TOOLKIT FOR CREATING A CIRCULAR ECONOMY FOR E-WASTE IN DISPLACEMENT SETTINGS

IOM
UN MIGRATION

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Acknowledgements

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1. INTRODUCTION

1.1Scope

This Toolkit for Developing a Circular Economy for E-waste in Humanitarian Settings ("The Toolkit") presents lessons learnt across a range of e-waste management projects in the form of tools (including checklists, assessments, best practices and case studies) for use by the humanitarian sector. It provides a model to replicate or scale-up circular economy initiatives ("the Initiative") to other locations.

This Toolkit recognizes that there isn`t one model, but rather a blend of adapted models based on what works and what is relevant to specific contexts. However, the Toolkit is based on lessons learnt from a range of organizations across a range of e-waste projects, which we hope can act as a guide to overcoming barriers and building on the sectoral knowledge for ongoing learning and improvements.

1.2Audience

The tools presented in this Toolkit are developed for the humanitarian sector, specifically international humanitarian coordination agencies such as United Nations agencies, and actors working in local camp management and operations including district officials, INGOs and NGOs. Several UN organizations have already placed the challenge of e-waste in displacement settings on their agenda, including International Telecommunications Union (ITU), United Nations Development Programme (UNDP), United Nations High Commissioner for Refugees (UNHCR), United Nations Environment Programme (UNEP), United Nations Institute for Training and Research (UNITAR) and World Food Programme (WFP).

Additionally, there is a growing number of initiatives, companies, and programs that prioritize e-waste management including:

- The GIZ Energy Solutions for Displacement Settings (ESDS) Programme provides sustainable energy solutions in Ethiopia, Kenya, and Uganda.
- The Global Platform for Action on Sustainable Energy in Displacement Settings (GPA) is a UNITAR-based initiative promoting sustainable energy access in displacement settings.
- Greening the Blue is a UNEP initiative assisting the UN system in transitioning towards environmental sustainability in its facilities and operations.
- GOGLA is a global association supporting the off-grid solar energy industry.
- Sofies Group, commissioned by GIZ ESDS, conducted research on e-waste management in Ethiopia, Kenya, and Uganda and aided in the development of a pilot e-waste project in a displacement setting.

Many of the above entities have contributed to this Toolkit. However, it is recognized that lessons learnt aren`t applicable for all audiences, who can vary significantly in terms of mandate and responsibilities in managing e-waste in displacement settings. Flexibility is a crucial aspect of creating a circular economy, therefore, this Toolkit presents different tools that can be extracted and used as stand-alone documents, combined and/or adapted depending on the audience and context. To support this, each tool is colour coded for its likely applicability to each audience.

International coordination agencies	In most cases, UN agencies are responsible for providing overview of initiatives within displacement settings, overseeing standardized elements, including engaging pre-qualified suppliers and implementation agencies, as well as coordination for continuous improvement and knowledge sharing.	
Technical working bodies and NGOs	Technical working bodies set the technical direction of the sector, and develop important research, guidelines, standards as well as undertake coordination and advocacy work. For the purposes of this Toolkit, they are not considered to be working in the field, but providing technical advice, whereby some tools may be relevant to their work.	
Local camp management and operations	At the camp-level, actors are responsible for implementing and operationalizing solutions in specific camps and adapting them to their context and capabilities. This level also comprises stakeholders in charge of operations, including collection, repair and sales, including integration of different informal actors such as scrap dealers and repair centres.	

1.3Background

Humanitarian agencies provide basic life-saving services to displacement settings. This can include electronic equipment to improve access to affordable energy and communications, which whilst serve their purpose of providing light and power for education, protection and livelihoods, can also cause bulk waste when these products are at end of life. Electronic waste (e-waste) has become the fastest growing waste stream in the world,[1] with displacement settings estimated to follow the same trend. However, displacement settings make this challenge even more complex, based on unique factors.

Legislative framework: Waste management is often not subsidized by the Government in displacement settings, meaning there is not enough of a profit margin to allow collection for economies of scale for the formal sector. Displacement settings may not have well-established regulations or policies regarding e-waste management. The absence of clear guidelines can contribute to unregulated informal recycling practices and the absence of enforcement mechanisms.

Set-up of humanitarian system: Consumers are often not the purchases of humanitarian products, which are procured and handed out by humanitarian organizations. This means the ability to take-back broken products under a warrantee is not possible. Further, humanitarian agencies are often subject to reporting to donors on number of people reached, therefore supplier price mark-up for proper end of life management or extended producer responsibility will reduce donor reporting numbers for humanitarian agencies, or reduce profits if the private sector was to increase durability in-kind. This further provides limited incentive for humanitarian organizations to prioritize e-waste management in displacement settings as it is not enforced by donors and the associated costs are not included in project or programme budgets.

International Coordination: Displacement settings may involve multiple humanitarian organizations, governments, and stakeholders from different countries, whereby e-waste management is not commonly included in the coordination agenda.

[1] ITU, UNU, UNITAR, ISWA, 2020, Global E-waste Monitor 2020, Global E-waste Monitor 2020 (itu.int)

Limited access: Private sector actors often have limited access to displacement settings, which can hinder e-waste collection activities by local service providers, and not incentivize international companies to work towards a solution.

Limited data: There is limited data on e-waste volumes, flows and disposal routes already existing in displacement settings, creating challenges for developing a sustainable business model for e-waste management (partially explored by the Sofies/ESDS study in three countries).[2]

Financial barriers: Humanitarian agencies operating in displacement settings often face resource constraints, including limited financial resources, personnel, and equipment. This can hinder their ability to implement effective e-waste management programs and invest in appropriate infrastructure.

Lack of infrastructure: Basic infrastructure for waste management is scarce, such as quality recycling facilities and designated collection points for e-waste. This makes it difficult for individuals to dispose of their electronic devices responsibly, leading to indiscriminate dumping or burning of e-waste.

Lack of awareness and capacity: Displaced populations may have limited knowledge and awareness about the hazards of e-waste and the importance of proper disposal. Lack of education can lead to inappropriate disposal practices and environmental contamination.

Informal waste sector: Informal collection and recycling are prevalent meaning often unsafe practices are utilized to gain small profit margins at the camp level. Improper e-waste management practices, such as open burning or dismantling without safety measures, can result in the release of hazardous substances and pollutants into the environment. This poses health risks to the displaced population and contributes to environmental degradation. particularly in displacement settings.

Environments: With harsh temperatures, as well as dust, flooding, and children playing with e-products, the environments of displacement settings are often harsh, and then durability is not considered in procurement, e-products have a short life expectancy, meaning more e-waste.

The above complexities mean displacement settings are commonly exposed to toxic compounds contained in e-waste during unsafe disassembly or disposal through burning or throwing in latrines, bushes or waterways. This includes heavy metals, polychlorinated biphenyls, brominated flame retardants, and chlorinated and brominated dioxin related compounds. The common practice of burning is known to increase the toxicity of inhaled particulate matter, in addition to expanding its geographical range of impact. This can have a wide-ranging impact on the environment and compounded by the often-congested nature of displacement settings, a large impact on human health.

[2] GZ, ESDS, Sofies, 2021, Baseline Assessment of Electronic Waste Management and Extended Producer Responsibility in Displacemnet Settings in Ethiopia,Kenya, Uganda, GIZ_ESDS_E-Waste_EPR_Displacement_Settings.pdf (energypedia.info)

2. ORGANIZATIONAL ASSESSMENT 

The below questions can be utilized as a starting point to assess the role and capacities your organization has in displacement settings, and to determine what steps might be needed at a systems level to ensure the proper engagement of all relevant actors, and that the creation of a circular economy doesn`t disrupt current markets and ultimately do harm.

Tool 2.A: Organizational assessment

- Does your organization have the licence, mandate and capabilities required for its role in the e-waste circular economy Initiative?
- What is your organization's responsibility in displacement settings, and does it align with creating or contributing to a circular economy for e-waste?
- Who will own the initiative, and be responsible for its ongoing support, monitoring, and improvements?
- Does your organization have institutional standards that can be utilized (or developed) at the systems level to secure quality implementation?
- Does your organization or a partner organization(s) have existing NFI, CBI or livelihoods programmes that will enable direct interventions with sustainable procurement, waste management services and markets?
- Does your organization or a partner organization(s) have a sub-office at the location to provide support during the roll-out of the Initiative?
- Does your organization have established partnerships or collaborations with relevant stakeholders such as local governments, UN agencies (particularly those required for camp access), waste management authorities, NGOs, or private sector entities?
- Are there any specific policies, guidelines, or codes of conduct within your organization that promote sustainable and responsible e-waste management? If not, are there plans to develop such standards to ensure the proper implementation of e-waste initiatives?
- What mechanisms does your organization have in place for monitoring and evaluating the progress and impact of e-waste management initiatives? How will you ensure that the initiatives are continuously improved and aligned with good practices?
- Are there any legal considerations or regulatory frameworks that need to be taken into account when implementing e-waste management initiatives? This includes considerations related to access, procurement of local waste management services, compliance with environmental regulations, and any relevant permits or licenses.

3. LOCATION SELECTION

There are critical elements and enabling factors that will determine whether a circular economy for e-waste is viable in selected locations. As relevant, it is recommended to undertake an assessment of various displacement sites to determine which are most feasible for the Initiative.

3.1Assessment of policy and regulations

E-waste legislation, taxes and subsidies affect operations and financial viability of the model. The below assessment will assist to assess whether e-waste is addressed in existing legislation, and to identify whether there are enabling factors or barriers that will influence the Initiative. For some initiatives, it may be appropriate to work with Governments to cooperate and support the initiative, or for the initiative to support Governments in addressing any identified gaps in e-waste policy and regulations.

Tool 3.A: Policy and regulation assessment process [3]

Step 1: Identify the environmental legislation, where municipal solid waste, hazardous waste or items related to trans-boundary movement of hazardous waste are addressed using the below table.

Convention/Regulation	Checklist	Impact on Initiative
	Global	
Basel Convention	Does the circular economy require transboundary movement of hazardous waste?	If yes, potential to block initiative.
Bamako Convention	Does the circular economy require transboundary movement of any waste?	If yes, potential to block initiative.
Minamata Convention	Does the circular economy require transboundary movement of mercury or mercury compounds?	If yes, potential to block initiative.
	National	
E-waste Legislation	Is there e-waste legislation published by the Ministries of Environment and/or Energy? Does it specifically cover the products to be managed?	This gives regulators, producers and recyclers clarity on the products that are governed by the legislation and will affects how (if) producers' financial obligations are calculated in the circular economy.
E-waste Regulators	Are there environmental regulators that regulate e-waste legislation?	This determines if the legislation is enforceable, and therefore how much impact the legislation will have on the circular economy financial model.
E-waste Regulations	What types of e-waste regulations exist (if any) for the products to be managed? E.g., Waste-holder financing: the individual disposing of the waste pays.	This will determine the type of finance mechanisms to work with to develop the circular economy model. To note that often in displacement settings, humanitarian organizations are

[3] Adapted from UNEP untitled (unep.org)

	Consumer financing: The consumer pays direct to the e-waste fund upon purchase of the new product. Producer financing: The producer, defined as the original equipment manufacturer or importer, pays. Hybrid model: Taxpayers finance access to waste and producers finance remaining steps.	the procurer, but not the consumer, and upon whom these regulations fall in the supply chain. It will also help determine who has the operational and financial responsibility for providing access to waste, collection, transport and recycle/disposal of waste, which will determine the wider system within which the circular economy in displacement can or cannot link into.

Step 2: Identify the sections and subsections where any item related to e-waste is mentioned.

Step 3: Look for following words in the legislation/ regulation and their definition and interpretation:

- Electrical and Electronic Equipment
- Electrical Assemblies/ Components/ Products
- Discarded / Disposal
- Used Goods/ Scrap/ Waste
- Recycle/ Reuse
- Treatment

Step 4: Prepare an e-waste definition reference matrix using the template below. In case of "Yes" specify the reference, its coverage and application in domestic and transboundary trade.

Regulation / drivers	Drivers		
	Definition of electrical and electronic equipment (yes/no)	Definition of loss of utility (yes/no)	Definition of way of disposal (yes/no)
Hazardous waste			
Non-hazardous waste			
Regulation related to Basel Convention			
Any other regulation			

Step 5: If e-waste is mentioned either directly or indirectly in any regulation, specify roles and responsibility of following stakeholders.

Stakeholder	Role	Responsibility
Generator/ Producer		
Exporter/ Importer		
Collector/ Transporter		
Waste Treatment Operator		
Regulatory Agencies (Local/ National)		

Step 6: Consider how the policy and regulations will impact the Initiative (including any gaps) and how (if) the initiative will work within current policy and regulations, including subsidies and taxes.

3.2 Site security and risk assessment

A site security and a risk assessment are essential for location selection, particularly for a pilot where the number of variables needs to be limited to test a proof of concept. Despite this, all displacement settings have the right to energy access, communications technology and environments free from contamination, therefore, the risks assessment should not prohibit projects being undertaken, but rather act as a guide for the implementation of mitigation measures and close monitoring. Some risks, however, would be seen as red flags that cannot be mitigated and would prevent benefits of the Initiative from being realized. Such risks would be a "No go" for the Initiative.

By proactively identifying and managing these risks, projects can better protect the well-being of beneficiaries, ensure the effective delivery of services, and enhance the long-term sustainability and impact. An example risk assessment template for creating a circular economy for e-waste in displacement settings is outlined below. As with all tools, this should be contextually adapted for the context of the potential location(s).

