragraph above, the SAS industry will support up 10,000 full-time equivalent (FTE) jobs by 2025, deliver savings of over ₦ 100 billion to households compared to other more polluting and lower quality forms of energy access (although it should be noted overall expenditure may increase as households move up to higher tier solar energy access). Access to solar technologies could also drive rural productivity and income-generating activities worth around ₦ 54 billion each year. Access to SAS technologies will also deliver important environmental and social benefits – each of these impact mechanisms is described in more detail in the subsections below.

₦ 1.7 billion per year
forgone net VAT and import duty receipts at today's market size

₦ 6.4 billion by 2025
forgone net VAT and import duty receipts if market reaches potential

₦ 5.4 billion per year
worth of economic livelihood benefits

₦ 4.6 billion per year
corporation tax

₦ 2.6 billion per year
income tax from worker's inthe SAS value chain

Further direct and indirect benefits of tax exemptions

730,000 households (3.6 million people) in addition reached by 2025 particularly the most vulnerable

₦ 5.4 billion per year reduced federal gasoline subsides in gensets each year

33,000 tonnes of CO_2 emissions avoided each year

3,200 jobs created in the SAS value chain providing **₦ 8 billion per year** in local salaries

₦ 48 billion per year reduced household expenditure on other energy access products

3 million study hours per day gained for children in rural households

Providing critical setrvices to vulnerable communities which will reduce starin on public sector services, including social safety nets, health care provision, unemployment programs etc

Figure 7: Summary of the case for VAT and import duty exemptions

Source: ACE TAF analysis

6.2 Socioeconomic Impacts by Type

Energy access and affordability

The first and most important impact of VAT and import duty exemptions is to accelerate access to energy for Nigerians – increasing the rate of access by between 400,000 and 750,000 additional households by 2025. As shown in Figure 8, under a reasonable but ambitious growth scenario 2.75 million households could be using a SAS product by 2025. However, this is based on both the "direct" and the "indirect" benefits of tax exemptions remaining in place. Without tax exemptions the price of SAS products would increase, slowing the ability of companies to reach their target customer base, and reducing the reach of SAS products to 2.43 million households by 2025. The lost "indirect" benefit of tax exemptions through their contribution to a favourable, efficient, and transparent enabling environment could reduce the reach of SAS technologies by a further 400,000 households, to around 2 million households. While these are modelled estimates and there is substantial uncertainty around the magnitude of both effects, it is clear that the potential impact of levying VAT and import duties is significant and would dramatically undermine the ambition to reach 5 million households with solar home systems in the coming years, and the government's 2030 and 2040 national electrification targets via SAS.

