January 2022

Electronic Waste (E-waste) Management for Off-grid Solar Solutions in Displacement Settings

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Acronyms

BMZ	The German Federal Ministry for Economic Cooperation and Development
EEE	Electrical and electronic equipment
EPR	Extended Producer Responsibility
ESDS	Energy Solutions for Displacement Settings
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GPA	Global Platform for Action on Sustainable Energy in Displacement Settings
ICT	Information and communication technologies
IOM	International Organisation for Migration
ITU	International Telecommunications Union
LAB	Lead-acid batteries
NORAD	The Norwegian Agency for Development Cooperation
NRC	Norwegian Refugee Council
PRO	Producer Responsibility Organisation
PV	Photovoltaic
SHS	Solar home systems
StEP	Solving the E-waste Problem
UN	United Nations
UNHCR	United Nations High Commissioner for Refugees
WASH	Water, Sanitation and Hygiene
WEEE	Waste from Electrical and Electronic Equipment
WFP	World Food Programme

Contents

Executive Summary

As the number of initiatives focusing on improving energy access for displaced and host communities increases, so does the quantity of electronic waste (e-waste) in displacement settings. E-waste management practices in displacement settings are not present or sufficient in eliminating or reducing health and environmental hazards due to leaking batteries or exposure to heavy metals. Initial research shows that only 1% of the e-waste generated reaches a formal recycler. Most of the waste ends up unused, buried, burned, or informally disposed of on the ground.

An analysis of the current e-waste management landscape revealed several challenges for establishing appropriate e-waste management programmes in displacement settings. There are various factors that result in the rudimentary e-waste management practices, including: a lack of rules and regulations concerning e-waste in countries with displacement situations; the absence of established mechanisms for repair, recycling, and collection of end-of-life products; the logistical disconnect between solar manufactures and distributors and after-sales services; the lack of expertise on safer e-waste management practices within humanitarian organisations; the lack of awareness concerning recycling and disposal of electrical products within vulnerable communities; and the limited economies of scale associated with e-waste management programs in displacement settings as a result of the low number of off-grid solar products. With only a few projects initiated, e-waste management efforts are still in their infancy and require substantial coordination to foster a collective learning environment within the humanitarian energy space and reduce the duplication of efforts.

To address a number of these challenges, the GPA Coordination Unit is presently establishing a task force dedicated to sharing lessons learned around past, ongoing, and future e-waste projects, raising awareness around e-waste at the decision-making level, supporting the implementation of e-waste pilot projects, and organising webinars and workshops to disseminate findings. To be effective, the E-Waste Task Force will require inputs from host governments, humanitarian organisations, research institutes, private sector partners, and energy and environmental specialist, including those on the NORCAP Energy Expert Roster.

Figure 1: *Unsorted plastic, metals and e-waste in Ali Addeh refugee camp, Djibouti. Photo: UNITAR / GPA Coordination Unit 2019, Thomas Fohgrub.*

1. Introduction

Currently, over 235 million people require humanitarian assistance (UN OCHA, 2021). This number includes refugees, internally displaced people (IDPs), returnees to areas rebuilding after conflict or disaster, and returnees settling outside their areas of origin. Of these, 91.9 million people had been recorded as displaced as a result of persecution, conflict, violence, human rights violations or events seriously disturbing public order (UNHCR, 2021a).

Energy is recognised as an enabler of basic human rights, however, most displaced populations still lack sufficient access to clean, sustainable, reliable, appropriate and affordable energy (GPA, 2021). According to estimates, 80 per cent of refugees and displaced people in camps have minimal access to energy, with high dependence on traditional biomass for cooking and no access to electricity (Lahn and Grafham, 2015).

Limited access to energy can have severe repercussions on the safety and security of displaced populations, limiting their opportunities to learn, become self-reliant and socialise with peers. There has, however, been an increase in the coverage of energy access in displacement settings by humanitarian organisations, nation states and local governments, business associations, think tanks, donors, private sector, and research organisations in the last six years (Rosenberg-Jansen, 2019). This situation has led to an increase in the number of energy projects and programmes in displacement settings which aim to enable access to sustainable and renewable energy solutions.

With energy access for displaced populations gaining attention, off-grid solar products have gained increased prominence as a potential solution for improving energy access while supporting education and livelihood activities of host and displaced communities (NORCAP and BCG, 2020). Such solutions include solar lanterns with phone charging capabilities, solar home systems (SHS) that include lighting, phone charging, radios and televisions, fuel-efficient stoves with electronic components, and electric cookers that can be connected to a solar system. The distribution of such electronic products to affected communities is recognised as improving their quality of life, however, it is uncommon for these products to be managed appropriately during their use, when they break or after their expected lifetime (ESDS, 2021a). The resulting electronic waste (e-waste) is expected to be taken apart for reuse or repurposing of the functioning parts like batteries and wires, kept unused at homes, buried, burnt, or left in the open with other waste (see Figure 1).

This landscaping report aims to raise awareness on existing e-waste management activities in displacement settings and to improve the coordination between stakeholders to reduce the duplication of mitigation activities. This report addresses the generation of e-waste in displacement settings from an increase in available off-grid solar products. Its findings and recommendations may, however, also apply to other electronic goods that may exist in greater quantities, including information and communication technology (i.e., mobile phones, tablets, computers, etc).

The production of the report was triggered by NORCAP's interest in providing specialist support to addressing this topic.

This chapter, Chapter 1, introduces the topic. Chapter 2 defines e-waste, introduces the types of e-waste generated from off-grid solar products, and notes e-waste management activities. Chapter 3 describes current e-waste management activities in displacement settings and identifies the challenges faced by, and the tools that can be applied by, humanitarian organisations. Chapter 4 provides an overview of key actors working on the e-waste topic and ongoing projects. Chapter 5 provides a reflection on the findings and recommendations for key actors.

2. E-waste

2.1. What is e-waste?

In order to define e-waste, it is necessary to first define electrical and electronic equipment (EEE). EEE is defined as "any household or business item with circuitry or electrical components with power or battery supply" (Step Initiative, 2014). EEE and its parts turn into Waste Electrical and Electronic Equipment (WEEE), or e-waste, after the items and their parts "have been discarded by the owner as waste without the intention of reuse" (Step Initiative, 2014).

E-waste is the fastest growing waste stream around the globe and as such has been defined as a "tsunami" by the UN (Forti et al., 2020). In 2019, the world generated 53.6 Mt of e-waste, a number projected to grow to 74.7 Mt by 2030 (Forti et al., 2020). Globally, only 20% of e-waste is handled formally, meaning it is documented, collected, and recycled (PACE & E-waste Coalition, 2019). The remaining 80% is disposed of as household waste, dumped in landfills, traded, or recycled by the informal sector in poor and hazardous working conditions (PACE & E-waste Coalition, 2019).

Since EEE covers a wide range of products, their material composition and recycling and disposal methods are different (Forti, Baldé, Kuehr & Bel, 2020). EEE are grouped into six categories based on their waste management attributes and are aligned with both the WEEE Directive, adopted by European Members States, and the internationally recognised framework for e-waste statistics (Forti et al., 2020). The six categories of e-waste are as follows:

- Temperature exchange equipment (refrigerators, freezers, air conditioners, and heat pumps);
- Screens and monitors (televisions, monitors, laptops, notebooks, and tablets);
- Lamps (fluorescent lamps, high intensity discharge lamps, and LED lamps);
- Large equipment (washing machines, clothes dryers, dishwashing machines, electric stoves, large printing machines, copying equipment, and photovoltaic panels);
- Small equipment (vacuum cleaners, microwaves, ventilation equipment, toasters, electric kettles, and video cameras); and
- Small IT and telecommunication equipment (mobile phones, GPS devices, personal computers, printers, and telephones).

2.2. E-waste from solar products

This report focuses on off-grid solar portable lights and solar home systems (SHS), given their increasing role in providing energy access in displacement settings. Whether off-grid solar products and their components can be defined as e-waste is a technical and legal discussion due to different legislative regimes that exist across the globe. For example, in the EU they are regarded as e-waste and recognized as hazardous waste whereas in the USA they are considered as neither (Magalini et al., 2016).

The main components of an off-grid solar product include photovoltaic (PV) solar modules, batteries (lithium-based or lead acid), lamps (mainly LED), control units with circuit-board-mounted electronic controls, cables, metal frames and fixtures, and appliances (TVs, radios, fans, etc) (GOGLA, 2019a). PV modules were not, however, defined as e-waste in the original EU WEEE Directive but were added a revised version of the Directive in 2012 (Magalini et al., 2016). After becoming waste, the components of the off-grid solar products are grouped according to their treatment and dismantling properties. Each waste group is called a fraction such as metal, glass, plastics, paper and cardboard, and cables (GOGLA, 2019a).

Figure 2 provides an overview of fractions of off-grid solar products. PV panels mainly consist of glass, followed by aluminium and mixed fractions (i.e., screws, metal and crystalline silicon). Lead is the main fraction of lead acid batteries, mixed with sulphuric acid and plastics. Lithium-Ion batteries consist of graphite, copper, aluminium, lithium, and plastics and should remain intact and treated as a separate fraction while being transported to final recycler for safety reasons. The main fraction for control units is plastic, in addition to printed circuit board and mixed electrical and electronic components. The cables are mostly made up of copper and plastic

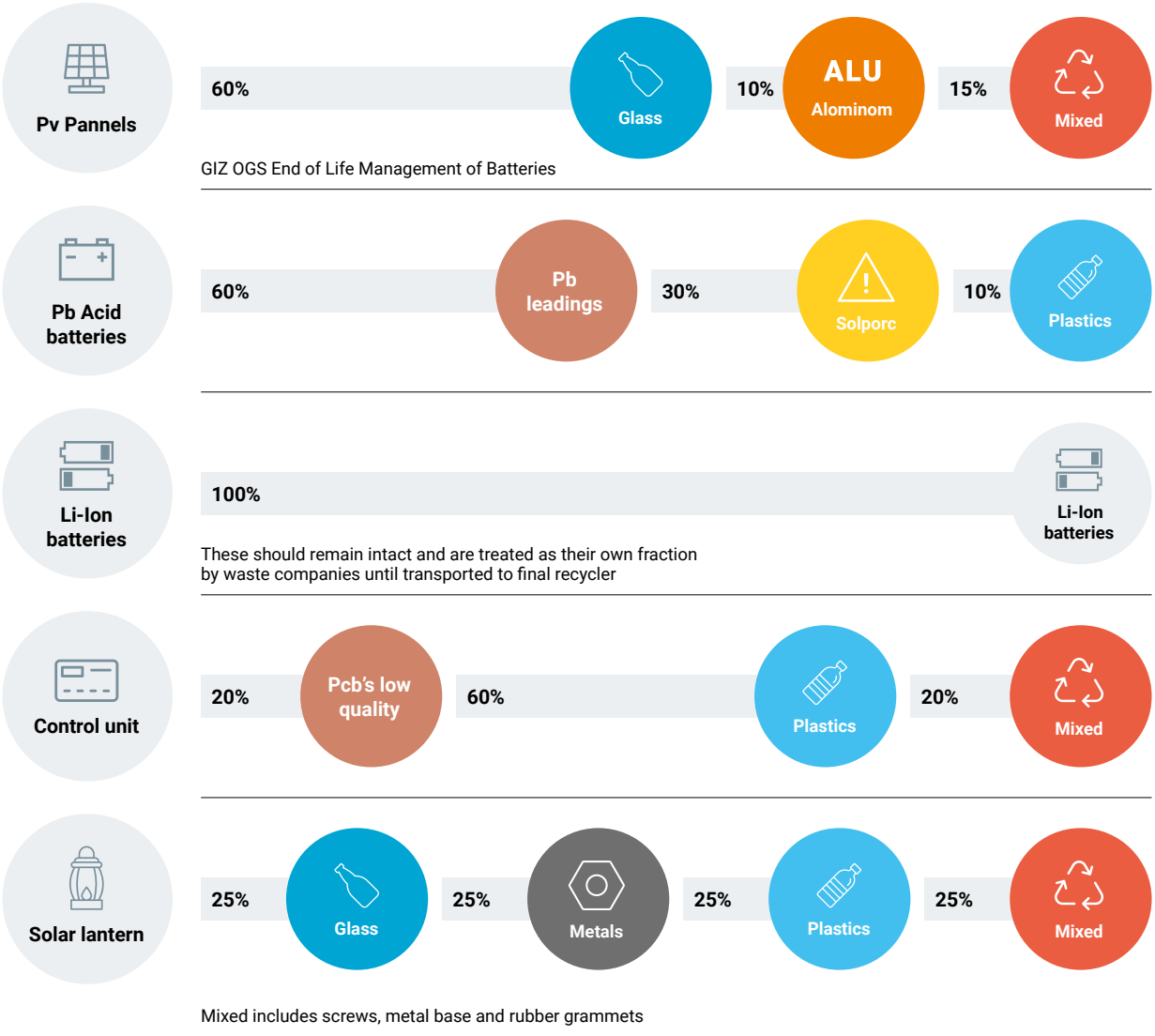
insulation. Finally, the fractions of solar lanterns consist of PV panel, lithium battery, LEDs, printed circuit boards, and plastic making the fractions a mix of glass, metals, plastics, and mixed materials.