Risk	Impact	Mitigation
Government policy changes that affect the camp such as camp closure	No go	
Intercommunal tensions and conflicts between displaced populations and host communities including violence, attacks and target killings	Physical security risks can directly impact the safety and well-being of project staff, beneficiaries, and stakeholders. They can lead to harm, injuries, or loss of life. These risks can disrupt project activities, delay implementation, and create an environment of fear and insecurity.	Implement community-based security initiatives, including community policing and early warning systems. Provide training and support to local security forces to ensure the safety of displaced populations.
Theft, particularly when there are items of value being brought in for the Initiative	Electronic waste and e-waste have a value in displacement settings. Further, recycling infrastructure can often be of extremely high value when using new technologies. Theft of critical infrastructure could halt specific activities, and theft of spare parts, tools and products could reduce the reputation of the project, reducing trust from the community about seeing their products returned.	Establish security patrols and presence in and around activity areas. Enhance lighting and visibility in high-risk areas, particularly at collection points and other areas where perceived valuable equipment may be stored. Establish mechanisms for reporting incidence, including ensuring effective investigation and response.
Sexual and gender-based violence	Gender-based violence and protection risks can have severe physical, psychological, and social consequences for affected individuals and communities. They undermine the safety, well-being, and dignity of displaced populations, particularly women, girls, and marginalized groups. These risks can impede the participation and empowerment of beneficiaries, affecting the overall success and impact of projects.	Establish mechanisms for reporting security incidents and ensure effective response and investigation. Establish safe spaces and collection/distributions times and drop-off points for e-waste that are specific for women. Work with protection teams to implement gender-responsive programming, including training on gender equality, prevention of gender-based violence, and women's empowerment. Encourage the participation of women in e-waste

		collection, repair and distribution where possible, with the aim of having gender-neutral teams. Engage men and boys in efforts to prevent and respond to gender-based violence, and to promote gender inclusion, particularly in non-traditional roles such as electronic and electrical repairs and recycling.
Lack of legal protection mechanisms for addressing potential issues including gender-based violence	If project staff are not able to protect affected populations with the right support, there can be severe psychological consequences, as well as damaging the credibility of the organization. These risks can impede the participation and empowerment of beneficiaries and risk the organization`s reputation in other projects.	Ensure all staff are trained on PSEA and know local referral pathways for complaints and feedback mechanisms, reporting to authorities and to protection experts identified as focal points within the organization.
Disease outbreak – spread of infectious disease due to overcrowding and poor sanitation and hygiene	Health and sanitation risks can have a significant impact on the health and well-being of displaced populations. Communicable diseases such as Ebola and COVID-19 may require social distancing and other measures be put in place that either slow down or halt the Initiative.	Work with WASH teams to provide access to clean water, sanitation and hygiene facilities, including latrines and handwashing stations. Along with e-waste management messaging, include public health messaging on proper hygiene practices and disease prevention. Work with health teams to ensure communications of disease surveillance results for early detection and response to outbreaks.
Natural hazards – floods, landslides, extreme weather	Environmental risks pose threats to both the physical infrastructure and the safety of displaced populations. Natural hazards can result in damage or destruction of project facilities, disruption of services, and displacement of beneficiaries. They can lead to logistical challenges, increased project costs, and delays in project implementation.	Conduct risk assessments and work with DRR teams to implement measures to mitigate the impact of natural hazards, such as early warning systems, evacuation plans, and resilient infrastructure
No access to income-generating opportunities due to Government bans on	No go	

refugees earning wages		
Lack of access to required infrastructure to allow Initiative to operate e.g., power, Wi-Fi, water, soap	Access risks can impede the delivery of project services and hinder beneficiaries' access to essential resources. Limited access to services can undermine the effectiveness and reach of projects and can result in unequal access to project benefits and exacerbate the marginalization of displaced populations.	Enhance coordination between humanitarian actors, local authorities, and security forces to facilitate safe and unhindered access to essential services.
Access issues including checkpoints, landmines or conflict-related restrictions	Generally, the creation of a circular economy would require interaction with national facilities, particularly for any complex recycling or disposal processes for e-waste that can`t be repaired, recovered, or re-used.	Depending on the setting, this may be a No go. Explore risk rating and assess whether establishing secure access with authorities would reduce the risk rating to medium or below.
International shipping	Delays in spare parts affect the capacity to repair, or time taken to repair. This can reduce the credibility of the Initiative when beneficiaries experience delays in having their product returned.	Identify needs for spare parts in advance based on waste volumes and product types (section 3.3) Maintain communication with repair and recycling technicians to ensure prompt response. Maintain awareness on potential impacts on timelines e.g., Chinese New Year if products are being manufactured in China.
Internal procurement procedures	Delays in spare parts affect the capacity to repair, or time taken to repair. This can reduce the credibility of the Initiative when beneficiaries experience delays in having their product returned.	Streamline internal procurement procedures as much as possible. For example, if the spare parts order is part of a larger agreement with the supplier.
Local bureaucracy	Delays in spare parts affect the capacity to repair, or time taken to repair. This can reduce the credibility of the Initiative when beneficiaries experience delays in having their product returned.	Maintain dialogue with local government to facilitate required licences and tax exemptions pre-emptively.
Technicians completing repairs outside their training	Sub-optimal repairs can generate more e-waste in the long run	Expand the scope of the repairs based on assessment of types of products in the camp (section 3.3). Maintain dialogue with field partner(s)/staff to identify trends in case further training on existing or new products are needed.

3.3 Waste volumes, infrastructure, environnemental conditions

Obtaining valuable e-waste in displacement settings can be a key challenge, therefore the location selection needs to ensure there is sufficient e-waste already within the setting or can be collected from within the host community, and/or that affected populations would be willing to return it for repair (and they receive it back) or recycling (they don`t receive it back). As waste in displacement settings is perceived to have value, consumers expect to be paid to hand over products or components at end-of-life given they could alternatively sell components to repair shops or informal collectors. Refer section 7.1 for more information on communications campaigns and incentivization to ensure adequate waste volumes.

Further, the location needs to have the infrastructure required to set-up and sustain a circular economy or be able to access it elsewhere. This can be from basic transport and recycling infrastructure, to large scale and complex disposal of end-of-life batteries, depending on the requirements of the initiative.

Lastly, environmental conditions, whilst aren`t a critical factor, can be an enabler or barrier to a successful project, whereby, for example, it is easy for dust or water to enter e-products and cause faults based on environmental conditions. This needs to be considered in terms of potential frequency and types of repairs.

Tool 3.C: Infrastructure and waste volume requirements checklist 

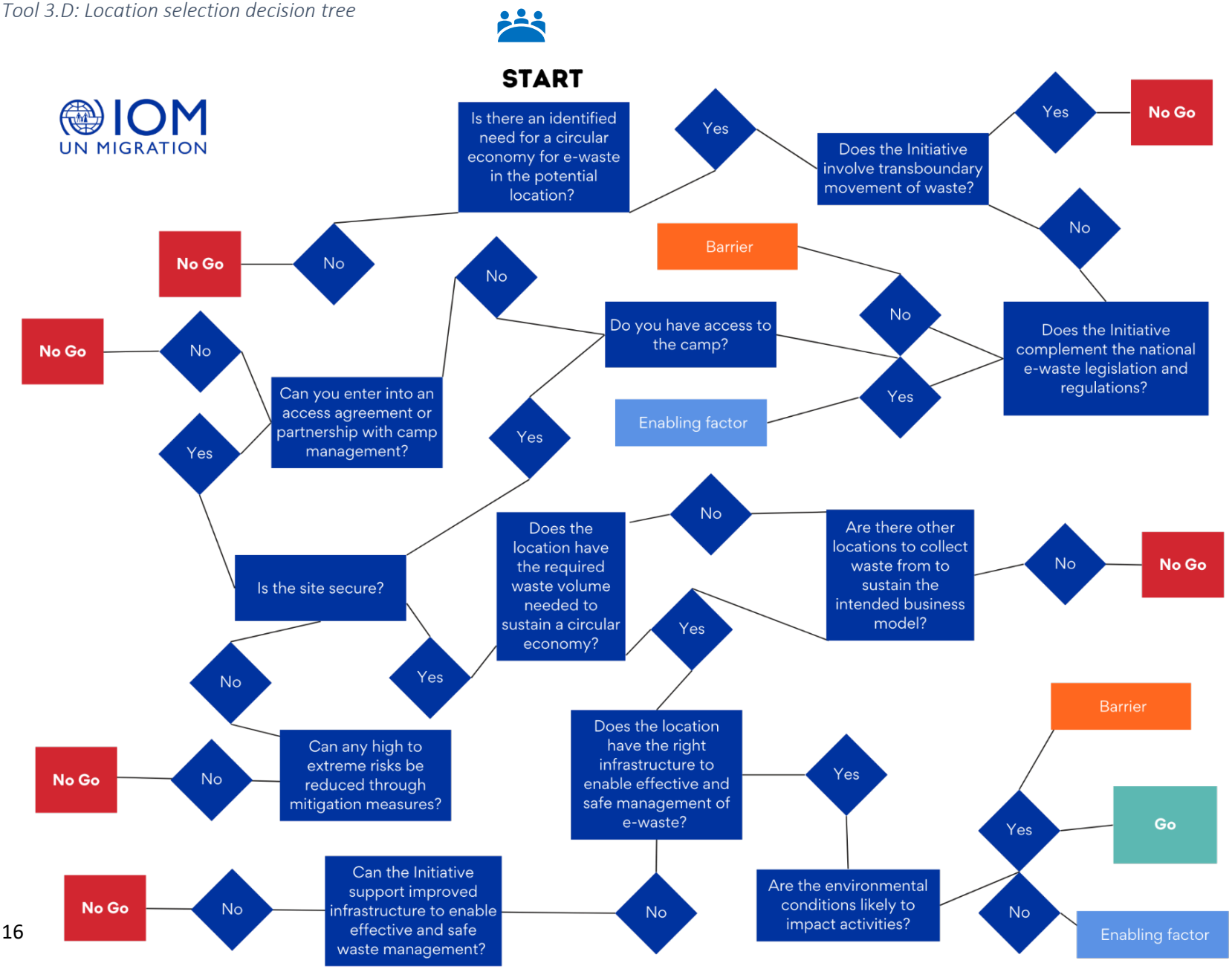
The below may or may not be a requirement of the initiative, however each should be assessed as to its potential impact on the location choice.

Checklist	Purpose	Assessment
Power availability for repairs	To assess the amount of power required for the Initiative, including power for Wi-Fi, repair tools, lighting etc., as needed. Consider using solar power, if possible, as well as backup power in case of power cuts. Consider the long-term sustainability and environmental impact of the power source, for example renewable energy such as solar would be preferable to diesel generators in most settings.	
High product volume	Work with IOM, UNHCR and other organizations that have distributed electronic or electric products in the selected area to establish as much accurately as possible the number of products, zones and years of distribution.	
High product failure rate	The years of distribution and the type of product and expected lifespan will provide an indication of the amount of volume of e-waste that can be expected to be collected.	
Brand information available	Specific information from distributors will support the waste volume calculation, given some brands will have different expected lifespans than others. It will also provide information on the likely type of repairs, and components of the products in case different recycling methods are needed for e.g., plastics, glass, metals, etc. A large range of distributors will also require additional repair and recycling training to ensure skills are compatible across brands. However, this could also improve technician knowledge in how to repair a wider range of products, enhancing their skills. Further, a larger range of distributors could mean competition for improving repairability and durability of products, that can be fed back into procurement guidelines for humanitarian agencies, and to manufacturers for enhanced product design ensuring all aspects of the circular economy are considered in the model.	
Distance to major city	If waste volumes are low, distance to major cities or towns could provide new waste streams for repair and recycling, integrating the displaced populations with surrounding host communities, whilst providing a service that reduces waste, extends the lifecycle of products both in and outside the camp, while supporting livelihoods and business growth through on-sell of products, or when repair is provided for a service fee. Similarly, host communities associated with a camp located far from developed infrastructure might have similar demands for portable electronics as the displaced persons. As a result, the market for e-waste could be more extensive, allowing the solution to expand its reach.	
Logistics	The time investment required for setting up a circular economy whereby international shipping is required can be extensive. Consider logistics and shipping and its impact on time, cost and ongoing supply to the camp, including distance of the camp to international airports.	

Sufficient recycling and disposal infrastructure	For some materials, advanced technologies are required for recycling, for example batteries and safe removal of precious metals from electrical boards, etc. Further, some products will be reaching the end of their life, and they need a safe disposal mechanism to ensure that there isn`t a build-up of hazardous chemicals in the displacement area, causing human health and environmental impacts and negating the benefits of the circular economy initiative. Options for transport, financing and contracting of these services with quality service providers is critical for the creation of a circular economy.	
Infrastructure	This will determine what type of circular economy can be created and whether large-scale infrastructure can be utilized for complex recovery and recycling, as well as end of life disposal, or whether this will need to be developed through the informal sector. Government-funded infrastructure or subsidies for waste management will influence the circular economy financial model.	
Environmental conditions	Dust, flooding, sun, children, animals or snow can all affect the lifespan and type of e-waste repairs required. Similarly, if the area is prone to flooding or other natural disasters, this can impede supply (e.g., road closures) at certain times of the year which will need to be anticipated and planned for (e.g., pre-positioning of additional stocks for rainy season).	

3.4 Location selection decision tree

Tool 3.D: Location selection decision tree



3.5 SWOT analysis of all locations with a "Go"

Tool 3.E: Example SWOT analysis

If multiple locations are determined as a "Go", to prioritize them, it is best to look at the enabling factors and barriers that may support or inhibit the initiative. An example is shown below.

Strengths	Weaknesses
Accessible recycling facility Range of brands and distributors Existing repair activity High no. target populations and awareness High no. of suitable implementing partners High engagement of camp E-waste legislation already in place Organization or partner sub-office in the location	Security risks that need to be mitigated. Lack of power available for technicians to perform repairs. Spare parts and tools expensive and/or not available in the local market
Opportunities	**Threats**
Waste being held at home. Plastics being burnt. Repairmen lack capital to extend businesses who could benefit from livelihoods component.	Disruption of legislation being implemented. Wide range of communities requiring multiple types of messaging Low demand for solar waste Theft at repair shops Fragmented waste activity Wide range of unknown products

4. STAKEHOLDER ENGAGEMENT

Involving the right actors at the right time and engaging them in the creation of a circular economy ensures the system is truly "circular" and incorporates, as much as possible, the diverse areas of expertise of private, government, academia and humanitarian sectors.

4.1 User needs, knowledge, attitudes and practices survey

The most essential question to ask in the preparation phase of the Initiative is "Is there a user-defined need for the Intervention?" The user needs, knowledge, attitudes and practices survey will answer this, as well as provide information on what current knowledge and attitudes are, and thus what type of education and incentivization might be needed, as well as practices, to understand current waste stream mapping and social, financial and environmental impacts which can be targeted for improved outcomes through the Initiative.

Suggested questions for conducting a baseline survey are outlined below. These should be contextualized to the potential location, including phrasing and language for local interpretation. It is recommended to keep surveys only to questions that will provide useful data for analysis, and to avoid time burden on interviewees. It is recommended to provide multiple choice answers for ease of data analysis, and to consider the most appropriate collection modality e.g., digital, hard copies, tablet that is saved offline, etc.