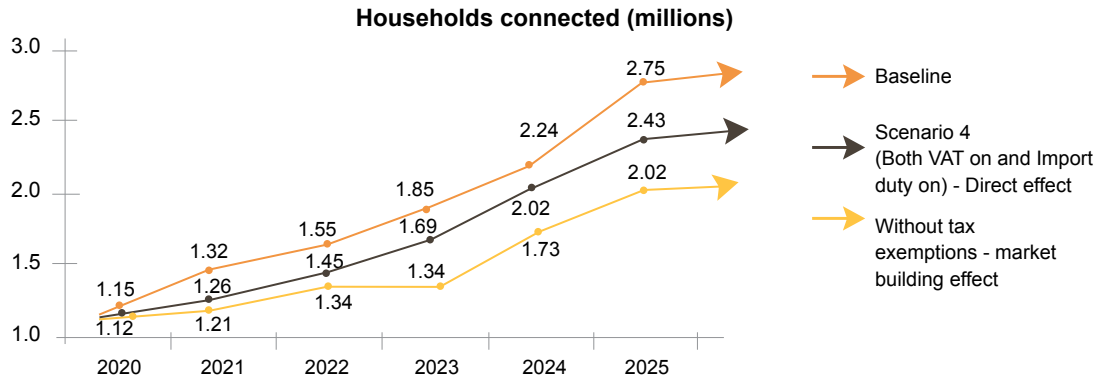

Figure 8: Energy access scenario with and without tax exemptions

Source: ACE TAF

The most direct contribution of fiscal incentives is in making SAS systems affordable for the currently underserved – predominantly low-income – customer base. As shown in Figure 9, the vast majority (86%) of Nigerian households are currently not able to save up and purchase a 11-20 Wp solar home system at present. While the PAYGo model and other alternative consumer financing models help to address this affordability challenge by spreading payments over 12 to 24 months, still around 45% of the population would not be able to afford a medium size solar home system.

It is also important to note that PAYGo is not a panacea, and can present other challenges for companies and households. For example, households have to effectively manage consumer credit, making long term financial commitments to repay the price of the system. For companies this raises a risk of customer default, introduces additional transaction costs to collect payments (especially if consumer fin ncing is cash based, not PAYGo), and also requires working capital as the company incurs the cost of providing the system upfront and only recovers these costs with a delay as the PAYGo payments are made.

Finally, with many companies accessing international credit lines (in USD), the PAYGo business model also introduces currency risk, with repayments made in Naira. Tax exemptions would help make these PAYGo products more affordable – reaching over 60% of the population. Nonetheless, other solutions will be needed, including deploying more basic entry-level solar home systems. It is estimated that over 90% of the population could afford a 11-20 Wp PAYGo system, while the remaining 10% is likely best served by pico lanterns in the short term.

It will be important to ensure that households gain access to technologies that strike the right balance between meeting high energy needs and ambitions, with affordable products and business models that grow a sustainable market.

