

E-waste 101

Introduction to e-waste for EARF borrowers

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Poll 1:

Within my business, we actively manage the e-waste we produce and ensure consumers know how to dispose of their products once they stop working:

1. Strongly agree
2. Agree
3. Not sure
4. Disagree
5. What exactly is e-waste?!



1 E-waste – what is it and why is it important

2 E-waste in off-grid solar

3 Low hanging fruit for OGS companies

4 Where to learn more...

54
million

Metric tonnes of e-waste generated globally in 2020.

Waste from off-grid solar products makes up only a small % of this – but many in the industry are driven to take action to mitigate the risk.

- Also known as Waste Electronic and Electrical Equipment (**WEEE**)
- Globally, e-waste has grown by **21%** in 5 years
- Mainly due to **high consumption rates, short life cycles, and few options for repair.**



Credit: Solibrium, Kenya

- Think about your last mobile phone...
- Where is it?
- How long has it been there...vs how long was it used for?
- **This is known as ‘hibernation’**



In the UK, only
~34% of mobiles
have been formally
recycled.

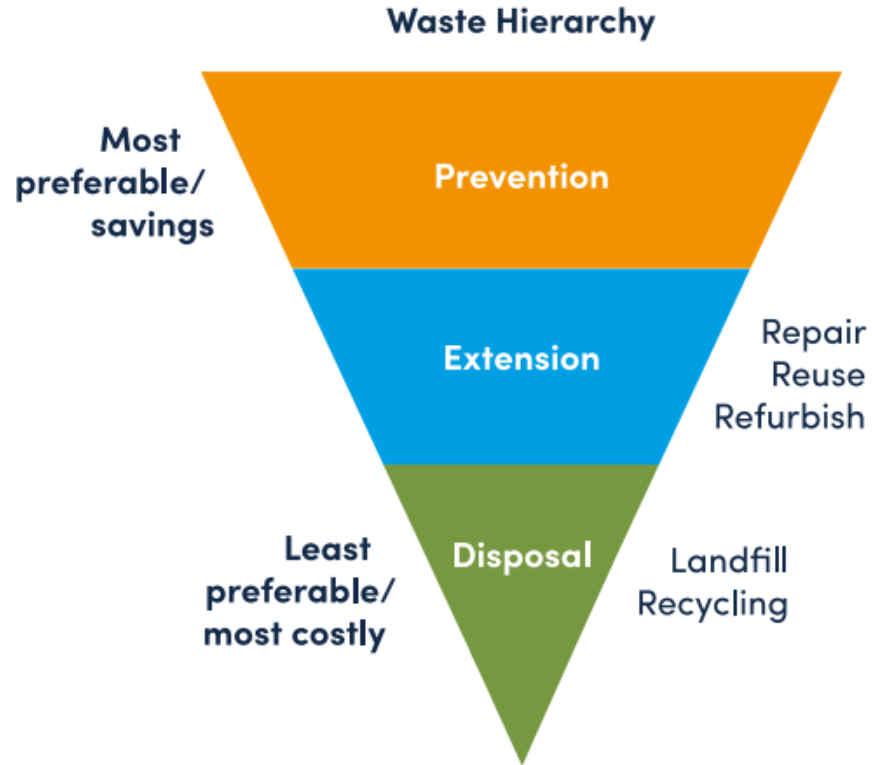
Users typically
hibernate a phone
for 3.5 years for
every 2 years of
use.

\$57
billion

The value of raw materials from e-waste that was most likely dumped or burned in 2020.

Including gold, silver, copper, platinum and other high-value, recoverable materials

Waste is leakage



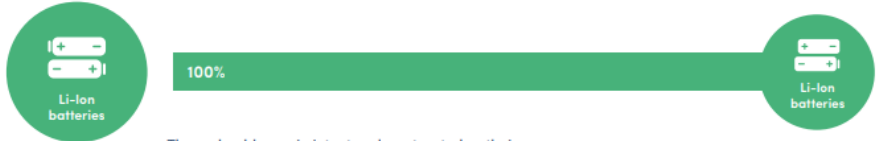


E-waste and off-grid solar

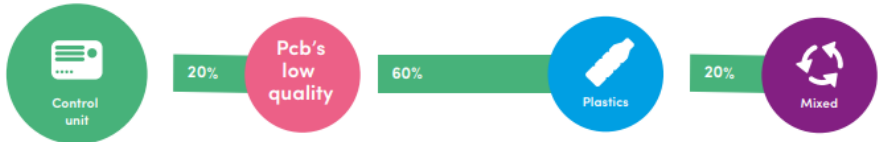
E-waste fractions from off-grid solar products