Tool 4.A: Needs, knowledge attitudes and practices survey questions

Survey question	Purpose of data collection
Gender	Allows gender lens analysis.
Age	Allows age lens analysis.
Language spoken	Informs communication campaigns.
Income or job (as appropriate)	Informs potential income to pay for services.
Where did you acquire the electrical/electronic product?	Informs where product entered the circular economy and likely condition when first received.
When did you acquire the products? Brought with me from before. Gift from friend or family member Bought here in the camp/host community. Given by UNHCR/IOM/development partner. Other (please specify)	Provides indication on if products are exceeding their expected lifespan or breaking beforehand.
What do you use the product for? E.g., cooking, children`s homework, lighting for security, etc.	Provides information of flow-on outcomes of repair. Provides high-level indication of needs.
Does it satisfy your needs?	Informs whether the product is user-focused, or if another solution might work better for their specific needs.
What brand is the product(s)?	Provides understanding of products in camp and potential associated issues to inform repair, spare parts and tools requirements.
Do you have any suggestions on how to improve the product?	Allows user-focussed design to be passed on to manufactures.
How many people in your house use the product?	Provides indication on no. of people reached with repairs.
How to the product(s) usually break?	Provides understanding of weakest points of products and any associated behaviours with breakages.
How long do the product(s) usually last?	Provides indication of lifespan of products and likely repair volumes.
What would you do when products break? Left it in the house. Repaired it myself. Took it to repair shop. Returned it to place where bought/received. Disposed of it Other (please specify)	Provides indication of repair culture, or waste management behaviour, as well as potential human health and environmental impact of waste management practices. Contributes to list of local businesses that should be incorporated into circular economy model.
If repair, where do you repair it? Why would you choose a particular repair-person over another? What is the furthest you would travel for the repair of the product?	Provides information for mapping repair services and geographic customer base. Provides understanding of user behaviour and types of communications campaigns and incentivization strategies for behaviour change.
If disposal, where would you dispose of it? Leave it in the house Put it in the bin/container/pit.	Provides understanding of user behaviour and types of communications campaigns and incentivization strategies for behaviour change.

Put it in the toilet/latrine. Throw it in the bush/nature. Burn it. Bury it. Sell it for scrap. Return it to the place where bought/received. Other (please specify) Why?	
If sale, where would you sell it? For how much?	Provides information to inform circular economy business model.
Are any companies providing repair services or warrantees?	Provides understanding of awareness of consumer rights awareness and access.
Have you attempted to repair it before? If so, were you satisfied with the repair? How long did it take?	Provides indication of quality of current repair services available and gaps in service delivery, satisfaction and expectations.
Where would you like to be able to drop off your item for repair? Household collection Agents Repair shops. Do you trust these different drop-off points?	Provides indication of preferences and expectations for user satisfaction and incentivization.
What would you be willing to pay for the repair?	Provides information for analysis of viable business model.
Can you tell me about some of the safety and environmental risks of disposal?	This will inform key messages to communicate in the communications campaigns.
Do you have any questions you would like to ask me? Or anything you would like to tell me?	Provides room for unknowns and insights not covered in survey questions.

4.2 Local stakeholder mapping

It is critical to understand all stakeholders active in e-waste management prior to selecting a location to ensure complementarity and cohesiveness, whereby the circular economy is part of a wider system. Further, in displacement settings, when e-products stop working, many consumer`s preferred action is to seek to repair it to sell it through the informal sector. This market is often significant in terms of scale and coverage, and consists of repairers, collectors (often urban waste pickers, or roaming door to door) and recyclers (typically extract precious metals through poor, unsafe practice). Given the multitude of repair and recycling businesses that exist, with collective access to large volumes of end-of-life (EoL) products and an expansive footprint in off-grid communities, there is an opportunity to tap into this as part of a wider waste management programme as part of the circular economy. At the same time, their inclusion taps into their expertise and contributes to existing businesses and livelihoods, while building capacity on health and safety throughout the e-waste value chain.

Engaging with the informal sector can be seen as difficult due to procurement restrictions and quality of service requirements from humanitarian organizations, however allowing flexibility through partnerships with other agencies will unlock valuable resources that can enhance financial viability, increase waste volume and secure a greater impact.

Tool 4.B: Initial local stakeholder mapping exercise – who does what? 

Local stakeholder mapping can be done in a variety of ways, however given the complex dynamics that often exist in displacement settings, it is recommended to start with participatory mapping; conducting workshops or meetings where stakeholders can collectively map out their perceptions, experiences, and priorities to help generate insights and allows stakeholders to have a voice in the mapping process from the outset. Key questions to understand in the initial phase of stakeholder mapping include:

- What is the coordination mechanism in the displacement setting? How is waste management coordinated?
- Who is the agency responsible for waste management in the displacement setting?4 How do they coordinate with other actors undertaking waste management activities?
- What other INGOs or NGOs are operational in the setting? What projects are they working on where there may be room for collaboration or to ensure cohesion of activities?
- Who are the relevant district officials that coordinate or regulate activities in the displacement setting? What are their roles and responsibilities in terms of waste management?
- Are there any historical programmes and activities focused on e-waste management that can be learnt from and built upon?
- What is the relationship like between the host community and displaced population? What is their interaction in terms of markets and waste management?
- Are there any local community-based organizations or grassroots initiatives working in the displacement setting? What are their roles and activities related to waste management, if any?
- What are the perceptions, experiences, and priorities of the displaced population regarding waste management? How can their perspectives and knowledge contribute to the design and implementation of e-waste management initiatives?
- Are there any relevant academic or research institutions that have expertise or ongoing studies related to waste management or e-waste specifically? How can their knowledge and findings be integrated into the development of effective strategies?
- What are the existing formal or informal networks and alliances among stakeholders involved in waste management? How can these networks be leveraged for collaboration and coordination in e-waste management efforts?
- Are there any local businesses or entrepreneurs that engage in activities related to waste management or recycling? How can their expertise and resources be harnessed to support e-waste management initiatives and promote local circular economy models?

[4] If not co-ordinated by Government, this will usually be the UN organization leading WASH or Camp Coordination and Camp Management.

- Are there any international or regional organizations working on environmental or sustainable development issues in the displacement setting? How can their expertise, resources, and networks contribute to the implementation and scaling up of e-waste management initiatives?

- What are the potential barriers or challenges faced by stakeholders in implementing e-waste management initiatives? This can include financial constraints, lack of infrastructure, limited technical expertise, or legal and regulatory obstacles.

- Are there any cultural or social factors that influence waste management practices in the displacement setting? How can these factors be taken into account to design culturally appropriate and community-driven e-waste management strategies?

Following gaining a broad understanding of roles and responsibilities of different actors present and their activities, it is useful to map local retailers, repairers and waste collectors using GIS, including their service areas. Understanding current waste management locations, geographic spread and service areas will allow the Initiative to understand where gaps exist in coverage, as well as who and were to include in the Initiative`s selected location.

At the same time, waste management service providers can be interviewed and observed to add depth to the data collection. The below acts as a guide for research assistants to map local waste management service providers within the site. It is not an exhaustive preparation list and should have supporting activities such as training on use of data collection software, a safety and security checklist and briefing and relevant contact list.

Tool 4.C: Mapping of local waste management service providers

The objective of the mapping exercise is to identify repair shops, recycling facilities and waste disposal sites within the camp and neighbouring host community. The mapping survey should be conducted through a digital application smartphones or tablets, with non-digital formats as a back-up. Research assistants should seek signed consent forms for collection of data, attributing quotes, as well as photos/videos.

Materials

- Tablet or smartphone, GPS and camera recording capacity, and ability to record data offline.

- Pen and notebook in case of issue with tablet

- Consent forms hard copy or digital through tablet or smartphone

- List of contacts hard copy or digital through tablet or smartphone. Should include project manager, site focal point (UNHCR, IOM, Camp Coordination), and contact details in case of emergency as a minimum.

Instructions

1. Seek permission from the camp manager to allow research assistants to systematically move around the displacement setting,

2. Determine the required sample size to collect representative data and map out the research area.
3. Cover a planned route that covers research area and stop when a repair, retail or recycling / waste scrapping business is identified. These can be identified through:
    - By a sign advertising TV, radio or mobile phone repair/recycling
    - By prior knowledge of the camp/area
    - By direction/recommendation from a community member
    - By sight; seeing someone using a screwdriver, soldering iron, heat gun or similar.
4. Approach business and introduce yourself and the initiative with provided script, including the disclaimer and consent form.
5. Record GPS location, business name and photo of the shop.

Tool 4.D: Understanding practices of local waste management service providers 

Materials

- Tablet or smartphone with voice recorder, camera recording capacity, and ability to record data offline.
- Pen and notebook in case of issue with tablet
- Consent forms hard copy or digital through tablet or smartphone
- List of contacts hard copy or digital through tablet or smartphone. Should include project manager, site focal point (UNHCR, IOM, Camp Coordination), and contact details in case of emergency at a minimum.

Instructions

1. Seek permission from the camp manager to allow research assistants to systematically move around the displacement setting,
2. Determine the required sample size to collect representative data and map out the research area.
3. Interview local repair, waste and retail actors to understand practices and gain insights into the awareness, knowledge, motivations underpinning them. The interviews will also provide an understanding of baseline awareness of e-waste issues and utilized solutions including spare parts and tools used, and disposal practices. Gender and diversity sensitivity should be applied so that perspective of all genders can be captured.

Conduct interview using the below as a guide, ensuring to save /upload once the relevant data has been collected. It is recommended to keep interview only to questions that will provide useful data for analysis, and to avoid time burden on interviewees.

Question	Purpose
Retailers	
Which brands/products do you sell most of? How much do you sell?	Provides understanding of volume and type of products in the camp.
Do you sell any spare parts?	Provides understanding if there are services for extending the lifecycle of products already existing.
Do you offer a warranty?	
Do you over any other services? If so, what?	Some retailers would have multiple businesses and may also act as repairer/recycler which they can also be interviewed about as relevant.

Repair workers	
What types of e-products do you repair?	Provides understanding of type of products in the camp and common issues.
What brands/products do you repair the most of? How much do you repair?	Provides understanding of volume of products in the camp and most common issues.
What is the most common fault you see?	Provides understanding of most common issues with specific products to inform tyle of spare parts, tools and training required.
How did you learn repair?	Provides understanding of formal/informal trainings already existing which can be built upon through repair training.
What would help you repair more products?	Allows user-focused design of program that supports repairer needs.
Where and how do you source your spare parts?	Information of other organizations that need to be included in circular economy, and availability of spare parts in the local market.
Are there any risks or dangers in your work?	Provides understanding of current knowledge and education, to inform communications campaign and training.
What do you do with your waste?	Provides understanding of current practices, to inform communications campaign and training, and identify if there are gaps in the circular economy e.g., disposal, as well as likely current human health and environmental impacts of improper disposal.
Waste recyclers/collectors/scrap dealers	
Can you describe your work to us?	Provides understanding of the informal waste system as a whole.
Do recyclers/collectors/ scrap dealers use any protection to do the job (gloves, masks)? If not, why not?	Provides understanding of health and safety and barriers to implementation.
Are collectors/scrap dealers of a prominent gender or there is a gender balance in this type of activity? Are children involved in collection?	If yes consider recommendations that should be shared with relevant protection actors as collection might be harmful for their health, same considerations for pregnant women and people with specific chronic diseases for whom collection might aggravate their conditions.
What types of e-products do you collect / sell? How much do you collect / sell?	Provides understanding of more common and valued e-products and volume collected / sold.
How do you usually collect / sell? Where from / to?	Provides understanding of geographic spread of services and allows mapping e-waste value chain.
What materials are contained in these items?	Provides understanding of intent and incentivization for building a circular economy, as well as requirements of financial business model. Provides information on awareness of human health and environmental impacts that can inform the communications campaign.
What is most valuable in them? How much do you sell them for?	
What is most dangerous/damaging in them?	
How do you pick apart the e-waste to get the most valuable elements for selling? What do you do with the remainder of the product?	Provides understanding of practices that can be built upon in training, as well as awareness raising on OH&S. Provides information on disposal and any gaps in

	the waste management model that require proper disposal.
How did you start this work? Where did you learn your skills?	Provides understanding of formal/informal trainings already existing which can be built upon through repair training.
What would most improve your work?	Allows user-focused design of program that supports waste recycler/collector/scrap dealer needs.

Tool 4.E: Observations of local waste management service providers

Research assistants should simultaneously observe interviewees, complemented by images and videos taken to gain a deeper level of detail about practices. Observations may include tools used, products brought in, interactions with customers, key locations where to find waste/spare parts and where/how the repair person is disposing of any materials or equipment.

It is to be noted that willingness to repair and entrepreneurial mindset may not be universal and could vary across different locations, which may affect the amount of data that is able to be collected through the local stakeholder mapping process.

Tool 4.F: Example: Willingness to repair and entrepreneurial mindset and impact on uptake of circular economy model in Bidibidi, Uganda.

> *Uganda has been recognized as the world's most entrepreneurial nation by the Global Entrepreneurship Monitor (GEM) in recent years. This entrepreneurial attitude contributes to the innovative and proactive nature of individuals in Uganda, which was a key strength of the IOM E-waste Project, whereby repair technicians were motivated to take their new skills beyond the scope of the project, indicating organic growth and market stimulation of the circular economy was likely, as well as indicating the financial viability of the business model.*

4.3 Private sector mapping

The Grand Bargain (2016) saw humanitarian organizations and donors commit to use existing resources and capabilities better to reduce humanitarian needs, whilst contributing to the Sustainable Development Goals (SDGs), including a focus on the private sector. The private sector is increasingly catering to the SDGs, with environmental, social and governance (ESG) reporting slowly becoming integrated into the core operating models of many businesses.

The global electronics industry, in particular, faces growing pressures to take responsibility for waste management, environmental footprints, and health impacts throughout the production, use, and disposal phases, and their incorporation into the circular economy model in displacement settings enables these private sector companies to fulfill their social and environmental responsibilities.

Tools for sustainable procurement of products from the private sector is outlined in section 6.1. This section provides tools on how to understand the barriers and opportunities for involving the private sector in the mapping of the circular economy solution.

Tool 4.G: Market dialogue questions 

Hosting a market dialogue with private sector electronic and electrical product designers, manufacturers, suppliers and waste management service providers can help to understand local, regional and global company best practices and contributions to the creation of a circular economy, as well as barriers and opportunities for creating a circular economy for e-waste in displacement settings.

The market dialogue should be an open forum, for example, a webinar or face to face workshop, and not specifically targeted to companies working in humanitarian or displacement settings. Rather, it is to understand best practices or near to market solutions are available that may be able to be adapted to displacement settings. Not all companies will be forthright with their ideas and company developments, in which case one on one interviews may be preferred. Further, given there is no commercial or financial benefits to companies, incentivization for being part of the circular economy solution in displacement needs to be negotiated on a project and organizational case by case basis.

Example market dialogue questions:

- Do you have any existing or near to market solutions for increasing repair and recycling of your e-products?
- What work has your company done to date to extend the lifespan of products, or to support their recyclability?
- Why would your company work towards making e-products more repairable or recyclable, or environmentally friendly?
- What are the opportunities for your company`s business model, or other?
- Why would your company want to work in displacement settings? What are the opportunities for your company`s business model, or other?
- What are the barriers to making e-products more repairable or recyclable, or environmentally friendly?
- What are the barriers to your company working in displacement settings?
- What would it take for you to work with other companies on different aspects of the e-waste value chain to create a circular economy model for e-waste in displacement settings?
- Who else do you need to support your company to create a circular economy model for e-waste in displacement settings? E.g., Government policy changes, e-waste transport providers, access to camps, etc.

