

# Advancing E-Waste Management & Circularity at Off-grid Solar Companies in Africa

Lessons Learned from a Technical Assistance Programme

**Programme Duration:** 8 Months

**Companies Engaged:** 15, financed through 3 investment funds

## Summary and Target Readership

This case study describes the approach and lessons learned from a **tailored 8-month technical assistance (TA) programme**, supporting off-grid solar<sup>1</sup> (OGS) companies across Africa with e-waste management and circularity topics.

The study is particularly relevant for stakeholders interested in OGS e-waste management, including:

- Donors and private-sector investors of TA programmes and Technical Assistance Facilities (TAFs)
- Managers of TA programmes and TAFs
- OGS companies who want to engage with TA providers and in TA programmes on e-waste management

It is also relevant to result-based financing (RBFs) and government-driven programmes that also have TA components.

**The case study is meant to spark conversations within organisations on how to best shape efforts to enable more effective OGS e-waste management.** The lessons learned – both success factors and challenges – are laid out transparently; it is hoped that this experience informs and inspires more such efforts to address the important social, environmental, and economic issue that is OGS e-waste.

# Abbreviations

<b>AGG</b>	Africa Go Green fund for Renewable Energy and Energy Efficiency
<b>C&amp;I</b>	Commercial and Industrial
<b>CAPEX</b>	Capital Expenditure
<b>CEI</b>	Circular Economy Initiative
<b>EEGF</b>	Energy Entrepreneurs Growth Fund
<b>EHS</b>	Environment, Health, and Safety
<b>ESG</b>	Environmental, Social, and Governance
<b>EV</b>	Electric Vehicle
<b>FEI OGEF</b>	Off-Grid Energy Access Fund
<b>FMO</b>	Nederlandse Financierings-Maatschappij voor Ontwikkelingslanden (Dutch Entrepreneurial Development Bank)
<b>GOGLA</b>	Global Off-Grid Lighting Association
<b>IP</b>	Intellectual Property
<b>KfW</b>	Kreditanstalt für Wiederaufbau (German Development Bank)
<b>OEM</b>	Original Equipment Manufacturer
<b>OGS</b>	Off-Grid Solar
<b>OPEX</b>	Operational Expenditure
<b>PCB</b>	Printed Circuit Board
<b>PRO</b>	Producer Responsibility Organisation
<b>RBF</b>	Results-Based Financing
<b>SECO</b>	State Secretariat for Economic Affairs (Switzerland)
<b>SOP</b>	Standard Operating Procedure
<b>SRI</b>	Sustainable Recycling Industries
<b>TA</b>	Technical Assistance

## About Cygnum Capital, Triple Jump, and the three funds

**Cygnum Capital** is a leading investment banking and asset management firm. It is the investment manager of the Africa Go Green fund for Renewable Energy and Energy Efficiency (AGG) and the Off-Grid Energy Access Fund (FEI OGEF). AGG was initiated by KfW on behalf of the German Government with a fund size of USD 138 million targeting investments mitigating or deducting greenhouse gas emissions pan-Africa. FEI OGEF provides flexible local currency solutions to companies and special purpose vehicles working on energy access in Africa.

**Triple Jump** is an impact-focused investment manager. It manages the Energy Entrepreneurs Growth Fund (EEGF), anchored by the Shell Foundation and FMO. With a fund size of USD 125 million, EEGF provides catalytic patient capital for early- and growth stage companies in Sub-Saharan Africa, operating in the access to energy ecosystem.

Besides financing, AGG, OGEF, and EEGF provide non-financial support to their investees, through their TAFs and in the form of various TA on individual and ecosystem level.

**The TA programme described in this case study marks the first cooperation between the funds' TAFs.** The funds had identified that they were investing in several of the same companies and, independently, each TAF had recognised e-waste as a priority topic requiring support. They concluded that a joint TA programme—targeting a group of companies from the portfolios—would lead to more meaningful, market-level impact while reducing duplication and saving time for the companies involved. As a result, the TAFs of the three funds signed a memorandum of understanding in 2024 and co-invested in the initiative. They coordinated effort through regular meetings among themselves and with the TA provider.