GIZ OGS End of Life Management of Batteries



These should remain intact and are treated as their own fraction by waste companies until transported to final recycler



- Lead acid batteries must be safely recycled to avoid harmful chemicals entering the environment and causing harm to consumers.
- Lithium-based batteries are safer, but if not properly stored may pose a fire risk.



Repairs and returns

Broken products and components recovered during in-warranty repairs.



Write-offs and repossessions

For PAYGo products, repossessed systems can often be in poor condition and not able to be refurbished or re-used.



Broken in transit

Last-mile, rural logistics is tough and some products are lost during transit, if possible.



Customer take-back schemes

allowing customers to return end-of life products to the supplier to increase e-waste recovered.

= Every OGS company has some e-waste, somewhere!

Barriers to e-waste management



Lack of consumer awareness

About the hazards of e-waste and options for responsible disposal.

Customers often hold on to broken products, or may dump them in informal refuse sites.



Expensive

Recycling for a typical pico-lantern costs about \$1.34/lantern.

Low volumes and shipping costs also make it more expensive.

When serving low-income consumers, affordability is key and companies do not wish to increase prices for customers.



Lack of recycling infrastructure

Few off-grid markets have adequate e-waste recycling facilities.

Companies struggle to find appropriate solutions for disposal of end-of-life products.



Difficulty accessing spare parts

Minimum order quantities and high importation costs make access to quality spare parts difficult for companies.

Repair and refurbishing is therefore costly and complex.



Nascent legislation

As yet, only 13 off-grid markets have regulations for e-waste management.

Extended Producer Responsibility is the common approach taken by governments across the world to regulate responsible waste management.

Imperatives for business action on e-waste





E-waste ecosystem

E-waste legislation



[Map \(globalewaste.org\)](http://globalewaste.org)

[GSMA | E-Waste Legislative Framework Map | Mobile for Development](#)

Recycling services

- Kenya, Rwanda and Nigeria have facilities that are well equipped to manage e-waste from off-grid solar.
- Availability of services in other markets varies.
- Recyclers should provide a certificate of recycling which acts as assurance that waste has been safely and appropriately treated.



Poll 2:

Effectively managing e-waste can benefit my business in the following ways (multiple choice)

1. It's good PR and protects my brand
2. Compliance with government regulations (current or future)
3. Makes the business attractive to new investors
4. It's the right thing to do
5. It can help me retain customers in the long term
6. All of the above
7. None of the above

E-WASTE COLLECTION POINT

EWASTE DROPOFF

CAUTION
Please do not touch the bins while using the facility



enviroserve E-waste Collection Point

Pioneering E-waste Management in East Africa

- Electronic waste collection
- Battery collection and recycling
- Data destruction
- Professional repair and refurbishment
- Electronic waste dismantling and recycling
- Technical training in waste/electronic repair, Refurbishment, reuse and recycling
- Technical Assistance and maintenance

enviroserve
Saving the Planet Naturally

enviroserve GLOBAL LEAD

Responsible collection and treatment of end of life electrical and electronic equipment in E-waste

... of e-waste collection points.

"Let's protect our environment by ensuring that our end of life electrical and electronic equipment are collected and treated properly"

Low hanging fruit for OGS companies



Product Quality Standards

Ensuring high quality products **prolongs the life-span** of products and **reduces the likelihood of malfunction or breakage.**

Make sure your products are certified to IEC standards (via VeraSol).

Compliance with national laws

Understanding the legal requirements for e-waste management is key, especially as where laws are in place, the common principle is **Extended Producer Responsibility.**

Review at least annually.

Safe management of hazardous waste.

Know what components are in your products and what the hazards are.

Implement procedures and training for **safe handling and storage** of e-waste as a minimum.

