

E-WASTE MANAGEMENT STRATEGIES IN REFUGEE CONTEXTS

About SUN-ESDS

Energy Solutions for Displacement Settings (SUN-SUN-ESDS) is a component of the Global Programme with UNHCR (SUN), which is commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) and implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The Global Programme supports UNHCR in facilitating the operationalisation of the Global Compact on Refugees (GCR) in the Humanitarian-Development-Peace (HDP)

Nexus. Its core mission is to address pressing energy challenges faced by populations affected by displacement. By focusing on the integration and deployment of reliable, clean, and sustainable energy solutions, SUN-ESDS aims to enhance the quality of life, well-being, and environmental conditions of affected communities. The project is instrumental in supporting the wider humanitarian, development and peace community in meeting the objectives of the Global Compact on Refugees (GCR).

Overview of the E-waste Challenge

The growing use of solar electric products in humanitarian settings, whether imported, sold by local vendors, or distributed by humanitarian agencies as core relief items, poses a significant challenge. Since 2017, approximately **114,473** solar lanterns have been distributed in refugee settlements in Uganda's West Nile region, with additional lanterns acquired through vendors in local markets. However, current e-waste management practices in displacement contexts are insufficient, creating serious risks to human and environmental health.

Improper disposal of solar electric products often leads to the release of toxic substances into the environment, exacerbating vulnerabilities in already fragile communities. A widespread practice, such as burning e-waste, further compounds these risks. Solar lanterns are a major contributor to the problem. While they provide critical lighting, they are often treated as disposable items due to their design and materials, which lead to rapid degradation. This not only worsens the waste issue but also undermines their intended long-term benefits.



Solar lantern. Photo Credit: Malaika/GIZ

Since 2017

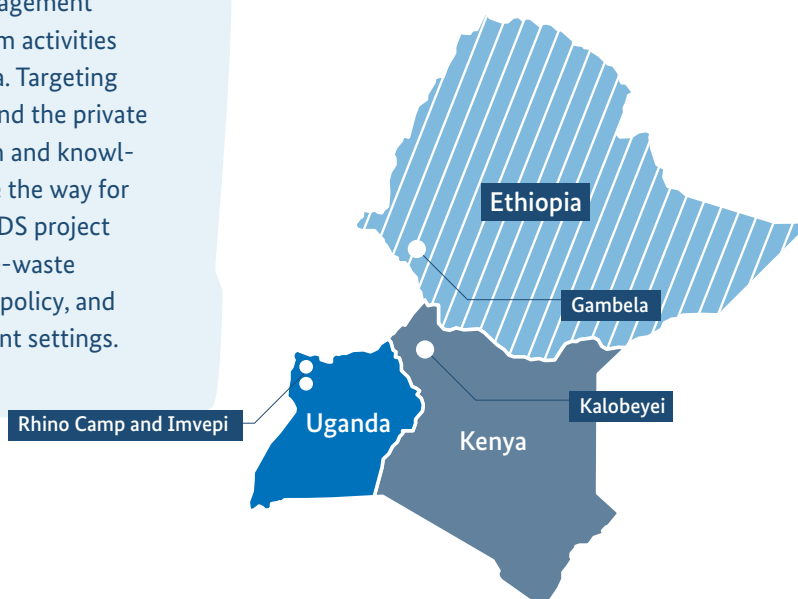
114,473

Solar lanterns in Uganda's West Nile region

There is potential to address this problem through repair and reuse. Many solar lanterns with defective wires or batteries can be repaired easily, as the repairs are straightforward and spare parts accessible. Leveraging these opportunities can help reduce waste while extending the lifecycle of these vital devices.

Description of the Intervention

The SUN-ESDS e-waste intervention aims to develop effective and sustainable e-waste management strategies by distilling lessons learned from activities conducted in Ethiopia, Kenya, and Uganda. Targeting humanitarian organisations, consumers, and the private sector, the project facilitates collaboration and knowledge-sharing among stakeholders to pave the way for improved e-waste solutions. The SUN-ESDS project seeks to create a structured approach to e-waste management that incorporates technical, policy, and business strategies tailored to displacement settings.



