

# E-Waste Guide for Stand-Alone Solar in Nigeria

**Africa  
Clean  
Energy**  
Technical  
Assistance  
Facility



# E-Waste Guide for Stand-Alone Solar in Nigeria



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# Abbreviations

<b>ACE TAF</b>	Africa Clean Energy Technical Assistance Facility
<b>ARBR</b>	Alliance for Responsible Battery Recycling
<b>EPRON</b>	Electronic Waste Producer Responsibility Organisation Nigeria
<b>E-Waste</b>	Electronic Waste
<b>EEE</b>	Electrical & Electronic Equipment
<b>EOl</b>	End of Life
<b>EPR</b>	Extended Producer Responsibility
<b>FmEnv</b>	Federal Ministry of Environment
<b>GEF</b>	Global Environment Facility
<b>GESI</b>	Gender Equity and Social Inclusion
<b>GIZ</b>	German Development Agency
<b>GOGLA</b>	Global Off-Grid Lighting Association
<b>GoN</b>	Government of Nigeria
<b>ICT</b>	Information and Communications Technology
<b>LDC</b>	Least Developed Countries
<b>Li-ion</b>	Lithium Ion
<b>FMEnv</b>	Federal Ministry of Environment
<b>NESP</b>	Nigerian Energy Support Programme
<b>NESREA</b>	National Environmental Standards and Regulations Enforcement Agency
<b>NSC</b>	National Steering Committee
<b>OEM</b>	Original Equipment Manufacturers
<b>OGS</b>	Off-Grid Solar
<b>PAYGo</b>	Pay-As-You-Go
<b>PCB</b>	Printed Circuit Board
<b>POPS</b>	Persistent Organic Pollutants
<b>PPP</b>	Polluter Pays Principle
<b>PRO</b>	Producer Responsibility Organisation
<b>PV</b>	Photovoltaic
<b>REA</b>	Rural Electrification Agency
<b>REAN</b>	Renewable Energy Association of Nigeria
<b>SAS</b>	Stand Alone Solar
<b>UEEE</b>	Used Electrical & Electronic Equipment
<b>ULAB</b>	Used Lead Acid Battery
<b>UPP</b>	User Pays Principle



# Regulatory Framework Analysis

## Background

Currently in Nigeria, the main piece of legislation concerning electronic waste management is the National Environmental (Electrical/Electronic Sector) Regulations of 2011. While Stand-Alone Solar (SAS) products are not specifically listed in these regulations or in any other national waste legislation, it is assumed they are included since they are used in electricity generation. However, being a relatively new market, there are no clear guidelines for the collection, management, and disposal of SAS e-waste in Nigeria. A number of solar companies are taking some responsibility by setting up take-back schemes for damaged products under warranty but there is no clear approach and many companies are either start-ups or have entered the market recently, meaning that SAS products have not reached End-of-Life (EoL) in the majority of cases. Most end-users also usually dispose of SAS products as general household waste or sell them to informal recyclers/scrap collectors.

The Government of Nigeria (GoN) through the Federal Ministry of Environment (FMEnv) and the National Environmental Standards and Regulations Enforcement Agency (NESREA) are being supported by ACE TAF on e-waste activities for the SAS sector. The FMEnv is also in the process of developing an

E-Waste Policy for Nigeria.

This document is aimed at providing guidance to the government and the private sector on managing SAS e-waste in line with the country's national e-waste regulatory framework. It will also serve as a standard e-waste reference document for the Nigerian SAS sector.

## The Stand-Alone Solar Industry and Products

According to the 2020 Global Off Grid Lighting Association (GOGLA) semi-annual report, access to energy keeps expanding, largely due to the proliferation of off-grid solar (OGS) products. Since 2017, almost 24 million products have been sold globally. In the second half of 2019 alone, there was 4.42 million sales, out of which roughly 324,000 were sold in Nigeria. Nigeria's national energy access targets include 8,000 MW of off-grid solar power in rural areas by 2030, expanded ICT access in rural areas and improvements in access to both electricity and financial services. Estimations from Nigerian Rural Electrification Agency (REA)<sup>1</sup> show that developing off-grid alternatives to complement the grid creates a 9.2B US\$/year market opportunity that could save 6B US\$/year for Nigerian homes and businesses (Figure 1).



Figure 1: Estimations from the Rural Electrification Agency (REA) on the market potential for developing off-grid alternatives to complement the grid.

<sup>1</sup>Rural Electrification Agency. The off-grid opportunity in Nigeria. [http://rea.gov.ng/wp-content/uploads/2017/12/REA-Presentation-Off-Grid-Opportunity\\_africa2017.pdf](http://rea.gov.ng/wp-content/uploads/2017/12/REA-Presentation-Off-Grid-Opportunity_africa2017.pdf)

The PAYGo (Pay-As-You-Go) Market Attractiveness Index 2019<sup>2</sup> highlights Nigeria's significant potential demand for OGS. The sector has experienced rapid growth over recent years, with over 1.7 million Nigerian households now using OGS products. Current market penetration nonetheless remains low at this stage (4%) but this is expected to rise sharply as local solar companies incorporate PAYGo technology and international PAYGo solar companies enter the largest and most populous economy in Sub-Saharan Africa.

Whilst the OGS sector generally comprises of SAS and solar mini-grids, this guidance document focuses solely on SAS. Whilst mini grids have an important role to play, they have a different product set, considerably longer lifespan (<25 years) and are less ubiquitous when compared to SAS. SAS includes pico-solar lamps; solar home systems (SHS) as well as the electrical and electronic devices powered by the SHS systems such as TVs, fridges, water pumps and fans; and productive use equipment powered by solar solutions below the capacity of mini-grids.

OGS waste contains toxic materials, such as lead, mercury, cadmium, arsenic and polychlorinated biphenyls which are harmful to the environment and

human health if improperly managed. In the context of developing countries, this is often the case as safe transport, disposal and handling of this waste can be complicated and costly. This is largely due to the absence of enforcement of pre-existing legal provisions (or the absence of legal provisions altogether) and lack of appropriate collection and recycling infrastructure. Informal handlers trying to exploit the economic value contained in the products (e.g. copper and lead) with rudimentary recycling processes and little regard to emission control lead to adverse impacts to the environment and public health.

Energy-access projects undoubtedly have numerous positive development effects and impact positively on newly electrified communities, but they also bring new challenges related to waste management. These challenges are linked to the fact that equipment used for SAS will sooner or later become waste (commonly referred to as e-waste and battery waste) and can be harder to collect as they are mostly used by rural communities which most times are difficult to access. Table 1 highlights the main components found in SAS, which forms the bulk of OGS e-waste.

