

Last mile repair

Innovation spotlight

May 2024



Extending product lifetimes through decentralised repair services

E-waste is the world's fastest-growing domestic waste stream, fuelled by higher consumption rates of electronic appliances, the rise of low-quality appliances with short product lifetimes, and few options for repair. A record 62 million metric tonnes (Mt) of electronic waste was generated worldwide in 2022 ([UN e-waste monitor](#)), up 82% from 2010. Whilst still only representing a fraction of the total volume, e-waste from off-grid energy products, such as solar lanterns and solar home systems, is set to grow exponentially in the very parts of the world that are currently least able to process it. The [Efficiency for Access Coalition](#) estimates that in 2020 more than 66 million off-grid solar products were no longer 'in use'. It is unlikely they have found their way into responsible electronic waste flows, which are non-existent or insufficient in low-income markets.

SolarAid, who have been pioneering e-waste management solutions in Zambia, found that almost 90% of non-functioning solar lanterns 'hibernate' within their customers' households. This is tragic because after examining some of these products, SolarAid found that more than 90% were repairable if customers or agents could access the right tools and spares (more findings from their research in 2022 and 2023 in the [SolarAid white paper](#)). It suggests that the vast majority of households are spending money purchasing new products when they could be saving money repairing their old ones.

Benefits of last mile repair services

1. Improved **customer satisfaction and loyalty**
2. New **revenue streams** from the same product
3. Opportunity to meet **sustainability commitments**



Building on learnings from pioneering last mile distributors

Traditionally, last mile distributors (LMDs) offer their customers basic troubleshooting support for products sold. Only LMDs with their own products, such as [Solar Village](#) who have developed a battery stick sprayer that is sold to small scale farmers in Zambia, offer more advanced repair services given their knowledge about the product and relationship with suppliers of the product's parts. However, in recent years, various LMDs have experimented with different approaches to expand on their repair services, from networks of trained and certified informal repair shops to repair apps. These yielded important lessons that other distributors should build on because implementing repair solutions is not easy and the effort should not be underestimated.

One could argue that LMDs operate business models which rely on repeat sales. And although customers may express willingness to pay for repair services, there is understandable concern that, by extending the lifetime of their products, LMDs and their sales agents will experience a loss in income. This is certainly a significant issue in a saturated market. The potential global off-grid solar market, however, is far from saturated, with still 733 million people without direct electricity access and another group of comparable size having unreliable grid access ([Lighting Global, 2022](#)).

Repair as the cornerstone of a circular economy

In a circular economy, the ability to repair is essential to prolong the life of a product or give broken appliances a second life, either by repairing for the same user, or by refurbishing and re-selling to someone new (often at a lower price). Repairing products requires a lot less energy and is generally cheaper than recycling them. This is because collecting and (centrally) processing e-waste relies on relatively expensive infrastructure and logistical operations. For emerging markets, where recycling infrastructure is often inadequate, repair presents an opportunity to delay the increasing volume of e-waste while providing a desired service to customers. Repair services, especially when organised using decentralised models by LMDs, can therefore offer a viable and scalable solution to extending the life of products sold and used in low-income markets.

If not repaired or unrepairable, households and repair shops might dispose of appliances or components in harmful ways ([USAID, 2019](#)), unaware they contain various hazardous materials, such as lead, cadmium, mercury, and sulfuric acid. These are substances which can cause serious adverse health effects to humans and the environment if not responsibly handled. Other households may hold on to the broken appliances and keep them at home. This is a missed opportunity for valuable electronic components to be reused in a circular economy, putting more pressure on finite planetary resources.



Opportunities and challenges for last mile distributors to offer repair services

Everyone deserves the opportunity to have their appliances repaired. Repair delivers significant social, economic, and environmental impact, and, as one of the market players relating most closely day-to-day with customers and their products, LMDs can play a key role in enabling these repair services.