In addition to understanding private sector opportunities and barriers, Initiatives need to ensure to attract the right potential private sector actors, for the right reasons in line with Do No Harm principles. Incentivization for the private sector could include non-exclusive access to displacement setting markets they otherwise wouldn't have access to, scaled sustainable social, environmental, and health impacts, as well as involvement in shaping the future landscape of e-waste. Given the requirements of UN procurement, fairness, impartiality, transparency, stewardship and avoidance of

conflict of interest and any impropriety or perception of such needs to be ensured, in addition to applying the organization's relevant policies, rules and procedures.

It is recommended to develop a company profile to gain an overall understanding of the benefits and risks to different private companies` involvement. Organizational due diligence requirements should also be followed, depending on the type of involvement. An example is outlined in Error! Reference source not found.

Tool 4.H: Example private company profiling

Company Information	Identified company best practices to create a circular economy for e-waste	Identified company barriers to create a circular economy for e-waste in displacement settings
Company profile	Strong social and environmental commitments Experience working in displacement settings. Large distribution and geographic presence High financial investment and intent to improve e-waste sustainability. Commitment to local capacity building Desire to partner with impact- based motivation Involved in various steps of waste stream	Lack of experience in displacement settings Lack of access to camps Poor environmental reputation Financial-based motivation and testing of products in displacement settings for future profits and price escalation. History of being involved in causing displacement due to land rights
Product design and manufacture	Manufacturer local presence in markets to engage with user needs. Able and willing to design and adapt products for easy spare part replacement. Able and willing to design longer lasting products. Able and willing to design using eco-friendly materials	Lack of funding to develop new products. Labour rights of supplier undetermined
Repair	Sales agents and technicians on the ground to educate users on best repair practices. Repair manuals, YouTube videos, phone apps and tools to train users and technicians.	Lack of affordable and quality spare parts Product disassembly Lack of financial incentive for after-sales services by private sector Siloed company efforts
Recycling	Discounts to distributors who have an agreement with licensed recycling facility. Use of own trucks/collection points to increase volumes and reduce cost. Pre-processing equipment (e.g., cable stripper) to expand storage Connection to large recycling facilities.	No lithium battery processing facility Basel Convention prohibits some international waste transport. Low profit margins in recycling therefore need volume to get value for money. Expensive to transport waste Siloed company efforts

4.4 Humanitarian and development sectors

Humanitarian and development actors present in the local setting can be mapped in line with Error! Reference source not found., however non-local actors may still have presence in the camps from previous activities or distributions. Understanding influence and historical activities, including e-product distribution can provide further background on the context, as well as provide an indication on the types of repairs, spare parts and tools needed, as well as types of recycling e.g., for plastics, metals, batteries, etc.

Tool 4.I: Humanitarian and development actor data and understanding

As a minimum, it is recommended to seek to understand:

- Approximate number of specific types e-products procured and distributed, preferably with long-term data to understand rate of procurement as well as potential waste accumulated in displacement based on the activities of all humanitarian and development actors in the camp.
- Brands of e-products procured and procurement selection criteria.
- Work organizations are undertaking in waste management, greening humanitarian response, sustainable procurement, cash-based interventions and livelihoods, or other relevant aspects of humanitarian response.
- Organization`s role and involvement on any global coordination bodies such as global technical working groups, or other.
- Will they be willing to collaborate, share data and ensure complimentary and cohesive implantation of activities?

4.5 National governments and district officials

Engagement of national government and district officials encompasses more than understanding the relevant legislation and regulations that the initiative needs to comply with. Government engagement from the outset can provide opportunities for co-development of initiative design that can provide evidence and case studies that address gaps to support government policymaking. Further, governments can support other aspects of the initiative in case exemptions are needed for importation of spare parts and components, including VAT exemptions to facilitate repair services to keep prices affordable.

Tool 4.J: National government and district official engagement

It is recommended to engage government at multiple levels as early and relevant as possible. Suggestions on government engagement include:

Extended Producer Responsibility (EPR): Advocate for the implementation of EPR programs for e-waste. EPR places the responsibility on manufacturers and importers to manage the entire lifecycle of their products, including take-back, recycling, and proper disposal of e-waste. Engage with government officials to develop and enforce EPR policies or regulations and provide technical assistance in implementing these programs.

Collaboration with industry: Engage government officials in dialogue with the electronics industry to encourage their active participation in e-waste management initiatives. Advocate for the adoption of environmentally friendly manufacturing practices, product design for recyclability, and responsible end-of-life management of electronic products.

International cooperation: Engage with national governments to align e-waste management efforts with international frameworks and agreements, such as the Basel Convention. Collaborate with government officials to develop strategies for cross-border e-waste movements, including import and export regulations, to prevent illegal dumping and promote environmentally sound recycling practices.

Policy and regulatory frameworks: Develop or adapt policies and regulations that specifically address e-waste management in displacement settings. These frameworks should consider the unique challenges and needs of displaced populations, their gender and other differentiated needs, including provisions for safe collection, recycling, and disposal of e-waste.

Partnership with humanitarian agencies: Engage with humanitarian agencies, (such as the UN entities) or relevant NGOs, to coordinate efforts and share resources for e-waste management in displacement settings. Collaborate with government officials to ensure effective coordination between the government and humanitarian actors.

E-waste collection and recycling infrastructure: Advocate for the establishment of e-waste collection points or recycling facilities within displacement camps or settlements and at national level. Work with government officials to identify suitable locations, allocate resources, and provide technical expertise to set up and manage these facilities. Consider mobile or temporary collection points to accommodate the mobility of displaced populations.

Informal sector integration: Recognize the presence of informal e-waste collectors or recyclers in displacement settings and work with government officials to integrate them into formalized e-waste management systems. Provide training and support to enhance their skills and ensure safe and environmentally friendly recycling practices.

Awareness and education: Government officials can support to develop and implement awareness campaigns on e-waste management in displacement settings. Target both displaced populations and host communities, raising awareness about the hazards of improper e-waste disposal and promoting responsible recycling practices. Provide information on collection points, recycling options, and the benefits of the circular economy.

Circular economy approaches: Advocate for the adoption of circular economy principles in e-waste management within displacement settings. Encourage government officials to explore opportunities for repair and refurbishment of electronic devices, promoting their reuse instead of disposal. Support initiatives that enable the recovery of valuable materials from e-waste through safe and environmentally sustainable recycling practices.

Capacity and skills development: Collaborate with government officials to provide training and capacity-building programs for displaced population, host community members, and relevant stakeholders (this should be done also nationwide). Offer technical skills training in e-waste collection, recycling, repair, and circular economy approaches. This empowers individuals to participate in e-waste management activities, potentially creating income-generating opportunities within the displacement setting.

Data management and monitoring: Collaborate with government officials to establish data management systems for e-waste in displacement settings. This includes tracking e-waste flows, monitoring recycling rates, and evaluating the environmental and social impacts of e-waste management initiatives. This data can be used to inform decision-making, policy development, and resource allocation.

4.6 Academia

The shortage of resources in the humanitarian sector, combined with the external data collection and analysis expertise of the academic research community can create a mutually beneficial partnership whereby Masters or PhD students can have access to real-world problems whilst contributing to evidence gaps.

Importantly, affected populations are innovative and have a wealth of knowledge to contribute to initiatives that affect their lives, and it is important to include affected populations in the process of research to create co-ownership and long term-sustainable business models for the e-waste circular economy. Much of the academic research community have skills in working with diverse communities to obtain qualitative, deep qualitative insights mixed with quantitative data to provide valuable recommendations for the initiative.

Tool 4.K: Academic institution engagement

Suggestions on academic institution engagement include:

Technology innovation and development: Collaborate with academic institutions to promote technological innovation in e-waste management. Engage students and researchers to develop new recycling techniques, sustainable materials, or circular economy models. This collaboration can contribute to the advancement of e-waste recycling technologies and support the development of scalable and economically viable solutions.

Capacity development and education: Partner with academic institutions to develop training programs, workshops, and courses on e-waste management. These educational initiatives can help build the capacity of students, professionals, and affected populations in various aspects of e-waste management, including recycling technologies, policy frameworks, and circular economy approaches.

Dissemination of research findings: Collaborate with academia to disseminate research findings through academic journals, conferences, policy briefs, and public awareness campaigns. This promotes knowledge exchange, informs decision-making processes, and raises public awareness about the importance of responsible e-waste management.

These partnerships can research opportunities can be explored on a case-by-case basis.

4.7 Cross-sectoral collaboration

Partnerships are crucial for circularity and sustainability as no one sector has all the attributes to allow it to be successful. Following location selection, it is recommended to bring stakeholders together for a workshop to ideate solutions and collaborations, to ensure mutual reinforcement across the waste stream rather than siloed efforts.

Cross-sectoral collaboration with sectors with different mandates can be complex where there are potential business interests involved, and it takes work to formalize these into legal contracts in line with agency procurement criteria. It is recommended to agree that:

- Any solutions should be available to other actors in the market, with brand-specific lessons learnt to be shared with other brands.

- Procurement platforms should be open access, to ensure outcomes are supplier and product neutral.

- All related evidence should be disseminated through different communication channels, including to other humanitarian organizations and private companies, with the goal of contributing to the global collective knowledge for improving e-waste management in displacement settings.

An example agenda and activities for a cross-sectoral ideation workshop is outlined in Tool 4L. To inspire creative thinking, consider hosting the workshop in a new environment that inspires creativity, or if online, using an online platform such as Miro. Consider recording it using new methods such as hiring a graphic designer to draw concepts and conversations. An example of a circular economy map that can be used in workshops as a visual aid for stakeholders understanding where they fit is provided in Tool 4M. A graphic design from an ideation workshop is provided in Tool 4N, which can be used to capture discussions as they are happening.

Tool 4.L: Example cross-collaboration workshop sessions

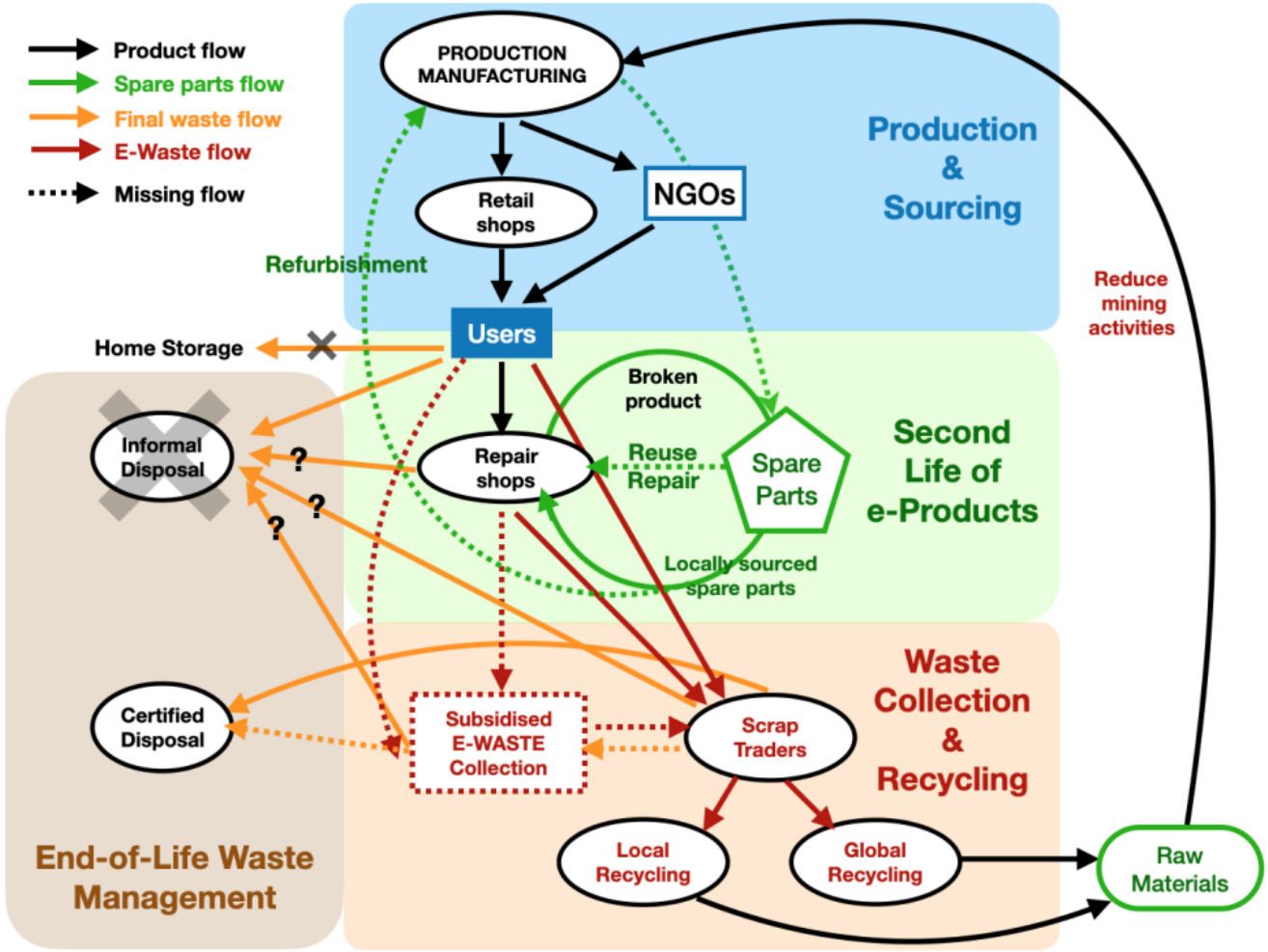
Goal: Establish new partnerships that build on one another`s efforts in a synergistic and cohesive way to establish an inclusive and complimentary e-waste circular economy in displacement settings.