**Table 1 – Typical components of SAS, main materials/components (in red those mainly targeted during informal recycling processes) and typical lifetime.**

Component group	Typical material composition	Expected lifetime
<b>PV panels</b>	Crystalline silicon, glass, aluminium, copper, trace elements (indium, tin, gallium....)	> 10 years (technical lifetime), but usually replaced at end of warranty (5 years) at least for certified products.
<b>Control devices</b>	Charge controllers, Printed Circuit Boards (PCBs), solder paste, various electrical and electronic components, plastics...	5 – 15 years
<b>Batteries</b>	Lead-acid batteries: lead, lead-oxide, plastics, electrolyte (sulfuric acid)  Li-ion batteries: Graphite, various organic substances, copper, aluminium, lithium, plastics...	12 – 6 years for lead-acid and 4-10 years for li-ion but often reduced due to poor maintenance or misuse: if automotive battery is used (designed for providing high current for a short duration, not to supply current for a long duration), would have a short lifetime and so have to be regularly replaced generating more waste.
<b>Associated components</b>	Copper, plastic insulation, battery mounting racks, cable covers	> 10 years, but usually replaced with the SHS.

<sup>2</sup> Pay-As-You-Go Market Attractiveness Index 2019. <https://www.lightingglobal.org/wp-content/uploads/2019/06/PAYGo-MAI-2019-Report.pdf>

Component group	Typical material composition	Expected lifetime
<b>Connected Equipment (lamps, radios, water pumps, fans, TVs...)</b>	Various plastic types, <b>aluminium, copper, ferrous metals</b> , various electrical and electronic components (microchips, displays, <b>transformers</b> , resistors...)	2 – 10 years

A broader and coordinated action to ensure proper management of SAS products at EoL is required that considers the following aspects:

- ☀️ Legally binding legislation and enforcement that cover SAS (regarding e-waste).
- ☀️ Adequate infrastructure for collection, management and treatment of e-waste as well as appropriate landfill for safe disposal of non-recyclable or hazardous fractions/components. Additionally, the presence of a thriving informal scrap-dealing sector can be observed. This often involves the scavenging of valuable components from e-waste, which can often pose severe threats to the environment and the human health of workers exposed to such waste.
- ☀️ Different OGS companies, at different stages of their maturity/growth have different ambitions and practices implemented to tackle the challenges that proper EoL management poses: take back of products, identification of local reliable recyclers to work with and financing of

collection and recycling operations.

The development of this E-Waste Guide for Stand-Alone Solar in Nigeria will enable the government and the private sector get ahead of the curve when it comes to managing the EoL for SAS, as well as all the social and environmental benefits associated outlined in the legislation.

### Estimation of the Stand-Alone Solar Market and Waste Generated

The estimation of waste generated by SAS product weight in the Nigerian market for the 2019-2025 horizon can be modelled using the sales-lifespan model<sup>3</sup>. Sales data (by units) are provided by GOGLA whilst the average lifespan and weight has been built through Sofies<sup>4</sup> internal datasets. See Figure 2 for results.

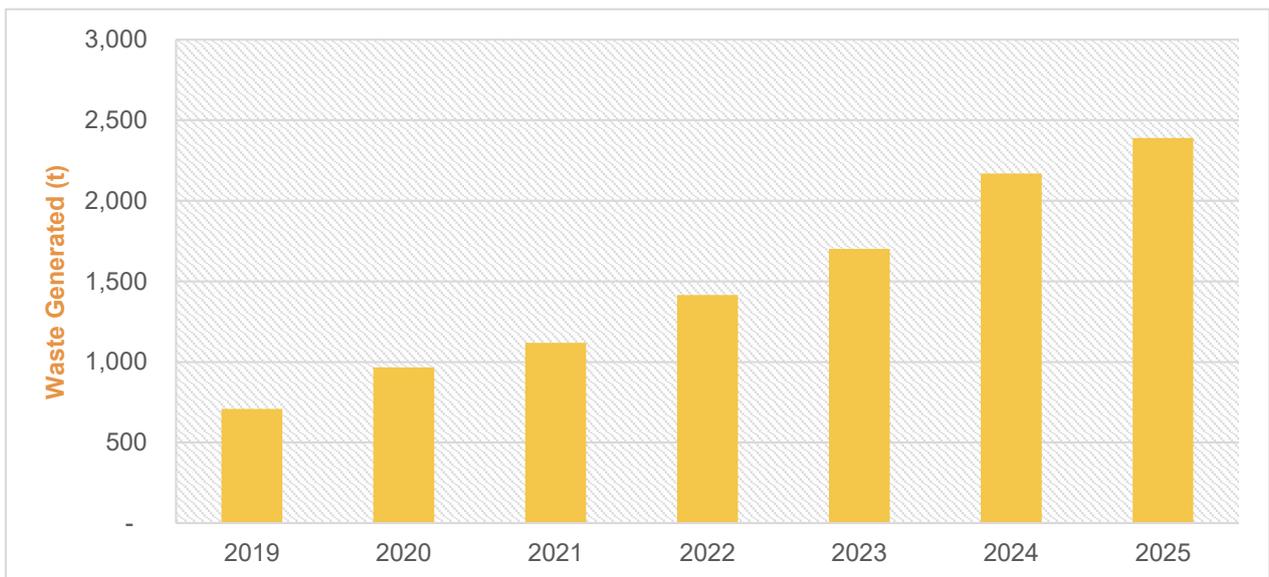


Figure 2: Waste generated (weight in tonnes) by country.

<sup>3</sup>See: [https://ec.europa.eu/environment/waste/weee/pdf/Final\\_Report\\_Art7\\_publication.pdf](https://ec.europa.eu/environment/waste/weee/pdf/Final_Report_Art7_publication.pdf) The same methodology is used for the Global E-waste Monitor published by UNU/ITU/ISWA

<sup>4</sup>Sofies is an international sustainability consultancy and private management firm (B-Corp certified) that provides innovative solutions in the fields of land resource development, eco industrial parks, organisation sustainability, production and value chains, waste management and alternative energy systems.

The results in figure 2 indicate a clear exponential increase in the amount of SAS e-waste projected on to the Nigerian market however, it should be noted that such an estimation does not consider the expected and plausible reductions in the operational costs of processing e-waste due to progressive optimisation of the recycling processes and economies of scale. Such improvements could lower the exponential trajectory shown in figure 2.

Currently three countries (Zambia, Nigeria, Ghana, with some other countries like South Africa revising their systems) in Africa have an EPR scheme in place.