**dss+ is a leading international operations management consultancy.** With vast experience in e-waste management, including in OGS, it was hired as the TA provider for this programme in 2024. dss+ was also an active part of the design of the programme.

20 companies, investees of at least one of the funds, were targeted by the programme, and **15 participated**. They span different business models - OGS and electric vehicle (EV) manufacturers and distributors, investment platforms, commercial and industry (C&I) solar installers – and operate in **over 10 African countries**.



# 1. The Context and Motivation for Action

OGS<sup>1</sup> e-waste management is vital from multiple perspectives:

## 1.1 The Systemic Challenge Perspective:

- OGS e-waste quantities are growing with the number of products reaching end-of-life especially in mature markets. This includes components like PV panels, EV batteries<sup>2</sup>, mobile phones and other appliances. When not managed appropriately, e-waste brings about **negative environmental and social consequences** like pollution, contamination, and worsened human health.
- E-waste management poses a unique challenge for a price-sensitive, operationally complex industry like OGS. It is still not part of product pricing - which targets first and foremost end-user affordability as a key driver for energy access aims. **Albeit an absolute cost, efficiency is possible but only unlocked through joint work and aggregation of effort and quantities** between companies and even donors.
- **Limited overall e-waste management systems and policies** in OGS markets persist, disincentivising action for first movers. Infrastructures differ from geography to geography, warranting regional and robust yet innovative approaches – something the OGS sector is well-versed in.

## 1.2 The Funder Perspective:

- OGS e-waste is both a material **ESG and a reputational risk for funds**, thereby mandating targeted and practical fund action, especially from TAFs.
- As investment is provided individually to OGS companies, investees need to **lower company-level ESG risks** such as e-waste through tailored individual support.
- **Unlocking market-level benefits** that go beyond individual companies is also in the fund mandate and should be explored through joint activities, like research or joint TA.

## 1.3 The Company Perspective:

- E-waste is **not a core business priority for most OGS companies**, especially for smaller or emerging companies, with self-perceived durable products, and/or operations in challenging markets. It is costly to do, there is **limited curated operational and knowledge support**, and **multiple operational challenges** exist for those doing it.
- **Fulfilling fund ESG requirements and sustaining overall funder relations** requires engagement and action on the matter.
- As awareness of environmental issues grows among consumers, governments, and partners, **demonstrating proactive e-waste management** can differentiate OGS companies in a competitive market. Responsible end-of-life practices signal long-term commitment to sustainability, which can **enhance brand loyalty** and open doors to partnerships with like-minded organisations and governments.

To respond to the systemic, funder, and company-level motivations for action on OGS e-waste management, **in 2023-2024 a TA<sup>3</sup> programme was designed by Triple Jump's EEGF TAF, together with dss+, and later Cygnum Capital**. Involving the consultant more actively in the programme design ensured that its expertise on the topic could be leveraged at the key first moments. Joining forces meant that the three funds' TAFs could homogeneously target a bigger portfolio, optimising effort and outreach.

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<sup>1</sup> For the purposes of this case study, off-grid refers to various technologies like solar lanterns, small solar home systems, C&I, and EV motorbikes. Note that different actors adopt different definitions.