Session	Purpose	Activity	Recommended time length
Setting the culture of collaboration	To allow different stakeholders to understand the varying motivation and responsibilities across the e-waste value chain in displacement settings, and to establish a collaborative environment with the intent of creating a holistic solution.	Group into stakeholder groups, e.g., e-product supplier, manufacturer, distributor, repairer, local NGOs, INGO, UN agencies, technical working groups, academia, local government, national government, etc. Have each group discuss their motivation, mandate and responsibilities and influence and involvement in the e-waste economy. Have one person present back to the group.	Depending on number of stakeholder groups, suggest 2 minutes per group.
Setting the scene	To allow all participants to have a broad understanding of: What is e-waste in displacement settings? What are the challenges? What information is available (academic studies, project data collected, etc). What is the context? What are the relative legislation and guidelines?	Have presentations from key experts about the challenge, as well as presentations of information collected to date, such as location context, policy and legislation, infrastructure availability and user needs, knowledge, attitudes and practices.	Depending on number of stakeholder presentations, no more than 30 minutes each.
Stories from the field	To allow participants to engage in the field perspective and focus the discussions on the overall objective to improve lives of displaced communities.	If video footage or photos were captured during the needs assessment, present them to participants to visualize the challenge for those who have not seen challenges of e-waste in displacement before.	5 minutes
Mapping the circular economy	To gain a holistic picture of the - waste value chain and where different stakeholders fit in. Shows participants that no one entity does it all, so partnership collaborations are essential for a truly	Using a whiteboard, map out what a circular economy might look like (refer Error! Reference source not found.**M** as an example). Ask one representative from each entity to write their entity`s name in the section they are involved in.	30 minutes.

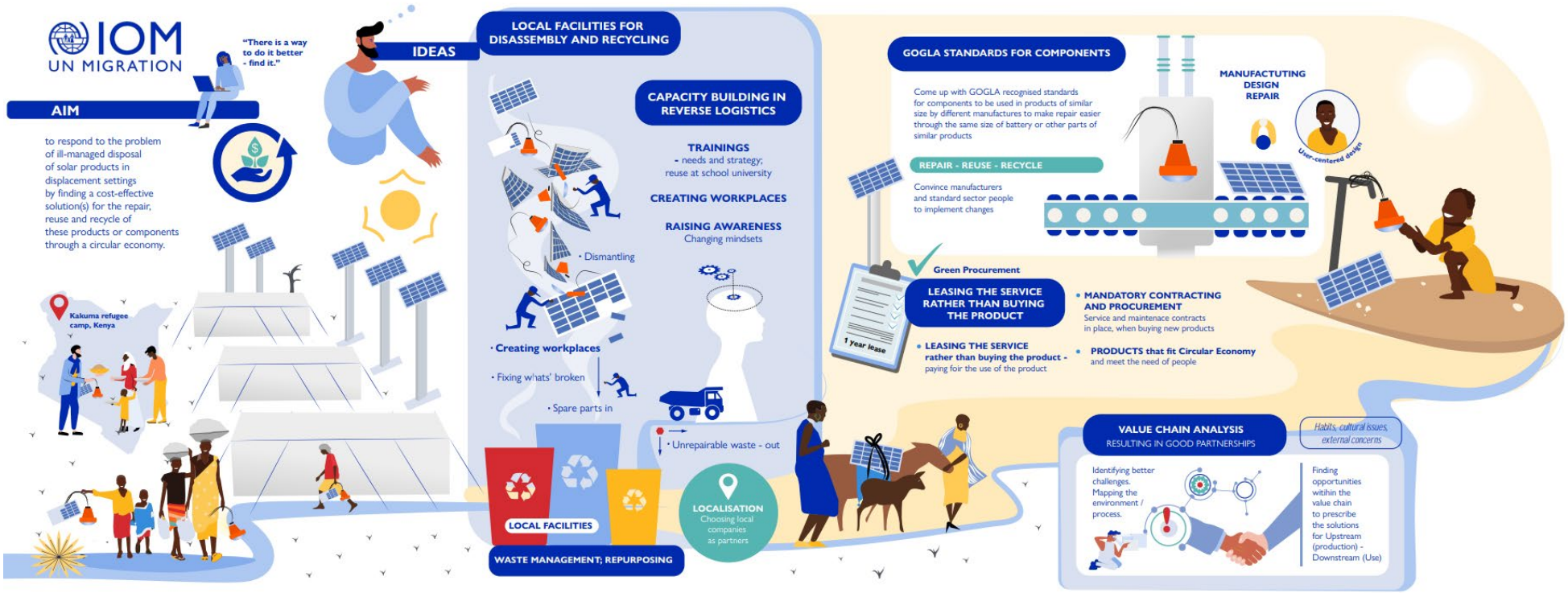
	circular model.		
What if?	To creatively ideate as many solutions as possible with no barriers in mind.	Ask participants to individually use post-it notes (or digital post-it notes) to map as many solutions as possible in three minutes, for creating a circular economy for e-waste. It can range from technical solutions to collaborations to policy change. Write one idea per post-it note. The aim is quantity over quality, and to have no restrictions on the ideas. Ask participants to get into groups of 5. Combine their ideas and select the top three. Write out the three ideas on a flipchart or on a digital flip chat, including, a) What challenges does it solve? B) What do you need to do differently to make it happen? C) What partnerships are necessary? Present one to three ideas back to group, depending on number of groups and time.	5 minutes 5 minutes 15 minutes 20 minutes per group
Partnership opportunities for e-waste management in displacement settings, how can we create shared value models?	To allow stakeholders to understand how partnerships can benefit their mandate and activities.	In each stakeholder group e.g., e-product supplier, manufacturer, distributor, repairer, local NGOs, INGO, UN agencies, technical working groups, academia, local government, national government, etc., write down the top 10 barriers that are preventing them from solving the challenge of e-waste in displacement settings on flip chart paper (or digital). Have groups move around to different flip charts, look at the challenges faced by other stakeholders, and write in a different colour, what they could do to help resolve each relevant challenge. E.g., private sector companies might not have access to camps, UNHCR and IOM can facilitate this, UN agencies might not have enabling government policy that allows fast importation of spare parts, the Government might be able to make exceptions or adapt this.	30 minutes 30 minutes

Co-creating solutions for circular economy e-waste management in displacement settings – what does it look like?	To allow stakeholders to formulate ideas with partners about what the future of e-waste in displacement could look like.	Using the two activities on ideation and partnership, have each individual entity come up with one solution that they can implement, and how it would contribute to the creation of a circular economy. Consider livelihood benefits, human health and environment benefits, financial models, partnerships and investment required, sustainability, etc. Present back to group	30 minutes 10 minutes per entity

Tool 4.M: Example of circular economy



Tool 4.N: Example graphic design from an ideation workshop



5. MONITORING AND EVALUATION

Monitoring and evaluation is critical to understand the dynamics of the circular economy financial market, user-behaviour and incentivization, the potential of the circular economy model (in terms of likely volumes of waste, willingness to pay, etc.) and to allow for adaptive programming. Best practice guidelines are outlined below (Tool 5.A), as well as example questionnaires that are recommended to develop data on user experience at e-product drop off (Error! Reference source not found. 5.B) and pick up (Tool 5.C) from the repair centre. It is also recommended to monitor repair technician feedback to allow additional spare parts, tools and trainings to be delivered as required (Tool 5.D). Other data collection data types such as in-depth interviews, human health and environmental data collection, and monitoring of financial transactions and willingness to pay is also recommended depending on the Initiative.

Tool 5.A: Monitoring and evaluation best practice guidance

- Monitor using both outcome and process indicators. Outcome indicators will provide information on Initiative effectiveness, and process indicators will provide information on Initiative efficiency, which combined can allow for understanding of complex processes and allow for incremental and adaptive programming.
- Data collection methods should aim to be consistent from the start, especially considering the capacity building activities that are required at field level to support e.g., digital data collection, and the most appropriate modality for collection in each context.
- Consider the context and other elements when studying the data and compliment quantitative data with qualitative interviews to gain deeper insights that may impact the findings.
- Use a digital offline data collection tool (that uploads when there is Wi-Fi) to avoid internet collection challenges and delays in recording data online.
- Ensure all relevant data collectors have the right equipment (e.g., tablets) to enable efficient collection.
- Ensure surveys are translated into local languages with the ability to upload photos for more descriptive monitoring data, particularly for repair technicians who may be requesting additional spare parts and tools.
- Have data feedback directly to suppliers and manufacturers for real-time data that feeds into long-term design and decision making.
- A balance between data for decision making and data for impact needs to be defined, noting bulk data can overwhelm resources. At the start of the Initiative, a lot of data may be required to fine tune the model. As the circular economy is established, a leaner model that racks high priority impact metrics aligned with goals may be more beneficial.
- Ensure to include questions to understand end-user uptake and system-wide transformation from the circular economy perspective, including any positive changes impacting the local/regional/national legislation on e-waste and the lives of the displaced populations and host communities.

Tool 5.B: Pre-service survey questions 

Suggested questions for conducting a pre-service survey are outlined below. Questions should be contextualized to the potential location, including phrasing and language for local interpretation. It is recommended to provide multiple choice answers for ease of data analysis.

Survey question	Purpose of data collection
Product ID	Ensures no repetitive answers are asked, whereby surveys are linked to the post-service questions.
Gender	Allows gender lens analysis.
Age	Allows age lens analysis.
Language spoken.	Informs communication campaigns.
Income or job (as appropriate)	Informs potential income to pay for services.
Where did you acquire the electrical/electronic product?	Informs where product entered the circular economy and likely condition when first received.
When did you acquire the products?	Provides indication on if products are exceeding their expected lifespan or breaking beforehand.
What do you use the product for? E.g., cooking, children`s homework, lighting for security, etc.	Provides information of flow-on outcomes of repair. Provides high-level indication of needs.
Does it satisfy your needs?	Informs whether the product is user-focused, or if another solution might work better for their specific needs.
Do you have any suggestions on how to improve the product?	Allows user-focussed design.
How many people in your house use the product?	Provides indication on no. of people reached with repairs.
How did it break?	Provides indication whether breakage was design and/or operation and maintenance issue.
When did it break?	Provides indication of lifespan when combined with when and where product was acquired.
What did you do with it when it broke?	Provides indication of repair culture, or waste management behaviour, as well as potential human health and environmental impact of waste management practices.
Have you attempted to repair it before? If so, did it work after the repair attempt?	Provides indication of quality of current repair services available.
If repair has been attempted, who did it?	Contributes to list of local businesses that should be incorporated into circular economy model.
How did you hear about the repair program?	Provides indication of repair culture, awareness and effective communication modalities.

Tool 5.C: Post-service satisfaction survey questions 

Suggested questions for conducting a post-service satisfaction survey are outlined below. These should be contextualized to the potential location, including phrasing and language for local interpretation. It is recommended to provide multiple choice answers for ease of data analysis.

Survey question	Purpose of data collection
Product ID	Ensures no repetitive answers are asked, whereby surveys are linked to the post-service questions.
Was your product successfully repaired?	Provides evidence of repair effectiveness
How long did it take to receive your product back?	Provides evidence of efficiency
Are you satisfied with the repair service?	Provides evidence of user-needs being met
What could be improved about the repair service?	Allows for adaptation of repair service, as relevant.
What will you do with your product now? E.g., take it home, sell it, give it away, other.	Provides evidence to understand circular economy model.
How much would you pay for this service in future?	Provides data to analyse a viable business model and price point.
Were any of your items refused for repair? If so, what did you do with them after? How much would you expect to be paid to dispose of the product?	If items are not able to be repaired, collection and safe disposal should be encouraged. This question will provide evidence on willingness to dispose and likely price point to encourage safe disposal rather than on-sell. **Note it is critical that waste scrappers are included in the circular economy model by being trained on safe disposal, so collected products can be sold to them, provided they have undertaken training and have the tools and personal protective equipment to safely pick apart products.
Is there any other broken electronic waste in house that you would want repaired?	Provides indication of scalability of circular economy to additional types of e-waste.
What are you doing with them now? E.g., pulling them apart and using the pieces for different things, keeping them in the house, give them away, sell them, etc.	Provides indication of scalability and impact of circular economy to additional types of e-waste.

Tool 5.D: Technician repair forms

Suggested questions for technician repair forms are outlined below. These should be contextualized to the potential location, including phrasing and language for local interpretation. It is recommended to provide multiple choice answers for ease of data analysis, and the option of using photos to describe issues.

Survey question	Purpose of data collection
Product ID	Ensures no repetitive answers are asked, whereby surveys are linked to the post-service questions.
Type of e-waste (radio, solar lantern, mobile phone, etc.)	Provides data on common e-waste types.
Brand	Provides data on brands of different products in camp and what repair technicians need to be trained in.
Broken part(s)	Provides data on the most common breakages and weakest points of electronic and electrical products for feeding back to manufacturers.
Spare part(s) used	Provides data on type of spare parts required, which can be

	further assessed as to their local availability or whether they need to be procured internationally with the initial product procurement.
Tools used	Provides data on type of tools required, which can be further assessed as to their local availability or whether they need to be procured internationally with the initial product procurement.
Repair successful?	Provides indication on effectiveness of repair, which can be compared to user responses.
Difficulty of repair (easy such as one button change, to difficult requiring multiple spare parts and tools)	Provides indication of time taken and reasoning behind any delayed repairs, as well as capacity gaps requiring additional training.
Were you missing any spare parts and tools to complete the repair? If so, could you find these in the local markets? If not, how did you repair the item? E.g., getting spare parts from other products to be disposed, using different type of tool, etc.	Provides data on type of spare parts and tools available, their local availability, their recoverability from other products, or whether they need to be procured internationally with the initial product procurement.

Tool 5.E: Example: The need for qualitative and quantitative contextualized data analysis

The below example shows the importance of field visits, observations and interviews when monitoring, to add depth and insights into the quantitative data collection.

Through a monitoring visit to gain qualitative feedback from repair technicians as part of the IOM E-waste Project, it was found that only lamps that were considered "repairable" upon collection by community mobilizers reached the repair workshop. Therefore, there was an initial filter being applied that the repair data (which indicated 100% repairability at the repair shop) did not represent, and a gap in the circular economy that would have otherwise been missed. It was unknown what type of training the community mobilizers received to identify what lamps could be repaired and what could not. Further, with irreparable lamps not reaching the workshop, many lamps that should have been for safe disposal were left in the community.

Further, repair technicians were taking usable parts from lamps that were not working/repairable to put into other lamps, meaning that the use of spare parts may have been under-reported (BRIGHT, 2023).

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6. CREATION OF A CIRCULAR ECONOMY

A circular economy is based on the entire value chain of a product, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. Given the interconnected nature of our global supply chains, it is almost

impossible to establish a circular economy in a single country, and a holistic understanding and inclusion of the entire waste value chain is required to ensure maximum efficacy.

6.1 Sustainable procurement

E-products cannot be totally circular with today`s technology and materials, meaning some form of final disposal is required. Sustainable procurement therefore means "starting from the start" for the effective creation of a circular economy. Sustainable procurement can reduce the environmental and social impact of raw materials extraction based on improved chemical management of e-products, repair-based product designs that extend the product lifespan, more user-focussed design that meets needs of beneficiaries, local distribution that reduces need for long distance shipping and carbon emissions whilst supporting local markets, and locally sourcing (where applicable and based on appropriate assessment). Essentially, sustainable procurement can start at the top of the waste hierarchy by reducing the number of e-products required for purchase due to keeping products within the circular economy before landfill.