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| Locations: | Kalobeyei, Kenya / Rhino Camp and Imvepi Refugee Settlements, Uganda / Gambela, Ethiopia Global: advisory services for UNHCR HQ |
| Target group: | Humanitarian organisations, consumers in the local community and private sector |
| Timeframe: | February 2022 – December 2024 |

Methodology of the Intervention

The SUN-ESDS initiated e-waste activities with a structured approach, beginning with commissioning comprehensive studies and assessments, such as a **Baseline Assessment on Electronic Waste – Management and Extended Producer Responsibility in Displacement Settings** in Ethiopia, Kenya, and Uganda. These efforts aimed to establish a solid foundation for addressing e-waste management challenges and exploring potential opportunities. Key activities included reviewing international e-waste management practices and standards, examining regulatory and legislative frameworks, mapping waste electrical and electronic equipment (WEEE) flows and product lifecycles, and analysing energy-related activities or strategies among humanitarian organizations (e.g., UNHCR).

Additionally, a detailed mapping of relevant stakeholders and actors within settlement contexts in each country was conducted, along with a series of techno-economic feasibility studies assessing e-waste collection, re-use, and refurbishment potential.

Through its co-lead function in a multi-organisational e-waste task force with UNHCR, IOM, WFP, NORCAP and the GPA, SUN-ESDS facilitated discussions on the results of ongoing studies to further guide intervention design and elaboration of relevant activities. These followed a multi-pronged strategy to explore and implement a variety of solutions to address e-waste management challenges in the various settings.

Key activities of the SUN-ESDS e-waste intervention include:

The design and piloting of cost-effective and sustainable solutions for the collection, refurbishment, repair, and recycling of solar e-waste through the establishment of e-waste collection in Uganda.

Training of a new cadre of e-waste technicians and waste entrepreneurs (WEs) in Ethiopia and Uganda, to create community benefits and new job opportunities in displacement settings.

E-waste Awareness Campaigns in Kenya aimed to increase the management skills of actors involved in the e-waste ecosystem, such as producers, retailers, and mini-grid operators, and in educating refugee and host communities on safe e-waste disposal methods and its relevance to health and environmental sustainability.

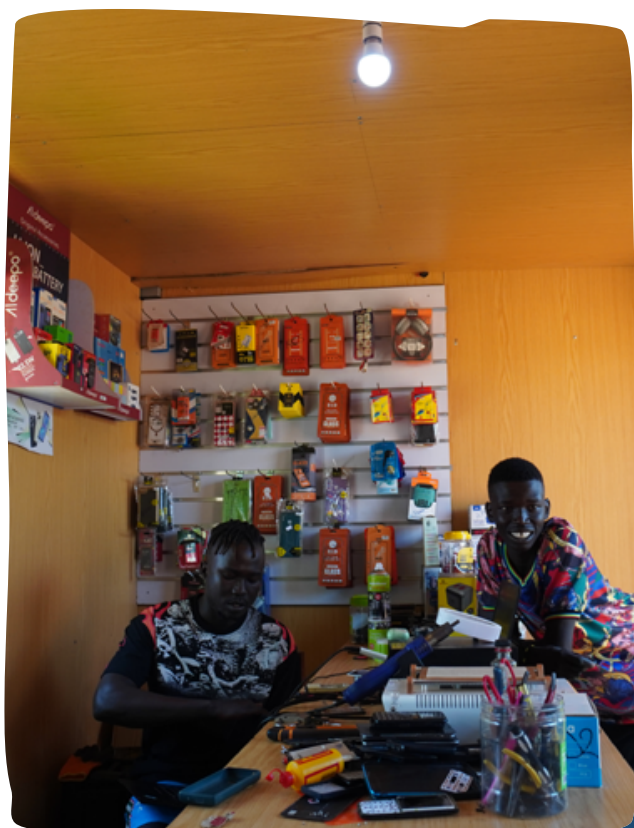


Solar E-waste Repair and Collection Centre – Imvepi
Photo Credit: Kisyá Freisleben/GIZ

Global activities to support the development of e-waste management strategies among humanitarian organisations and producers, with a strong emphasis on procurement processes and on extended producer responsibility (EPR) principles, as well as mainstreaming of e-waste management considerations in the design of broader energy projects implemented by HDP actors, including infrastructure development and energy services provision activities involving government and the private sector.