Current practices

Globally, there is a resurgence of consumer interest in repairing products, as they seek to save costs by fixing what they have, rather than investing in new technologies ([The Guardian, 2020](#)). Low-income consumers are no different. In fact, these consumers have traditionally been more inclined to fix things rather than throw them away. A small-scale study of 114 people carried out by SolarAid's social enterprise [SunnyMoney](#) in Zambia, in 2020, found that 43% of the surveyed households tried to either fix their solar lights themselves or asked someone else to do so. This even happens during the warranty period, because according to SolarAid, households are sometimes not aware of their warranties or do not hold on to their receipts. In contexts where returning broken products to a vendor incurs time and travel costs, people often choose third-party repair offered in their communities, for example by informal repair workshops.

The informal sector handles the majority of repair and e-waste collections ([GSMA](#)), with some repair technicians extending their work to include solar repair. Some markets, like [Nigeria](#), have well-organised hierarchical informal e-waste ecosystems while others, like [Rwanda](#), are more dispersed and less organised. In Western Kenya, [Solibrium Solar](#) developed a first-of-its-kind [map](#) of the regional solar e-waste ecosystem, locating informal solar technicians. The capacity of these informal repair technicians is, however, often limited to a few repairs a day. The quality of their repairs can be compromised by a lack of tools and components, and to a lesser extent, limited skills which informal repair entrepreneurs typically gain through trial and error or by consulting their peers. [SunnyMoney](#) found that 60% of the repairs offered at local repair shops were not successful and, of those that were, few repaired products lasted longer than six months.



Why last mile distributors can and should play a role in improving repair and e-waste

LMDs are well positioned to influence consumer behaviour change

As trusted stakeholders, LMDs are well positioned to influence consumer behaviour change. A [USAID](#)-funded study in Uganda in 2019 found that a key predictor for more responsible e-waste disposal behaviour by rural

consumers is owning a branded appliance that a trusted distributor sells. This suggests that LMDs can educate customers about the opportunities for product repair and safe disposal.

LMDs can keep costs down for themselves and their customers alike

By setting up decentralised repair solutions, LMDs can keep costs down for themselves and their customers alike. Warranty packages for solar lanterns and solar home systems range from one to five years ([USAID, 2019](#)), with additional and sometimes longer component-based warranties offered by the original manufacturer. Under warranty protection, LMDs act as repair agents for manufacturers and perform repairs and replace faulty system components at no cost, though some charge for local transport or require their customers to travel with the product to a point of sale. In cases of system failure resulting from product misuse or failure outside the warranty period, companies will often repair the system for a fee. Basic troubleshooting and repair are already commonly practised by LMDs. If repair requires more advanced technical know-how, testing and equipment, or spare parts, products are typically returned to the

manufacturer, often outside the country. This requires investment in reverse logistics, which poses a key cost and affordability constraint in the context of rural economies. It also leaves customers without a product unless a (temporary) replacement is offered to them. This demands a decentralised approach in which LMDs organise local repair services. When SolarAid started to offer extended repair services to their last mile customers, they learned that many faulty products could be rather simply and cheaply “repaired” by, for example, replacing the battery (in about 69% of the cases), having dirt removed at the power switch, or fixing the wiring.

LMDs selling PAYGo appliances understand that assets which remain in need of repair during the customer’s payment period cost them money – whether in terms of lost revenue, the costs of storage or disposal. A product that is out of action represents lost income and customer dissatisfaction. If a product can be repaired locally, and quickly, all the better.