Figure 1 Waste hierarchy

UN agencies and NGOs can influence the market by applying a procurement strategy based on sustainability criteria. It is important to mention that there is no universal definition of "sustainability" as it depends heavily on the local context and constrains. For example, the sustainability criteria and the level of exigence are not the same for the use in refugee camps and the use in a disaster-hit situation. This is why it is difficult to provide a scoring system to measure the sustainability in the humanitarian context as the situation changes from one location to another.

Despite this, the logical thinking must remain the same for the case of displacement settings. It is recommended to use five building blocks to build a case-by-case definition of "sustainability" for any electronic products procured in the humanitarian sector in order to protect the health of people, preserve the environment, and reduce the waste. These sustainable procurement criteria for e-products were developed based on technical expertise and literature reviews, as well as interviews and workshops with humanitarian procurement specialists, humanitarian operations specialists, academia, technical bodies and high-level

decision makers. It is noted that these are complimentary and more specific to e-waste procurement compared to the UN Sustainable Procurement Indicators, which are broader indicators for social, environmental and economic considerations.

Tool 6.A: Recommended sustainable procurement criteria for e-products

Further information can be found at www.solvoz.com

Criteria	Reasoning	Example criteria
Toxicity to protect health and the environment	E-products can contain components with harmful chemicals. There are active informal waste treatment sectors meaning high risk of exposure. The repair shops are not well equipped with repair tools meaning high risk of exposure. Children tend to play with e-products meaning high risk of exposure.	Conformance with international standards such as List of Declarable Substances under the International Electrotechnical Commission 62474 and the European Union Restriction of Hazardous Substances Directive.
Quality to guarantee the safety and the durability of the product	The distributed e-products should serve displaced populations for a number of years and of good quality to ensure their durability. Should be adapted to the use of displaced communities as well as the local climate.	Global quality standards e.g., GOGLA for solar lanterns.
Reparability to extend the product life cycle	Supports value for money of the initial purchase given recycling costs of many products require quantities of scale for profit. There are repair shops in refugee camps, so the repair-based ecosystem can be fuelled by the humanitarian sector to reduce the number of solar products that enter into e-waste, whilst providing local business opportunities.	Documentation for troubleshooting instructions, failure diagnostics, disassembly and repair provided in local languages. Identification of parts prone to be replaced, repaired re-used or upgraded. Use of standard connectors. Use of interoperability components (batteries, light bulbs, charge controllers, inverters.) Requirement of no special tools to gain access to parts that failed. Design for easy disassembly. Availability of spare parts provided by producer or distributor. Repair training. General consideration on upgradeability.
Resource management (recyclability and end of life management) to save resources	Provision of value to take back e-waste stocked at households, whilst connects the informal waste sector to scrap traders.	Declaration of recycled content in product. Labelling for material identification. Enhancing recyclability of product. List of valuable materials with trading prices for e-waste collection. EoL waste management fees paid by product manufacturers.

		End of life product take back scheme. Service contract with local e-waste management company.
Local production to enhance local economy and capacity to develop a circular economy	Locally produced electronics have greater advantages as it builds the local capacity and the knowledge to facilitate local business development and increase the flexibility and the promptness of local repair services.	Local production. Product manufacturers with ability to adapt products based on user needs.

Tool 6.B: Example solar supplier evaluation tool

Available at www.solvoz.com

Categories	Questions	Answers
General	Are you part of the UN Global Compact?	Yes/No
	Is your product/company is certified/labeled? (TCO - ISO 14024 - ISO 14000 -	Yes/No
	Do you have audit process from external actors?	Yes/No
Warranty and After Sales Service (ASS)	Is your product under warranty? If yes what is the warranty policy?	Text
	What is the type of warranty? (manufacturing - performance - system - supplier - component - quality of installation)	Text
	What is the warranty duration?	Number
	What is covered and not covered under your warranty?	Text
	Do you have an after sales service (ASS)?	Text
	What are the cost related to ASS?	Price
	Do you have a take back process?	Yes/No
	How can we return your product? - Do you have a "Take Back" process?	Yes/No
Social	Do you comply to the UN Code of Conduct?	Yes/No
Quality / Tech specification	Is the product complies with IECS TS 62257-9-8? Or equivalent standard?	Yes/No
	Does the product meet the functional specifications? (see solution criteria files with tech criteria)	Yes/No
Toxicity	Is the product complies with EU's RoHS directive?	Yes/No
	Can you provide a proof of compliance to EU's RoHS directive?	Yes/No
	Can you provide the list of declarable substances as per IEC 62474	Yes/No
	Is the product composed of hazardous components?	Yes/No
	What is the level of chlorine in electric wires?	<5000ppm
	What is the level of bromine in electric wires?	<5000ppm
	What is the level of fluorine in electric wires?	<1000ppm
	What is the level of chlorine in plastic parts greater than 25gr?	<5000ppm
	What is the level of bromine in plastic parts greater than 25gr?	<5000ppm
	What is the level of fluorine in plastic parts greater than 25gr?	<1000ppm
	What is the level of mercury by weight in the batteries?	<5ppm
	What is the level of cadmium by weight in the batteries?	<2ppm
	Are the batteries composed with more than 40ppm lead, 20ppm cadmium or 5ppm mercury marked with the chemical symbol for the metal?	Yes/No
Repairability	Is the product has been design to ease the repair?	Yes/No
	Can you provide troubleshouting/repair manual?	Yes/No
	Can you provide list of spare parts?	Yes/No
	Can you supply spare parts?	Yes/No
	Can you share distributor contact of spare parts if not you?	Yes/No
	Can you provide repair manual?	Yes/No

	Does the product still under warranty if DIY troubleshooting actions?	Yes/No
	Are the tools used for repair standard tools?	Yes/No
	If specific tools are required, can you provide repair tools kit?	Yes/No
	Is a certified skilled technician mandatory for reparation?	Yes/No
	Do you provide appropriate trainings?	Yes/No
	Is your product composed of interchangeable parts?	Yes/No
	Is the product composed of software?	Yes/No
	If the product is composed of software, can the update by done remootly?	Yes/No
Ressource Management	Can you provide the composition of the product with end of life management?	Yes/No
	Is there any hazardous component ? If yes, please be specific	Yes/No
	Is the product can be easily recyclable (dissotiation of component and materials are easy)?	Yes/No
	Are all component recycable?	Yes/No
Local Production	If you are a distributor, can you share the localisation of the manufacturer?	Yes/No
	If you are the manufacturer, can you provide productio localisation?	Yes/No
	Can the repairability be done near xxxxx place?	Yes/No
TCO analyses	Analyses Total Cost of Ownership	Price
	Unit purchasing prices	Price
	Packaging & transport cost	Price
	Usage costs (energy/bulbs life duration…)	Price
	Repair costs (tools, spare parts, warranty…)	Price
	End of life costs (disposal costs according to composition)	Price

Tool 6.C: Example: The case for user-needs based products

The below example highlights the importance of qualitative data collection to understand user-needs, and to design products based on this.

Solar cables were found to be standardized to require a length of 3-4 meters in humanitarian procurement. However, when combined with technical knowledge from a supplier plus interviews of user needs, this was found to be detrimental. First, the longer the cable, the more power is lost, second, the cable is one of the most expensive parts of the lamp and third has a high carbon footprint. At the same time, cables were found to be being cut for selling, or to try to charge other item directly with the remaining cable, both of which can be dangerous practices. A shorter cable would mean products are more powerful (given users reported dim lighting to be one of the main issues), cheaper, more environmentally friendly, and safer. If users need to charge other items, manufacturers can consider their needs using a different product specifically designed fit-for-purpose.

6.2 Health and safety

Staff should be properly trained and use the correct personal protective equipment (PPE) including chemical resistant and sturdy gloves to protect hands from cuts, harmful dusts and chemicals, safety glasses to prevent dust and debris from entering the eyes during dismantling, coveralls to protect against dust, work boots, and in some bases a respirator. PPE should be removed after exiting the facility to avoid transferring dust and chemicals to other areas.

The below provides a guide to handling different e-waste types. In addition, the below must not be practiced:

- Disassembly of rechargeable battery cells.
- Burning of any e-waste and/or its components including cables and plastics.
- De-soldering the lead-containing solder.

Component	Description	Risk	Handling, storage and transport
Lead Acid batteries	Lead, when disturbed during battery dismantling or melting, releases hazardous lead dust and fumes. It is easily absorbed by living organisms, accumulating over time and causing various health issues like miscarriages, developmental problems, cognitive decline, and cancer. Battery acid, containing toxic sulfuric acid and lead particles, harms ecosystems, pollutes groundwater, and poses risks to human health.	High	• Keep batteries away from direct sunlight. • Drain wet batteries using distilled water and store the acid in secure bins. • Do not open sealed batteries. • For storage, place batteries on pallets on top of a non-permeable surface, arranging similar sized batteries beside each other. Insert a layer of thick cardboard between each layer to absorb potential acid leakage. • Limit the stacking of batteries to a maximum of three layers high. • For transport, wrap and seal the stacked pallets with plastic wrap and criss-cross the plastic for load stability.
Lithium-based batteries	Lithium batteries present a risk of fire and are a common factor in warehouse fires.	High	• Prior to storage, fully discharge the batteries and avoid damaging the cells. • Do not attempt to dismantle battery packs. • Cover the battery poles with insulated tape. • For storage, place them in plastic containers covered with sand. The sand acts as a thermal absorber and forms a protective barrier, containing any potential fire. • Choose a storage area that is sheltered from heat and rain. • Allocate separate area within the warehouse exclusively for lithium battery storage to reduce the risk of fire spreading.

Flat panel displays	The most hazardous fraction of FPDs is the backlight tubes, which contain highly toxic mercury.	High	• Store on an impermeable surface with sealed drainage. • Stored in enclosed weatherproof containers to prevent mercury contaminated rainwater being generated and to prevent emissions. • Prevent breakage of the fragile internal mercury backlights. No not drop, crush or compact them. • any mercury contamination of other WEEE streams.
Printed circuit boards	Printed circuit boards come in various grades. Informal recycling normally consists of burning or use of acids to strip the gold from the board. This comes with extremely high hazardous to the environment and workers and should be avoided.	Low to High	• PCBs should only be processed by a reputable recycler. They are classified by the recycler according to the amount and types of metals present. If stored and transported to a recycler, PCBs are low risk.
Cables	Cables mostly consist of copper surrounded by PVC. If burnt, the PVC releases dioxins (one of the most potent carcinogens) into the atmosphere.	Low to High	• As long as open burning and incineration are not used to strip the copper of the PVC, cables do not contain many hazards.
Mixed components	E-waste includes a lot of small or miscellaneous components, for example small rubber seals from solar lanterns to screws, stickers and labels. Due to their small size, and often unclear material composition, mixed components (i.e., what is left after dismantling) are often landfilled. They can be hazardous if the quality of segregation and dismantling is low, leading to fractions containing mercury and other components being included.	Medium	• Products should be stored in segregated components (cables, photo-voltaic panels etc). This assists in tracking how much the e-waste is worth. • All containers should be clearly labelled and tracked.
Plastic	General e-waste plastic can be hazardous as it often contains brominated flame retardants (BFRs) and heavy metals such as lead and cadmium (often in PVC). These additives can be extremely hazardous in ingested.	Low	• Should not be recycled but safely disposed of in a lined and managed landfill.

6.3 Collection

Collection refers to the infrastructure and operational requirements of a collection network. In most displacement settings this is done through the informal sector (local repair shops, door-to door collectors or dumpsite scavenging).

Accurate monitoring of data is required to ensure e-products are returned to their owners, that they are contactable, and that recordings of the type of e-waste and financial transactions are available. The monitoring can be done manually using paper sheets and collection stubs given to users, or electronically. It is recommended to select one recording methodology and stick with it, so as to not introduce multiple new practices at once.

The below checklist is provided for creating collection points with displaced populations:

Tool 6.E: E-waste collection services checklist 

Available at Solvoz.com

Criteria	Requirement	Y/N
Collection points	Several collection points installed throughout the displacement settlement to facilitate accessibility.	
	Published operating hours, location of collection points and payment rates for different types of -waste communicated to the community in local and culturally appropriate language.	
	Trained staff (storekeepers) to oversee collection points and to assess whether the e-product can be repaired or is waste, as well as to be trained in health and safety of e-waste management.	
	Storage space for e-products to be repaired. Storage space for e-waste before being moved to central collection point.	
	Fixed durable and impermeable e-waste bins (thick plastic) with cover, each for different types of e-waste (solar lanterns, torches, mobile phones, tablets, electric cables, metals, glass).	
	Secure locks to prevent theft during and after business hours.	
	Desk with weighting scale to weigh quantity of e-waste.	
	Paperwork for tracking e-products and e-waste including date, name of the person who brought the e-products or e-waste, ID number for e-products, contact details of customer, the types of e-product or e-waste received, weight of e-waste, incentive being paid for the e-waste or payment for repair, signature of the person who dropped off the e-product or e-waste.	
	Sheltered against rainfall and direct sunlight (with roof or bin).	
	Lifted floor to avoid e-waste contact with soil.	
Sorting of collected e-waste at central location	Workshop for dismantling collected e-waste that is well-ventilated with enough workshop space.	
	Personal protective equipment for staff including gloves, security goggles, and appropriate cotton clothes.	
	Trained staff in e-waste identification and segregation of e-waste including health and safety requirements (Refer Tool 6.D).	
	Contracts in place for pick-up or delivery to the accepted e-waste treatment locations.	
	Appropriate storage for PCBs (printed circuit boards), cables, metals, plastics, glass and batteries (Refer Tool 6.D).	

Financial models	E-waste collection point should buy e-waste or provide economic incentives calculated from the local e-waste trade values to encourage the displaced population to bring in their e-waste. Although brought-in e-waste can generate some money by selling the collected (and sorted) e-waste to a local scrap dealer or a recycler, it will likely need supplementary subsidies to operate correctly. If e-waste collection service is expected to self-finance in a long term, different business models should be explored. It is recommended to consider multiple models to combine the self-funding capacity to operate e-waste collection points in a sustainable and responsible manner.	
Destination of collected e-waste	E-waste should be visually inspected first at the collection point to determine if it is repairable, partly re-usable, or waste. The e-waste is segregated and sold to scrap dealers or a recycling company. It is important to understand the downstream practices to ensure full life-cycle responsibility. For example, some recyclers may not have the infrastructure to recycle specific types of e-waste and will only store it.	