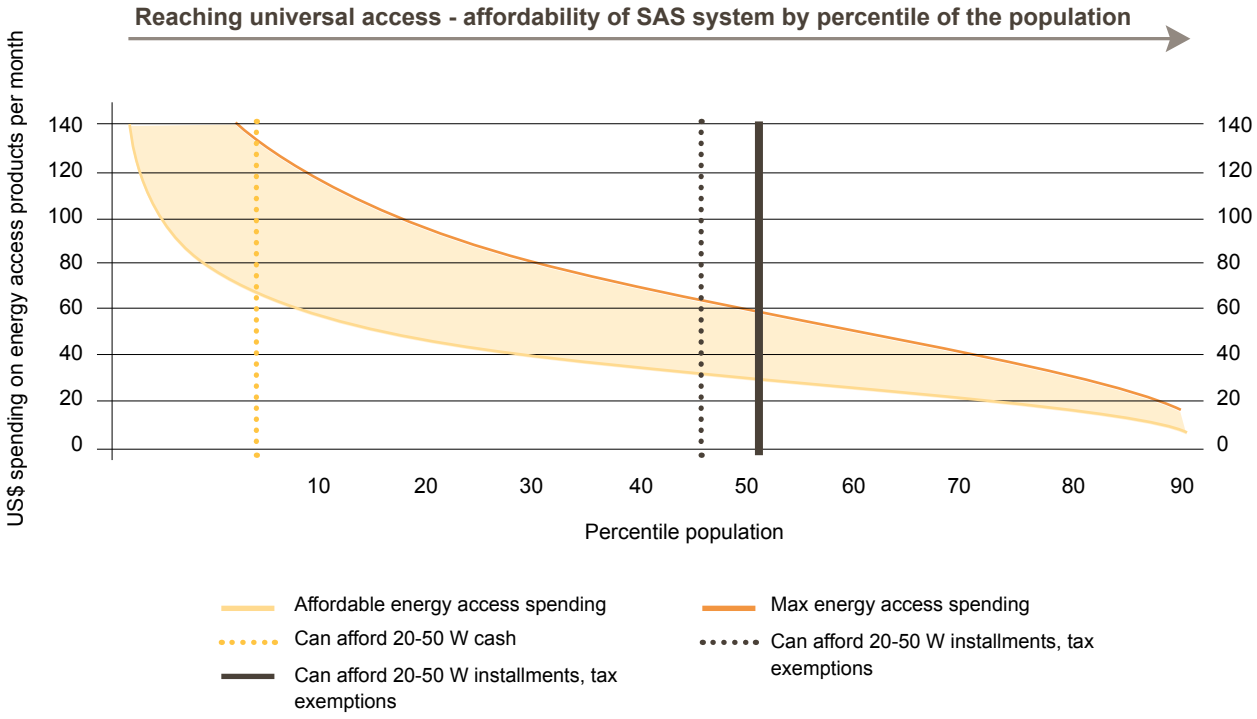

Figure 9: Affordability of a medium sized solar home system between 11-20 Wp capacity

Source: ACE TAF analysis

6.3 Household Income Generation and Potential Energy Savings

Access to SAS technologies can provide the power, access to information and communication technologies, and appliance for households to put to productive use. As described in the modelling assumptions in Section 5, some households will have enhanced earning capabilities once they access a solar home system. Even using a relatively conservative estimate of just 14% households putting their system to generate additional income of around ₦ 12,000 per month, across all SAS users by 2025 this would amount to an annual gain to the economy of ₦ 54 billion. This value derives from income-generating activities, such as establishing micro-enterprises such as hair salons, electricity charging services for the community, pay-per-view television, etc. SAS systems can also help local enterprises like small shops and village markets to operate during the evening. It is also worth noting that women are often the main beneficiaries of improved household energy access.

In addition to the income gains made by some households, access to SAS products can significantly reduce spending on other, lower quality, and more harmful energy sources. Once SAS products are installed, the operating and maintenance costs are relatively low, providing energy access that is near-free at the point of consumption. However, the upfront costs are high –or may be spread using the PAYGo business model or other forms of consumer financing over up to 24 months on average. In the Nigerian context, solar products often struggle to compete with kerosene and gasoline gensets, as the upfront payment is a significant deterrent even if the ongoing monthly payments would then be lower than fuel consumption. Access to SAS products could save households some ₦ 180 billion each year on fuel, although this may not represent a net saving as expenditure could be the same or indeed higher if accessing larger more powerful solar kits.

6.4 Broader Social and Environmental Benefits

Access to quality lighting remains one of the most basic driving benefits of access to SAS products – with SAS technologies supporting up to 10 million study hours each day by 2025. Solar lighting allows rural families to extend their workday into the evening hours, and extends availability of light for students of all ages, and improves quality of life. Assuming lighting delivers an additional two hours of study hours per student, by 2025 over 10 million study hours each day will be gained through access to SAS, helping create a skilled workforce of the future to take advantage of job opportunities. Without tax exemptions in place, between 2 and 3 million of these study hours would be lost.

Given the high prevalence of small gasoline (or diesel) gensets and kerosene, accelerated access to SAS products would deliver significant environmental benefits, reaching up to 126,000 tonnes of CO_2 emissions avoided each year by 2025. By replacing all genset consumption, and 60% of kerosene consumption in the household, up to 126,000 tonnes of CO_2 emissions would be abated each year by 2025, which would be worth ₦ 2.4 billion (at a social cost of carbon of USD 50 per tonne), and contributing towards the attainment of the government's climate target. Without the tax exemptions up to 33,000 tonnes of this benefit would not be achieved, at a cost ₦ 630 million.

6.5 Jobs of the Present and Future in the Solar Value Chain

Creating the right enabling environment for the SAS industry to reach its full potential in the coming five years could create around 10,000 full-time equivalent jobs. These jobs would be distributed throughout the value chain, including in rural distribution networks where jobs are much needed. These jobs will cater for a range of skilled and low-skilled employment and will also transition towards greater participation in the formal economy. In the absence of tax exemptions, as the industry's growth would be slow, up to 3,000 of these jobs would not be created, which also represents up to ₦ 8 billion less in salaries, and lower potential income tax contributions (described above).