Batteries, which are generally considered the 'weakest part' of many solar products, are not included in e-waste regulations (Forti et al., 2020; GOGLA, 2019a). Batteries are commonly defined as hazardous waste and are therefore subject to a different but complementary regulatory regime with regard to waste management. This report considers the management of waste batteries from solar products, given the close association between the two items.

Different types of batteries are used in solar products. Lead-acid batteries (LABs) are used for mini-grids, larger PV systems and self-made systems and may require replacing as frequently as every five to six years. Recycling LABs is relatively common, but the disposal and recycling methods need to be improved in terms of safety. Lithium Ion (Li-ion) batteries are found in smaller plug-and-play systems (solar home systems, solar lanterns, etc.). LMO (lithium-manganese-oxide) and LFP (lithium-iron-phosphate) are currently the most relevant Li-batteries for off-grid solar products. Li-battery recycling is, however, a high-tech and high-cost process, only found in industrialised countries (GIZ, 2018).

Figure 2: The waste components of off-grid solar products

Adapted from GOGLA, 2019a



Due to the involvement of batteries and materials used during manufacturing, there have been concerns about the environmental impact of solar PV technologies. The assessment of life cycle of these technologies includes analysis of manufacturing, materials used, construction and installation phase, lifetime, and end-of-life decommissioning (Rabaia et al., 2021). Since solar PV technologies do not produce noise nor release toxic or greenhouse gases during their lifetime, they are environmentally safe after manufacturing and installation phase (Rabaia et al., 2021). In addition, compared to diesel generators, they have significantly less impact on climate change, particulate matter, photochemical oxidant, and terrestrial acidification (Bilich et al., 2017) and in Kenya, batteries have proven to be a better option for PV microgrids than diesel generators (Bilich et al., 2017). It is, however, possible to significantly reduce the environmental impact of PV-battery systems through waste minimisation and recycling at end-of-life since the use of primary metal constitutes most of the impact (Bilich et al., 2017; Rabaia et al., 2021).

Waste volumes from the off-grid solar sector have been deemed negligible, in proportion to the quantity and environmental impact of the total e-waste stream (Magalini et al., 2016). However, with rapid growth in the sector, it is estimated that e-waste volumes will increase directly through the distribution and use of solar panels, lamps, cabling and control systems, and indirectly through other EEE that will become available with improved energy access (Magalini et al., 2016).

2.3. E-waste and the circular economy

From the mining of valuable materials to manufacturing, distribution, sale, consumption, and disposal, electronic products generate large amounts of waste and environmental impact. Embracing a new vision for circularity for electronics offers significant health, environmental, and economic benefits by reducing the need for mining valuable materials, extending the lifetime of electronic products, creating jobs in the formal recycling sector, and decreasing prices by 7% by 2030 and 14% by 2040 (PACE & E-waste Coalition, 2019).

The "circular economy is a system in which all materials and components are kept at their highest value at all times, and waste is designed out of the system" (PACE & E-waste Coalition, 2019). This is different from today's dominant linear economy in which materials are used to manufacture products which are then disposed of at their end-of-life. Although treated as a separate subject in this report to introduce the topic, the circular economy should be the guiding framework for all e-waste management activities.

Figure 3 illustrates how the notion of circularity can be applied for e-waste across design, manufacturing, distribution, consumption, collection, recycling, and raw materials. For instance, products can be designed for durability, reuse, repairability, and easy disassembly while enabling safe recycling (PACE & E-waste Coalition, 2019). As durable products stay in use for longer periods of time, can be easily fixed, or adapted to changing customer needs, waste volumes are reduced. For products at their end-of-life, take back schemes ensure that they are collected, stored, and transported safely. Improvements in the recycling sector are also put in place to ensure high quality recycled materials that can be used in new electronic products (PACE & E-waste Coalition, 2019). By closing the loop, metals and minerals extracted from e-waste are used in the manufacturing of new products.

There are different business models for circularity such as products as a service, sharing of assets, life extension, and recycling to reduce generated waste (PACE & E-waste Coalition, 2019). Displacement settings should not be the test bed for circular economies, however, the principles can be adopted to ensure a more sustainable approach to the selection, repair, repurposing and recycling of e-wastes while providing opportunities for livelihoods programmes for humanitarian organisations.

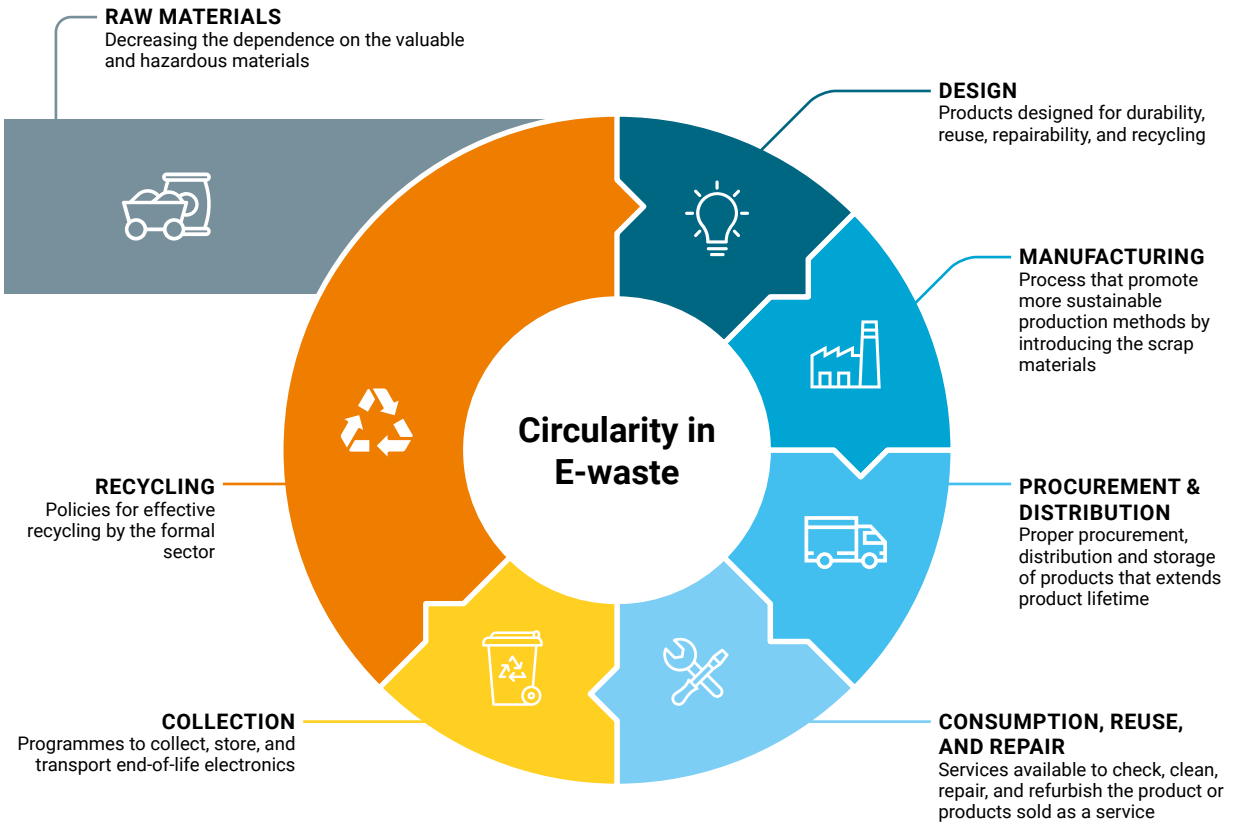
2.4. E-waste management activities

Effective management of e-waste demands a comprehensive and structured approach with the physical means to manage the waste (African Clean Energy Technical Assistance Facility, 2019). This requires behaviour change at the policy and intervention levels. A simplified version of the Behaviour Change Wheel Framework is used as a starting point to identify the different aspects of an e-waste management intervention that should be considered to ensure its success (Michie, Van Stralen, West, 2011). The various aspects associated with e-waste management can be explained through the following seven categories:

- **Policy:** A conducive policy environment at national level and within the humanitarian institutions themselves is essential to develop and implement an effective e-waste solution. Therefore, e-waste management systems are likely to be more successful in contexts where e-waste policies, rules and regulations are enacted and enforced.

Figure 3: Circularity in e-waste

Adapted from PACE & E-waste Coalition, 2019; Polypipe, 2021



- **Legislation:** Various legislative texts, associated guiding principles and tools relating to e-waste exist in Europe and its Member States. Development support should be provided to create a similar regulatory framework, which is appropriate to the hosting countries needs and context. International rules may, however, apply to e-waste in countries where there is no specific regulatory regime, which may include the Basel, Minamata, Stockholm, and Bamako Conventions.
- **Guidelines:** The creation of guidance documents recommending or mandating principles regarding changes to waste management service provision can be used for training and education on the impact of e-waste and how to repair, recycle, and dispose of e-waste appropriately.
- **Environmental and social planning:** By providing easy access to services the opportunity, capacity, and motivation for end users to repair or dispose of their e-waste is created. Such activities could include:
  - Repair and reuse: Providing spare parts, tools, and instructions for the repair and reuse of broken products;
  - Access to waste: Obtaining waste from the customer, which requires additional costs to incentivise users to hand over their waste products;
  - Collection: Hiring/leasing a space, purchasing containers, recruiting human resources at the collection points or using more innovative

forms of collection by conducting collection from home to increase collection rates and enhance opportunity of customers to return waste;

- Transport: Transporting waste from the collection point or consumers' location to a treatment facility; and
- Treatment: Reusing, recycling and appropriate disposal of collected e-waste, including labour costs, energy costs and the depreciation of capital investments.

- **Fiscal measures:** In addition to considering its legal obligations, any management system handling residual e-wastes must also consider the anticipated volumes of waste, their avenues for treatment, associated financial costs, and the engagement of consumers (African Clean Energy Technical Assistance Facility, 2019). With regards to costs, e-waste disposal programmes can be financed through various mechanisms, including:
  - Waste-holder financing: payment is made by individuals disposing of the waste, similar to "polluter pays principle".
  - Consumer financing: consumers make a direct payment to an e-waste fund when purchasing a new product.
  - Producer financing: the cost is covered by the equipment manufacturers or product importers through the implementation of Extended Producer Responsibility (EPR) principle. EPR shifts the responsibility for waste (physically and/or economically; fully or partially) upstream toward the producer and away from municipalities (ESDS, 2021b).
  - Hybrid model: Waste collection is paid for by taxpayers, while producers cover the remaining steps of the e-waste management process (GOGLA, 2020) X
- **Service provision:** Providing after-sales services for broken products, recycling services at end-of-life can reduce the creation of e-waste and it impact on the environment. Pay-as-you-go (a financial model allowing pre-payment in small instalments in order to use a service or goods) and product leasing can increase the lifespan of products if they are refurbished and reused after the initial contract.
- **Communication/Marketing:** Using print, electronic, and broadcast media to raise awareness around e-waste. Takeback schemes for end-of-life products with incentives such as receiving a new product at a discounted rate can be included to reduce uncontrolled disposal.