6.4 Repairs

Repair exists in camps and is a constant practice both formally and informally. Repair economies can connect displaced and host communities (Refer section 7.3), with a role for government and humanitarian sectors to enhance and increase repair activity through the providing spare parts, requiring occupational health and safety standards and ensuring sustainable procurement procedures to improve toxicity, quality, repairability and recyclability of product designs. Repair conserves embodied energy, materials and water used for product manufacturer, and reduces the use of scarce materials such as heavy metals. Repair also reduces transportation costs required for purchase of additional products, saving costs and supporting local job creation and market stimulation, ultimately generating additional economic revenue from the original product. Best practice guidance for setting up repair centres is outlined below.

Tool 6.F: Repair centre best practice guidance 

- Include training and simple trouble-shooting guidance for users in their own language for all brands that require repair, as determine through the needs assessment.
- Ensure awareness of repair shops in host and displaced communities (Refer section 7.1).
- Conduct a market assessment to understand availability of spare parts and repair tools prior to international procurement.
- Ensure availability of spare parts, diagnosis and repair tools for all brands of products requiring repair, as determined through the needs assessment.
- Ensure safe storage of non-repairable components and connect the repair service providers to the recycling and recovery service providers to ensure connection of the circular economy.
- Enable affordable, regular, and well-coordinated transport to nearby towns to enhance waste volumes.
- Batteries, when supplied alone (not inside a product) must be shipped by sea and require COC before shipment. It is recommended to evaluate the potential battery needs over a long

period of time and order larger volumes considering that the battery sea freight can take months in some locations.

- Whenever possible, speed up internal procurement processes when there are already project agreements in place. This can include dialogue with local authorities to speed up tax exemption processes. The recommended incoterm for the shipment of spare parts is DAP.

- As outlined in section 5, ensure quantitative and qualitative monitoring from repair technicians, so additional training, spare parts and/or tools can be provided as new findings come to light.

- Allow a communication mechanism between repair technicians and product manufacturers so that product designs can be adapted for repairability.

Tool 6.G: Repair technicians services checklist 

Available at Solvoz.com

The below provides a repair services checklist for engaging repair technicians. Some of these may or may not be applicable to the informal sector, and/or capacities within the informal sector may need to be built up to enable criteria to be met.

Criteria	Requirement	Y/N
Administration (applicable to formal sector only)	An active registration.	
	Audited accounts or up to date accounts.	
	Have a good reputation in community and transparent ownership with good reputation of owners, directors and board members.	
	Service contract includes minimum repairs provided.	
	Have insurance for property and equipment.	
	The service provider should be able to keep basic paperwork, quotations, invoices, and tracking of jobs as well as keeping an inventory of the repair shop, spare parts and equipment.	
Location	Secure and accessible to displaced communities.	
	Secure agreement for use of the location.	
Infrastructure	Well-ventilated workspace with sufficient room.	
	Access to power for soldering irons, battery chargers, and testing power sources (DC) e.g., batteries via a viable power source such as solar system.	
Security	Lockable area for tools, equipment and products.	
Spare parts and tools	Stock of fast-moving spare parts.	
	Availability of the right tools and test equipment.	
	Inventory of spare parts and tools.	
	Fixed location (toolbox or board) for each repair tool and piece of equipment which allows regular inventories to be performed efficiently.	
	Access to suppliers of parts for more infrequent but expected repair jobs.	
Capacity	Staff have skills to repair.	
	Staff trained (formal or informal) and can undertake repairs with supervision or monitoring, including understanding safe handling, storage and disposal of e-waste (Refer Tool 6.D).	
	Staff have personal protective equipment for including gloves,	

	security goggles, and appropriate cotton clothes as relevant. (Refer Tool 6.D).	
Waste management	Contracts in place for pick-up or drop off of any waste to an accepted waste treatment location or sold to scrap dealers or a recycling company. It is important to understand the downstream practices to ensure full life-cycle responsibility. For example, some recyclers may not have the infrastructure to recycle specific types of e-waste and will only store it.	
	Appropriate storage for PCBs (printed circuit boards), cables, metals, plastics, glass and batteries prior to pick up or drop off (Refer Tool 6.D).	
Financial models	Repair cost should be based on local market value and should be less than the cost of a new product to incentivize repair over new purchases.	

Tool 6.H: Spare part requirements case studies

Solar panels were reported as being a key weak spot of solar lanterns. However, whilst these were sometimes dirty, when the voltage was tested with the galvanometer, it became clear that the solar panel itself was functioning. Upon further inspection, part of the cable was missing in all "broken" solar panels. The project sought information on community behaviours and found that many end-users cut and sell the solar panel cables to scrap dealers in the camp or attempt to charge other items directly. Constant communication with the technicians is required to understand what spare parts are needed, as well as what has caused the issue to identify the root causes of repairs to allow evaluation and adaptation of the spare parts and training as needed. (BRIGHT, 2023).

PCBAs were reported as the second most common component reported as broken by repair technicians. However, after discussions between repair technicians and supplier technical experts, it was found that PCBAs did not actually need to be replaced, but simply cleaned properly. Given the repair technicians didn`t have the correct tool for cleaning (i.e., a small vacuum cleaner or brush), the only way they could repair the lamp was by replacing it. This was a substantial finding considering that PCBAs have a higher carbon footprint than other spare parts. Once the issue was identified, the solar lantern manufacturer added cleaning tools to the next spare parts delivery free of charge.

Repair technicians were reporting old versions of solar products that were being requested for repair, that were not captured in the needs assessment. The spare parts and tools ordered for the displacement camp did not account for this model, which stopped distribution in 2014, highlighting the need for an in-depth needs assessment of all brands, models and types of e-waste requiring repair for accurate spare parts and tools procurement and trainings.

6.5Battery recycling

There are now technologies available to take apart batteries down to individual cells, for assessment and recovery and re-assembly them into battery packs for ongoing use. In traditional batteries, if one part fails, the entire product goes to waste, this new approach means that a single part can be swapped out for a working or updated replacement and the battery in its entirety can continue to fulfil its purpose.

This serviceable battery model can significantly reduce battery waste, as well as ensure that the maintenance, servicing, and upgrade can be carried out locally, creating jobs and reducing environmental footprint and delays from shipping. This approach presents a key empowerment opportunity for locals to be trained to maintain and service battery packs wherever they are in the world, creating much needed employment opportunities as well as guaranteeing consumers a robust support service network that does not need the products to be shipped to their original manufacturer or in far off countries.

Tool 6.I: Best practice guidelines for battery recycling

- On-site battery recycling is only recommended using approved infrastructure, with the ongoing support of an expert technical team.
- Collection of large volumes of used batteries with a high percentage of working viables cells is required, therefore the potential to get feedstock from within displacement settings, as well as surrounding host community and nearby towns/cities should be considered.
- Incentivization should be provided to accelerate collection of used batteries within the displacement setting.
- The location of the battery recycling facility should consider the availability of feedstock and market outlets for repurposed packs.
- Re-purposed battery packs can be sold to humanitarian agencies for their operations, to individuals e.g., for charging homes, electrical bikes, or other, to businesses e.g., supplying light at night, or to camp coordination for developing mini grids for displaced community energy access.
- Where possible, charging stations can be handed over to affected populations to manage as a local business for charging of power banks, mobile phones and other portable equipment.

6.6 Recycling and disposal

There are certain types or components of e-waste that cannot be safely traded within displacement settings (e.g., PV panels, PCBs and lead batteries), and need to be formally recycled or disposed of. It

is recommended to connect the informal collection and repair services from multiple displacement sites with the formal recycling and end-of-life management contractors, if possible, to ensure economies of scale and allow profit (if selling waste) or reduce costs (for disposal). Partnerships and cooperation with other product companies (such as in the mobile industry) as well as governments and development partners are recommended to be explored.

Tool 6.J: E-waste recycling and disposal centre service requirements, available at Solvoz.com

The below provides a recycling services checklist for engaging the formal recycling or disposal sector. Until technological advancements allow safe decentralized recycling practices, the informal sector should not be engaged for recycling of harmful components such as PV panels, PCBs and lead acid batteries, or for disposal due to the limited infrastructure available in displacement settings to do this safely.

Tool 6.K: Recycling and disposal services checklist 

Criteria	Requirement	Y/N
Off-site e-waste management	The contracted service provider is offsite (not in the camp) at an authorized e-waste management site. Such a facility must comply with the national laws and regulations with regard to transporting, handling, processing, and recycling of e-waste.	
E-waste treatment facility	The facility complies with national and/or local laws and regulations specifically relevant to handling, processing, and recycling of e-waste, and proper authorization by all appropriate governing authorities to perform such handling, processing, and recycling.	
Safety measures	The e-waste management facility has appropriate measures to safeguard occupational and environmental health and safety, including: • Environmental health & safety (EH&S) training of personnel, including training with regard to material and equipment handling, worker exposure, controlling releases and safety and emergency procedures. • Documentation that completion of an EH&S audit is completed and certified by a competent internal or external auditor on a periodic basis (generally annually). • The facility manages all materials to minimize adverse exposure to workers and releases to the environment. • The facility provides appropriate personal protection equipment (PPE) to workers.	
Transport of e-waste	The service provider adheres to local regulations when transporting waste from the camp to the facility.	

Inventory monitoring and administration	Inbound and outbound materials arising from the collected e-waste are safely stored and monitored, including: • Storage areas adequate to hold all processed and unprocessed inventory. • Use of a regularly implemented and documented monitoring and record-keeping program that tracks inbound material weights (total) and outbound material weights (total to each destination). • Records of transactions that involve the export of materials to a foreign country (directly or indirectly through downstream market contractors).	
Hazard and accident contingency plan	The e-waste management facility has appropriate measures for potential hazards caused by the operation, including: • Written hazardous materials identification and management plan. • A system for identifying and properly managing hazardous components (e.g., circuit boards, batteries, CRTs, mercury phosphor lamps, etc.) that are removed from e-waste during dismantling and treatment operations. • A written plan for reporting and responding to exceptional pollutant releases, including emergencies such as accidents, spills, fires, and explosions. • Maintenance of Commercial General Liability Insurance or equivalent corporate guarantee for accidents and other emergencies as required by local regulations.	

If the transfer of collected e-waste to an authorised facility is not possible (low volume of e-waste for a transport, no e-waste treatment facility in reasonable distance nor in the country, etc), and/or if there are regional regulations that prohibit the transfer of hazardous waste such as e-waste, which prevent the sound and sustainable e-waste management in countries without proper e-waste treatment facilities, e-waste must be stored and managed on-site until the situation changes in these situations. Some African regions are in discussion of lifting a transboundary transport ban for certain classes of waste to facilitate the waste management.

Criteria	Requirement	Y/N
On-site storage	E-waste not able to be recycled or disposed of at the facility is stored on-site in waterproof containers or on roofed shelves where there is a future intention to transfer the accumulated e-waste to an authorized facility.	
On-site underground storage	All types of batteries must be removed from e-waste prior to the e-waste being stored underground. E-waste must be contained in a waterproof container such as plastic containers. If removed batteries cannot be stored securely above-ground, they must be stored underground in sand-filled water-proof containers or lined pits (that do not allow runoff or seepage). The underground storage location must be registered and marked for a future recovery of e-waste.	

6.7 Circular business model

Circular business models enable closed resource loops to reduce the need for materials and resources whilst generating profit through repair, recycling, repurposing and recovery. However even in the most developed parts of the world, only up to 50% of e-product components (example from FairPhone) can be recycled properly. Therefore, recycling is not enough to reach a circular economy of e-products and there must be subsidies from polluters (manufactures) by the means of EPR (Extended Producer's Responsibility) mechanisms and/or from the government by the means of public subsidies. In East Africa, the state subsidies for e-waste management do not exist as of 2023, therefore the creation of a circular economy in these settings (and others) must be financially supported by the displacement camp management or UN agencies.

One of the challenges with market-based solutions for energy access is that every context is different. Some potential income streams that can be explored are outlined below, which need to be assessed based on the income potential in each setting.

Income type	Example	Possible buyers / funders	Considerations
Payment for repairing products	Repairing e-products	Existing owners in and outside displacement setting including displaced communities, host communities, humanitarian organizations and local businesses.	The repaired/refurbished products already have an established market, indicating the existence of a demand for such items. However, the impact of the repaired/refurbished aspect on consumer willingness to purchase and the price they are willing to pay remains uncertain. The IOM repair feedback form has assessed the hypothetical willingness to pay for solar lamp repair services.
Sale of products	Sale of repaired e-products	End-users who want to purchase products at a lower price. Additionally, a seamless process for further repairs or product replacement in case of failure may be important to them. Businesses motivated by social and environmental benefits and who can be charged a price premium, or who want to purchase products at a power price.	Quality and warranty of the products must meet expectations and be comparable to other products. For businesses, gathering more data, not only from surveys and consumer behaviour to determining the price point. It would be advantageous to secure a few larger clients that prioritize the environmental and social aspects and are willing to pay a premium, whilst providing these businesses with documentation that can contribute positively to their climate accounting. These clients could be from both regional and international markets.
	Sale of refurbished battery packs	Businesses motivated by social and environmental benefits and who can be charged a price premium, or who want to purchase products at a power price.	It would be advantageous to secure a few larger clients that prioritize the environmental and social aspects and are willing to pay a premium, whilst providing these businesses with documentation that can contribute positively to their climate accounting. These clients could be from both regional and international markets.
	Sale of spare parts	Businesses motivated by	Quality and warranty of the products must meet expectations and be

	from unrepairable e-waste.	social and environmental benefits and who can be charged a price premium, or who want to purchase products at a power price.	comparable to other products.
Products as a service	A subscription service for e-products that includes repairs and swapping/upgrading of products.	Displaced populations, host community, businesses, other organizations	This model addresses concerns about the quality of used products by providing a seamless service for swapping or repairing over time. Additionally, with a subscription model, customers have the flexibility to upgrade, or downgrade based on their changing needs at a lower cost. In the procurement process for new products by the humanitarian sector, specifications could include requirements for products-as-a-service, with suppliers encouraged to meet sustainability criteria. These models can also serve as frameworks for the sales of repaired/refurbished products within the solution. By adopting subscription-based services or similar models, the project can provide customers with the option to buy repaired or refurbished products without the uncertainty of longevity.
Selling collected e-waste	Tech companies buy their own products.	Apple, Samsung, Sony, Schneider Electrics, etc.	Tech companies like Apple and Samsung have established systems for buying back their e-waste due to the valuable components within the e-waste, creating a potential market. While the volumes required to secure agreements with these companies are uncertain, this could be a promising avenue to ensure high volumes of e-waste collection, and a financial incentive for collectors.
Urban mining (in partnership with existing informal actors)	Specific components/ resources from e-waste	Sale to specialized businesses and companies in the sector	Urban mining has emerged as a potential income stream, with an industry that focuses on the sales of valuable minerals extracted from e-waste, as exemplified by organizations like WeeCentre in Kenya (https://weeecentre.com/). This area holds the potential to increase the value of the collected waste and enhance the financial sustainability of the circular economy. Moreover, it can increase the value of the model by enabling the expansion of the types of e-waste collected and addressing the challenge of managing unrepairable products.