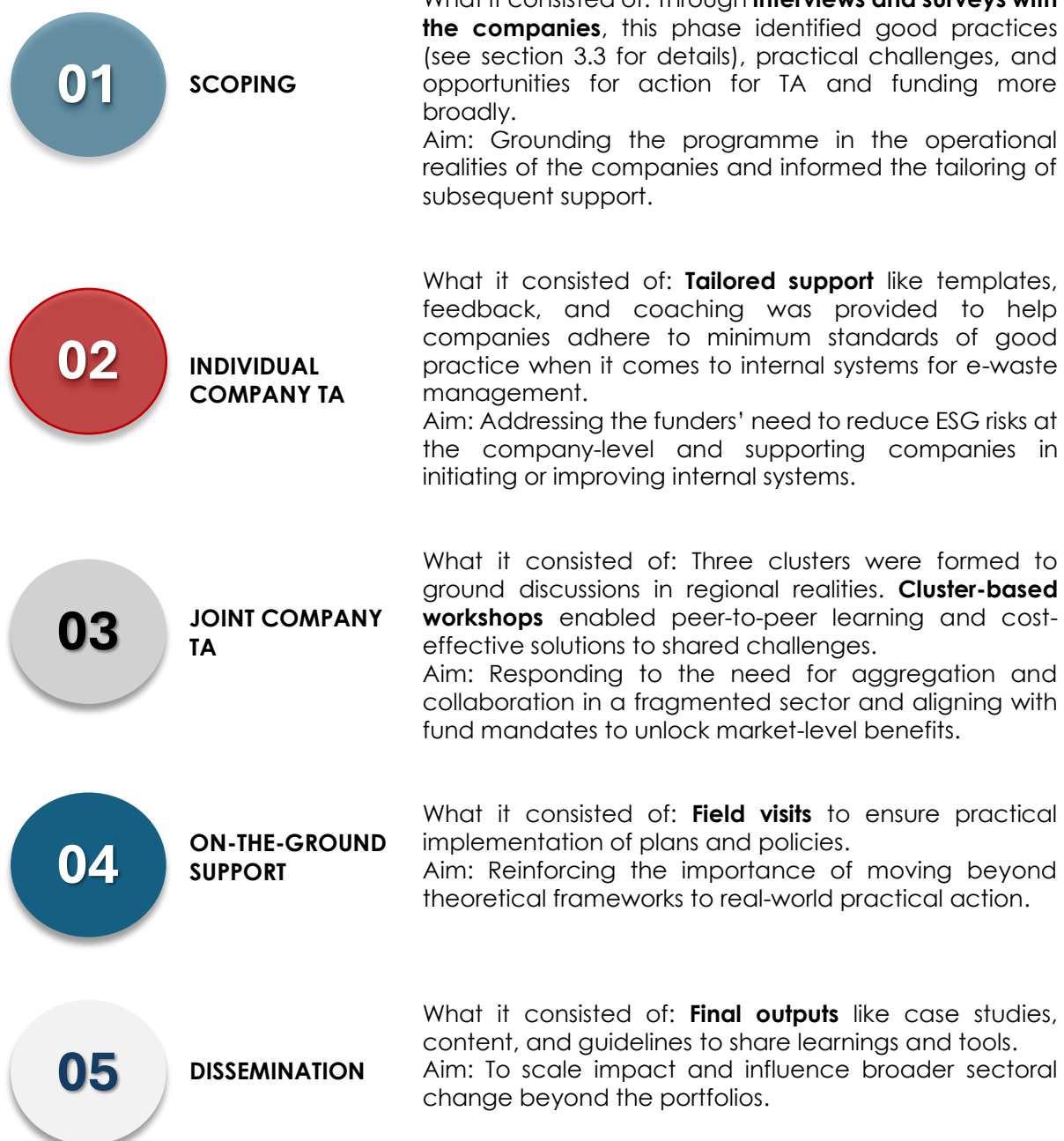
<sup>2</sup> Batteries are usually considered part of the strict definition of e-waste when they are part of electronic and electrical equipment – as they are not waste electronic and electrical equipment themselves.

<sup>3</sup> Technical Assistance (TA) is the provision of training, facilitation support, and new knowledge products to companies, to assist them in enhancing business performance, accessing finance and/or scaling up their operations.