2.5. Why is e-waste relevant to humanitarian energy programming?

Given their potentially harmful components (especially with regards to batteries), the lack of appropriate waste management practices can lead to contamination of groundwater, soil, and air with carcinogenic compounds. Indigestion or physical contact with these hazardous components might cause serious health issues by such as spontaneous miscarriages, birth defects, neurological, cognitive, and physical impairment in children (ESDS, 2021a; PACE & E-waste Coalition, 2019; UNICEF, 2020). As such the lack of appropriate waste management practices in displacement settings is contradictory to the 'do no harm' principle that many humanitarian actors subscribe too.

The amount of e-waste generated in displacement settings is not known, however, it is expected to increase over time as more energy programmes are implemented. Improving e-waste management in displacement settings is therefore essential and should be undertaken in parallel with the promotion of energy projects.

Humanitarian organisations may, however, be able to offset some of their procurement costs through e-waste management activities, such as repairing and reusing end-of-life products, which would reduce the need to purchase replacement products, such as solar lanterns. In addition, repair and recycling activities present opportunities for livelihoods for the host and displaced communities.

3. Managing e-waste in displacement settings

3.1. What does current e-waste management look like in displacement settings?

Once off-grid solar products, such as solar lanterns, have been distributed by humanitarian actors in displacement settings they are often left to the end-user to repair, repurpose, and dispose of. Unfortunately, many products are not designed to be manually dismantled and repaired, which in turn may result in health, environmental and safety concerns (leaking batteries, hazardous material thrown in pits, etc.). Even with proper use and care, a solar product will reach its end of life at some point, turning it or its parts into e-waste (ESDS, 2021a).

UNHCR's Emergency Handbook sets waste management standards, a joint responsibility of camp coordination and camp management, WASH, and the health sector (UNHCR, 2021c). The handbook states that field staff and partners should arrange the collection of hazardous materials such as lead-acid batteries and broken electrical equipment separately (UNHCR, 2021c). It has, however, been observed that e-waste can end up in landfills near displacement settings, exposing people, soil, and groundwater to hazardous materials (see Figure 4). In addition, a report from Thankhali refugee camp in Cox's Bazar, Bangladesh highlighted the problem of children dismantling and playing with waste batteries that they had found (McGrath & Korn, 2017).

Figure 5 provides an example of current e-waste generation in a displacement setting by following the life cycle of a solar home system (SHS) entering a displacement setting in Kenya through a certified off-grid energy company. After an off-grid product malfunctions or breaks in market, there are several routes it may follow. If the product is not in warranty, it becomes e-waste regardless of its repairability. In the case that an informal recycler is present and accessible

Figure 4: *Small battery on the ground in Ali Addeh refugee camp, Djibouti. Photo: UNITAR / GPA Coordination Unit 2019, Thomas Fohgrub.*

in the settlement, the product is stripped of its valuable components and disposed of in the local environment. If the product is in warranty and an off-grid company picks up the product, the product might be fixed or swapped on the ground and given back to refugees for reuse. Alternatively, the product might be transferred to a company service centre. If the product is at end-of-life, it is formally recycled or landfilled (ESDS, 2021b).

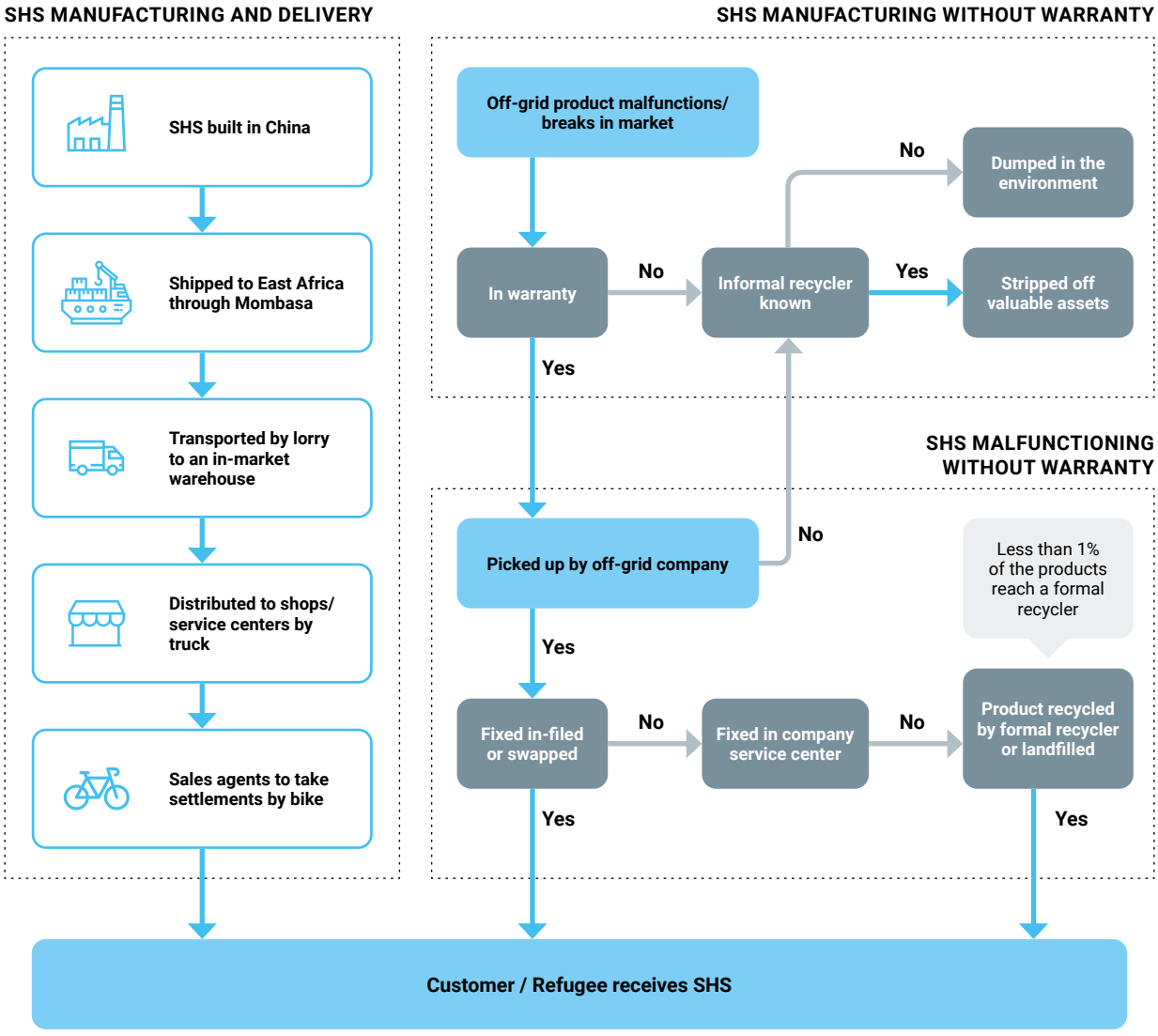
This illustration depicts the access and logistical disconnect between solar companies and displaced people in many settings. **It is estimated that less than 1% of products reach a formal recycler** (ESDS, 2021b).

Due to the lack of formal training and spare parts and tools, combined with the limited access of solar product suppliers in displacement settings, products at their end-of-life seldomly reach vendors who can repair or forward them to formal waste management facilities.

Often products end up with informal recyclers who strip the products of their valuable assets and dump the residual waste in the local environment (ESDS, 2021b). More research is, however, required to show the recycling and collection rates of solar products and set up appropriate e-waste management programmes.

Figure 5: Example of flow of SHS e-waste in displacement settings

Adapted from (ESDS, 2021b)



3.2. Challenges around e-waste management in displacement settings

There are several challenges present in displacement settings that hinder e-waste management practices, including:

- **Policies and legislation:**
  - Lack of national policies that are legally binding to promote e-waste management in hosting countries.
  - Poor waste management practices and limited (if any) e-waste management programmes in several hosting countries.
  - Differences in terms of taxpayer status of host communities and displaced populations and the public services that they receive.
  - Lack of private actor access to displacement settings.
- **Guidelines and capacity building:**
  - Limited awareness on the hazards associated to e-waste.
  - Insufficient data on e-waste volumes, flows and disposal routes.
  - Lack of training for displaced communities on how to use, repair, and dispose electronic products.
- **Environmental/social planning:**
  - Limited capacity in terms of physical waste collection, waste treatment and recycling infrastructure, and service providers.
  - The absence of recycling facilities that meet minimum standards.
  - Extended storage periods for solar lanterns resulting from 'stockpiling' goods for potential emergencies deteriorating the battery and shorten the lifespan of the product, resulting in an increased rate of e-waste generation.
- **Financial barriers:**
  - High costs associated with collecting, transporting, treatment and shipping wastes.
  - Low economies of scale as the number of off-grid solar products are limited to make recycling and collection schemes financially sustainable.
  - Limited budgets and short funding cycles of humanitarian organisations.
  - High costs associated with producer-led take back schemes, especially from remote displacement settings.
  - Lack of incentives for producers to cover costs for e-waste.
  - Developing financially sustainable solutions considering limited funds, low purchasing power, and limited right to work for displaced communities.
- **Service provision:**
  - Few manufacturers willing to change product designs to facilitate replacement of parts for repair or disassembly of products for recycling.
  - Lack of availability of spare parts and tools for repairs.
- **Communication/Marketing:**
  - Limited awareness by humanitarian organisations on repair, reuse, and recycling activities associated with e-waste.
  - Lack of stakeholder engagement and, where it exists, engaging with an established informal sector.
  - Engaging with stakeholders to act together and accept shared responsibility (Blair, Wambui, Rhodes & Murray, 2021; African Clean Energy Technical Assistance Facility, 2019).

Even with such challenges, it is important to start developing e-waste management programmes (including batteries) in displacement settings to avoid a negative impact on the environment and displaced and host populations, green humanitarian operations, and create livelihoods opportunities.