## Current Legislation in Nigeria

While the EU currently sets the Waste Electrical & Electronic Equipment Directive (WEEE Directive) which sets the criteria for the collection, treatment and recovery of WEEE, most African countries do not have an overarching framework for e-waste management. Only 10 countries (Egypt, Ghana, Kenya, Madagascar, Nigeria, Rwanda, South Africa, Cameroon, Ivory Coast, Zambia) have specific e-waste legislation that is legally binding (act, law, statutory instrument etc.); in addition, Tanzania has policies relating to e-waste that are not legally binding (i.e. strategies, policies, guidelines etc.). While still in its early stages, more African countries are starting to look at ‘take back’ legislation based on the Extended Producer Responsibility (EPR) principle, thereby legally requiring manufacturers and importers to finance the take back and proper recycling of products placed on the national markets.

## General Waste Management in Nigeria

When Electrical & Electronic Equipment (EEE) legislation is drawn up, often not all EEE, including OGS products and batteries, are specified in the scope of legislation, as seen with the National Environmental (Electrical/Electronic, Sector) Regulations, 2011. However, it is important to note that proper collection and recycling of e-waste is difficult to achieve without either a legal obligation or a voluntary initiative from industry (producers and importers or waste holders).

International conventions, treaties and agreements can be driving factors in promoting the development of national frameworks, providing a common point of reference relevant to e-waste. Many countries have either signed or ratified several international conventions that touch on e-waste management and they are summarized in the table below. While these conventions are not legally binding, countries such as Nigeria are expected to transpose them into national law. Nigeria has signed up to a couple of waste management international conventions, as seen in Table 2.

**Table 2 - International waste management conventions Nigeria is signatory to**

Convention	Main Development
<b>The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal</b>	<p>International treaty designed to reduce hazardous waste generation and promote the environmentally sound management of hazardous wastes, as well as reduce the movement of hazardous waste between nations, preventing the transfer of hazardous waste from developed to less developed countries. The Convention is also intended to minimize the amount and toxicity of waste generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist least developed countries (LDCs) with environmentally sound management of hazardous waste (and other waste) generated.</p> <p>Nigeria signed the Basel Convention in 1990 and it came into force in May 1992. Nigeria also signed the Ban Amendment to the Basel Convention, which prohibits the export of hazardous waste from developed countries to developing countries. This entered into force in December 2019.</p>
<b>The Stockholm Convention on Persistent Organic Pollutants (POPS)</b>	<p>The Stockholm convention was signed by Nigeria in 2001 (enforced 2004) and focuses on the proper management of specific components of e-waste. The bulk of the newly listed POPs come from the imports of plastic products, electrical and electronic goods, computers, mobile phones, foams and flame retardants. The main challenge that comes with chemical use is the proper management of chemicals across the entire lifecycle. Poor management of chemicals comes with a price, degrading ecosystems and damaging public health.</p>

**Bamako Convention  
(Regional)**

This treaty, ratified by the Member States of the Organisation of African Unity, came into force in 1998 and focused on prohibiting imports and controlling movement of hazardous wastes within Africa. It was born out of the need to overcome certain issues that the Basel Convention was not able to address. The treaty prohibited imports of all waste without any exceptions and provided a much stronger tool to prevent trade of hazardous waste to less developed countries. Nigeria has only signed this convention, it has not been ratified.

In terms of national legislation generally concerning waste, the main ones are described below:

**Table 3 - National regulation regarding waste management**

Legislation Name	Brief description	Main stakeholder (s)	Status
<b>The Management of Solid and Hazardous Wastes Regulations, 1991</b>	Regulates the collection, treatment and disposal of solid and hazardous waste for municipal and industrial sources; provides a comprehensive list of chemical waste typologies that constitute hazardous waste; identifies sources of toxic and hazardous waste produced by manufacturers and industry; provides guidelines on the storage and collection of waste from industrial areas.	Federal Ministry of Environment, NESREA	In force
<b>Harmful Waste (Special Criminal Provisions, etc.) Act, 2004 - (Proposed Amendment - (on import of electronic devices) Senate Bill No. 287, 2009</b>	Electronic devices imported into Nigeria from the commencement shall be Subject to the following: <ul style="list-style-type: none"><li>(i.) All electronic devices imported into Nigeria shall be in good condition.</li><li>(ii.) Electronic devices that has been used for more than 5 years outside Nigeria are prohibited from being imported into Nigeria.</li><li>(iii.) All electronic devices shall have accession number before imported or allowed into Nigeria</li></ul>	Federal Ministry of Environment, NESREA	In force
<b>The National Environmental (Sanitation and Waste Control) Regulation, 2009</b>	The purpose of this regulation is the adoption of sustainable and environment friendly practices in environmental sanitation and waste management to minimize pollution. Electronic devices are considered as hazardous waste in these regulations.	Federal Ministry of Environment, NESREA	In force

<b>National Policy on the Environment, 2016</b>	<p>Nigeria is committed to a national environmental policy that ensures sustainable development based on proper management of the environment. This policy derives its strength from the fundamental obligation for the protection of the environment as stated in section 20 of the Constitution of the Federal Republic of Nigeria 1999, which provides that the “State shall protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria.</p> <p>This policy gives guidelines on the following sustainable development principles and their implementation:</p> <ul style="list-style-type: none"> <li>○ The precautionary principle</li> <li>○ The pollution prevention pays principle</li> <li>○ The polluter pays principle (PPP)</li> <li>○ The user pays principle (UPP)</li> <li>○ The principle of intergenerational equity</li> <li>○ The principle of intra-generational equity</li> </ul>	Federal Ministry of Environment, NESREA	In force
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## E-Waste

Nigeria is one of the few countries in Africa to have specific national legislation concerning e-waste:

**Table 4 – National legislation regarding e-waste**

Legislation Name	Brief description	Main stakeholder	Status
<b>National Environmental (Electrical/ Electronic Sector) Regulations SI No 23 of 2011 (updated 2021)</b>	<p>The principal aim of these regulations is to prevent and minimize pollution from all operations and associated activities of the Electrical/Electronic Sector to the Nigerian environment. These Regulations cover both new and used Electrical/Electronic Equipment (EEE/UEEE).</p> <p>Manufacturers, importers, distributors or retailers are to take back end-of-life EEE and set up collection points/centres. Manufacturers and producers of EEE are to ensure environmentally sound management of e-waste from collection points/centres to accredited recyclers. Importers of new and/or used EEE are to pay administrative fees to promote environmentally sound management of WEEE.</p>	Federal Ministry of Environment, NESREA	In force