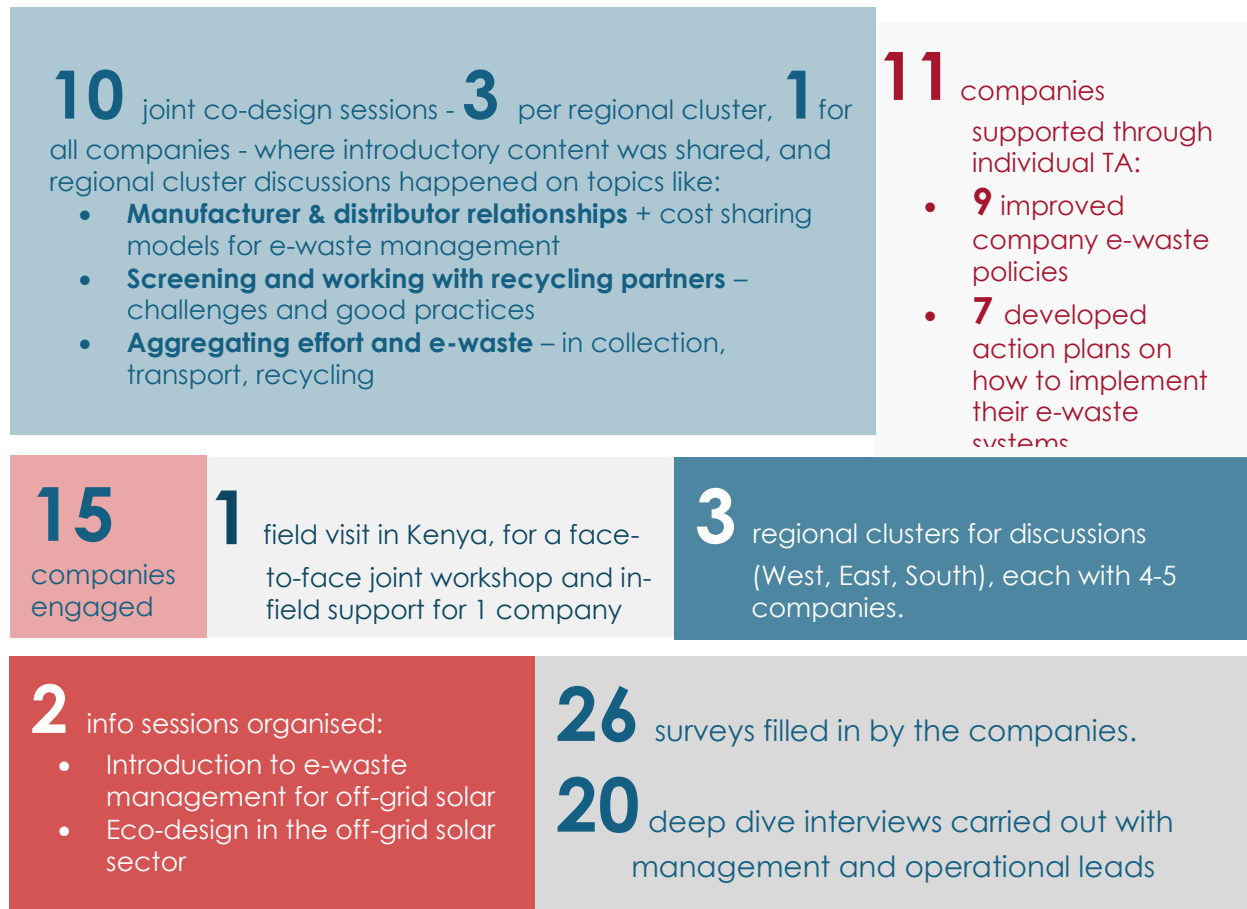
## 2. The Programme

### 2.1 Design

Recognising the growing environmental and social risks of unmanaged e-waste, the TA programme aimed to **build foundational systems**, like building relevant policies, procedures, and partnerships **at the company level while fostering solutions that require collective effort** (as discussed in point 3 below) **to sector-wide challenges**. It was structured into **five interlinked phases** (listed below), each addressing a specific motivation for action. Some of the phases overlapped throughout the **8-month duration** of the programme.



## 2.2 By the Numbers



Any TA programme needs to include impact in its design, by developing lean key performance indicators and defining its impact. Due to the relatively short duration of the assignment, impacts were not measured. The TA team intends to do an impact measurement exercise in the future.