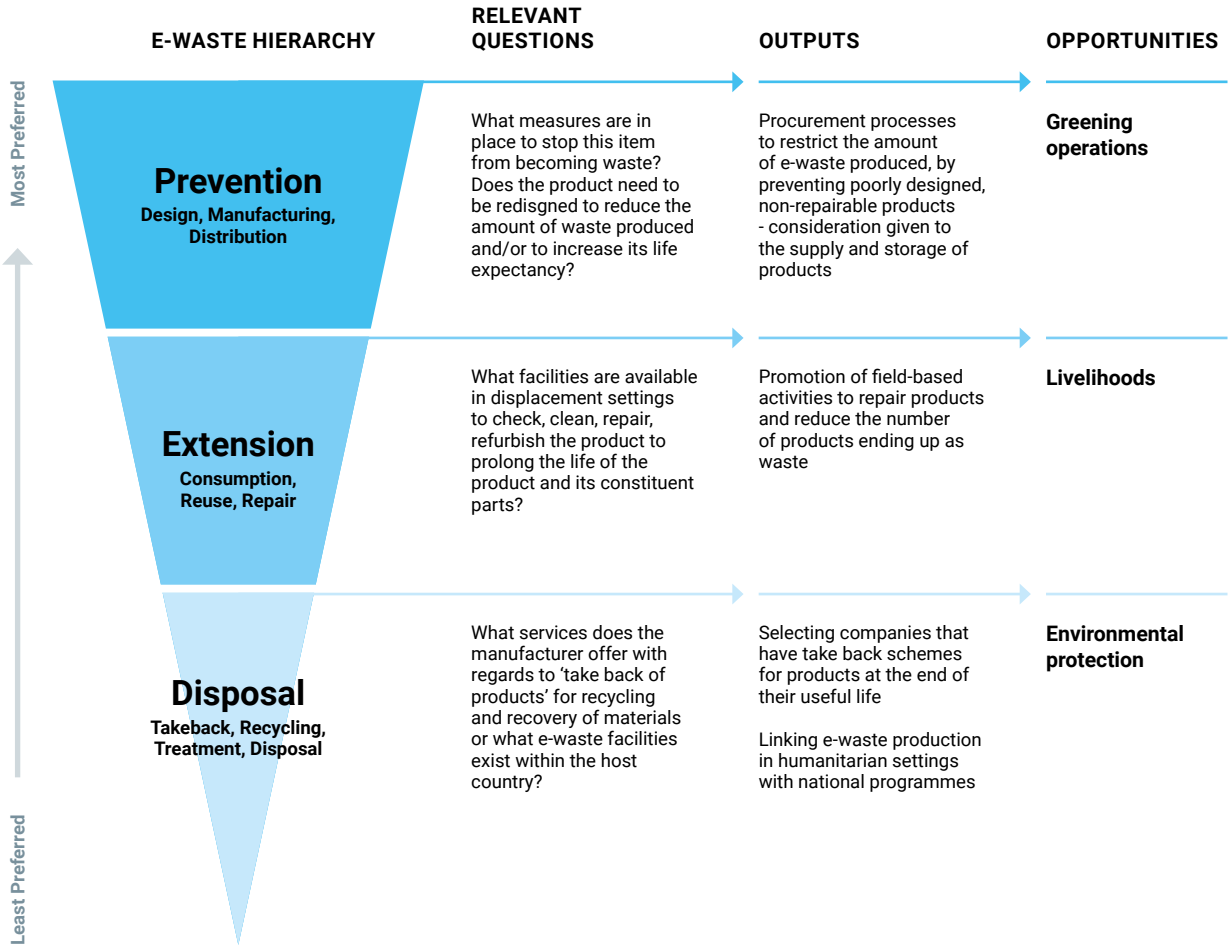
3.3. E-waste management tools for humanitarian organisations

E-waste management goes beyond the capacity of the off-grid solar industry due to its high costs and complex nature (African Clean Energy Technical Assistance Facility, 2019). This concern is even greater when the limited financial and human resources associated to humanitarian organisations operating in displacement settings in considered. As such, it may be more useful for humanitarian organisations to focus their limited resources on ways in which they can reduce and properly handle the amount of e-waste generated in displacement settings.

Adapted from waste management hierarchy, the e-waste hierarchy is a tool used to identify the activities that can help reduce the amount of e-waste generated (see Figure 6). The hierarchy is updated with circular economy components to show the lifecycle of products: design, manufacturing, distribution in prevention; consumption, reuse, and repair in extension; and takeback, recycling, treatment in disposal activities (GOGLA, 2019a). Each activity is explained in the following sections, aiming to provide a overview of possible solutions that humanitarian actors could use to mitigate e-waste in displacement situations.

Figure 6: The E-Waste Hierarchy

Adapted from GOGLA, 2019a



3.3.1. Prevention

Prevention is focused on limiting the amount of e-waste generated in a displacement setting. It is not practicable to suggest that solar products should not be deployed in displacement settings to prevent the generation of e-waste. It is, however, more appropriate to ask what measures are in place to minimise the impact associated with a particular product becoming e-waste and how the humanitarian community can limit the amount of e-waste being generated in displacement settings through the products that it purchases, distributes, and employs.

A means of reducing the environmental impacts of solar projects is through improved product and system design. Setting quality and durability requirements that enable long battery and system lifetimes that effectively reduce the amount of e-waste generated from off-grid solar products.

In order to minimise the amount of e-waste generated from a particular product, design considerations based on sustainability principles need to be incorporated into the product. Relevant design consideration may include improving the quality of the component parts to extend the life expectancy of the product, labelling materials to aid with recycling, reducing the number of different types of plastic used in the product, designing the product to be disassembled and repaired, providing tools and spare parts for repair at the time of purchase, and reducing physical tamper proofing, expanding digital tamper proofing mechanisms, and improving battery management systems (GOGLA, 2019b).

Redesigning existing products to improve their sustainability and reduce e-waste impacts takes time, measurable in years, not months. It is also anticipated that a more robust and repairable product would cost more, although this would be offset against an extended product life expectancy. In addition, the added value associated with the repairability of a product only counts if a repair service or spare parts and tools are available in the displacement setting.

Humanitarian organisations can restrict the amount of e-waste being generated in a displacement setting by only purchasing products that have been designed with an extended life expectancy and/or are repairable. This would require the development of procurement language and tools to support the approach. Given the anticipated increase in individual costs accounted to such products, consideration would also have to be given to weighting proposals away from costs and towards sustainability.

It is not known how many EEE producers have, or are looking into developing, products that are designed for sustainability. It is, however, anticipated that only a handful of producers are doing so at present. As such it will take time for purchasers to receive tenders that are compliant with new procurement language, as producers redesign their products to meet the specifications. Given the expected purchasing power of humanitarian organisations, especially for solar lanterns, the new procurement language could drive change in the market.

There are, however, a couple of key challenges with the approach. Although humanitarian organisations are expected to purchase a significant number of solar lanterns, it is not known how this translates into purchasing power and changing the sector's approach to the sustainable design of solar lanterns. Furthermore, the purchasing power of other solar products, such as SHS and standalone solar plants, or modern cookstoves with electronic parts are expected to significantly lower and as such revised procurement language from humanitarian organisations may not have the same impact on the wider solar marketplace.

In addition, procurement specifications can be based on the ease of repairability, ease of disassembly for recyclability, availability of spare parts, materials used (e.g., bioplastics instead of plastics), origin of products (e.g., local manufacturer to reduce CO2 emissions in transport), and use of hazardous chemicals during manufacturing. The development of such specifications is complicated by the lack of a common definition of what constitutes 'easily repairable.' The Off-Grid Solar Scorecard does, however, include repairability as a criterion to evaluate products, and Solvoz is working on developing ethical procurement criteria on behalf of IOM (see Section 4.3.4).

Developing a standard to which a solar product's repairability can be assessed will, however, require significant advocacy efforts from within the industry as well as certification bodies, such as VeraSol.

3.3.2. Extension

The extension element of the e-waste hierarchy for displacement settings aims to extend the lifetime of a product or its constituent parts through repair, reuse and refurbishment, thereby reducing the volume of e-waste.

Although solar lanterns distributed free of charge in displacement settings come with guarantees and warranties, there is no mechanism for individual end-

users to take advantage of them, as the manufacturer who is offering them is detached from the end user by the procure and distribute model.

In many contexts, displaced populations are already involved in the management of e-waste through informal collection and repair activities (ESDS, 2021a). It is, however, recommended that field based 'life extension activities' are promoted and developed in displacement settings. The promotion and development activities should include engagement with existing informal markets and collectors, which may reduce the costs and complexities of managing e-waste (GOGLA, 2019b).

A key challenge for repair and refurbishment activities is that the product must be designed in a way that facilitates such activities (see section 3.3.1). In addition, spare parts and tools, technical designs, and specifications for products must be readily available to ensure technicians or users can disassemble and repair products without damaging them or causing harm to themselves while working with hazardous materials. Furthermore, training in local language may be required to provide individuals with the skills to undertake such activities. Ideally repair and refurbishment activities should be financially self-sustaining, which will require the development of an appropriate business model. The commercial viability of such activities may, however, be limited by the number of items and products in the market. In other words, there needs to be a sufficient demand for the service, and where more than one brand is in use, consideration should be given to centralising repair activities.

3.3.3. Disposal

The traditional waste hierarchy splits recycling, recovery and disposal into separate activities. For the purposes of displacement settings, they have been combined for simplicity as they should be undertaken by specialist waste management companies. In addition, producer take back schemes have been included, as the waste would be passed back to the producer for them to recycle, recover and dispose of the e-waste. Such activities are likely to be licensed, where regulatory regimes exist, and would have to meet minimum safety and environmental standards. Therefore any 'disposal' activities should be linked to national waste management programmes.

One of the proposed solutions under Extended Producer Responsibility (EPR) legislative programmes is to make companies responsible for taking back, recycling and disposing of the products that they sell. The level and type of the responsibilities, cost distribution and control mechanisms of EPRs can vary, but their common feature is that they are legislated nationally. This means that in order for take back schemes for e-waste to be systemically applied in displacement settings, nation states must establish the necessary regulatory framework (ESDS, 2021b).

Takeback schemes that are brand agnostic can increase the number of products collected (Blair et al., 2021) and may help reduce costs, however, it may be a challenge for all producers to agree on an approach and the division of subsequent costs.

In addition, proper labelling of component parts, availability of takeback and recycling information, reducing the number of plastic types used and the ease of disassembly of a product can increase its likelihood of being taken back or recycled (GOGLA, 2020) and therefore reduce the products environmental impact.

Recycling activities, when residing with the informal sector, might hinder recovery of valuable materials and therefore is not preferred to documented and formal recycling activities (Forti et al., 2020). Recovery includes, amongst others, activities where precious metals are recovered from electronic components, reducing the dependency on mining of virgin materials, or the burning of waste material to recover heat energy. Recovery of certain materials, such as germanium and indium, might be challenging since these are used dispersedly and the products are not designed with disassembly and recycling in mind (Forti et al., 2020).

The residual waste (waste that cannot be recycled or recovered) is disposed of, for instance, in a landfill site, which should be licensed to accept the type of waste being disposed of which might not be possible in many displacement settings.

The management of e-waste can also be subcontracted out to waste management companies, although given the lack of regulatory context in many hosting countries, it could be a challenge to identify a suitable service provider who meets acceptable environmental and safety standards. The customary method for off-grid solar companies is to work with one waste management company that collects, transports, dismantles waste products and manages the relationship with treatment processors and disposal companies. With the exception of lead-acid batteries, for which working with a recycler directly is more cost-effective and logistically feasible (GOGLA, 2019).

4. Key Actors

There has been increasing interest from various actors on managing e-waste in displacement settings. The following Chapter provides a brief overview of key actors who are either actively working in displacement settings or have learnings that could be transferred to the humanitarian sector. Where relevant, a short summary of existing or pending e-waste projects has also been provided.

4.1. Hosting governments

As noted in the previous Chapter, the host government's policy and regulatory regime associated with e-waste is a contributing factor to a successful e-waste management system.

The GSMA E-waste Legislative Framework Map provides, amongst other things, a summary of the e-waste regulatory regime within 76 countries, as a result of a study conducted by the GSMA from late 2019 to early 2020 (GSMA, 2021).

Based on the outputs of the GSMA study, Annex A of this report provides an overview of the e-waste policy and regulatory regimes associated with the top fifteen host countries for displaced people in Africa. Eight of the countries (Burkina Faso, Central African Republic, Chad, Democratic Republic of the Congo, Niger, Somalia, South Sudan and Sudan) have no specific regulatory regime for the management of e-waste. Only Cameroon, Côte d'Ivoire, Mozambique and Nigeria are reported to have legally binding regulatory regimes. Two countries (Uganda and Ethiopia) have e-waste regulatory regimes, although they are reported as not being legally binding. Kenya is the only country with an extensive national e-waste legislative regime.

An overview of the status of the waste management systems associated with e-waste for these fifteen countries has not been undertaken as part of this paper. A recent paper written by Sofies (see Section 4.3.3) on behalf of GIZ ESDS (see Section 4.2.2), however, noted that a "detailed analysis of the legislations and regulations at international and national scale in Ethiopia, Kenya and Uganda was conducted and demonstrated the lack, if not the total absence, of e-waste legislation" (ESDS, 2021b). Which, with regards to Kenya, is at odds with the GSMA study and may reflect the ongoing implementation of the existing legislative regime.

4.2. International organisations

4.2.1. Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, (GIZ)

GIZ commissioned a study on "Leveraging Formal-Informal Partnerships in the Indian E-Waste Sector" in 2017 (African Clean Energy Technical Assistance Facility, 2019). As a follow up to this project, GIZ is in the process of developing guidelines for energy access projects to promote the efficient handling of e-waste.