<b>Import of Used Electrical Electronic Equipment (UEEE), Guidelines, 2011</b>	This guidance document highlights some of the do's and don'ts of shipment of UEEE into Nigeria. It is intended to help importers including private persons, companies, organisations and shipping companies to differentiate between UEEE and WEEE.	Federal Ministry of Environment, NESREA	In force
<b>National Environmental (Energy Sector) Regulations, 2014</b>	The purpose of these regulations is to minimize pollution and encourage energy efficiency in all operations and ancillary activities of the energy sector in achieving sustainable economic development in Nigeria. It includes fossil fuel, renewable and nuclear resources. These regulations cover power generation, transmission and distribution from fossil fuel, renewable and nuclear resources.	Federal Ministry of Environment, NESREA	In force
<b>Draft National Electrical/Electronic Waste Management Policy</b>  <b>Prepared by</b>  <b>E- Waste Management Technical Working Group, Federal Ministry of Environment</b>	The overarching aim of this policy is to mobilise the country on appropriate e-waste management and to reduce importation of non-functioning EEE. To achieve this, the FMEnv has several objectives including: reduce the amount of e-waste in the country to a bare minimum, ensure proper management and disposal practices of WEEE, provide guidelines for UEEE handlers in public and private sectors and communities attempting proper e-waste management.	Federal Ministry of Environment, NESREA	Draft

## Battery Waste

Li-Ion batteries are gaining importance in all parts of the world. While they have been used for over 10 years in mobile electronic applications such as notebooks and mobile phones, they are now also starting to be used in the mobility sector (e.g. electric bicycles) and in stationary power storage. The latter application might be particularly relevant for Nigeria as various rural electrification projects and companies consider switching from lead-acid batteries to more durable (but still more expensive) Li-Ion batteries. To date, market penetration of Li-Ion batteries in the SAS sector is still low with almost no waste batteries being generated yet. However, lead acid batteries have been greatly used. If not recycled and disposed

of properly they can damage the environment and human health.

Presently, collection, transportation, storage and processing of used batteries especially lead-acid battery (ULABs) is predominantly informal. There are few formal recycling plants in the country. With no proper segregation of waste, many of the lead-based batteries are mixed with municipal wastes at dumpsites. The Federal Ministry of Environment is currently developing a policy for the regulation of used batteries with the technical support of the GIZ with the Harmful Waste Decree and the Basel Convention providing the basis for the development of this policy. In addition to this policy, NESREA is also in the process of developing draft Used Battery Waste Control Regulations.

**Table 5 – National legislation regarding battery waste**

Legislation Name	Brief description	Main stakeholder	Status
<b>Draft Policy for the Regulation of Used Batteries (ULAB, Lithium-Ion Batteries) in Nigeria</b>	<p>The goal of the Policy is to ensure environmentally sound management of used batteries and create an enabling environment for the business of collecting, transporting, storing, processing/recycling and transboundary movement of used batteries to thrive in Nigeria with minimal negative or harmful impact to life and environment. The policy states guidelines for used battery users – collection, storage, transportation and recycling of used batteries.</p> <p>Solar PV operators will be required to auction their used batteries to registered recyclers and collectors. Exporters or transporters of used batteries will have to get a permit from the Federal Ministry of Environment. Recyclers of used batteries will also be obligated to meet certain performance, environmental and technical standards in line with the policy and environmental regulations and laws of Nigeria.</p>	Federal Ministry of Environment, NESREA	Draft
<b>National Environmental (Battery Control) Regulations 2021</b>	<p>The purpose of these Regulations is to prevent and minimize pollution and wastes emanating from used batteries to the Nigerian environment and these Regulations shall cover new, used and end-of-life batteries including those used in the OGS sector.</p> <p>All importers, exporters, manufacturers, distributors, retailers, collectors and recyclers involved in the battery sector shall subscribe to an Extended Producers Responsibility Programme.</p>	Federal Ministry of Environment, NESREA	Draft

## Ongoing Initiatives and Projects

### Global Environment Facility

With backing from the Global Environment Facility (GEF), the Government of Nigeria has joined forces with UN Environment and partners to turn the tide on e-waste. This will be done under the Circular Economy Approaches for the Electronics Sector in Nigeria project. The \$15 million initiative

is led by NESREA and brings together players from government, the private sector and civil society. The project supports the implementation of EPR legislation in Nigeria, while working closely with the private sector (particularly with the newly set-up E-PRON, the Producer Responsibility Organisation, or PRO for short) to develop cost-effective solutions and integrating informal workers in the sector. Currently, the project has also reviewed the current 2011 E-waste Regulations. It also aims to develop a practical circular electronics model for Africa by sharing best practices regionally and globally.

## Global LEAP Awards

The Global LEAP Awards is an international competition to identify and promote the world's best off-grid appliances, accelerating market development and innovation. The second Global LEAP Solar E-Waste Challenge, supported by USAID, made \$1.2 million in grant funding available to support the research and development of more sustainable solar home systems and battery technologies for the off-grid solar sector in sub-Saharan Africa. The Awardees received funding to support implementation of their proposed projects over an 18-month period, with individual awards ranging from \$50,000-\$300,000.

In Nigeria, Hinckley Recycling received the award and with it will coordinate formal and informal collectors to ensure that solar batteries are recycled safely. Hinckley will evaluate the efficacy of incentives and improved logistics to access remote solar e-waste sources. The grant funding will contribute to equipment procurement and capacity building for the solar e-waste recycling facility. Hinckley aims to develop a process to reuse battery cells by manufacturing new products from off-grid solar batteries.

## Renewable Energy Association of Nigeria

The Renewable Energy Association of Nigeria is an independent, non-profit industry association formed by stakeholders in the renewable energy sector in 2016 with the aim of engaging with the public and private sector to guide advocacy, policy formulation, and investment in the sector. The Association with the support of the Heinrich Boell Stiftung has developed a Battery Stewardship Program for the renewable energy sector and has developed its ULAB Policy which serves as a guiding principle for

the environmentally sound management of ULAB for all its members. The Association also plans to expand the scope of the policy to include other e-waste generated by the renewable energy sector.

## Alliance for Responsible Battery Recycling

The Alliance for Responsible Battery Recycling (ARBR) was formed in 2018 to help manage the pollution from informal battery recycling of used batteries in the country. They currently have programmes and projects to promote the reduction of used batteries in the waste stream, ensure environmentally sound battery recycling, and create public awareness on the hazards of improper battery disposal. ARBR membership is open to all companies, organisations or associations operating in the battery sector. The ongoing and planned activities of the Alliance include: providing support to used battery take-back schemes, collection and management of data and information on the battery sector, undertaking research on new and innovative battery technologies, supporting expansion and technology upgrade of the battery recycling value chain.

The Alliance supported the Renewable Energy Association of Nigeria (REAN) in developing the Battery Stewardship Program for the renewable energy sector and is working with the Federal Ministry of Environment to develop a National Policy on Used Batteries for key sectors such as the renewable energy, telecommunication, ICT. It is working to establish battery take-back schemes and has been registered by NESREA as a Producer Responsibility Organisation for the battery sector in Nigeria.