International knowledge-sharing has enhanced through collaboration with networks like the Humanitarian E-waste Network (HEWN) and the Multi-organizational E-waste Task Force, fostering dialogue and innovation among diverse global stakeholders. These efforts have positioned SUN-ESDS as a driving force in aligning international initiatives and promoting sustainable e-waste management practices.

Additionally, SUN-ESDS has **leveraged Energypedia as a key platform** to share studies, insights, and best practices, thereby raising awareness of effective e-waste management strategies.



Solar E-waste Repair and Collection Centre – Ofua
Photo Credit: Kisyá Freisleben/GIZ

Achievements and Initial Impacts

Following thoughtful business scenario considerations in **Uganda**, ESDS supported a pilot project which saw the establishment of three repair workshops and storage facilities in the West Nile region of Uganda (Imvepi and Rhino Camp Refugee Settlements). The repair workshops were planned to facilitate the repair of solar lanterns and other small Electrical and Electronic Equipment (EEE) such as radios, speakers, and mobile phones. Training on e-waste and circularity, with a strong focus on solar lantern repairs for 15 technicians (including two women) from various refugee settlements the West Nile region who were pre-identified based on their existing engagement in repair activities. Trained participants were equipped with repair kits which in addition to basic repair tools, comprised of electrical testing devices, soldering equipment, and personal protective equipment (PPE).



Training for 15 technicians (including two women)



The repair and collection centres in Imvepi and Rhino Camp Refugee Settlements in Uganda and an e-waste collection point in Gambella, **Ethiopia**, were deliberately established near existing energy and repair service providers, such as energy kiosks and phone repair shops active in the camps, or set-up in areas where gaps were observed. This was essential to ensure e-waste management coverage and consumer convenience which is critical for fostering awareness of e-waste management options and other conducive behaviour. Consumers in Uganda were incentivized to use the new e-waste facilities to get broken EEE repaired or dispose of their existing WEEE during an awareness campaign that provided repairs for broken EEE at no service fee, though spare parts had to be paid.

The collection points in **Uganda** were designed to provide safe storage to support future recycling and refurbishment of e-waste items such as batteries and solar lanterns. This would be achieved with the support of existing and new WEs, as well as improved WEEE value-chain linkages with upstream actors. Early linkages have already been forged through collaboration support related to spare parts exchange, battery refurbishment and joint collection/safe storage and onward transmission with other HDP actors in a neighbouring refugee settlement. These are important steps for the further market development of WEEE refurbishment and recycling services in both refugee settings and in national contexts.



New collection points provide safe storage to support future recycling and refurbishment of e-waste



Consideration of e-waste into the planning of new policies and infrastructure development

Other important achievements include the integration of e-waste consideration into the planning of new policies and infrastructure development initiatives, such as mini-grid development activities in the Kalobeyi settlement in **Kenya**. For example, private sector has been sensitized through targeted technical assistance to include e-waste considerations in their technical and financial modelling efforts, and awareness of e-waste management has also been mainstreamed into technical trainings focused on the operation and maintenance of distribution network infrastructure. Strong results have also been achieved through SUN-ESDS's work with a multi-organisational E-waste Task Force which explored steps that can be taken to promote stronger EPR principles by HDP actors to make producers and importers more accountable for the lifecycle of EEE and their safe disposal.

Best Practices and Sustainability Aspects

The SUN-ESDS has been pivotal in establishing e-waste management systems and policies across various humanitarian settings. Through its research, assessments, and knowledge-sharing initiatives, the SUN-ESDS has illuminated the challenges and potential of WEEE while complementing these efforts with behavioural data and cost scenarios to drive business development and coordinated action among humanitarian organisations. The technical feasibility studies were crucial in planning and designing the e-waste activities and for tailoring approaches for the different countries.

The pilot e-waste repair and collection centres are a cornerstone of the SUN-ESDS approach to managing e-waste in displacement settings. Drawing on business insights and research, these centres provide a strategic foundation for implementing effective and scalable solutions. The SUN-ESDS initiative has also contributed to the development of actionable policy recommendations and played a pivotal role in shaping UNHCR's **Operational Strategy for Climate Resilience and Environmental Sustainability 2022-2025**. This strategy guides UNHCR's responses for recycling and reusing solar lanterns and introduction of safe recycling and disposal systems, underscoring a strong commitment to advancing e-waste management in humanitarian-development-peace (HDP) contexts.