GIZ published a training manual on the handling of e-waste in line with the German Cooperation programme for "Environmentally Sound Disposal & Recycling of E-waste" running from August 2016 to January 2020 (GIZ, 2019). The manual aims to improve the capacity of the informal sector, guide the establishment of organisational structures for collection and recovery facilities, and reduce the health and environmental risks of e-waste (GIZ, 2019), The training provides a compact summary of defining e-waste, dismantling various products in practice, identifying the types of fractions recovered after dismantling, the management of a small-scale recycling facility, and the organisation of training programmes (GIZ, 2019).

GIZ also published a report on the management of batteries for the end-of-life off-grid solar products in low-income countries (GIZ, 2018). The report deep-dives into different end-of-life characteristics for lead-acid and lithium batteries such as types, prices, lifetimes, toxicity potential and safety risks, recycling practices and required infrastructure. The report then provides an overall summary of business models (direct purchases compared to lease-to-own models) and how they impact end-of-life management of off-grid solar products. The report concludes with guidelines

on points to consider for energy access projects for better e-waste management, including choosing battery types, product and system design, partnerships and business models, and policy frameworks.

In addition, GIZ implemented two pilot projects on lithium-ion batteries. One is focused on collection and recycling measures in Nigeria, and the other explores the repurposing of batteries in Tanzania. The results of the studies are presently being processed. In 2020 GIZ Ethiopia also launched a battery recycling project for lead acid batteries, which included a roadmap, stakeholder mapping, and the production of standard guidelines.

4.2.2. GIZ Energy Solutions in Displacement Settings (ESDS)

The GIZ Energy Solutions for Displacement Settings (ESDS) Programme (funded by The German Federal Ministry for Economic Cooperation and Development (BMZ)) is supporting UNHCR (see Section 4.2.10) in providing sustainable energy solutions to refugee and host communities in Ethiopia, Kenya and Uganda, with an aim of enhancing self-reliance.

GIZ ESDS organised an online workshop in June 2020 to collect ideas, identify existing e-waste initiatives in displacement settings, and explore synergies with comparable initiatives (ESDS, 2021b). Following which, ESDS commissioned Sofies (see Section 4.3.3) to undertake a review of e-waste management in Ethiopia, Kenya, and Uganda. The subsequent report included a review of legislative frameworks, practices of stakeholders and a mapping of the flow of e-waste, while highlighting the legislative and practical challenges of e-waste management in displacement settings.

Sofies were also commissioned to develop a concept for a pilot e-waste collection scheme based on the EPR principle in Rhino Camp Refugee Settlement in Northern Uganda. The overall objective of the concept is to create a collection mechanism that removes e-waste from the environment and acts as first step to introducing a circular economy as outlined in the Pathways to Repair in the Global Off-Grid Solar Sector Report produced by Efficiency for Access Coalition and The University of Edinburgh (see Section 4.4.1) (ESDS, 2021b).

GIZ ESDS also initiated and chair the Technical Working Group on E-Waste Reduction in Displacement Settings, which brings relevant actors together to share ideas and activities on e-waste management (ESDS, 2021a). GIZ ESDS is also working on updating the Solar E-Waste Reduction in Displacement Settings page on Energypedia, a wiki platform for collaborative knowledge exchange on renewable energy, energy access, and energy efficiency topics in low-income countries.

4.2.3. Global Platform for Action on Sustainable Energy in Displacement Settings (GPA)

The GPA is a global initiative to promote actions that enable sustainable energy access and use in displacement settings, based at UNITAR (see Section 4.2.11).

As part of its global coordination role, the GPA Coordination Unit has drafted this paper for the wider community, following a request from the Norwegian Agency for Development Cooperation (NORAD), with support from NORCAP. It is also working with GIZ ESDS, IOM, and UNHCR through an E-waste Task Force in order to establish a global coordination and knowledge sharing platform for e-waste in displacement settings.

In addition, the GPA Coordination Unit is presently supporting the development of a pilot project, with UNHCR Bangladesh, Schneider Electric, and Electriciens Sans Frontieres, in Cox's Bazar to create an innovation centre focused on recycling, repair and upcycling of solar products, which would be paired with vocational training on solar energy systems to refugees and local host community members.

4.2.4. Innovation Norway

The Humanitarian Innovation Programme of Innovation Norway provides funding and support for the development, testing and scaling of new solutions that can contribute to better and more efficient humanitarian action, and building joint solutions with the private sector.

Innovation Norway is presently supporting an e-waste initiative with IOM (see Section 4.2.5). The IOM E-waste Project: Greening humanitarian response through recovery, repair and recycling of solar products in displacement settings, aims to respond to the problem of ill-managed disposal of solar products in displacement settings by finding a cost-effective solution(s) for the repair, reuse and recycling of these products or components through a circular economy.

It aims to: gather evidence to influence manufactures of solar products to make their products more repairable/recyclable; extend the lifecycle of existing technologies and improve waste management in displacement settings; create jobs, support livelihoods and provide business opportunities for refugees and host communities; and inform humanitarian sustainable procurement policies. The project will also share lessons learnt to address the unique factors of e-waste management in displacement settings, provide evidence for its replication in other settings and to scale up beyond solar products to other types of electronic waste (IOM, 2020).

4.2.5. International Organization for Migration (IOM)

In coordination with UNHCR, IOM is working on the e-waste initiative funded by Innovation Norway (see Section 4.2.4).

The project adopts a circular economy approach and includes multiple activities undertaken by three partners – TotalEnergies (see Section 4.3.5), BRIGHT Products (see Section 4.3.1) and Solvoz (see Section 4.3.4), to holistically address the waste value chain from manufacture and distribution, to repair, recovery, recycling and procurement.

A solarized and transportable battery rejuvenation centre will be established (the BatLab), which will be developed by TotalEnergies' partner Aceleron (see Section 4.3.5). It uses an innovative method to rejuvenate battery cells and is expected to refurbish 70% of batteries that would have otherwise been disposed of. The repair will be done in an easily transportable, modular, and solarized unit which will be operational in Bidi Bidi settlement at the start of 2022. A marketing campaign will be launched which offers a small incentive for each battery brought to the BatLab. The project will also work with refugees to train them in technical and business skills for the operation of the Batlab, thereby creating entrepreneurship opportunities. TotalEnergies will collect monitoring information on profit and loss to make changes to the business model as required, to allow it to be self-sustaining by the second year of operation, and for the potential handover of the Batlab to local refugees.

A tablet-based learning platform will be created by BRIGHT Products to train displaced people on how to repair their products. At the same time, BRIGHT will supply spare parts and tools which are otherwise unavailable in the camp to undertake the repairs. BRIGHT will collect monitoring information on the most common problems encountered by the repair centres, which will be shared with manufacturers to help improve the design of their solar solutions.

Solvoz will contribute to open-access knowledge in an online platform including a range of solar solutions from small to complex, and from local and international suppliers. The aim of the Solvoz activities is to support the purchase of repairable, robust solar products that results in a reduction in e-waste generation in displacement settings. Solvoz will also develop sustainable procurement documentation for the purchasing of off-grid solar products for use by organizations in the humanitarian sector, and that work within current UN procurement systems.

Through a market dialogue, IOM engaged with a number of private sector actors who are undertaking several innovative activities around e-waste. The key findings from the engagement are below:

- Some manufacturers are more willing and able to change product designs to facilitate replacement of parts for repair or disassembly of products for recycling.
- Some repair manuals and tools are ready to train users and technicians in how to fix common faults.
- Challenges are partner engagement, access to camps and funding – these are due to a mix of the costs involved and a lack of interest or understanding on the topic.
- In-country recycling opportunities are limited to plastics and metals, to process other materials would require very large capital investments. For instance, there is no lithium battery recycling facilities in sub-Saharan Africa.

The implementation phase of the IOM E-waste Project will launch in Q3 of 2021 and conclude by July 2022, with the option for partners to continue activities.

4.2.6. International Telecommunications Union (ITU) of the UN

The ITU is the UN's specialised agency responsible for all matters related to global information and communication technologies (ICT). ITU has undertaken a broad range of activities to address the e-waste challenges at global, regional, and national levels for information and communication equipment.

This includes conducting life-cycle analysis of products and processes, supporting the shift to green and circular economy for ICT equipment, promoting policy development, creating standards, improving the collection of global e-waste data through the Global E-waste Statistics Partnership, and raising awareness by participating in the UN E-waste coalition (ITU, 2021).

In addition, ITU has also developed a Massive Open Online Course (MOOC) on e-waste management for understanding the e-waste challenge and identifying ways in which policymakers, industry leaders, academic, and consumers can take action. ITU also provides Members States with technical assistance with developing national policies and regulatory standards for e-waste (ITU, 2021). In doing so it has produced an E-waste Policy Tool Kit and a set of Guidelines for Designing E-waste Management Systems.

4.2.7. United Nations Development Programme (UNDP)

UNDP implemented a project in Egypt to reduce health and environmental risks concerning persistent organic pollutants (POPs) originating from incineration and open burning of health care and e-waste in 2013.

In 2016 UNDP, with Ministry of Environment in Jordan, implemented a sustainable and replicable waste management project for electronic, hazardous, healthcare, and municipal solid waste to reduce the release of POPs and carbon dioxide.

UNDP, in partnership with the Jordanian Ministry of Environment and the Secretariat of Basel Convention, initiated an end-of-life computing equipment management and monitoring programme in Jordan (UNDP, 2021a). The e-waste project aims to improve collection and recovery practices in an environmentally sound manner, provide technical assistance to project team, assess, and examine existing e-waste regulatory frameworks in Jordan, and influence decision makers on the gaps in laws and implementation (UNDP, 2021a).

4.2.8. United Nations Environment Programme (UNEP) & Greening the Blue

UNEP is part of the UN E-waste coalition, a group of seven UN entities working towards increasing cooperation and supporting Member States and Parties to address the e-waste challenge (PACE & E-waste Coalition, 2019). UNEP, together with the Nigerian government and the Global Environment Facility, invested 2 million USD to kick off a formal e-waste recycling industry in Nigeria (UNEP, 2019). The investment aims to formalise people working in the informal e-waste sector and to utilise the 500,000 tonnes of e-waste generated in Nigeria each year (UNEP, 2019).

Greening the Blue is a UNEP initiative to engage and support the UN system in the transition towards greater environmental sustainability in the management of its facilities and operations and chairs a Sustainable Procurement Working Group.

E-waste has not, however, been a focus of the Sustainable Procurement Working Group. Although there are some generic clauses that are recommended for use, which includes: “the bidder must share a plan for a take-back programme for the “good in question (e.g., ICT equipment, etc.) at the end of its useful life;” and “the bidder will include a formal plan to properly manage any waste or waste by-products created during the execution of the contract.”

4.2.9. United Nations High Commissioner for Refugees (UNHCR)

At the global level, UNHCR is in the process of mapping out its internal solar procurement process, understanding where it has distributed portable solar lanterns in the past, and developing a strategy to extend their life expectancy through repair, refurbishment, reuse and recycling activities. Its activities are being supported by the University of Edinburgh (see Section 4.4.1.). In this regard, the University of Edinburgh is producing an internal facing report to seek buy-in from organisations and guide future action. The internal report was delivered to UNHCR in September 2020. An external facing report based on the general findings of the study would be of benefit to the wider community.

In conjunction with the work being undertaken by the University of Edinburgh, there are ongoing coordination activities with supply (procurement) colleagues, technical teams who write specifications for solar products and country implementation teams, to improve e-waste management. The aim is to develop long-term framework agreements that reduce e-waste from solar products purchased by UNHCR.

At the field level, GIZ ESDS is providing support in developing e-waste solutions for UNHCR activities in Ethiopia, Kenya and Uganda (see Section 4.2.2).