6.6 Local Manufacturing and Assembly

Local assembly and manufacturing of solar is a key priority for Nigeria and represents a substantial opportunity. As described above, the domestic SAS market alone represents a 1,000,000 annual unit sales opportunity within the next five years, or around USD 200 million in revenue.

It is important that the fiscal incentive regime balances the needs to accelerate energy access to Nigerian communities, and supporting the local industry develop. The local assembly and manufacturing industry for solar products is still at a very nascent stage and requires tailored support beyond the application of import tariffs to develop. At its current stage, the local industry is unable to meet the SAS market opportunity in-country, and attainment of the government's electrification targets. While there is the need to develop the local assembly and manufacturing industry for solar products in the country, such should not come at the expense of increased electrification, rather a coordinated approach towards balancing the electricity demand and improving the enabling environment to encourage local assembly and manufacturing. As the local assembly and manufacturing industry matures and the SAS sector scales, import tariffs can be re-evaluated.

Import duty exemptions will be essential not only for supporting the existing SAS sector of imported kits, but also to the development of the local assembly industry which will need access to imported component parts. The main opportunities for the local industry – especially in the next few years – lies in assembly of component parts, with a significant proportion of the hardware imported.[43] In a similar vein, VAT exemptions should be applied for imported components and kits, at least until the local manufacturing capacity develops. Even then, VAT exemptions should be applied to both imported and locally produced products – the local market need of at least 1 million products per year is far greater than the local manufacturing and assembly capabilities will be able to reach in the coming years.

Analysis from an SEforALL[44] study shows that focused implementation of key enablers in existing policies such as fiscal incentives, access to data, low-cost finance and capital investments provide the best pathway to increased electrification and localisation of the upstream value chain for solar products. An ACE TAF Report that assessed the local manufacturing landscape for off-grid solar in Sub-Saharan Africa specifically Ethiopia, Rwanda, Tanzania, Zambia and Nigeria also emphasises the need for these countries to put in place a conducive environment to encourage local manufacturing of SAS before putting in place polices that prioritise local content in OGS procurement, as otherwise this will likely create supply side constraints in reaching energy access targets.[45] This has been backed by similar studies from McKinsey.

Given the benefits of accelerating access to quality SAS products set out in this study, we recommend tailored additional support to local assembly and manufacturing, rather than introducing "disincentives" for imported products.

43. *SEfoAall and AllOn (2021) "Achieving Economies of Scale in the Nigerian Solar Value Chain - Opportunities and Benefits of Upstream Localization". Link*
44. *ibid*
45. *ACE TAF (2021) "Assessment of Local Manufacturing of Off-Grid Solar in sub-Saharan Africa – Report". Link*

7. RECOMMENDATIONS

While increasing tax revenues is critical to supporting effective government, the gains from the development of the SAS greatly outweigh the revenue that could be generated from VAT and import duties. Tax revenues are a crucial resource to support government expenditure on infrastructure, social security, and delivery of crucial public services, while reducing reliance on external development finance. However, the potential to raise national revenue from the stand-alone solar sector is very limited at the moment, while the sector remains relatively small and certainly far away from its potential size. While import duties and VAT could raise some revenue already, the potential will increase markedly as the sector grows in future – not only from VAT and duties, but through corporation and income taxes from workers in the SAS value chain. Furthermore, tax exemptions are an invaluable tool for essential products and services to reach vulnerable populations, and which can provide a productive economic uplift that outweighs the cost of the exemption. SAS products match both descriptions, increasingly reaching into hard-to-reach and low-income rural areas, while also offering important employment both in the SAS value chain and for households who use their SAS systems for productive economic purposes.

While these recommendations are focussed on the imported SAS market, they are consistent with supporting a nascent local manufacturing and assembly market. Given the benefits of accelerating access to quality SAS products set out in this study, it is important that imported goods are not "punished" – there is a large market still to be served. We recommend tailored additional support to local assembly and manufacturing, rather than introducing "disincentives" for imported products.