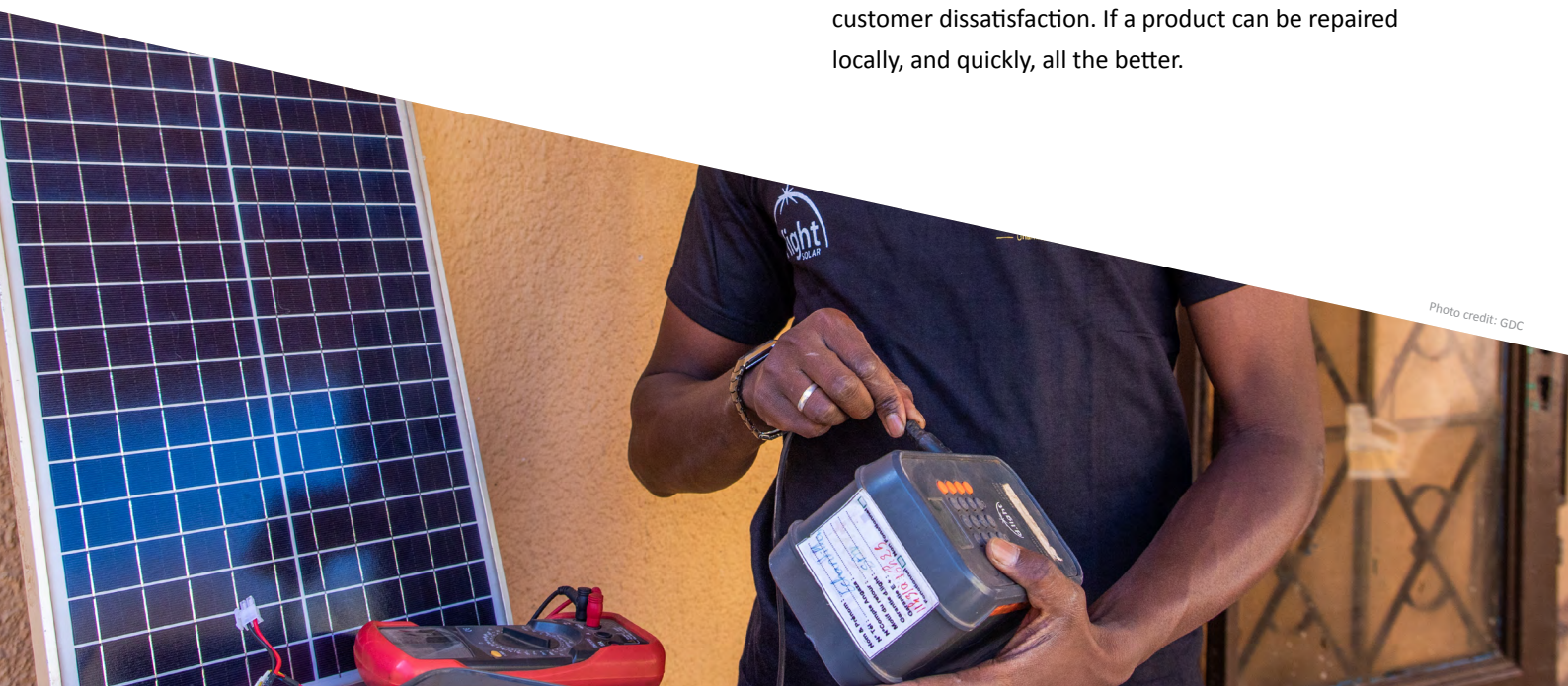


Photo credit: GDC

Offering repair services can open new doors for LMDs

Offering repair services can open new doors for LMDs with their existing customers. Embracing repair operations presents LMDs with an opportunity to enhance customer value and extend their relationships with customers through increased touchpoints, such as repair shops. These increased interactions can be leveraged to reacquaint the customer with the company's brand; introduce the customer to - and

provide demonstrations of - new products on offer; and, ultimately, up-sell customers additional products and services. This model therefore not only enables customers to access more support for in-warranty products requiring repair or replacement, it also offers a further revenue stream for LMDs through the sale of spare parts and repair services to customers with post-warranty products.

LMDs taking action can prepare the wider sector

LMDs taking action can prepare the wider sector for longer-term, positive change. By promoting repair and safe e-waste handling, LMDs help prepare the sector for future regulatory initiatives, such as the Extended Producer Responsibility (EPR) schemes that are already being implemented in countries like Kenya. The EPR schemes make manufacturers and importers

of electronic appliances responsible for cleaning up "their" e-waste. A transition to circular practices, with local repair as the cornerstone, also mitigates the potential risk to LMD brand names, as governments, donors and investors become increasingly concerned about the growing stream of toxic e-waste components in the sector.