Implement an e-waste management plan

Setting out your **ambitions and planning** for e-waste management before it becomes a problem is key.

This helps your **financial planning** and **demonstrates responsibility.**

Educate your customers

Small changes can make a big difference in awareness.

Make sure disposal information is **clearly labelled** in product manuals, and **communicated during installation**, and at the **end of the warranty period/expected lifespan.**



Where can I find more?

E-waste Toolkit

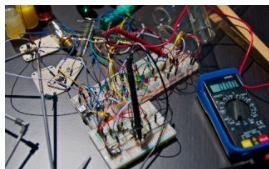
Off-grid solar is delivering **huge social impact to customers**, mitigating greenhouse gas emissions from traditional polluting lighting sources, and supporting economic development in low-income countries. As the sector grows, companies and investors are increasingly focusing on resource efficiency and lifecycle of products – from design and manufacturing to end of life. In this hub, you will find resources aimed at helping address the main challenges in setting up sustainable recycling chains. This **toolkit is a work in progress** and content will be added regularly as modules are developed.

Looking for additional learning materials about e-waste management in the off-grid solar sector? Download materials from [the e-waste festival](#).



Introduction to Recycling

Module 1 is a high-level technical understanding of how each component is recycled and where to begin with identifying recycling partners. [Learn more](#)



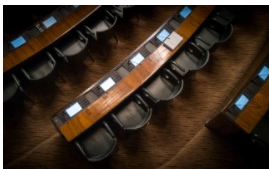
Design for Reduction of E-Waste

Module 2 will focus on waste reduction strategies within the off-grid solar sector, looking at circular design principles and how they can be applied. [Learn more](#)



Financials of Solar E-Waste

Module 3 will look at the financials of solar e-waste by breaking down its supply chain, identifying where the costs lie and who is responsible for them. [Learn more](#).



Policy and Regulation

Module 4 of the E-waste toolkit aims to provide a high level introduction to e-waste legislation, existing typologies and their financing mechanisms. [Learn more](#).



E-waste and the Consumer

Module 5 focuses on the consumer experience, awareness and disposal behaviors upon product end-of-life. [Learn more](#)



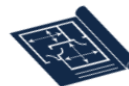
Take-back and Collection

Module 6 of the toolkit focuses on take-back and collection channels, challenges and incentive. [Learn more](#).

Circularity Toolkit: E-waste Blueprints

These E-waste Blueprints have been created to help off-grid solar companies implement and improve e-waste management across their operations.

Companies are encouraged to follow the **user journey** and adapt the Blueprints to their business, operational, geographical and resource context.



[Start here: E-Waste Blueprints User Guide](#)



1. Assess

Use our assessment tool and conversation guide to better understand how e-waste management activities can be tailored to meet your company's goals.



2. Plan

Once you are ready to begin your e-waste journey, start by building your OGS e-waste management policy, design e-waste processes and establish roadmap.



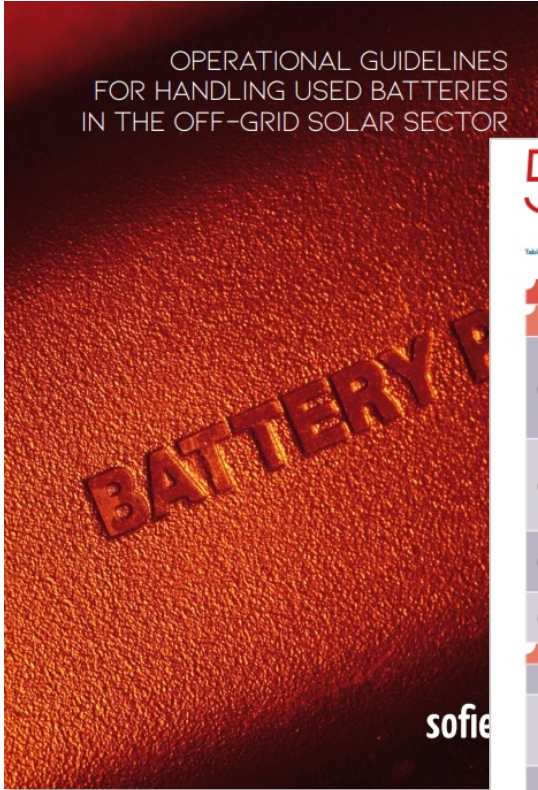
3. Execute

Find tools and resources to help you implement your e-waste management plan, including recommended KPIs, waste-processor selection and contracting, and training content.