<sup>30</sup>WEEE Resource Management System in Costa Rica, Abarca-Guerrero et al, Resources, 2018

## Other African E-Waste Initiatives

**Table 6 – E-waste initiatives**

Initiative	Expected outcome
<b>WEEECAM Cameroon 2017 - ongoing</b>	WEEECAM is an e-waste recycling project in Cameroon, coordinated by a consortium of French and Cameroonian stakeholders. Its goal is to set up an industrial scale e-waste collection and recycling activity in Cameroon's two major cities, Yaoundé and Douala, and to validate a scalable business model relying on both refurbishing and material value of the waste. Its budget of 6 million euros is funded by French and international institutions.
<b>GIZ &amp; KfW Ghana 2018-present</b>	<p>The Ghanaian-German Financial Cooperation is supporting Ghanaian partners to set up an incentive mechanism for sound recycling of e-waste as well as the construction and operation of a so-called Handover-Centre serving as the logistical basis for reception and storage of purchased e-waste (KfW).</p> <p>In parallel, a Technical Assistance Facility is in place to support the Ghanaian government in the implementation of E-waste bill (Act 917) and related provisions (GIZ).</p>
<b>Sustainable Recycling Industries 2 (SRI 2) Ghana and Egypt 2019-ongoing</b>	<p>The Ghana-part of the Sustainable Recycling Industries project supports small and medium sized enterprises that would like to become part of a sustainable e-waste recycling chain in Ghana. This support encompasses the development of alternative business models, transfer of know-how on recycling practices and technologies, as well as the access to markets for recycling outputs.</p> <p>Specific emphasis will be paid to informal recyclers and ways to make them part of a more sustainable e-waste recycling system without endangering their livelihoods. Local standards and conformity assessment systems are also important elements for the overall project aim to build a global sustainable secondary raw material supply.</p>
<b>CDC Pilot Project Kenya 2019-ongoing</b>	The project involves three components: (i) training program for sales agent to decentralize repair at consumer's home, (ii) development of incentive scheme to collect out-of-warranty faulty products and (iii) piloting of collection and recycling of various WEEE streams (not only Off-Grid solar).
<b>ICT Sector Reform Project (World Bank) Cameroon 2020- 2022</b>	After installing a backbone of optic fibre interconnecting the countries of Central Africa (program Central African Backbone, 2014-2018), the next phase aims to build the capacity of local institutions so they can exploit the new infrastructure at its full potential. This program considers its repercussions in terms of increased e-waste generation and should act jointly with the GEF waste project in Cameroon (below) to reach the same outcomes.
<b>GEF Project Cameroon 2020- 2022</b>	This GEF funding program is implemented by the African Development Bank and piloted by the Cameroonian Ministry of Environment. It aims at improving the management of municipal solid waste in Cameroon, putting an accent on e-waste and contaminated healthcare waste. The main outcomes include improved institutions capacity, e-waste treatment industrial infrastructure and an EPR scheme complete with funding mechanism.

<sup>31</sup>Framework of India's E-Waste, India Urban Development Gateway, UK India Business Council

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**LEAP - Enviroserve  
Rwanda**

Enviroserve Rwanda will establish solar e-waste collection points in each of Rwanda's thirty districts and neighbouring country border points. Enviroserve Rwanda will also develop a tracking system to optimize logistics and streamline communication with users.

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**LEAP - WEEE Centre  
Kenya**

WEEE Centre will focus on collection, refurbishment, and recycling of OGS products. The Centre will conduct a nationwide awareness campaign to increase public knowledge on the importance of solar e-waste recycling and existing e-waste collection centres. The grant funding from LEAP will allow WEEE Centre to increase capacity and training for solar e-waste recycling both within and outside the Centre.

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## Extended Producer Responsibility (EPR) Program

The E-Waste Producer Responsibility Organisation (EPRON) is a non-profit organisation set up by electrical and electronic producers in Nigeria. The organisation was founded in March 2018, driven by NESREA along with key stakeholders including HP, DELL, Phillips, Microsoft and Deloitte, contributing towards its establishment in Nigeria. The board of directors includes representatives from HP, MTN and reputable experts from the waste management industry. It is the first Producer Responsibility Organisation (PRO) for electronic waste in Nigeria. EPRON works with producers, collectors, and recyclers including interfacing between the government and producers to ensure the safe management of waste electrical and electronic equipment (WEEE) in order to reduce the hazardous effects on health and the environment.

The model is based on incentivizing the collection of all e-waste; linking this to the existing regulation on e-waste that all producers should be responsible for their end of life management. The system includes:

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-  Compliance – producers importing, manufacturing, assembling, or distributing electrical and electronic equipment in Nigeria are required to comply with the EPR program as indicated in the National Environment (Electrical/ Electronic Sector) Regulations 2011.
  -  Registration – producers are obligated to comply with the EPR policy (including but not limited to brand owners, manufacturers, importers, and distributors) and register with the PRO.
  -  Collection Centres – EPRON provides a record of accredited recyclers/authorized treatment facilities and collection centres for end-users to get involved in the buyback/recovery and recycling program. Partnerships between producers and collection centres allow the implementation of the buyback/recovery and recycling program, whereby the collection centres collect and store e-wastes temporarily before they are responsibly recycled.
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# Stakeholder Consultation

## Mapping of Stakeholders

In Nigeria, there are several stakeholders involved in SAS e-waste management including government

agencies, SAS companies, industry associations, development programmes, research organisations, and recycling companies. The table below provides a breakdown of key stakeholders, their roles, and activities.

**Table 7 – Breakdown of key SAS e-waste stakeholders in Nigeria**

Category	Stakeholder	Description
Government Institutions	Federal Ministry of Environment (FMEnv)	The FMEnv oversees environmental protection, natural resources conservation and sustainable economic development in Nigeria.
	National Environmental Standards and Regulations Enforcement Agency (NESREA)	The Agency is a parastatal of the Federal Ministry of Environment and is responsible for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources and as well as the coordination, and liaison with relevant stakeholders within and outside Nigeria on matters around the enforcement of environmental standards, regulations, rules, laws, policies and guidelines. NESREA is also in charge of registering PROs and recycling companies.
	Federal Ministry of Power	The Federal Ministry of Power is responsible for provision of power in the country and oversees the power sector.
	Rural Electrification Agency (REA)	The REA is the implementing agency of the federal government tasked with the electrification of rural and unserved communities. Its mandates include: <ul style="list-style-type: none"><li>○ Promoting rural electrification in the country</li><li>○ Coordinating rural electrification programs in the country</li><li>○ Administering the Rural Electrification Fund (REF) to promote, support and provide rural electrification through public and private sector participation</li></ul>