Photo credit: Practical Action



Managing efficient repair operations can be challenging

[Efficiency for Access](#) examines issues that may restrict a company's ability or willingness to support repair. Besides their general resistance to change business models, Efficiency for Access cites safety and security concerns with the prospect of opening up products, as well as inadequate legislative support, as key reasons for their resistance. However, two specific barriers stand out that apply to LMDs: the cost and the complexity involved.

The associated financial costs of changing business and product strategies to include repair services can be substantial; often proving to be beyond the scope of viability for well-established, let alone new, LMDs. In addition, if LMDs have to pay manufacturers to import spare parts and the minimum order quantities required by manufacturers exceed what they need, this can make repair uneconomical (also, considering imported spare parts may also attract import or VAT duties). Access to appropriate and high-quality spare parts is a crucial barrier to repairability, which is exacerbated as

many manufacturers use non-universal parts and their updated models frequently introduce new components, making it hard for LMDs to keep up with the updates. Meanwhile, irregular and dispersed demand for spare parts can make the supply chain logistics challenging. Another issue flagged by Efficiency for Access is non-repairable product designs. Manufacturers, including those making products with PAYGo technology, traditionally opt for closed proprietary hardware ecosystems. While such a "black-box" design strategy protects their IP and ensures products are not tampered with, it limits the products' repairability. To combat this, and incentivise more positive strides, the [Global LEAP Awards](#) has provided recognition and grant funding to firms that improve the repairability of solar components. An example of this includes [Aceleron](#) in Kenya and Rwanda, which builds recyclable and easily repairable battery packs from waste cells collected from the off-grid solar sector (by late 2023, the UK company ceased to trade but their Kenyan entity continues to trade for the time being).



Photo credit: Esmart

Trailblazer story

SolarAid (Zambia)

“We’re ready for a repair revolution to help keep solar lights switched on for longer.”

About the organisation

Founded as an international charity in 2006, [SolarAid](#) has been combating poverty and climate change through its social enterprise SunnyMoney. After selling over two million solar products across rural Eastern and Southern Africa, it saw the obligation to formally tackle the challenge of broken solar products its customers were facing and reporting.

What have they accomplished so far?

Through their interactions with customers, SolarAid discovered that 89% of non-functioning solar products were ‘hibernating’ in the household. SolarAid has been testing different strategies designed to extend the lifespan of small solar products and build local repair capacity to benefit customers and reduce e-waste. SolarAid open sources its work so that learnings, knowledge and models can benefit and be adopted by the wider off-grid solar sector.

A key part of this work has been SolarAid’s work trialling different approaches to address the issue of solar e-waste. This has included a partnership with the University of Edinburgh in 2018/2019 to pilot the distribution of [SolarWhat?!:](#) “a small portable solar lamp that is easily repairable and powered by a mobile phone battery that is widely available across Africa”.

SolarAid was a Solar E-Waste Challenge winner of the 2019 [Global LEAP Awards](#). This provided pilot funding for them to conduct solar repair experiments across Zambia, including work with local repair technicians and building capacity to repair solar lights, as well as developing a repair mobile app to facilitate diagnosis and repair of solar lights by technicians in rural areas. The app can be freely downloaded at the [Google Play store](#). For those without smartphones, SolarAid prepared a [repair manual](#) that can be printed.

Most recently, with funding from GIZ, on behalf of the Federal Ministry for Economic Cooperation and Development, SolarAid implemented the Solar Saver: second-generation lights project in 2022 and 2023. The project had the objective of extending the life of small solar lights through better maintenance and repair for low-income Zambians. This was realised via experimenting with interventions that address many of the issues of solar repair and waste.