These three key recommendations should be implemented to maximize the benefits delivered by the SAS industry, and ensure value for money for tax exemptions.

Recommendation 1: Apply import duty and VAT exemptions to quality-verified SAS technologies

• Expand the current VAT Modification Order to include,

1. Pico solar lamps as defined under the Common External Tariff (CET) Code 8513 specifically CET Code 8513.10.0000.

2. SHS kits which are integrated solar products used specifically for electrification but imported in individual components. These include items with CET Codes 8539.3190.00, 8528.7190.00, 8529.1000.00, 8513.10.0000, 8527.1920.00 and 8414.5900.00 used for solar electrification purposes.

3. Batteries that fall under the CET Code 8506 specifically CET Codes 8506.30.0000, 8506.40.0000, 8506.50.0000, 8506.60.0000, 8506.80.0000 and 8507.80.0000 used for solar electrification purposes.

4. Productive use equipment such as solar water pumps as defined under CET Codes 8419.19.1000, 8502.391.1000, 8419.31.0000 used for solar powered applications.

The expanded VAT Modification Order should accurately classify these products as exempt under the exemption list, with relevant descriptions provided under the explanatory notes as solar electrification products. The exemptions should also be tied to the propriate quality standards as defined by SON and applied to solar products and technologies that meet the quality standards. This should be appropriately enforced by the relevant government institutions primarily the FMFBNP, NCS and FIRS, as well as with relevant government institutions such as the Ministry of Power and the Rural Electrification Agency (REA).

1.2 Expand and enforce the Ministerial Directive on exemption of renewable energy equipment from import duty issued in 2019 to include,

1. Solar panels which possess diodes and other elements used for electricity generation under Heading 8501. As defined under the explanatory notes to Heading 8501 (XVI-8501-3), "photovoltaic generators consisting of panels of photocells combined with other apparatus, like storage batteries and electronic controls (voltage regulator, inverter, etc.). It also covers Panels or modules equipped with elements, however simple (for example diodes to control the direction of the current), which supply the power directly to, for example, a motor, an electrolyser, etc."

2. Pico solar lamps as defined under the CET Code 8513 specifically CET Code 8513.10.0000.

3. SHS kits which are integrated solar products used specifically for electrification but imported in individual components. These include items with CET Codes 8539.3190.00, 8528.7190.00, 8529.1000.00, 8513.10.0000, 8527.1920.00 and 8414.5900.00 used for solar electrification purposes.

4. Batteries that fall under the CET Code 8506 specifically CET Codes 8506.30.0000, 8506.40.0000, 8506.50.0000, 8506.60.0000, 8506.80.0000 and 8507.80.0000 used for solar electrification purposes.

5. Productive use equipment such as solar water pumps as defined under CET Codes 8419.19.1000, 8502.391.1000, 8419.31.0000 used for solar powered applications.

1.3 The expanded Ministerial Directive should accurately classify these products as exempt under the exemption list, with relevant descriptions (such as applying a prefix 'solar powered') provided under the explanatory notes as solar electrification products. The exemptions should also be tied to the propriate quality standards as defined by SON and applied to solar products and technologies that meet the quality standards. This should be appropriately enforced by the relevant government institutions primarily FMFBNP, NCS and FIRS, as well as with relevant government institutions such as the Ministry of Power and the Rural Electrification Agency (REA).

Appropriate measures to guide the enforcement of both the VAT and import duty exemptions, ensure application to quality verified products, prevent "leakage", and ensure the exemptions benefit the target population and meet the desired impact can be done through a Technical Working Group, leading to the next recommendation.