## 2.3 Knowledge Products Created

Key outputs from the TA programme for the companies included:

- **Introductory material** such as templates for company-level systems, definitions and reading list of key reports and readily available toolkits
- **Open-source map of e-waste management service providers and a catalogue with further details** about the providers and generally e-waste services in Africa
- **Guidelines on safe handling of OGS e-waste (storage, transport)**
- **Summary of good practices, challenges and opportunities spotted across the portfolio**
- **Targeted content and materials developed for the regional co-design and info sessions, on multiple topics** (e.g. eco-design, provider auditing, cost sharing models, contracting, Guidance on waste transportation & recycling partner MoU's + IP clauses.

### 3. Emerging Insights on OGS E-Waste and Circularity

Through the TA programme, various insights about TA, but also circularity and e-waste management topics emerged. **A variety of good practices already implemented on company-level were identified.** Persistent structural challenges like missing local infrastructures for collection and treatment were also highlighted. However, overall e-waste management is often seen as a burden and an investor relations issue rather than an opportunity for bettering company operations overall.

#### 3.1 Technical Assistance for OGS E-Waste and Circularity

**Staff availability, incentives, and priorities are key to companies' ability to make the most of TA on e-waste management.** OGS company teams that work on e-waste (e.g. ESG teams) are often understaffed across multiple priorities, seeking convenience when evaluating potential TA opportunities. In addition, staff turnover and insufficient onboarding for new hires often preclude efficient internal knowledge management and deep e-waste conversations. This all impacts the company's overall capacity to effectively participate in and absorb the TA.

Some of the other important takeaways include:

##### **Onboarding companies:**

- Before beginning with the TA, introductory kick-off meetings had to be organised with each company to introduce the programme, set expectations, as well as to incentivise and ensure participation. This had not been planned for initially.

##### **Engagement with programme sessions**

- The participation in different TA sessions varied, with participants skipping sessions or coming to those that were convenient rather than the ones targeted for them. Regional sessions and discussions were therefore less productive than expected, for example. To accommodate for this, the TA team changed its approach mid-way and allowed for flexible participation, merging some sessions, and repeating and broadening the discussion when needed.

- New OGS staff were more active than others, as they saw the opportunity for the TA programme to help their own onboarding. The TA team therefore treated them as key champions across the group.
- The programmes offer of one-on-one TA support was not taken up from all investees and was mostly skipped by those without e-waste management contractual obligations. The TA team put effort into encouraging participation (e.g. multiple email reminders or nudges through the fund investment teams) but also valuing the choice and unavailability of companies.
- Digital sessions, while convenient and easy-to-access in theory, are often less convenient for OGS teams in practice. Internet/technical issues, participant distraction with other duties, as well as pre-conceptions that digital sessions are for listening in (rather than joint work) should be taken into consideration. The TA team managed to organise one face-to-face session, which was very positively perceived by participants, who requested more face-to-face interactions.

**TA on e-waste management is seen by companies as a driver for improved investor relations, but not for operations.** E-waste is often seen by OGS companies as a topic for investor relations rather than operations or strategy. Only established companies have significant e-waste amounts (and costs) to manage, with the rest experiencing the topic as rather abstract and currently non-material. Due to investor interest, however, OGS teams feel the need to act, to a certain extent.

- Investor presence in sessions increased participation. This was rather contrary to the TA team's initial belief that a safe

discussion space without investors would be seen as more valuable for the joint discussions of companies. The TA team therefore started using investor participation as a trigger for company participation in key sessions.

- Due to the lack of clear investor-driven incentives for the companies' participation (e.g. contractual obligation) and under conflicting business priorities, some companies decided not to make use of the TA, either partially or in full. The TA team put in effort to encourage participation (e.g. multiple email reminders, nudges

through the fund investment teams, etc.) but also valued the choice and unavailability of companies.