Photo credit: SolarAid /Jamiel Banda

Learnings

SolarAid found out that 91% of their customers' broken solar lanterns were repairable. They initiated the successful repair of 1,000 products of 21 different types. This was predominantly through equipping repair shops and sales agents, with limited prior knowledge of repair, with the tools they need to repair effectively and safely. As a result, customers built more trust and loyalty towards the SunnyMoney brand. 85% of participating customers said they would consider repair services again, as compared to 43% at the baseline. SolarAid's pilot results, learnings and recommendations can be found in their [white paper \(2023\)](#).

Understanding that localised repair is possible and effective, SolarAid is currently in the design stage for the scale-up of its repair project. They will conclude the economic viability of repair delivered by their agents as well as informal repair technicians, and package the business models and tools for distributors across the off-grid energy sector. This is while working with leading off-grid sector organisations to deliver research and capacity-building action to ensure repair can turn from a burden to an opportunity.

[Visit website](#)

Photo credit: SolarAid



Trailblazer story

ECO2LIBRIUM (Kenya)

“There’s no need to replicate a system that already exists.”

About the company

ECO2LIBRIUM (ECO2) applies business solutions to solve social and environmental problems. Its solar division, Solibrium Solar (a GDC member), has sold thousands of PAYGo solar home systems, amongst other products, to households, schools, churches, and small businesses in rural Kenya.

What have they accomplished so far?

In 2018, Solibrium started to explore business solutions that tackle the rising e-waste problem, as part of their [REWMOS Project](#), which was funded by the Swiss Government and myclimate Foundation. This was extended as part of the [I2G Project](#) – which was aimed at addressing the information and infrastructure gap in solar e-waste management in western Kenya - together with the Centre for Large Landscape Conservation and Foundation myclimate, and funded by a grant from the [Global LEAP Solar E-Waste Challenge](#). This work included a pioneering mapping of informal repair technicians that could offer e-waste takeback and repair services to Solibrium’s customers.

Photo credit: ECO2LIBRIUM



Learnings

So far, Solibrium has trained over 16 informal repair technicians, also known as Jua Kali in Kenya. Solibrium learned that many of them have built trusted relationships with last mile customers, which they could piggyback on. This group acted as a conduit to collect e-waste from rural communities and direct it to Solibrium while receiving support to access spare parts. Solibrium stores the e-waste at their warehouses as it has been too costly for them to transport it to a recycler in Nairobi; but this is a compromise that Solibrium is willing to take since it helps to prevent e-waste from being disposed of unsafely, which could result in environmental pollution.

Besides repairing the products of customers who pay for their service, Solibrium also orients the local repair technicians on opportunities to refurbish solar products and sell these to new customers. While Solibrium had to invest a lot in training repair technicians, they learned that the economics work out better if informal entrepreneurs purchase broken appliances from local households and refurbish them. They pay households a much smaller amount, as compared to when a company like Solibrium collects the broken appliances. Apparently, households are smart and expect companies to have more money to spend.

Having witnessed the potential of these local repair technicians, as well as the opportunity to present low-income households with cheaper refurbished products,

ECO2LIBRIUM decided to reduce their sales activities for new PAYGo appliances. Refurbished solar home systems can be sold at less than half the retail price of a new PAYGo system and do not require partial or daily payments, freeing households from a potential debt trap in the event of poor financial planning or monetary stress. In 2022, Solibrium therefore made a bold move to shift its focus from “selling as many solar products as possible” to “repairing and refurbishing as many solar products as possible”. For this purpose, they retain a small number of Solibrium sales agents and depend more on existing rural networks and word-of-mouth to sell products on a cash basis. Most of the sales, however, are expected to come from the informal repair shops, which Solibrium will continue to work with. In consultation with these repair shops, Solibrium sets standardised prices for refurbished items. These items generally do not come with a warranty as most customers understand that the purchase is at their own risk.

To finance their activities with informal technicians that collect, repair solar products, and sell refurbished ones, Solibrium continues to fundraise from donors who have a specific interest in combating e-waste. They will likely remain dependent on grants because making a business case for sales of refurbished products to customers in a market flooded with cheap alternatives remains a challenge.