E-waste repair and collection centre, Rhino Camp Refugee Settlement; Uganda. Photo Credit: Sandra Haskamp



Solar Jerusalem Trading Centre Mini-grid in Uganda. Photo Credit: NOA Uganda

By integrating e-waste management with broader energy initiatives, such as solar mini-grids in Kenya, the SUN-ESDS demonstrates a model of sustainability and practical implementation in complex environments. These initiative-taking efforts serve as a platform for testing and refining strategies to enable the wider adoption of e-waste management solutions.

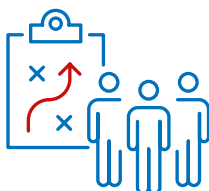
This approach highlights the project's dedication to transforming challenges into opportunities, paving the way for environmentally sustainable energy systems that enhance living conditions for refugees and host communities alike. Through these initiatives, the SUN-ESDS sets a benchmark for innovative, inclusive, and sustainable energy practices in displacement settings.

Challenges and Lessons Learnt

The ESDS project was a pilot, emphasizing the need to distil lessons learned and distribute them for broader application. This iterative process of learning and adaptation is crucial for scaling successful practices. Through desk-based research, recent on-the-ground assessments, and follow-up interactions with a range of engaged stakeholders, several challenges for e-waste management in displacement settings and the sustainability of activities initiated by SUN-ESDS have been identified. These include:



Importance of regulation: Regulatory changes are anticipated to have a greater impact on e-waste management than isolated efforts to pilot local e-waste repair and collection centres. Effective e-waste management in displacement settings demands strong collaboration among vendors, producers, national policymakers, and HDP actors. Sustainable progress is unlikely if initiatives are not aligned with national policies and broader developments.



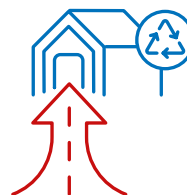
Operational and Management Issues in E-repair

Centres: Despite the training of WEs that included a training component on how and where to obtain spare parts for EEE, the trained technicians report difficulties obtaining crucial spare parts like charging ports, switches, control boards, and batteries. Additionally, e-repair centres lack coherent business strategies and formal management structures, operating as disparate entities rather than unified service providers. Their large group sizes and lack of formal management structures adds complexities to decision-making. In those cases where they are in proximity to energy kiosks, the business viability of e-repair centres is undermined due to overlapping services, suggesting these centres may thrive only as components of an expansive e-waste management strategy that is strongly integrated in upstream WEEE activities.



Insufficient Time to Assess the Impact of Pilot

Activities: The exploration of E-waste management, recycling and refurbishment potential started in 2022 through the commissioning of several studies. Investment in facilities and technician's training for pilot activities in Uganda and Ethiopia were executed close to the project's end and afforded limited time for trained participants to establish and sustain operations, thus impeding comprehensive impact assessments. Nevertheless, the interventions provided an opportunity to pilot practical solutions for e-waste repair and collection, and the opportunity to raise further awareness among HDP actors.



Transportation Bottlenecks for E-waste Collection

Centres: For larger and more complex e-waste items, such as batteries, stronger partnerships with local and national government waste management and upstream actors are essential. Evidence suggests that the current volume of e-waste in displacement settings may not justify the economic costs of transportation to upstream processing entities, although this is expected to grow over time.



Lack of E-waste Awareness: Field assessments consistently highlight a significant need for education on safe e-waste disposal among consumers, as well as further capacity strengthening of WEs in collection, recycling and refurbishment activities. Strengthened country-specific regulations on EEE product quality and WEEE disposal are necessary to drive behavioural change among consumers and retailers. As energy services in displacement settings rise, particularly with the adoption of solar home systems, the issue of e-waste grows ever-more pressing.