- Good practice and learnings from 8 projects in Kenya, Zambia, Uganda, Rwanda and Nigeria.
 - Consumer awareness raising and incentivisation
 - Take-back and collection
 - Repair and refurbishment
 - Recycling
- Recommendations for companies

Operational guidelines for storage and handling

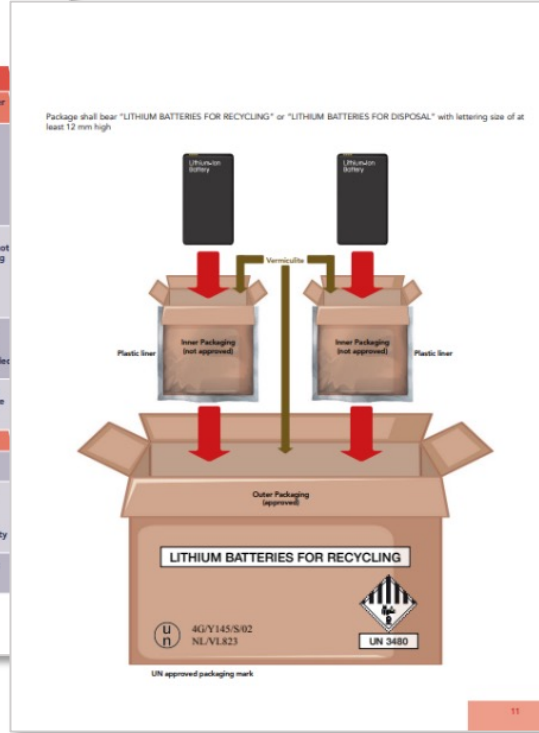


OPERATIONAL GUIDELINES FOR HANDLING USED BATTERIES IN THE OFF-GRID SOLAR SECTOR

5 TRANSPORT OF USED BATTERIES AND EQUIPMENT

Table 4: Packaging instructions from ADR for lithium batteries

P909	PACKING INSTRUCTION	P909
This instruction applies to UN Nos. 3090, 3091, 3480 and 3481 carried for disposal or recycling, either packed together with or packed without non-lithium batteries.		
(1)	<p>Cells and batteries shall be packed in accordance with the following:</p> <p>(a) The following packagings are authorised, provided that the general provisions of 4.1.1 and 4.1.3, are met: Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G); Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H2); and Jerrycans (3A2, 3B2, 3H2)</p> <p>(b) Packagings shall conform to the packing Group II performance level.</p> <p>(c) Metal packagings shall be fitted with an electrically non-conductive lining material (e.g. plastics) of adequate strength for the intended use.</p>	
(2)	<p>However, lithium-ion cells with a Watt-hour rating of not more than 20Wh, lithium-ion batteries with a Watt-hour rating of not more than 100Wh, lithium metal cells with a lithium content of not more than 1g and lithium-metal batteries with an aggregate lithium content of not more than 2g may be packed in accordance with the following:</p> <p>(a) in strong outer packaging up to 30kg gross mass meeting the general provisions of 4.1.1, except 4.1.1.3, and 4.1.3.</p> <p>(b) Metal packagings shall be fitted with an electrically non-conductive lining material (e.g. plastics) of adequate strength for the intended use.</p>	
(3)	For cells or batteries contained in equipment, strong outer packagings constructed of suitable material, and of adequate strength and design in relation to the packaging capacity and its intended use, may be used. Packagings need not meet the requirements of 4.1.1.3. Equipment may also be offered for carriage un packaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.	
(4)	In addition, for cells or batteries with a gross mass of 12kg or more employing a strong, impact resistant outer casing, strong outer packagings constructed of suitable material and of adequate strength and design in relation to the packaging's capacity and its intended use, may be used. Packagings need not meet the requirements of 4.1.1.3.	
Additional requirements:		
1	Cells and batteries shall be designed or packed to prevent short circuits and the dangerous evolution of heat.	
2	Protection against short circuits and the dangerous evolution of heat includes, but is not limited to: <ul style="list-style-type: none"> - Individual protection of the battery terminals, - Inner packaging to prevent contact between cells and batteries, - Batteries with recessed terminals designed to protect against short circuits, or - The use of an electrically non-conductive and non-combustible cushioning material to fill empty space between the cells or batteries in the packaging. 	
	Cells and batteries shall be secured within the outer packaging to prevent excessive movement during carriage (e.g. by using a non-combustible and electrically non-conductive cushioning material or through the use of a tightly closed plastics bag).	