Recommendation 2: Set-up a Technical Working Group to support the implementation of the exemptions

The FMFBNP should set-up a Technical Working Group (TWG) comprised of key government institutions - including the FMFBNP, NCS, FIRS, Standards Organisation of Nigeria, Nigerian Investment Promotion Commission, Federal Ministry of Power, and Federal Ministry of Industry, Trade, and Investment - where applicable in consultation with the private sector such as through the industry association, and development partners. The roles of the TWG will include but not be limited to:

1. Review findings from this study and the cost-benefit model and develop a plan for implementing the exemptions in the short to long term. This will also consider measures to be taken to develop the local assembly and manufacturing industry while the exemptions are in place, and timelines for review and update.

2. Review all solar electrification products and technologies particularly those that benefit the rural and vulnerable un-electrified population and develop appropriate CET Code classification and definitions for products to be exempted.

3. Ensure the exemptions apply only to quality-verified products that meet the relevant quality standards as set out by the SON.

4. Monitor the effectiveness and impact of the exemptions to ensure the desire impact are being met, including making necessary adjustments in the enforcement process where necessary.

5. Review and update the exemption list for solar technologies considering the development of the SAS market, development of the local assembly and manufacturing capacity, electrification targets, and innovation with SAS technologies.

6. Facilitate government inter-agency coordination, and government – private sector coordination on matters related to the solar industry.

7. Provide advisory to the government on matters related to the implementation of existing policies as related to SAS such as fiscal incentives, provision of data, and other relevant areas of technical support required to meet government's goals and development of the SAS market.

8. Engage with relevant stakeholder groups with regards to fiscal incentives and policy implementation for SAS electrification in the country.

A multi-stakeholder TWG will ensure all key stakeholder groups are represented, and a collaborative and coordinated approach for fiscal incentive implementation. It will also benefit from the support the various stakeholder groups can bring to the table.

Recommendation 3: Improve the importation process for solar products to reduce delays and resultant costs that are passed on to the end user

The NCS should identify the bottlenecks that make the importation process for solar products complex and cause delays that lead to demurrage and other associated costs which are passed to the end user. As identified through stakeholder engagements, these include:

1. The inconsistent interpretation of HS codes for solar technologies particularly SHS kits leading to varying taxes and levies applied on these products, and delays that lead to demurrage payments. These may likely result from limited understanding of solar products by the NCS officials at the ports.

2. Proper implementation of the Import Duty Ministerial Directive and VAT Modification Order, with the applicable taxes and exemptions for solar products and technologies under both.

3. Length of time it takes to clear solar products and technologies, and other bureaucratic bottlenecks that come up at the ports.

This can also form part of the responsibilities of the TWG, and capacity building and other required technical assistance can be provided by stakeholders such as development partners to NCS and other relevant government officials at the ports.

ANNEX 1: SUMMARY OF FINDINGS FROM PREVIOUS STUDIES

a) Inventory of existing tax and stand-alone solar sector studies

A number of studies have investigated the (two-way) link between tax policy and stand-alone solar market development in the last five years. The key aspects of methodology and findings of each of these are summarised below, for each of the following studies (listed by order of publication):

- Energy Africa 2016 – Mozambique OGS Fiscal Study
- Energy Africa 2017 – Malawi OGS Fiscal Study
- Energy Africa 2018 – Uganda OGS Fiscal Study
- Energy Africa 2018 – Zambia OGS Fiscal Study
- Shell Foundation 2018 – Uganda-Fiscal-Policy-Analysis for OGS
- Duke 2019 – The True Cost of Solar Tariffs in East Africa
- HBS 2019 – Policy Research on the 10% duties on solar (Nigeria)

This Nigeria assessment builds on the findings and methodologies of a growing body of international evidence and local data. The paragraphs below provide a brief summary of the main findings from some of these previous studies.

b) Key findings from the international literature on tax in the stand-alone solar sector

An ECA (2016) study in Mozambique developed the first cost-benefit approach to estimate the impact of VAT and import duties on SAS sector development. There were no import duty or VAT exemptions on SAS products in Mozambique at the time. One of the key trade-offs discussed is the potential for import tariffs to encourage local production of solar components, which would be more competitive if imported products faced import duties. However, the report concludes that this is not a realistic prospect, as local production could only meet a fraction of demand. The assessment falls back on some high-level assumptions from the international literature, including for extra job creation (+30 per 10,000 units sold) for SAS compared to traditional fuels, extra lighting hours both for small businesses (10-12 business hours) and (+2 hours) education, (USD 20 – USD 40 per year) financial savings for households.