#### **Learnings on inclusiveness of approach**

- A dedicated email chain and two sessions were organised for TAFs, donors, investors, and programme managers working on OGS e-waste. Though not part of the original project design, they were added to facilitate discussions on donor approaches, incentive schemes, and to give high-level visibility to different strategies and mandates for company support and engagement.

## 3.2 Structural and Strategic Barriers to Effective OGS E-Waste Management

**Client management and end-user mindsets.** End-user participation in e-waste management is hindered by low awareness, trust issues, and logistical barriers, resulting in clients' reluctance to return or part with their old products. Some companies are attempting to address this through incentives, local ambassadors, and integrating e-waste messaging into customer communication channels.

**Traceability and e-waste management provider availability and reliability are major operational issues.** Companies consistently struggle to find trustworthy, licensed e-waste management providers, especially in challenging markets. Weak traceability, limited monitoring of provider practices, and the absence of joint collection points increase compliance risks and hinder responsible disposal. Even where some national e-waste policies exist, the lack of local treatment facilities renders them ineffective. Several companies emphasised the urgent need to build local capacity for e-waste collection and processing. The absence of a functioning local chain—from collection to treatment—forces reliance on costly and complex export routes that not all take. Long-term storage is often the only practical solution.

"The lack of a national e-waste policy is a gap, but there is an even bigger gap – what you can and cannot do without treatment facilities, regardless of whether a policy exists."  
(Company 2)

## 3.3 Company Practices and Identified Gaps in OGS E-Waste Management

**Foundational systems exist but lack strategic integration.** Many portfolio companies have created basic e-waste policies, standard operating procedures (SOPs), and safe storage practices. Some also monitor e-waste volumes and designate clear internal leads. However, these efforts often remain siloed and are not embedded into broader business routines or strategic planning. Ensuring that policies and procedures are part of company operations by design—rather than added as an afterthought—is vital. To remain relevant and effective, they must accurately reflect on-the-ground realities and be regularly updated. Training and capacity building of e-waste management, especially of relevant staff, is often insufficient or non-existing. Individual and team achievements and shortfalls should also be targeted through appropriate incentives.

**Cost pressures and limited cost awareness undermine action.** E-waste management is frequently deprioritised during business downtimes, as a non-core operation. While OGS

product affordability and company profitability concerns are well-known, companies also lack a full understanding of e-waste's cost implications-such as logistics, compliance, and infrastructure-which hampers effective budgeting and long-term planning.

**Product procurement and design for circularity remain underdeveloped in practice.** Balancing product affordability with durability remains a challenge, and distributors are struggling to form long-term original equipment manufacturer (OEM) partnerships considering e-waste, with issues like lack of trust and transparency, and perceptions for misaligned priorities around circularity. Embedding eco-design and ESG principles into procurement strategies is still at its onset, while batteries recycling, refurbishment, and safe storage are significant challenges.

“Top management doesn't always understand the topic and cannot give a strategic steer. The EHS department knows what it is doing but needs the steer. So, finding ways to increase the awareness of high-management and convince them is critical.”

(Company 14)

**Leadership awareness and governance are Inconsistent.** There is a certain level of disconnect between operational teams and top management. High management self-reports and is reported to be lacking full capabilities in e-waste management. At the same time, there is a difference in how management and other roles are reporting if basic e-waste systems exist (policy, SOP). Other roles are sometimes reporting that they do not know of these policies and processes, indicating some potential misalignment across role levels – e.g. policies, even if existing on paper, might not be well known and implemented at all different levels.

**Repair Feasibility is Lacking with Various Roadblocks.** For many OGS companies, integrating repair into operations is fraught with challenges. Spare parts are often hard to source, expensive due to import taxes, or of inconsistent quality. Even when parts are available, companies frequently lack the technical capacity to carry out repairs safely and efficiently. Intellectual property restrictions further complicate third-party repair options, limiting flexibility. Combined with a lack of industry momentum and incentives, repair remains more of an aspiration than a practical solution for many players in the sector.