Category	Stakeholder	Description
<b>Industry Association</b>	Renewable Energy Association of Nigeria (REAN)	The Renewable Energy Association of Nigeria (REAN) is an independent, non-profit industry association founded by stakeholders in the sector dedicated to promoting the growth and development of the industry in Nigeria by engaging with the public and private sector to guide advocacy, policy formulation and investment in the renewable sector.
	E-Waste Producer Responsibility Organisation of Nigeria (EPRON)	EPRON is a social enterprise developed to coordinate the environmentally sound recycling of end of life EEE with adherence to the EPR Principle. It was set up to fulfil the PRO role for the EEE sector as specified by the EPR operational guideline.
	Alliance for Responsible Battery Recycling (ARBR)	<p>The Alliance works with battery manufacturers, importers, distributors, retailers, recyclers, renewable energy companies, environmental groups, and government agencies across the country to execute programmes and projects that promote the removal of used batteries from the normal waste stream, ensure their environmentally sound recycling, as well as build capacity and knowledge around proper recycling practices, and public awareness on the hazards of improper battery disposal.</p> <p>The Alliance is also a licensed PRO in charge of helping to manage battery pollution in the country as well as implement the EPR for used batteries.</p>
	Waste Battery Recyclers in Nigeria	An association of informal battery recyclers in the country.
<b>International Donor/ Development Agency</b>	United Nations Development Programme (UNEP)	The United Nations Development Programme (UNEP), Global Environment Facility (GEF) was established to help tackle the most pressing environmental issues globally. In the area of off-grid lighting, the facility is founded on policy de-risking, financial de-risking and knowledge management.
	Africa Clean Energy Technical Assistance Facility (ACE TAF)	ACE TAF aims to catalyse a market-based approach for private sector delivery of quality stand-alone solar (SAS) systems in 14 countries across Sub-Saharan Africa with an emphasis on rural communities and marginalised groups. It complements government, private sector and donor initiatives to overcome the barriers preventing the development of markets for high quality stand-alone solar systems.
	GIZ/Nigerian Energy Support Programme (NESP)	The Nigerian Energy Support Programme (NESP) co-founded by the European Union and the German Government and implemented by GIZ focuses on creating an enabling environment for fostering investments in renewable energy, energy efficiency and rural electrification in Nigeria.
	Heinrich Boell Stiftung (HBS)	The Foundation works with activists, thinkers and networks in civil society, business and politics to stimulate public debate and action for a socially just and sustainable country. HBS supported the Renewable Energy Association of Nigeria (REAN) develop ULAB Stewardship Programme for its members.

## Consultation Results

During the development of this guidance document, interviews were held with 14 stakeholders to obtain insight on the e-waste landscape in Nigeria for off-grid solar products. These included government institutions, donor & development programmes, SAS companies, e-waste recyclers, industry associations, and e-waste sector support organisations.

### Government

Several e-waste related activities and initiatives have been adopted and are being developed by government institutions in Nigeria. The Federal Ministry of Environment and NESREA launched the Extended Producers Responsibility Program (EPR) in 2011 with the objective of making all producers responsible for the end of life management of their products. This program also led to the registration of EPRON by NESREA to serve as the PRO for e-waste management in the country.

Currently, several e-waste related policies and guidelines that include SAS are being developed by NESREA in collaboration with a host of stakeholders. These include a policy and regulation for the management of Used Batteries (covering both Lead Acid Batteries and Lithium Batteries), and a *Guideline for the Implementation of the Extended Producer Responsibility (EPR) Programme for the Electrical Electronics Sector in line with the Circular Economy in Nigeria* which was recently completed in 2020.

On stakeholder coordination, the REA is engaging with the FMEnv and NESREA to harmonise the certification of e-waste recycling facilities in the country. In addition, the Rural Electrification Fund (REF) under the Agency requires their SAS contractors to have an environmental management plan for the duration of the project at the proposal stage and monitor the execution of the project including the contractor's e-waste management practice through their regional desk officers.

However, coordination among key stakeholders remains a major challenge with regards to e-waste management in the SAS sector. To address this challenge as well as ensure proper SAS e-waste management, the following measures could be adopted:

- Proper mapping of stakeholders involved in e-waste management at the federal and state levels in Nigeria specific to the SAS sector, and their roles/activities.
- An effective coordination mechanism between key stakeholders in the SAS sector (government, private sector, donor programmes etc).
- An assessment of the source and estimation of the volume of SAS e-waste in Nigeria.
- Stakeholder education on e-waste management for SAS – government, SAS providers, end-users, industry associations, and other relevant stakeholders.

### International Donors, Development Co-operation Agencies and Initiatives

There are several international donor and development co-operation agencies supporting e-waste initiatives in the Nigerian SAS sector.

- The United Nations Environment Program (UNEP), Global Environment Facility (GEF) as part of its Circular Economy Approaches for the Electronic Sector in Nigeria project is currently reviewing the 2011 E-Waste Regulations and working with NESREA to develop a guideline for the Extended Producers Responsibility (EPR) program.
- The GIZ Nigerian Energy Support Program (NESP II) is working with the Federal Ministry of Environment to develop a Used Batteries Policy and build the technical capacity of some formal battery recyclers in the country.
- The Heinrich Boell Stiftung provided support to the Renewable Energy Association of Nigeria (REAN) in developing a Battery Stewardship Program for the renewable energy sector, and has supported research and studies on ULAB management.
- The World Bank and African Development Bank funded National Electrification Project currently being implemented by the Rural Electrification Agency (REA) requires SAS contractors to have an environmental management plan for the project duration (including EoL product management).

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 The Africa Clean Energy Technical Assistance Facility (ACE TAF) funded by the UK government, is supporting government institutions across countries in sub-Saharan Africa including the FMEnv, NESREA and REA in Nigeria develop appropriate, efficient, and affordable e-waste management processes for SAS systems. This guidance document forms part of the overall support.

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A major challenge faced by stakeholders is lack of data on the total number of SAS products currently being used in the country and the SAS e-waste volume generated. Other challenges include the need for effective stakeholder coordination on SAS e-waste management, and the need for public sensitisation on the environmental and health impact of SAS e-waste.

## Industry Associations & Solar Companies

Most solar companies in Nigeria are unaware of existing national regulations on e-waste. Foreign companies operating in the country seem to be more aware of these regulations than local companies although most already adhere to global e-waste management practices due to their global nature. Currently, SAS companies adopt varying approaches in managing their products' EoL which ranges from export, partnership with licensed e-waste recyclers in the country, and returning EoL products to Original Equipment Manufacturers (OEMs). To do this they engage in either self-collection, customer incentivisation measures to return faulty/end of life products, selling quality products with a longer life span, and sensitisation of end-users on the proper disposal of the products.

Several SAS providers only sell products from certified OEMs and have measures in place to collect EoL SAS products from end users to send them back to the manufacturers. SAS products usually have a life span of 2-12 years and come with a one or two-year warranty.