Carbon credits	By documenting the reduction of greenhouse gas in the solution carbon credits can be a potential source of income	Carbon credits markets	Carbon credits offer companies and individuals the opportunity to offset their unavoidable emissions by purchasing credits from certified activities that reduce or eliminate greenhouse gas (GHG). Projects that can demonstrate a substantial reduction in GHG emissions may be eligible to sell carbon credits in a marketplace, and this might be a viable option for the solution if it can get sufficient volume.
Extended producer responsibility	Producer contracts collection, repair, dismantling, segregation and storage of waste from the local waste management service providers, including the informal sector.	Manufacturers	Some e-waste fractions that cannot be safely recycled or disposed in the displacement setting will need to be sent to recyclers for treatment, recovery and disposal. This needs to be considered as part of the business model.
A compliance scheme or Producer Responsibility Organisation (PRO)	Fulfils the obligations on behalf of the members through contracts with local waste management service providers, including the informal sector.	Manufacturer group members	The compliance scheme/PRO manages the financing of the system, whereby members pay an annual fee for waste management services. The PRO runs as an independent for-profit company that acts as a service provider for producers.
Sales of collected data	Data on repairs, on consumer behavior, etc.	Research, private sector	
Private sector payment for research and development projects	Funding from industry and others for using the project as an arena for research (technical, behavioral, process)	Research, private sector	Research and development in displacement settings has ethical considerations, however creating a circular economy for e-waste provides a corporate social responsibility initiative for many organizations, which serves as a significant incentive for potential private sector partners.

Design of new products	Delivering products such as micro-grid-solutions based of recovered batteries	Private sector, camp coordination, humanitarian agencies, government	In addition to selling repaired/refurbished products, there is potential in incorporating them into more comprehensive offerings. For example, instead of selling battery packs individually, a subscription-based system could be implemented to sell complete microgrids with solar charging and integrated battery packs. This approach can increase the value of the products and mitigate any negative perceptions associated with "second-generation battery packs." The funding could be a mix of private and public sources, with a local entrepreneur(s) managing and operating the midi-grid system as a business. Scalable private sector is more suitable for mini-grid operation than the utilities. Hybrid operator models are also possible combining investment, ownership and operation which can be undertaken by different entities.
Training	Conduct training for other organizations and communities	Mainly B2B	An additional income stream could be the provision of training programs to other camps or organizations on the development of e-waste collection and repair systems. This training can be linked to the "start-up kit" and serve as a means of recruiting new organizations into the scaling process
Adding a component in procurement specifications	Specify the need for training as part of the delivery, and give the option to pay for using the existing platform	Suppliers	

7. CAPACITY BUILDING AND COMMUNITY ENGAGEMENT

7.1Communications campaigns

Communications campaigns are context specific, and the language, modality and message delivery will need to be assessed at a local level. There should be a strong focus on communications campaigns which is essential for both the financial viability and expansion and impact. High level best practice guidelines for communications campaigns for the creation of a circular economy for e-waste are provided below.

Tool 7.A: Best practice guidelines for communications campaigns for creating a circular economy for e-waste in displacement settings

- Consider timing so that communities are informed before services are available, to ensure there is sufficient volume of e-products or e-waste at the start of implementation, however not so long that they expect services quicker than what they arrive.

- Work closely with community leaders (religious leaders, women and youth representatives and local leaders. These will help spread awareness to communities via the different platforms available to them like church sessions and village meetings.

- Share or broadcast awareness messages in the commonly used languages to reach wider audiences.

- Use IEC materials to clearly describe the scope of your work and risks related to poor e-waste disposal. For instance, items considered for repair, how collection and handing back will be done and the time frames to avoid miss communication. Place IEC materials in conspicuous locations like at community halls, water collection points, among others.

- Inform affected populations about the issues of holding on to or retaining e-waste and where they may be able to repair items or sell the e-waste. In addition, show that repair is cheaper than on-selling waste, more effective than not repairing, and more convenient and cost efficient than getting a new product.

- The delivery of campaigns can be through a variety of actors including off grid solar companies, e-waste collectors, through targeted channels (such as SMS to existing consumer lists) or broadcast on radio, etc.

- Formulate a structured network within the camp (Refer Tool X.X) to support delivery of key messages, including the informal sector who will benefit from increased community awareness of services.

- Consider referrals discounts for customers that e.g., bring three additional families to the collection centre for dropping off e-waste. Positive word-of-mouth and recommendations from existing customers can significantly contribute to organic growth.

- Ensure customer dialogue at collection centres to support a seamless user experience, ensuring satisfaction throughout their interaction with the service to build trust and foster long-term engagement, as well as collecting stories that support monitoring data.

- Operations must uphold the services that communications campaign are advertising, delivering high standards in a reliable, efficient and effective way to contribute to customer retention.

7.2Collection and repair training

Collection and repair training is context specific, with the language, modality and best learning structures recommended to be assessed at a local level. High level best practice guidelines for collection and repair training for e-waste is provided below.

Tool 7.B: Collection and repair training best practice guidance

- Depending on the context, control over repairs in displacement settings can be difficult to control, especially when there is already a culture of repair, whereby technicians will repair e-products using skills they have if are not taught an alternative. For this reason, it is important to provide holistic training that covers a range of technical faults across the brands for specific products available in the camp. This may mean specialized technicians for specialized types of e-waste to reduce overwhelming technicians.

- It is important to continue mapping the types of repairs that are conducted outside the original training in order to evaluate their adequacy and to ensure that the repairs performance is optimized by connecting repair technicians with technical experts / suppliers.

- Raise awareness on the importance of completing optimal repairs which can pass the test of time and extend the life of the e-products as much as possible.

- If training is provided through digital platforms, training on the use of the digital platform may also be required, which improves their digital skills as an additional benefit to the collection or repair training.

- If using a digital platform, it is recommended each repair technician/storekeeper collector is provided with a tablet or similar to bookmark specific pages, take notes and set up the training content in a way that is best for them. This could include the use of sub-titles in different languages, or an audio voice narrating any videos.

- Training should be face to face where possible, with the instructor continuing oversight of the repairs until confidence in all repair types is established.

- It is recommended to go through the training material at least once before testing the repair steps on the e-products. This ensures that technicians undertake repair steps in the correct order, implementing an optimal repair routine.

- Linguistic and digital literacy may vary among participants; therefore, it is important that the trainer can offer technical support on how to operate the tablet as well as support the technical aspects of repairs.

- Allow storekeepers for collection and repair technicians to request further training, to support their professional development and skills. For example, in Bidibidi in Uganda, repair technicians requested additional training on how energy works, and how to speak more confidently to a group to communicate e-waste risks, which was self-identified as a skill needed for the role.

- Create a ‘certification scheme’ for storekeepers for collection and repair technicians to decrease the risk of poor-quality repairs. This improves the perception of the solution in the camps and supports career development.

- Ensure to include e-waste human health and environmental issues in the training so that not

only do storekeepers and technicians understand the "how" but the "why," and can pass this information on to other members of their community to further support the communications campaigns.

- Ensure to include occupational health and safety as part of the training, including provision of PPE.

7.3Community cohesion

The creation of a circular economy can support cohesion between displaced communities and host communities, by stimulating markets and increasing the flow and trade of products and services that are mutually beneficial for increasing income and social benefits.

Tool 7.C: Community cohesion case study

In Bidibidi, some affected populations had their solar panels stolen, or the glass broken from children playing soccer nearby. A community charging station was presented by the Yumbe District Government, where individuals could gather and charge their lamps from one solar panel grid, which would be equipped with energy storage systems (such as recycled battery packs) to extend the time and duration of electricity use. This can also support first time refugees with immediate and reliable energy access. This was positively received by the community. It should be studied in advance if this measure is accepted by the community and safe, and that it does not encourage other types of practices that might defeat the purpose (e.g., end-users might feel more motivated to sell solar lantern cables if they know they will have a permanent charging point).

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8. APPENDICES

8.1 IOM office battery management

IOM GUIDELINES ON OPERATIONAL BATTERY MANAGEMENT

Photo credit: IOM Yemen, 2022, © International Organization for Migration, 2022

BATTERY RECYCLING IN IOM OFFICES INCORPORATES THE FOLLOWING

1. Assigning responsibility
2. Consulting local regulations and guidelines
3. Conducting an inventory
4. Listing, where possible, local suppliers and recyclers
5. Establishing coordination plans with other UN agencies
6. Building staff capacity and awareness
7. Ensuring accessible and safe waste storage, recycling and disposal chain
8. Monitoring compliance
9. Tracking and reporting

IOM recognizes that a healthy environment is inherently linked to the safety, security and well-being of migrants and societies. As part of IOM's mission to uphold the well-being of migrants and communities, IOM made an institutional commitment in 2017 to mainstream environmental sustainability in its strategies, projects and programs, and facility management and operations. This commitment is in line with the environment-related commitments of the Sustainable Development Goals, the environmental sustainability related commitments of the United Nations and the latest Strategy for Sustainability Management in the United Nations System 2020-2030. To achieve these objectives, IOM launched its global Environmental Sustainability Programme, with a focus on three key environmental management areas: clean energy, water and waste management.

Two of IOM's key commitments are related to the clean energy transition: enabling access to clean energy in the organization's facilities and operations as well as in its projects, in line with Sustainable Development Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all, while ensuring environmentally sound management of waste associated with such transition, in accordance with Sustainable Development Goal 12: Ensure sustainable consumption and production patterns. Given the humanitarian sector and IOM's vision on the clean energy transition articulated through the sector-wide initiative, the Global Plan of Action for Sustainable Energy in Displacement Settings, IOM aims to ensure that challenges and opportunities related to e-waste, including batteries, are systematically addressed through a lifecycle approach and in partnership with relevant entities.

It is recognized that IOM has global missions in vastly different contexts, with different legislation, infrastructure and capacities to effectively manage batteries and other types of e-waste. This guidance is provided as an overarching framework or process to follow, whereby following the relevant guidelines more contextually specific mission-level processes can be developed.

For more information on the above activities please contact Environmental Sustainability Unit (ESU) at greening@iom.int

1. ASSIGN RESPONSIBILTY

Assign responsibility to specific individuals or departments for implementing and monitoring the policy.

2. CONSULT LOCAL REGULATIONS AND GUIDELINES

Consult with local regulations and guidelines regarding e-waste management to ensure compliance with applicable laws in your country or region.

3. CONDUCT AN INVENTORY

Perform an inventory assessment to identify the types and quantities of batteries used within the office.

Categorize the batteries based on their chemistry (e.g., lithium-ion, nickel-cadmium, lead-acid). Provide pictures. Include UBS batteries used in field missions where there are power outages.

Alkaline Batteries:

- Appearance: Alkaline batteries are cylindrical and have a metal casing with a positive and negative terminal on either end.
- Chemistry: Alkaline batteries use an alkaline electrolyte, typically a potassium hydroxide solution, and a zinc powder as the anode.
- Examples: AA, AAA, C, D, 9V batteries.

Lithium-Ion Batteries:

- Appearance: Lithium-ion batteries are typically rectangular or cylindrical, enclosed in a metal casing with two terminals.
- Chemistry: Lithium-ion batteries use a lithium compound as the cathode and a carbon-based material as the anode.
- Examples: Rechargeable laptop batteries, mobile phone batteries.

Nickel-Cadmium (NiCd) Batteries:

- Appearance: Nickel-cadmium batteries are cylindrical and have a metal casing with two terminals.
- Chemistry: NiCd batteries use nickel oxide hydroxide as the cathode, metallic cadmium as the anode, and potassium hydroxide as the electrolyte.
- Examples: Rechargeable AA, AAA batteries, power tool batteries.

Nickel-Metal Hydride (NiMH) Batteries:

- Appearance: Nickel-metal hydride batteries are similar in appearance to NiCd batteries, usually cylindrical with two terminals.
- Chemistry: NiMH batteries use a nickel oxide hydroxide cathode, a hydrogen-absorbing alloy as the anode, and potassium hydroxide as the electrolyte.
- Examples: Rechargeable AA, AAA batteries, hybrid car batteries.

Lead-Acid Batteries:

- Appearance: Lead-acid batteries are large and rectangular, consisting of multiple cells.
- Chemistry: Lead-acid batteries use a lead dioxide cathode, a sponge lead anode, and a sulfuric acid electrolyte.
- Examples: Automotive batteries, backup power supply batteries.

4. LIST LOCAL SUPPLIERS AND RECYCLERS

List, when possible, local suppliers and recyclers that would enable the long-term sustainable battery e-waste management.

5. ESTABLISH COORDINATION PLANS WITH OTHER UN AGENCIES

If applicable, establish coordination plans with other humanitarian actors to share battery collection and recycling processes.

6. BUILD CAPACITY AND AWARENESS

Conduct training sessions to raise awareness among staff about the importance of proper battery disposal and the potential environmental and health hazards associated with e-waste.

Provide guidelines on how to identify different types of batteries and separate them for recycling.

Conduct advocacy and awareness raising activities on rechargeable activities: Encourage the use of rechargeable batteries whenever possible to reduce the overall volume of battery e-waste generated.

7. ENSURE ACCESSIBLE AND SAFE WASTE STORAGE, RECYCLING AND DISPOSAL CHAIN

Implement Collection Points:

- Set up designated collection points within the office premises for employees to deposit used batteries.
- Clearly label the collection points and provide information on accepted battery types and recycling procedures.

Ensure Safe Storage:

- Store collected batteries in a safe and secure location, away from potential hazards such as extreme heat, moisture, or flammable materials.
- Implement proper containment measures to prevent leaks or spills.

Contract with Certified Recyclers:

- Establish partnerships with certified e-waste recycling vendors who specialize in handling batteries.
- Verify that the recyclers adhere to environmentally sound practices and comply with relevant regulations.

Arrange Regular Pick-ups:

- Schedule regular pickups or drop-offs with the chosen recycling vendor to ensure timely and proper disposal of collected batteries.
- Keep records of the quantities and types of batteries handed over for recycling.

8. MONITOR COMPLIANCE

Conduct periodic audits to ensure compliance with battery disposal procedures and adherence to the organization's policy.

Address any issues or non-compliance promptly and provide additional training if necessary.

9. TRACK AND REPORT

Maintain records of battery disposal activities, including quantities recycled, recycling certificates, and any relevant documentation.

Prepare periodic reports on battery e-waste management efforts, including key metrics and achievements.

Maintain records of associated costs to enable their inclusion in future donor proposals.

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