4.2.10. United Nations Institute for Training and Research (UNITAR)

UNITAR is the leading UN organisation in e-waste research and training and hosts the GPA (see Section 4.2.3). UNITAR also manages SCYCLE, a network of networks supporting the development of successful partnerships to address the e-waste challenge, which it approaches from a lifecycle and holistic lens. In addition, SCYCLE helps partners develop e-waste management systems, including supporting legislation, financing, and setting up collection and recycling facilities, often through public-private partnerships.

UNITAR is also a member of the Global E-waste Statistics Partnership and the UN E-waste coalition.

4.2.11. World Food Programme (WFP)

In 2021, WFP signed long term agreements with two e-waste management companies, to manage e-waste in Kenya and Somalia. In Kenya, WFP has contracted the WEEE Centre to recycle its e-waste and re-inject usable products back into the market. In addition, WFP is in dialogue with Close the Gap, based in Mombasa, that has a model whereby they purchase old laptops, phones, screens from organisations, refurbish them to a high quality, and resell them on the local market while sharing the profit with the organisation who previously owned them. In Somalia, WFP has contracted Enviroserve to consolidate its e-waste and transfer it to Dubai for processing. Other e-waste activities include projects with Enviroserve in Rwanda and The Democratic Republic of Congo, DanOffice with WFP Headquarters in Rome, and AST Recycling in South Africa.

WFP is looking to work with other partners to be able to develop and consolidate e-waste contracts with specialist waste management contractors in other countries such as Ethiopia, South Sudan, and Sudan.

4.3. Private sector actors and associations

4.3.1. BRIGHT Products

BRIGHT Products is a Norwegian solar product company offering a range of solar lamps and home systems with charging options. Since 2014, the company has sold over 2.6 million of its lamps to humanitarian actors, which have ended up in displacement settings.

Research in Jordan and Kenya revealed the importance of addressing solar e-waste, as it was noted that many of the broken solar lamps encountered could have been repaired easily, thereby reducing wastes and extending the life of its products (BRIGHT Products, 2021). As a result, the company launched the BRIGHT Solar E-waste Project in Bidi Bidi Refugee Settlement with IOM (see Section 4.2.5) to extend the life of solar lamps, provide job opportunities in displacement settings, build technical capacity, reduce the need for new lamps, and reduce the generation of e-waste. The company will provide spare parts, toolkits and a digital learning platform designed for refugee settings, in addition to training refugees on product repair. BRIGHT Products is looking for a local implementing partner to launch a second pilot in another displacement settlement.

Funded by the European Union, the company has also begun designing a sustainability programme for its solar lanterns, to make them more durable and repairable. This programme began in 2020 and is expected to be completed over two years. It will also incorporate lessons learnt from field-based repair activities through its BRIGHT Solar E-waste Project.

BRIGHT Products has also expressed a concern over the storage of its solar lanterns, once they have left its manufacturing plant, as lengthy storage periods in high temperatures can reduce the efficiency and life expectancy of the associated battery. Which, in itself, can increase the amount of e-waste being generated in displacement settings. As an example, it was reported that with poor storage and no recharge of the batteries over long periods of time, the capabilities and capacity of the battery might deteriorate. This results in a situation where if the lamp is supposed to last for 6 hours on high setting, this time can be reduced to 3 to 4 hours after three months of use.

4.3.2. GOGLA

GOGLA is a global association for the off-grid solar energy industry. It chairs an E-waste Circularity Working Group with GOGLA members, companies, investors, manufacturers, universities, and research institutes, which acts as a consultation group for developing learning output and sector guidance, through particular themes (repairability, standardised product labelling for disposal), and sharing best practices, problems, and solutions.

GOGLA has also published an E-waste Toolkit of six modules with accompanying briefing papers and

webinars addressing recycling technology, policy, and finance aspects associated with managing e-waste. The six modules of the toolkit are as follows:

- Module 1: Technical introduction to recycling of off-grid products provides a high-level overview of recycling of off-grid solar products and management of waste, and selection of recycling partners.
- Module 2: Design for reduction of waste highlights tools for reducing waste in the off-grid solar sector by exploring products, services, and business models and provides four innovative case studies.
- Module 3: The financials of e-waste management provides an overview of financial costs associated with e-waste management, such as recycling of solar fractions, charges of waste management companies, transport, and compliance to rules and regulations.
- Module 4: E-waste regulation and compliance offers guidance on the current regulations associated with e-waste and different financing mechanisms in order to facilitate informed discussions among stakeholders.
- Module 5: E-waste and the consumer presents tools and strategies for improving consumer behaviours upon end-of-life of products through communication with customers, awareness raising, after sales services, and incentives and messaging.
- Module 6: Take-back and collection details take-back and collection schemes available for companies such as owned/reversed logistics, third-party collection and informal sector engagement.

The next version of the E-waste Toolkit (release date presently unknown) is expected to include blueprints for company-level policies, action plans, and guidance around training and key performance indicators and a standardised method to measuring e-waste generation.

In addition, GOGLA has produced a catalogue of waste management and recycling partners providing services in different countries for its members. For example, Enviroserve has collection points in every county in Rwanda, at the border with Uganda.

4.3.3. Sofies

Sofies was commissioned by GIZ ESDS (see Section 4.2.2) to analyse the status of e-waste management in Ethiopia, Kenya, and Uganda and to support the development of an e-waste pilot project in a displacement setting.

Based on its research in Ethiopia, Kenya, and Uganda, Sofies state that "Despite the signing or ratification of several international conventions that pertain to e-waste, adequate regulations are either not yet fully developed due to gaps in their enforcement, have a non-binding form or do not exist. Due to this, companies involved in disseminating off-grid energy solutions in camps and settlements, and the countries in general, are not obliged to handle waste generated from their products. On the other hand, most humanitarian or development actors active in distributing solar products, be it as giveaways or via incentivisation schemes for companies, have not systematically incorporated e-waste in their operations despite generic waste management and sensitization activities enacted as part of wider environmental policies. (…) Neither companies nor organizations have a clear understanding on the exact amount of products entering and exiting displacement settings. (…) In general, waste management practices in camps and settlements include dumping waste gathered from collection points in community pits in surrounding areas and to cover or burn them, while in some cases waste is managed more rudimentary without any strategy. Segregation of waste is at best rudimentary and for e-waste relies on sub-standard practices which aggravate environmental pollution and pose safety risks" (ESDS, 2021b).

The results of the study have been used to develop a pilot for a market-based approach for managing e-waste in Rhino Camp Refugee Settlement in Northern Uganda during 2021. Rhino Camp was selected as solar products have been distributed and sold there, and a GIZ-supported energy kiosk exist that could act as collection point. The objective is to create a 'collection of mechanisms' that removes e-waste from the environment and acts as a first step to developing a circular economy. For functional products, this would include repair, reuse or refurbishment, while unrepairable items would be recycled. It is important to note that repair, reuse or refurbishment can be achieved locally by trained technicians, while recycling includes complex technical procedures at commercial facilities, which at present do not exist in Africa (ESDS, 2021b).

Table 1: Summary of e-waste activities

Activity	Actor (Section No.)	Displacement Setting	Summary
Enabling Framework	*GIZ (4.2.1)*	No	Developing guidelines for energy access projects to promote the efficient handling of e-waste
	ITU (4.2.6), UNEP (4.2.8) & UNITAR (4,.2.10)	No	Part of the UN E-waste Coalition working towards increasing cooperation and supporting Member States and Parties to address the e-waste challenge
	UNITAR (4.2.10)	No	Manages SCYCLE, a network of networks that supports the development of partnerships to address the e-waste challenge. It also helps partners develop e-waste management systems, including supporting legislation, financing, and setting up collection and recycling facilities
	ITU (4.2.6)	No	Provides Members States with technical assistance with developing national policies and regulatory standards for e-waste and has developed e-waste policy tool kit and guidelines for designing e-waste management systems
	GIZ ESDS (4.2.2) & Sofies (4.3.3)	Yes	Review of e-waste management in Ethiopia, Kenya, and Uganda
E-waste Prevention	*IOM (4.2.5) & Solvoz (4.3.4)*	Yes	Development of an online platform that supports the purchase of repairable, robust solar products and the development of sustainable procurement documentation for the purchasing of off-grid solar products
	BRIGHT Products (4.3.1)	Yes	Designing a sustainability programme for its solar lanterns, to make them more durable and repairable
E-waste Extension	*IOM (4.2.5) & BRIGHT Products (4.3.1)*	Yes	Provision of spare parts and the development of a tablet-based learning platform to train displaced people in Uganda on how to repair BRIGHT products
	IOM (4.2.5) & TotalEnergies (4.3.5)	Yes	Creating a solar battery rejuvenation centre at Bidi Bidi settlement in Uganda
	GPA (4.2.3)	Yes	Development a pilot project in Cox's Bazar to create an innovation centre focused on recycling, repair and upcycling of solar products
	UNHCR (4.2.9) & Uni. of Edinburgh (4.4.1)	Yes	Internal report on e-waste to support the development of a strategy to extend the life expectancy of solar lanterns through repair, refurbishment, reuse and recycling activities
	Uni. of Edinburgh and partners (4.4.1)	No	Produced a report that provides evidence on the case for developing and implementing repairability assessment standards for off-grid solar products
	Uni. of Edinburgh and partners (4.4.1)	No	Developed a website that ranks available solar lanterns against parameters such as modularity, ease of disassembly and availability of spare parts
E-waste Disposal	*WFP (4.2.11)*	No	Signed long term agreements with two e-waste management companies, to manage e-waste in Kenya and Somalia
	GIZ (4.2.1)	No	End-of-life characteristics for batteries, prices, lifetimes, toxicity, safety risks, recycling practices and required infrastructure
	GIZ ESDS (4.2.2) & Sofies (4.3.3)	Yes	Developing a pilot e-waste collection scheme based on the EPR principle in Rhino Camp Refugee Settlement in Northern Uganda
Coordination	*GOGLA (4.3.2)*	No	Chairs an E-waste Circularity Working Group that acts as a consultation group for developing learning output and sector guidance
	GPA (4.2.3)	Yes	Developing E-waste Task Force
	GIZ ESDS (4.2.2)	Yes	Chairing the Technical Working Group on E-Waste Reduction in Displacement Settings
Training & Tools	*ITU (4.2.6)*	No	Developed Massive Open Online Course (MOOC) on e-waste management
	GOGLA (4.3.2)	No	Published an E-waste Toolkit with accompanying briefing papers and webinars addressing recycling technology, policy, and financing
	GOGLA (4.3.2)	No	Produced a catalogue of waste management and recycling partners providing e-waste services in different countries
Projects	*UNDP (4.2.7)*	No	Implemented nationwide e-waste projects in Egypt and Jordan

4.3.4. Solvoz

Solvoz is an online platform providing procurement support for aid agencies, health facilities, social impact organisations, NGOs, and civil society organisations in lower middle-income countries. The platform allows organisations to define technical specifications so they can receive competitive bids from suppliers. The open access platform supports planning and procurement processes while improving efficiency, effectiveness and responsibility, localising supply chains, and empowering local responders.

Solvoz is contributing to the e-waste project in Bidi Bidi refugee settlement through an open-access online platform for solar solutions and procurement documentation (see Section 4.2.5).

4.3.5. TotalEnergies Offgrid Solar Solutions (TEOSS)

Since 2021, TEOSS, through its Access to Energy program, has distributed 4 million solar lanterns and kits to low-income communities (TotalEnergies, 2021). Following a life cycle analysis of its SUNSHINE products, it was noted that designing a better product would have the biggest impact on waste management at the end of its life. The company works in four pillars to improve the sustainability of their solar products: using materials with lower environmental impact; recycling; encouraging repair; and developing collection and take back schemes. In 2015, TEOSS joined forces with the WEEE Center in Kenya that collects and dismantles used Total electronic products and separates the electronic components from plastic. In addition, a new trilateral partnership was concluded between TotalEnergies, WEEE Center and Aceleron to give a second life to batteries.

TEOSS is also part of the BatLab project at Bidi Bidi Refugee Settlement (see Section 4.2.5).