Figure 1. Disassembly of a PCB board (Source: SRI)

## 3.4 Illustrative Company Journeys – What Drives or Derails Progress on E-Waste Management

### Case Study 1: A Model of Engagement and Progress

This relatively small solar home system company joined the TA programme later than most participants but quickly became a standout example of effective engagement. As both a manufacturer and distributor, with no existing e-waste policies or procedures, they started from scratch. A key factor in their success was the presence of a dedicated internal “e-waste champion” who served as a consistent point of contact. Using the templates and guidance provided, the company developed robust policies through several feedback rounds and an internal sprint. They also convened an internal strategy meeting to align on priorities, which directly informed a well-structured action plan. **This plan included achievable goals that accounted for budget, timelines, and operational priorities, demonstrating how tailored support and internal commitment can lead to meaningful progress in e-waste management in rather short time.**

### Case Study 2: Challenges of Capacity and Priorities

In contrast, the TA engagement with other larger manufacturer/distributor companies highlighted the difficulties of working with more complex and geographically spread organisations operating in multiple markets and regions. Two of these companies only had a single point of contact responsible for multiple jurisdictions, which limited their capacity to engage deeply with the TA process. Despite efforts to tailor support, such as offering to review existing policies and focus on priority areas, progress was slow and ultimately stalled due to delays and limited availability. External factors, including socio-political disruptions that forced operational shifts, further deprioritised e-waste initiatives in another smaller, single-market manufacturer. **Although additional resources and guidance were provided for future use, the TA support window concluded without measurable outcomes, underscoring the importance of internal bandwidth and stability for successful TA implementation.**



Figure 2. Face-to-face joint workshop in Nairobi, Kenya (March 2025)

## 4. Tips for Future Implementation

### 4.1 Tips for Investor and Donor Action of E-Waste Management

E-waste management is a systemic issue that needs to be targeted at different levels – OGS company, but also country and region. Missing physical infrastructures for collection, storage, repair, and treatment mean that TA programmes can only have a limited impact. Indeed, technical assistance is not a silver bullet – to work at best, it should be coupled with targeted financing, especially when it comes to physical infrastructures.

**Technical assistance, financing, and a mix thereof should all be considered when targeting the OGS e-waste topic.**

#### Through TA

##### Training

- Offer commercial training on costing and budgeting for e-waste management, especially for smaller distributors or more challenging markets.
- Provide technical training targeting both battery refurbishment and general repair.
- Offer strategic and business training for manufacturers on repair-enabling business models (e.g. accessory and component sales business management; certification for pre-owned/refurbished products).

##### Facilitation

- Assist companies in jointly finding and negotiating with e-waste management service providers, supporting aggregation of quantities and effort and good partnerships.
- Assist companies in continuously accessing good practices both from OGS but also broader EEE market.
- Continuously facilitate company conversations around joint advocacy and operational efforts, especially regionally.
- Facilitate a coalition/alliance for sustainable OGS product procurement.
- Facilitate discussions between companies and policy makers on e-waste transboundary movement and emerging EPR requirements.

##### Knowledge products

- Provide consistent access to basic knowledge products, maps, templates, guidance on applicable policies and legislation.

#### Through financing

##### Financing terms

- Incentivise and/or finance companies practicing e-waste management (e.g. include e-waste in financing terms, milestones, concessional interest rates).
- Include minimum requirements for reparability and recyclability of products in investment due diligence (for manufacturers).

##### Direct investment

- Align with other investors (also out of OGS space) to fund more e-waste management companies, regional-level treatment facilities, joint testing and repair facilities, combined local assembly and disassembly units, now largely missing.
- Fund collection infrastructure e.g. coordinated yearly collection drives and end-user programmes (awareness, repair roadshows, innovative incentives for return, repair, disposal).

#### Through TA and financing mix

- Provide individual support (TA and pilot funding) for developing company-level policies and systems.
- Facilitate OGS company coordination and fund CAPEX (e.g. equipment and facilities) where needed to enable producer responsibility organisations (PROs), regional hubs for storage and disposal.
- Pilot (fund software, TA) country-specific secondary markets for spare parts (e.g. starting at a single-country level).
- Fund end-user studies and tests in different countries on behaviours with solar (maintenance, repair, disposal). This is to support building common knowledge on finding effective end-user engagement strategies.