Storage and handling of components

While handling e-waste, health and safety and environmental considerations are relevant for both regulatory and operational reasons. Although there are some general principles to be upheld when handling and storing e-waste, risks derived from fraction handling (not inherent hazards of fractions) can be mitigated by following good practices and a focus on quality operations. For example, while Pb [Lead] acid batteries should be transported whole, plastics should often be chipped and sent to plastic manufacturers. This section will dive into how handling needs differ for each fraction, as well as provide practical information for storage and transportation.

Staff safety – equipment and training

Staff health and safety is paramount; staff should be properly trained and use the correct personal protective equipment (PPE). The appropriate PPE depends on the components or fractions being handled by the facility and staff as well as the machinery used.

Common PPE to be used across most facilities include:

- Chemical resistant and sturdy gloves to protect hands from cuts, harmful dusts and chemicals.
- Safety glasses to prevent dust and debris from entering the eyes during dismantling.
- Coveralls to protect against dust. These should be removed after exiting the facility to avoid track dust and chemicals to other areas.
- Work boots to protect against heavy objects and sharp punctures from dismantled sectors.
- In some cases, a respirator and personal ventilation systems when handling fractions that contain hazardous dust.

Lithium Batteries

It is crucial that lithium batteries are either stored in their original product (i.e. not removed) or in a plastic drum between layers of sand (see below). E-waste management companies sometimes provide plastic bins for the storage in an exchange program (i.e. they loan you six, and upon collection, replace with another set).



Plastic drum



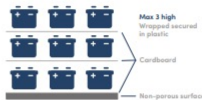
Layer of discharged batteries buried

The main risk of lithium-based batteries at end-of-life is fire. Lithium-Iron-Phosphate batteries (most common in off-grid solar) are the lowest risk in terms of fire but should still be handled with care. Risks from lithium:



Example of poor storage. Photo: Recycling

Lithium-Iron-Phosphate batteries are less prone to thermal runaways (short circuit) than other lithium-based batteries, but they should still be stored within layers of sand and with their terminals taped and covered.



Lead-acid Batteries should be stored and transported on pallets (see image below). Similar sized batteries are placed next to each other. Every layer of batteries includes a layer of thick cardboard in between to absorb any leakage of battery acid. The batteries are stacked no further than 3 layers high.

Lead acid Batteries should be stored and transported on pallets (see image below). Similar sized batteries are placed next to each other. Every layer of batteries includes a layer of thick cardboard in between to absorb any leakage of battery acid. The batteries are stacked no further than 3 layers high. Once stacked, the pallets are wrapped and sealed with airtight covers.



ABOUT US PORTFOLIO IMPACT FINANCING SUPPORT RESOURCES NEWS PUBLICATIONS



Off-grid solar (OGS) technologies provide life-changing access to modern energy services for people and communities currently living without electricity. Yet these products can have negative impacts on human and environmental health if not disposed of properly. The risk of the adverse effect is particularly high for women and children.

Investment in anticipatory e-waste management strategies will reduce these risks and ensure the OGS industry's growth is sustainable over the long term. Efforts to recapture and recycle e-waste are gaining ground in Africa, but they are still limited by uneven regulations, low infrastructure and capacity, and a lack of consumer awareness.

Mapping Report

Approaches to e-waste management

for the off-grid solar sector. Solar e-waste and solar-powered appliances at their end-of-life have already reached their end-of-life. Of the 55,000 tons of total e-waste produced in Africa, off-grid solar e-waste is particularly challenging.

in remote areas. The cost is high for two-way transport of dispersed users' homes and returning



Wear personal protective equipment



Avoid dust to babies

Thank you!



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