Next, an ECA (2017) study in Malawi revised the cost benefit model, and considered the impact of the import duty exemptions in place, and the prevailing 16.5% VAT. A key source for the study is a BIF (2016) survey that benchmarks typical energy access expenditure in Malawi.[46] The study adopts similar assumptions to the earlier Mozambique assessment, such as the same +2 hours of light assumption, household savings of USD 20 – USD 40 per year, and job creation of 30 jobs per 10,000 units sold. It also specifies an assumption that 90% of tax costs will be passed through to consumers, and cites the Off-Grid Solar Market Trends Report 2016 estimate of price elasticity of demand at -0.567.

The next study, again carried out by ECA in early 2018, concerned Uganda, but discusses fiscal policy options rather than conducting a socioeconomic impact assessment. Uganda had VAT and import duty exemptions in place for solar products, but had reintroduced both import duties (25%) and VAT (18%) on solar powered appliances. It cites a widely used although now dated study of the adoption of SAS at different prices, from just 37% at USD 7, rising to 69% at USD 4 (Solar Aid, 2014). A subsequent analysis from the Uganda Off-Grid Energy Market Accelerator (UOMA) then developed a model to estimate the impact of various tax incentives and subsidy incentives, with a clear differentiation of the main products on the market and their prices, compared to

46. *BIF (2016) "Off-grid lighting and mobile charging study: A snapshot of household technologies, habits and expenditure in Malawi". Link*

average monthly expenditure on kerosene and phone charging. The study goes on to estimate willingness to pay for SAS products in different regions of Uganda and to make the case for a phased implementation of (maintaining) tax exemptions and subsidies to support market development.

The fourth and final study in this series, focused on Zambia (2018), where SAS were already exempt from both import duties and VAT. Although this policy was not consistently applied particularly when it came to bundles / kits that included both solar panels and appliances. The analysis used a range of price elasticities for sensitivity analysis, assumed a net margin of between 0% - 10% for SAS companies (to understand pass-through of taxes to end users), and included an assumed reduction in current energy access expenditure of between 50% and 100% of the average USD 11 spent by households. It also assumes that for income increases among SAS users, 15% of that income will fall into personal income tax bands.

The Duke (2019) study covers both Uganda and Kenya and offers a detailed description and model of how taxes and SAS market development interact.[47] The core findings of the study are that introduction of 20% tax (be it VAT or import duties), which would be fully passed through to customers, would reduce sales of small solar home systems by 20%, and larger solar home systems (with TV) by 32%. This would have a significant impact on energy access, leaving 58,000 fewer households in Kenya and Uganda with energy access, with total foregone benefits of USD 2.2 million (USD 39 per household). The Duke study assembled seven years of data of sales of over 700,000 SHS sold in Kenya and Uganda in order to observe a large range of price points for indicative product types. The authors estimate a price elasticity of demand of -0.9 for small SHS, and a range from -0.03 to -4.1 for larger SHS.

Finally, a previous study found demand for solar lighting products is highly price sensitive,[48] with 29% uptake at prevailing market prices in rural Kenya, but 69% uptake when offered at a discounted price. This is likely to remain the case in rural markets in Kenya which still have low rates of energy access (as described in Section 3 above), where ability to pay is limited and as such even small changes in price may significantly suppress demand.

46. Fetter, Rob, and Jonathan Phillips (2019) "The True Cost of Solar Tariffs in East Africa". Link

47. Harrison K., Gunther I., & Rom A. (2017). "The Economic Impact of Solar Lighting: Results from a randomized field experiment in rural Kenya". Link

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