## 4.2 Tips for OGS Company Action on E-Waste Management

**OGS companies need support in their e-waste efforts yet can undertake rather simple steps to ensure progress on e-waste management.** They could:

- **Actively share with donors their e-waste pain-points and solutions** that can be solved through TA but also OPEX and CAPEX financing.
- Institutionalise e-waste management early in the company lifetime. **Adopt an e-waste policy and strategy first**, to send a strong signal to investors and donors on the importance of the topic.
- Also **assign clear internal responsibilities for the topic early on**, ideally as part of official job descriptions. The overall responsibility should lie with one e-waste champion who can drive the thinking and operationalisation internally. Target having both **high-management and operational staff involvement**.
- Leverage core local networks by partnering with community leaders or local influencers to act as e-waste ambassadors and **build trust with end-users**
- **Monitor and use key knowledge hubs like GOGLA** to get access to first key knowledge products (templates, maps, etc.) and insights but also contacts in the e-waste management space.
- **Strategically prioritise circularity**, making sure that e-waste is not an afterthought in the company's operational system. Ignite discussions across their own supply chains, with OEMs, distributors, and recyclers at minimum.



Figure 3. Shredded plastic segmented by colour (Source: SRI)

## 4.3 Tips for TA Design & Company Engagement for E-Waste Management

**As a TA leader, make sure that your TA delivery programme is well designed to ensure impact:**

- **Make your programme design flexible**, to incorporate lessons learned and adapt on-the-go during implementation.
- **Think carefully about the duration of your programme and its components.** A TA programme shorter than 6 months would not allow enough time for companies to implement all changes and learnings. Due to specific business times (investment rounds, core business downtimes), they might also not be able to participate. At the same time, designing for and incentivising work sprints (times when the companies dedicate significant time on a specific task) is warranted as it can ensure focus and outputs.
- **Ensure both operational and higher-level OGS management staff are targeted and involved – in different ways.** This would make sure the e-waste topic is not compartmentalised and can be looked at both the strategic and operational level – leader visions trickle down, and operational realities are incorporated in high-level thinking.
- **Prioritise face-to-face delivery for sessions that require joint discussion and co-design work.** Online sessions could be used for info sharing where discussion is not expected and reading materials disseminated. This will ensure focal OGS staff give their undivided attention.
- **Actively coordinate with other funders and donors – on TA efforts, approaches, and requirements.** This will ensure more efficient TA spending for better market-level results.

**As a TA leader, make sure companies allocate and prioritise the time they spend on TA absorption for any major environmental risks identified:**

- **Consistently show up and take interest in the topic**, explaining its high-level importance for your own strategy and own risk management approach.
- **Do ESG diagnostics relatively early in the investment cycle** (ideally for all material ESG risks), make TA participation part of their obligations to the investor or in the contracts.
- **Clarify early-on minimum performance requirements for companies** (e.g. existence of e-waste policy) and ideally make it part of their obligations or put it in the contracts.
- **Apart from financing TA, ideally finance the time of the company staff for absorbing the TA.** By providing a small internal budget to finance staff time, TA absorption becomes an official effort and mandates company action.
- At the same time, where possible, **make sure OGS companies can say no to TA offers and the outcomes of TA without the fear of possible repercussions, e.g. losing funding.** Clarifying numbers of participating companies early-enough with the TA provider (at scoping and not after contracting) is also warranted to ensure efficient TA fund spending.
- **Source ideas from the companies themselves on their priority core challenges they need support on.** This will ensure interest and. However, do not expect all companies to have an idea or willingness to act, or that TA is the only solution to all challenges.
- **Actively coordinate with other funders and donors – on TA efforts, approaches, and requirements.** This will signal companies you wish for efficiency and effective use of their time.

## 5. About the TA team

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