4.3.6. VeraSol

VeraSol is a quality assurance program that has evolved from the Lighting Global Quality Assurance Programme. It develops quality assurance standards for off-grid solar solutions and tests products to help identify 'quality' solutions. At present it does not have a repairability standard for off-grid solar solutions.

4.4. Research organisations

4.4.1. University of Edinburgh

University of Edinburgh is conducting a project with UNHCR (see Section 4.2.9) that includes collecting examples of repair and repurposing activities of off-grid solar in refugee camps. The goal of the study is to map existing practices and examine potential effects on procurement strategies to support repair and repurposing.

The commission followed the publication of the Pathways to Repair in the Global Off-Grid Solar Sector Report produced by the University of Edinburgh in partnership with the Efficiency for Access Coalition. The report provides evidence on the case for developing and implementing repairability assessment standards for off-grid solar products, identifies the benefits, risks, key issues, and key players, and lays out pathways to justify and inform future work.

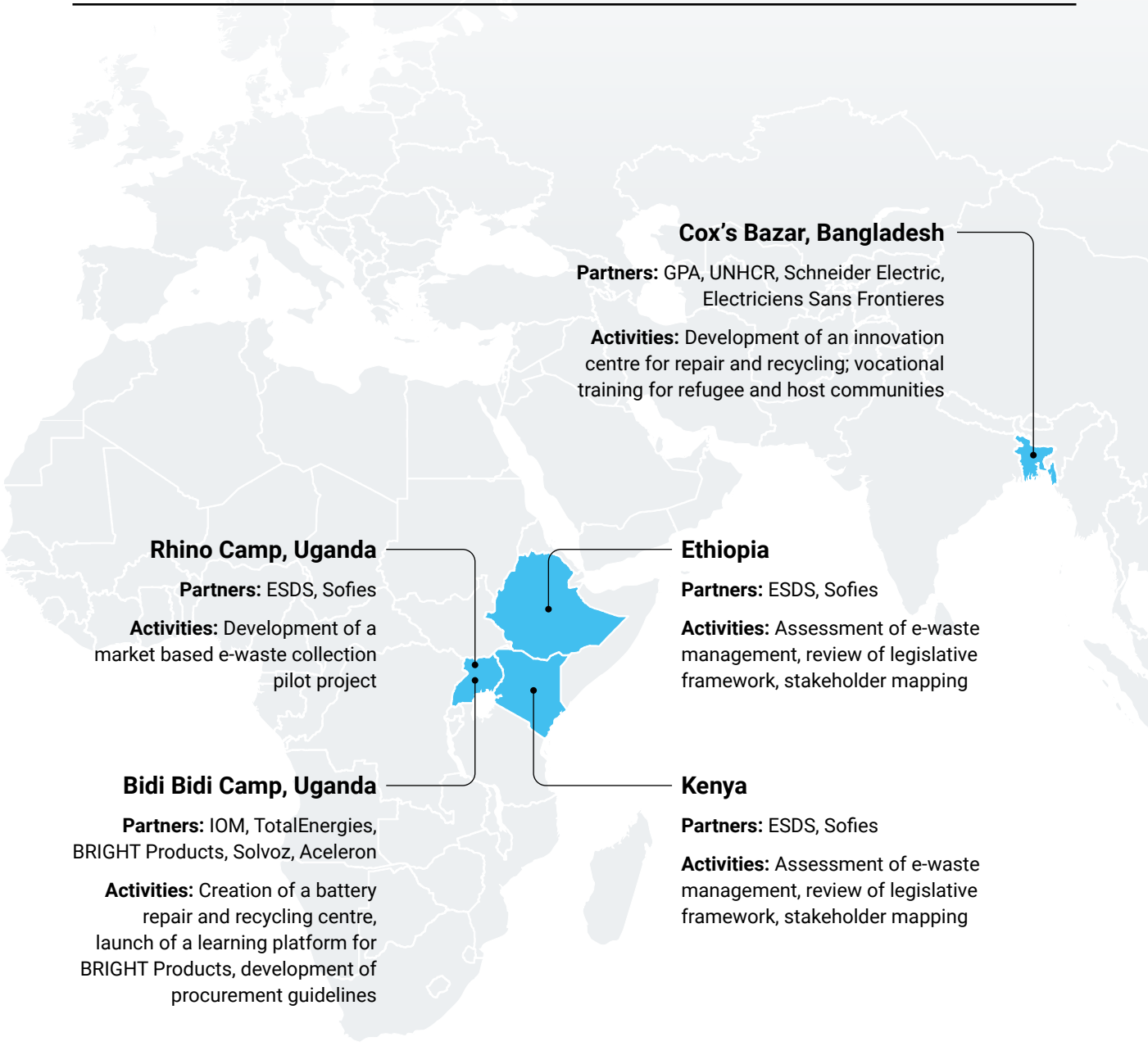
A working group for repairability standards for solar lanterns is in development, which would be comparable to VeraSol (see Section 4.3.5) and has a website (offgirdsolarscorecard.com) that ranks available solar lanterns against parameters such as modularity, ease of disassembly and availability of spare parts.

4.5. Summary of E-waste Activities

Table 1 provides a summary of the activities noted above, aligned to e-waste management activities.

Figure 7 provides an overview of what e-waste projects are being undertaken in displacement settings and where, based on the preceding sections. The concentration of e-waste activities in the East Africa region is due to the popularity of off-grid solar products in the region, the locations of displacement settings, the inclusion of e-waste in humanitarian agencies' activities and availability of technical support.

Figure 7: An overview of ongoing e-waste management programmes in displacement settings



5. Conclusions and recommendations

5.1. Conclusions

E-waste management in displacement settings is in its infancy, with interest in this field only gaining traction over the past two years. As a result, the amount of e-waste generated in displacement settings is not known, although the volume of e-waste is expected to increase as more energy programmes involving off-grid solar products and other electrical appliances are implemented. ***Pilot activities focused on managing e-waste have, however, commenced in displacement settings, which are being led by IOM and GIZ ESDS, on behalf of UNHCR.***

Whilst key humanitarian partners are beginning to look at the issue, e-waste management strategies have yet to be developed. In addition, waste management practices in displacement settings can be rudimentary given the lack of waste management infrastructure. As a result, ***inappropriate e-waste management activities could lead to serious health and environmental concerns***, which would translate into a reputational risk for humanitarian actors. Improving e-waste management in displacement settings is therefore essential and should be undertaken in parallel with the promotion of energy projects that could result in the generation of e-waste.

5.1.1. High-level lessons learned

Several high-level lessons have been identified during this study through desk research and interviews with experts, which include:

- Coordination is crucial to delivering holistic e-waste programmes at scale and across a broad spectrum of displacement contexts and geographic areas.
- A wide range of actors such as humanitarian organisations, product manufacturers, suppliers, as well as displaced and host communities, national and local governments, waste management contractors, the informal waste sector, and specialists with an understanding of e-waste and repair facilities should be engaged to develop lasting solutions.
- The costs associated to e-waste management solutions and the disposal of residual waste are at present unknown. Understanding and incorporating these costs into project budgets and working with the relevant stakeholders on developing financially sustainable solutions are essential.
- Any e-waste management initiative should be aligned with national policies, the local regulatory framework and supporting guidance documentation, however, in many hosting countries such an enabling environment rarely exists.
- Although batteries are not always legally defined as e-waste, it is important that any e-waste management strategy also considers waste batteries and that the batteries are managed in a compliant manner.
- The operational framework of the humanitarian system does provide a good opportunity for the development of a more sustainable approach. Unlike other settings where a greater variety of products, vendors and distribution modalities may exist, many electrical products in displacement settings are routed through a distribution network based on a centralised procurement system. This presents an opportunity to develop preferential procurement guidelines that reduce the amount of e-waste being generated in displacement settings that will encourage humanitarian actors to only purchase quality products that can be repaired, whose spare parts are readily available and have been designed in a manner that extends their useful life.
- It is anticipated that it will take several years for a common procurement language to have an impact. In addition, the procurement language needs to be supported by an internationally accepted definition of 'reparability' and a standard to verify such claims needs to be developed.
- An appropriate recycling and waste disposal system, with supporting infrastructure and facilities are critical. Such activities are, however, usually beyond the remit and capacity of humanitarian

actors and as such they should be developed by waste management organisations and undertaken in a manner that meets national regulatory requirements, ensures the safety of workers, and protects the local environment.

- Many hosting countries struggle to develop and maintain a suitable waste management system. This challenge highlights the importance of preventing poor quality products that could result in increased rates of e-waste from entering a displacement setting; and being able to extend the useful life of solar products once in such a setting.

- Manufacturers and suppliers have an important role to play by designing goods based on sustainability principles and supporting the repair, reuse and refurbishment activities in displacement settings.

- There are a number of short-, medium- and long-term activities required to develop solutions for, and support the management of, e-waste in displacement settings, ranging from the development of procurement guidelines, developing training tools, and piloting and scaling up market-based repair facilities. All of which will require experienced solar, waste management, e-waste, and circular economy specialists.

- Additional support can be provided by the private sector, with regards to repairing solar products. It is, however, considered likely that private sector support would only be focused on solutions for that company's own products.

5.2. Recommendations

Based on the conclusions and high-level findings noted above, the following recommendations are made.

5.2.1. Coordinate e-waste activities within the humanitarian sector

Given the limited experience of humanitarian actors with regards to e-waste management, it is imperative that lessons learnt from ongoing and future projects are widely disseminated, along with a message to advocate for increased action and raise awareness of the impacts associated to poor e-waste management and lobbying for inclusion of e-waste at the decision-making level.

This can be achieved through the E-waste Task Force, which is being initiated by GIZ ESDS and the GPA Coordination Unit, with messaging through the GPA Steering Group, Humanitarian Energy Exchange Network and NORCAP Energy Expert Roster. Through the Task Force, priorities can be established with regards to, amongst other things, assessing the need for regulations for procurement and disposal, collecting data on e-waste flows, understanding what conditions are required for an e-waste management programme to be viable and effective, developing stakeholder engagement processes, assessing local and national waste management facilities and waste management contractors, sharing or combining long term agreements with e-waste contractors, advocating for UN-wide rules on dealing with e-waste, understanding costs and developing financially sustainable solutions, and what to do in the absence of national and local waste management practices.

Since humanitarian partners have only just begun looking at this topic, consideration should also be given to incorporating the outputs from industry and research initiatives being undertaken by the likes of GIZ, GOGLA, and the University of Edinburgh, as well as the international community such as the World Economic Forum. Lessons learnt from recently commenced field-based pilot projects will also be an important source of material, however, they are not anticipated to be available until the second half of 2022.

It is also important to maintain a directory of ongoing projects and activities with regards to e-waste, not only to support knowledge sharing and the development of new initiatives but also to reduce the likelihood of duplication of effort. This could be achieved through an online, interactive map hosted by Energypedia.

5.2.2. E-waste management and enabling environment

Humanitarian actors should consider the development of e-waste strategies that considers all e-waste not just waste resulting from solar products, which should be integrated into a wider waste management strategy for the displacement setting and the associated humanitarian response.

Improvements to e-waste management in displacement settings should be based on the waste management hierarchy and be focused on the activities that humanitarian actors have control over. The humanitarian community should therefore be prioritising the 'prevention' of e-waste while promoting the 'extension' of product life and ensuring that the unavoidable e-waste generated is disposed of in an environmentally safe manner. While displacement settings should not be considered as a test bed for

circular economy activities, humanitarian organisations should keep its principals in mind to improve their operations.

In addition to the response in displacement settings, consideration should also be given to countrywide UN e-waste initiatives, which includes its implementing partners, as this is not just a concern for humanitarian actors. In doing so, development actors could also support the creation of an appropriate regulatory regime and associated waste management infrastructure. In this regard, a project manager could coordinate key actors at the country level to accelerate the efforts for developing e-waste management regulations and programmes.

All e-waste activities must be undertaken in compliance with the local waste management policies, guidelines and regulatory regime. Where Extended Producer Responsibility regulations exist, consideration must be given to evaluating what legal liabilities are attached to humanitarian organisations importing products that could result in e-waste.