Recommendations

Scaling the piloted e-waste management activities in displacement settings is gauged to be unviable and unsustainable without the ongoing support of HDP actors and transition to professional private sector actors with support from local and national government. This underscores the need for additional approaches that build connections across different actors in the WEEE value chain, alongside the need for establishing supportive national legislation, compliance mechanisms for Extended Producer Responsibility (EPR) and waste management and its operationalisation. Strengthening regulatory frameworks that integrate

HDP contexts, encourage partnerships, and support WEEE business development, combined with public awareness efforts, could foster behaviour change, and promote sustainability. While gaps of the kind mentioned above are seen in several countries, a strategic decision was taken to pilot only a limited number of e-waste value chain activities.

Based on the SUN-ESDS experience, the following recommendations are provided to support actors in their quest for sustainable solutions in displacement settings, and in for the broader environmental good:

Raise Awareness and Foster Behavioural

Change: Conduct targeted awareness raising for local communities to improve understanding of safe e-waste disposal methods, and knowledge of quality products and repair possibilities.

Advocate for Integrated E-waste Management

Systems: E-waste management provisions should be integrated in broader energy, environmental and humanitarian policies to ensure sustainability and scalability of supportive practices; they should also be integrated into procurement processes of HDP actors to ensure environmental accountability.

Scale Pilots but Carefully Consider Siting:

E-waste repair and collection centres are only likely to be successful as part of a broader system which incorporates user accessibility consideration and relevant upstream actors. Prioritizing siting of collection centres near existing energy or repair service providers can enhance accessibility and community engagement. Siting repair centres in proximity to existing energy service providers or energy kiosks is only likely to be successful if repair centres offer complementary services and therefore siting efforts should be carefully considered to safeguard business viability.

Promote Multi-Stakeholder Collaboration:

Leverage international platforms for knowledge-sharing to disseminate best practices and foster innovation and establish national or regional task forces or networks involving humanitarian actors, producers, distributors and policymakers to drive collection action; HDP actors, private sector and national and local governments should collaborate with each other to align efforts supportive toward e-waste management, including EPR frameworks that promote energy inclusion and circularity principles.

Enhance Capacity Building of WEs:

Expand local training programmes for WEs and technicians to include comprehensive repair, refurbishment, and business management skills. There is a need to focus on formalizing management structures and legal status of e-repair centre operators to improve efficiency and strengthen formal partnerships – this could be a potential immediate follow-up activity in Uganda.

Address Operational Bottlenecks:

Develop partnerships with other actors to overcome transportation challenges for bulky e-waste items; Strengthen supply chains for spare parts to support repair activities and improve the functionality of existing e-repair centres.

To ensure the sustainability and impact of the SUN-ESDS initiative, it is recommended to build upon its foundational activities through a follow-on project. Achieving long-term success will depend on establishing robust monitoring frameworks to evaluate the effectiveness of e-waste management strategies. Additionally, addressing regulatory barriers, enhancing business training, securing sustainable funding, and fostering alignment among diverse stakeholders will be critical.

The SUN-ESDS activities mark a pioneering effort in understanding and addressing e-waste challenges in displacement settings. These initiatives should be strengthened and supported to build on their early successes. Existing studies highlight that solar lanterns distributed by HDP actors are a significant contributor to Waste Electrical and Electronic Equipment (WEEE) in these settings. In the short to medium term, HDP actors must prioritize raising awareness about the importance of procuring durable electrical and electronic equipment (EEE) with locally repairable or replaceable components.

For immediate improvements, HDP actors are encouraged to review internal operational and procurement guidelines to emphasize the durability and reparability of EEE, both for in-house use and for distribution. For example, solar lantern procurement should prioritize third-party verified data over manufacturer-provided information to ensure quality and longevity. Standards such as the **Verasol Pico-PV Quality Standards (Version 8.0)**, adopted by UNHCR, provide reliable third-party verification mechanisms and are a best practice for solar equipment procurement. By aligning procurement guidelines with e-waste considerations, HDP actors can improve the environmental and health outcomes in displacement settings.

As cash and voucher systems become increasingly prevalent in HDP contexts, the demand for durable, quality-certified solar electric devices is expected to grow. To meet this demand, raising awareness of market opportunities for private sector actors and exploring public-private-community partnerships in e-waste management are essential. Capacity development and awareness-building efforts should target suppliers, vendors, procurers, and consumers to foster sustainable market-driven solutions.

By addressing these priorities, actors can continue to drive innovation and sustainability in e-waste management, creating positive impacts for displaced populations and host communities alike.

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