Some companies have also adopted a repair and refurbish approach as well as a product upgrade policy to encourage end users return faulty or EoL SAS products to them. In addition, some of these companies, pending partnerships with registered e-waste recyclers to process their e-wastes, have warehouses where they store components from the faulty SAS products that have been disassembled.

The industry association, the Renewable Energy Association of Nigeria (REAN), has developed a self-regulatory framework on Used Lead Acid Batteries

(ULAB) for its members with plans to expand it to include other solar e-waste components. The association is currently carrying out a baseline study to understand the volume of ULAB in the country.

The Alliance for Responsible Battery Recycling (ARBR) also known as the Battery Alliance is currently working with the FMEnv and NESREA to develop a used batteries policy. Their current activities as relevant to SAS include:

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-  Working to provide vehicles for the proper transportation of ULAB.
  -  Working with the Waste Battery Recyclers of Nigeria (the union of informal recyclers in the country) to build capacity for their members.
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Several challenges are currently being faced by both industry associations and private solar companies related to SAS e-waste management. These include:

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-  Limited resources for the industry association and solar companies on proper SAS e-waste management.
  -  Low awareness of existing national e-waste regulations among solar companies and end users.
  -  Lack of an existing specific policy on used batteries.
  -  Limited number of e-waste recycling companies in the country.
  -  Complexity in the documentation process for licensing e-waste recycling companies in the country.
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There were several recommendations proposed during the stakeholder consultations. Some are economically driven such as the introduction of financial and non-financial incentives for both end-users, e-waste recyclers and SAS providers. Others were governance related, such as better coordination amongst stakeholders, increased government support and endorsement of e-waste initiatives of the industry association.

Other recommendations include issuing certificates of compliance to SAS providers with good e-waste track record and making these certificates a requirement for securing government contracts. Stakeholders also highlighted the need for gender and social inclusion in ensuring that a safe working environment is provided for women and vulnerable groups across the SAS e-waste value chain, for example, setting up SAS e-waste collection points or

recycling plants far from communities/villages.

## Recyclers

Licensed e-waste recycling companies in Nigeria are building their knowledge of the solar sector with some entering partnerships with SAS providers in managing and recycling their e-waste. Most formal recyclers have recycling facilities and offices in Lagos, Abuja and Port Harcourt.

Currently, a significant volume of e-waste generated in-country end up in the informal recycling sector. For this reason, formal recyclers are exploring ways to work with the highly organized informal recycling sector and build their capacity to adopt proper environment-friendly e-waste management practices. Some of the challenges facing licensed formal e-waste recyclers include the ineffective enforcement of existing national e-waste regulations and the foreign exchange volatility which has made access to finance very difficult. These challenges could be addressed with the following recommendations:

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-  Better coordination between stakeholders.

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  -  Introduction of financial incentives for formal recyclers (tax credit, tax rebates etc.).

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  -  Capacity building of the informal recycling sector.

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  -  Education and awareness creation programs on proper e-waste management practices targeted at both informal recyclers and end-users.

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  -  Having a PRO (which could be EPRON or other relevant body) which will cover SAS e-waste and making membership mandatory for SAS providers.
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# Guidance for Stand-Alone Solar E-Waste Management

## Lessons Learnt from Chapters 1 & 2

Findings from the stakeholder consultations highlight several challenges such as poor stakeholder coordination, inadequate data on the volume of waste generated from SAS, and a lack of regulatory awareness on e-waste management by end users, informal recyclers and SAS providers.

A major concern is that treatment/recycling is being carried out by the informal sector with little or no knowledge of the environmental and health risks of improper recycling, as well as the country's environmental e-waste guidelines. There is also limited knowledge by most SAS providers of existing national e-waste legislation and how or whether they apply to the disposal of SAS e-waste. The most recent efforts by the government has seen the launch of an EPR programme on WEEE seeking to put more responsibility onto the importers, exporters, manufacturers, assemblers, distributors, and retailers whose products end up as e-waste. Informal activities are nearly impossible to stop and reducing the scale of their activities takes time, regardless of how strict the legislation is. The optimal way forward is to find ways of collaborating with this sector to steer it onto a more environmentally sound footpath.

SAS providers are currently adopting a variety of approaches to manage the end-of-life of their products. The primary strategy is a 1 - 2 year warranty. This means that if a product fails within this two-year period, the company will collect the product from customers and, if unrepairable, send it to a recycling company or the OEM. The lifespan of a SAS product can range from 2-12 years (depending on individual components and the quality of the products), which means the vast majority of products will not be covered by warranty and will not be collected at the end-of-life. Regulation is key to solving this problem.

Ensuring the effective design and implementation of regulation is vital, both to avoid negatively affecting financially vulnerable end-users and to the potential success of the intended outcomes of these regulations. A rushed implementation of any regulation poses a potential for unintended harm: hurting poor end-users as quality products from responsible companies seeking to comply

with applicable standards and regulations become significantly more expensive while creating room for the non-compliant products that negatively impact the market. Furthermore, the rural nature of the customer base creates challenges in the collection and transportation of e-waste from the end users.

Although regulations have been published and facilitated the establishment of recycling facilities and the first PRO for electronic waste (EPRON), there are still large gaps in their ability to effectively deal with e-waste as well as a lack of awareness in the industry of these laws. In particular, the draft policy for the regulation of used batteries does not incorporate all the chemistries involved in batteries from SAS. It focuses a lot on lead-acid batteries and leaves out li-ion based applications, which will become an increasingly large issue in terms of end-of-life management for SAS.

Most stakeholders believe that an assessment of the sources and volumes of SAS products and e-waste, improved coordination among stakeholders, awareness creation campaigns targeted at both informal recyclers and end users, financial and non-financial incentives for formal recyclers, SAS providers and end users, increased government support and endorsements of e-waste initiatives of industry associations, and the issuance of award/certificate of compliance could be helpful in addressing these issues.

## Guidance for Stand-Alone Solar Companies

The issue of waste and e-waste has long been on the agenda with many companies voluntarily establishing e-waste management operations and partnerships, even in the absence of regulation or necessary infrastructure to support the management of e-waste. These efforts are motivated by the companies' environmental and social missions, which are firmly aligned with the interests of the majority of investors in the sector. In 2014, members of GOGLA, the global off-grid solar industry association voted to adopt an Industry Opinion on lifecycle and recycling. The Industry Opinion states that members are committed to the principle of Extended Producer Responsibility with specific goals, including:

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-  Develop products that can be easily maintained and repaired. Spare parts need to be made available.

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  -  Strategies to implement proper take-back and recycling should be envisaged in countries of operation.

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  -  Identify synergies in the use of standard resources and materials to facilitate separation during recycling and reuse.

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  -  Avoid the use of hazardous substances and find alternatives for them, if technically possible. If this is not possible, incentives for collection of the parts containing these hazardous substances should be developed.