5.2.3. Procurement guidelines for humanitarian organisations

Although it may take time for new procurement language to impact the design and repairability of solar products, they should be prioritised to ensure there is no additional delay. The results of the work presently being undertaken by IOM will be posted on an open platform and continue to be presented through the Technical Working Group. There would, however, be additional benefits for the outputs to be shared through the UN's Sustainable Procurement Working Group, managed by the Greening the Blue Initiative.

The use of new procurement language needs to be supported by internationally recognised definitions and standards and include disposal activities by enforcing EPR principles. It is recommended that, with the support from the E-waste Task Force, stakeholders advocate for the inclusions of such into VeraSol's quality assurance programme for off-grid solar solution.

Given its anticipated purchasing power, such use of procurement tools may only have an impact on goods that are bought in large quantities and to which the humanitarian actors represent a significant buyer in the marketplace, such as solar lanterns and possibly modern stoves with electrical components. Other initiatives that are encouraging the humanitarian response to enter third party operation and maintenance agreements for solar power plants ("energy as a service") and developing market-based solutions for increasing household access to energy could, however, address some of these concerns by passing on the liability for e-waste management to the contracted party or vendor.

Any products that are 'defined' as being robust and repairable should be included and 'prioritised' in any product procurement catalogues collated by humanitarian organisations to support field colleagues purchase items.

5.2.4. Safe repair, recycling and disposal infrastructure

Consideration should also be given to triggering repair, reuse and refurbishment activities, and warranty and takeback schemes in displacement settings at the same time a humanitarian actor is planning to undertake a large distribution of products that could generate e-waste. Additional support should be provided by the manufacturer or supplier by repairing any products that are not working at the time of the distribution and providing training to individuals on such activities. Following which an ongoing repair programme can remain in the settlement with spare parts being made readily available. Such an approach should be based on the findings from the ongoing pilot activities presently being undertaken by GIZ ESDS and IOM.

The results of WFP's engagement of third-party e-waste contractors in Kenya and Somalia will be of interest to the wider community. Especially with regards to lessons learnt, costs, where such solutions can be replicated and the benefits to sharing or piggybacking such agreements, especially in circumstances where e-waste volumes are relatively low. It is also noted that low volumes of solar products may also limit the sustainability of repair, reuse and refurbishment schemes.

It is also recommended that the supply chain for electronic products is mapped out for emergencies and protracted situations, to establish if there are any options to reduce the generation of e-waste by improving the storage, transport, and distribution of solar goods. The results of which may provide supporting evidence for repair activities to be developed alongside distributions of solar products, especially solar lanterns.

In instances where 'operation and maintenance' contracts are required for energy systems in displacement settings, the management of waste, including e-waste and hazardous wastes, from that system should be transferred to the contractor. In addition, the contract should, amongst other things, reference waste minimisation in the operation of

the plant and state that the contractor will manage (store, handle, transport and dispose of) wastes in a safe manner and comply with all relevant regulatory requirements. Similar arrangements should also be included in energy access programmes that are supported by humanitarian organisations and/or donors to supply goods or services to households via private sector led solutions.

5.2.5. Financial incentives for manufactures to design for sustainability

In the absence of procurement or legal requirements, manufacturers and suppliers should consider options for redesigning their products for sustainability and how to support repair, reuse and refurbishment activities in displacement settings. Not only will this lead to more sustainable products, it could also provide them with a competitive advantage when new procurement language is adopted.

Options to reduce packaging waste associated with the solar products should also be considered during this process, to minimise all wastes entering displacement settings.

5.2.6. Support host countries on developing e-waste management legislation

In many displacement settings, there is a need to support national and local governments to develop appropriate waste, e-waste and hazardous waste policies, regulatory frameworks, infrastructure and waste management facilities, including Extended Producer Responsibility regulations. This would require direct support from donors and development actors and could use the skills and e-waste tools developed by GIZ, ITU, UNEP and SCYCLE at UNITAR.

A humanitarian e-waste programme or, preferably, a UN countrywide programme including implementing partners could become the nucleus to developing an e-waste management system for a host country.

5.2.7. Engage with donors on e-waste

Donors should consider supporting e-waste programmes from a holistic viewpoint; looking at how they can support humanitarian actors manage wastes more appropriately within a displacement setting but also providing the host country with assistance in developing waste management frameworks and infrastructure, while encouraging a UN countrywide response.

Donors could also encourage the use of appropriate procurement language that favours robust and repairable electronic goods, even in instances where the product may cost more. In addition, they could require energy access programmes that they fund to include an e-waste strategy addressing repair, recycling, and safe disposal issues.

5.2.6. Capacity building and livelihoods activities

Managing e-waste and developing repair facilities requires specialist skills and knowledge. It is therefore necessary to identify training needs of the various actors and to place specialist personnel in project teams to develop viable solutions. This could include training repairers on product specifications and error and fault finding, which is best provided by the manufacturer and/or supplier of the product or general training academies for repair technicians. In addition, displaced and host communities should receive training on how to use, repair, and recycle their products in an environmentally safe way to raise awareness of responsible waste management. In addition, takeback and recycling schemes could incentivise communities and provide livelihood opportunities.

The focus of any stakeholder engagement should also be extended to the development of a sense of shared responsibility, to ensure stakeholders act together in developing sustainable solutions. As such, the training needs of stakeholders would also need to be considered, including awareness raising on the hazards associated to poor e-waste management.

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Authors and acknowledgements

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The authors would like to thank the following for input to, and/or feedback on, the report, including provision of photographs:

- BRIGHT Products: Madeleine Chapman Kjellevand;
- GIZ ESDS: Natalie Rzehak;
- GPA Coordination Unit: Thomas Fohgrub, Jonathan Archimi, Aimee Jenks, Sadiq Zafrullah and Arielle Ben-Hur;
- IOM: Gemma Arthurson;
- NORCAP: Karina Fredly Sætre and Lama Gharaibeh;
- NORCAP E-waste Working Group: Rebeca Solis and Joseph Hwani
- UNDP: Stephen Gitonga and Denis Korchunov;
- UNHCR: Agnes Schneidt; and
- University of Edinburgh: Rowan Spear and Jamie Cross.

Annex A

The table shows a summary of the national e-waste policy and legislations in the top fifteen host countries for displaced populations (including refugees under UNHCR's mandates, asylum-seekers, IDPs of concern to UNHCR, Venezuelans displaced abroad, stateless persons, and others of concern) in Africa, based on the GSMA E-waste Legislative Framework Map (GSMA, 2021). The overview shows that many countries have limited policy framework for e-waste management, however, new legislations are underway in some of the countries like Kenya.

		National E-waste Policy and Legislation			
Country	**Total Displaced Population** *(UNHCR, 2021b)*	**Document Title**	**Description**	**Status**	**Legally Binding**
Democratic Republic of the Congo	5,689,854	N/A	N/A	N/A	N/A
Uganda	3,797,682	Electronic Waste (E-waste) Management Policy for Uganda, 2012	Guides, promotes and ensures the safe management of e-waste in Uganda, contribute to reduction of environmental degradation and for enactment of specific legislation for proper e-waste management and disposal to safeguard human life and the environment against the hazardous components in e-waste. The Uganda e-waste policy has the following objectives: • To provide for establishment of e-waste facilities in the country. • To mobilise and sensitise the government, private sector and the communities on the proper management and handling of e-waste on a sustainable basis. • To provide for the putting in place of specific e-waste standards, regulations and guidelines for the acquisition, handling and disposal processes; • To develop a critical human resource base knowledgeable in e-waste management; • To provide for resource mobilisation for efficient management and disposal of e-waste. • To establish incentives for encouraging both local and foreign investors to establish e-waste facilities in Uganda.	In force	No
Sudan	3,612,203	N/A	N/A	N/A	N/A
Ethiopia	3,536,447	Management of Electrical and Electronic Wastes Council of Ministers Regulation 425/2018	Determined the management of electrical and electronic equipment and the electronic waste hierarchy, the responsibilities of the producers, consumers, and how WEEE should be collected, dismantled, reused, refurbished, recycled, labelled, etc.	Status Unknown	No
Somalia	2,991,972	N/A	N/A	N/A	N/A
Nigeria	2,679,146	Guidelines for E-Waste Management in Uganda, 2016	Provide guidance and ensure clarity on the role of each category of stakeholders in the lifecycle of electronic and electric products. The guidelines therefore serve to: • Articulate the duties and responsibilities of each stakeholder • Propose best techniques and approaches for each stakeholder • Define linkages between the different duties and responsibilities of the stakeholders • Provide a coherent e-waste management framework.	In force	No
		Strategy for Electronic Waste Management, 2013	Supports the implementation of the e-waste policy approved by Uganda Cabinet in 2012. The strategy highlights nine key strategic actions and includes an implementation plan, monitoring framework, with targets and progress indicators identified, implementing agencies, timelines for deliverables, a provision for surveillance by a coordinator based at MoICT, as well as a five-year budget for the implementation.	In force	No
South Sudan	2,178,470	N/A	N/A	N/A	N/A

National E-waste Policy and Legislation

Country	Total Displaced Population *(UNHCR, 2021b)*	Document Title	Description	Status	Legally Binding
Cameroon	1,476,372	Management of Waste Electrical and Electronic Equipment, Order No. 005, October 2012	Provisions with regard to the management of WEEE. Electrical and electronic equipment essential for the protection of the state as well as military equipment are specifically excluded. A licence/technical visa is required for the manufacture, importation and sale of electrical and electronic equipment set out in the regulation. The selective treatment, recovery and disposal of e-waste need to be conducted by entities approved by the government (art 10), holding a specific environmental permit to collect, recover, recycle and where possible export of any waste resulting from the EOL equipment.	In force	No
Burkina Faso	1,095,275	N/A	N/A	N/A	N/A
Côte d'Ivoire	962,310	Decree N° 02017-217 of 05th April 2017 on the environmentally sound management of waste electrical and electronic equipment	Wants to encourage producers/importers to be responsible. All producers/importers of EEE need to register with a WEEE register. The Government wants to ensure that Côte d'Ivoire will no longer receive waste from EEE and will acquire necessary resources for the control, management and extermination of such waste, therefore creation of the Renovo programme	In force	Yes
Chad	919,121	N/A	N/A	N/A	N/A
Mozambique	695,237	Decree No 83/2014 approving the Regulation on Hazardous Waste Management	This regulation aims to establish general rules related to waste disposal, explicitly including electronic waste and introducing the principles of EPR.	In force	Yes
Central African Republic	691,298	N/A	N/A	N/A	N/A
Niger	573,178	N/A	N/A	N/A	N/A
Kenya	565,677	E-waste Guidelines Kenya, 2010	Provide a framework for the development of regulations and policies to enhance environmental protection from e-waste, establish a basis for a policy and regulatory frameworks on e-waste management, and raise public awareness on sustainable management of e-waste in Kenya.	In force	No
		Environmental Management and Co-ordination Draft E-waste Regulations, 2013	Regulations to manage e-waste, in accordance with Environmental Management and Co-ordination Act (EMCA). Producers intending to introduce new or used EEE to Kenya need to apply for registration from the authority.	Draft	Not yet
		National E-waste Management Strategy, 2019	Analyses the current situation of e-waste in the country to help the government and stakeholders to understand the need to develop regulations on e-waste management collaboratively. The strategy is a plan covering the period 2019/20 to 2023/24 aiming to review and streamline existing policy, laws, and standards and develop a national e-waste policy.	Draft	No
		The Environmental Management and Co-Ordination (Extended Producer Responsibility) Regulations, 2020	Provide mandatory EPR to all products and packaging in all phases of their life cycle, including EEE and their packaging. According to the EPR regulation, every producer shall take financial and or physical responsibility for the management, treatment and disposal of their post-consumer products and end-of-life treatment for the waste generated by their products; producers shall fulfil their obligations by setting up individual enterprise-based EPR compliance scheme or a pooled compliance scheme.	Draft	Not yet

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