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These four goals are a good place to start for any company selling SAS products. As means of a framework to help implement them, all SAS companies should create a Standard Operating Procedure (SOP) to assist with the operational delivery of an e-waste management strategy, which includes but is not limited to the content of Table 8. Note that the Industry-led initiative for take-back is the type practiced in Nigeria.

**Table 8 – SAS Standard Operating Procedure (SOP) template**

SOP Section Name	Description
<b>Purpose and Scope</b>	Outlines the reason for waste management practices and the SOP, as well as the responsibilities of the document itself
<b>Responsibilities and Authorities</b>	A descriptive list of the primary job roles involved in the operational implementation of the document detailing accountability. This could include descriptions of Project Managers, Design Managers, Commercial Managers, sub-contractors and HSE Coordinators
<b>Document Amendment Record / Document control</b>	A table indicating when this document has been changed and how
<b>Definitions</b>	A list of any acronyms or technical definitions required for the lay reader to understand the content

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**Practices for Waste Management**

A breakdown explanation section of how the waste management operations are undertaken, including practices for:

- *Waste Hierarchy Approach:* To specify how waste prevention or preparation for reuse might be preferred by the company before material recovery, export or landfilling.
- *Waste Minimisation:* This should recognize the different components of SAS systems and consider how the use of materials can be minimized.
- *Segregation:* Here the operations team must be made aware of all available avenues for waste segregation.
- *Storage:* A section to outline where e-waste and particularly batteries should be stored i.e. protected from direct sunlight, water and excessive humidity, in well ventilated premises, which are not subject to flooding, and can be easily evacuated.
- *Transportation:* Specifying how to safely transport waste or products (to avoid further damages) including specific procedures for lithium batteries and their fire hazard, or leaches of acid for lead-acid batteries.
- *Disposal/Recycling of Waste:* When storage is deemed to be full, a designated member of staff should arrange for collection to be made for recycling, export or disposal, depending on the recyclability of the components and the network available.
- *Monitoring and Evaluation:* A series of indicators assessing products in the field such as KPIs (Key Performance indicators), ensuring that waste management practices are followed by staff
- *Waste Record Keeping:* including incidence, audits and reviews of compliance

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**Competence, Training and Awareness**

An educational chapter informing the reader of the necessary training required to deliver the objectives of the SOP. This should not just include internal training on the latest e-waste management practices but should also include strategies to educate the end user on e-waste management, ideally resulting in the return of the product to the seller at end-of-life

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**Risk Management**

Project mitigation and management measures for waste and energy impacts

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**Legal References**

References to relevant policy and legislative requirement for waste management in the relevant context, as well as coordination plans with the relevant government authority

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**Gender Equity and Social Inclusion (GESI)**

This section should outline measures to ensure gender equality and social inclusion in the e-waste management system, such as creating a safe working environment for women and disabled workers, setting up of collection points or recycling plants in safe locations away from communities and vulnerable population, etc

Some companies will already have a variation of this SOP in place, but it can always be iterated and improved upon. To build upon this, Nigerian SAS providers should work together to create an industry led initiative that pilots improved take-back, collection and treatment. It is a mechanism that allows for the development of collaborative operations for a more efficient and cost-effective framework and can be easily formalized into a PRO. This PRO could be achieved through EPRON, the Battery Alliance, the renewable energy industry association, all three or an external third party. The following options are therefore readily available:

-  The EPRON PRO could be expanded to include all waste from SAS, including batteries.
-  The EPRON PRO could be expanded to include waste from SAS (PV and all connected devices) but not batteries and the Battery Alliance PRO to deal with the waste batteries from SAS.
-  A new PRO is set up to deal purely with all waste from SAS, including batteries.

It is advisable for the industry association to engage with both PROs and establish a mutually beneficial arrangement for the SAS sector that does not impose extra burden on SAS providers while aligning with the EPR through the PROs.

## Recommendations for Government

There is need for effective coordination between stakeholders including FMEnv, the Ministry of Power, NESREA, REA, REAN, EPRON, ARBR (or relevant PRO) to improve e-waste management for SAS. A recommended approach will have REA as the anchor being the focal government agency for off-grid solar in the country, and inclusive of other key stakeholders. As activities in the sector scale, other increasingly relevant stakeholders and development partners providing support in this area can be included into the coordination framework set up.

A first step would be to outline the roles and responsibilities of each stakeholder's remit on SAS e-waste and establish the coordination mechanism. It will also be ideal to identify focal desks/persons in each of the institutions, primarily REA and NESREA, on e-waste management for the off-grid sector. Both desks/persons can provide oversight and support required for off-grid solar e-waste activities.

A second step would then be for all parties to work together to undertake a national assessment of the sources and volumes of SAS e-waste. This will provide a baseline for stakeholders to work from in ensuring sustainable e-waste management for the sector in the country.

As part of this report, specific regulatory recommendations were made to NESREA following an in-depth review of existing e-waste regulatory documents in Nigeria, and anchored on two in particular – the National Environmental (Electrical/Electronic, Sector) Regulations, 2011 and the draft National Environmental Used Battery Waste Control Regulations. Both have been analysed in depth to ensure there are no conflicting requirements between them and areas where regulatory coordination and improvement were required, were highlighted and submitted to NESREA. NESREA has received and incorporated these recommendations into its current e-waste regulatory improvement work.

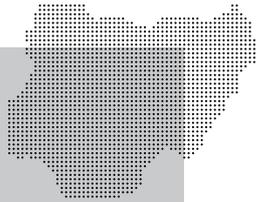
## Conclusion

The analysis completed in this report leads to three primary conclusions:

-  All SAS product components should be clarified in the E-Waste Regulation (through an amendment to the existing bill), apart from batteries, which should be specified in the used battery management legislation (through an edit to the current draft).
-  The end-of-life management of SAS and off-grid solar waste needs to be dealt with through a PRO, which producers should be required to join. This should be mentioned in the policy and regulation on batteries and e-waste.
-  Improved coordination between stakeholders such as the Ministry of Environment, NESREA, REA, REAN, EPRON, ARBR (or relevant PRO) is needed. A first step would be to outline the roles and responsibilities of each stakeholder's remit in SAS e-waste. A second step would then be for all parties to work together to undertake a national assessment of the sources and volumes of SAS e-waste.

# Africa Clean Energy Technical Assistance Facility (ACE TAF)

Tetra Tech International Development leads the implementation of the Africa Clean Energy Technical Assistance Facility together with several key partners. Coffey is responsible for the programme set-up, leadership and overall management taking an inclusive and collaborative approach ensuring that we engage partners throughout implementation of the programme.



E-Waste  
Guide for  
Stand-Alone  
Solar in Nigeria



ACE TAF PARTNERS INCLUDE:



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