[Visit website](#)

Photo credit: ECO2LIBRIUM



GETTING STARTED

Exploring the opportunity for your last mile distribution company to offer repair services

Good repair services bring faulty products to a condition where they can fulfil their intended use again. For LMDs to expand their repair operations beyond basic troubleshooting, the following success factors should be considered.

Can I offer repair services?

Are customers willing to pay for repairs (outside the warranty policy)?

Various studies have demonstrated that consumers are willing to make exceptional efforts for their product to be repaired when it is not covered by a warranty. Validating customers' willingness to pay is important before LMDs incur any additional expenses relating to agent training and/or procurement of spare parts and repair equipment. A large-scale [survey](#) of 1082 households in Odisha, India, found that people travelled, on average, more than 20 kilometres in search of repair services. A study by [UNSW and SolarAid](#) found that 30% of respondents in Kenya were willing to pay more than 20% of the original appliance cost as a repair fee. The other 70% said they would pay less than 20%. Note that this study did not consider quality and speed of repair, which could positively influence willingness to pay.

Tip



Conduct a survey among a small group of customers and gauge their interest in different repair offers and pricing models; from one-off repair fees to extended warranty periods and technical support plans, taking inspiration from e.g., [AppleCare+ subscriptions](#). When you talk to customers, also ask them what repair facilities they already use in case you are interested in exploring partnerships with local repair technicians.

Can the product be easily repaired?

When LMDs select new appliances to add to their product portfolio, they might not consider how easy the appliance will be to repair in the same way that they would typically consider brand reputation, product robustness, and affordability. For good repairability, system components need to be designed in a way that enables trained personnel to carry out repairs, preferably with locally available spare parts and equipment. This means that the casings of batteries and control devices must be easy to open and connections should not be glued or welded (note that, for safety reasons, some components, such as battery packs should be protected from manipulations). Furthermore, establishing lasting relationships with suppliers is important. They should not only provide guidance documents on how to conduct the most common repair operations, but they could also be requested to provide access to technical after-care expertise or 'train the repair agent trainer' courses, and commit to maintaining the guidance documents and stock of relevant spare parts for the entire lifetime of their products, or at least five years after delivery.

Tip



When you are first scoping out a new product to offer customers, be sure to check whether the battery casings, connections, etc., can be opened and not glued shut. You can also test out repairability with local (informal) repair shops by presenting them with your product and asking how easy it would be for them to repair or replace parts.

□ Can repair be carried out by local agents or technicians?

We can distinguish three models for local repair, which are not mutually exclusive but can be combined. These are in-house repair, third-party repair, and repair by consumers.

In-house repair

SolarAid found that their sales agents are capable of repairing solar lanterns after receiving the right technical training, tools, spare parts and documentation. Not all agents might be interested in this, but those that are will be building their skillset and adding repair as a new commercial service for “their” customers. LMDs should ensure these agents are adequately compensated for travel time and costs. Many agents already report that commissions do not take into account extra commitments like the time taken to travel to a customer’s home for after-sales support.

Third party repair

LMDs can also leverage the dynamic network of informal repair technicians that are found in great numbers in low-income countries, and who are already accessible and widely used by last mile customers. These informal technicians present an opportunity to fulfil a growing demand for repair services that exceeds what distributors’ agents can realistically offer. Rather than specialising in one type of product or brand, these technicians tend to be generalists; meaning it is important they attend rigorous, product-specific training and that they are certified by LMDs before customers are referred to them. For easy identification, these trained repairers could receive co-branding from the LMDs; essentially setting up an affiliate technician scheme. When collaborating with informal repair technicians, LMDs should consider whether they safely dispose of broken components that have been replaced or products that cannot be repaired. In East Africa, e-waste recyclers such as [Enviroserve](#) and [WEEE Centre](#) are licensed by national authorities to collect,

transport, and process unwanted electronic components. In Nigeria, [Hinckley Recycling](#) has been paving the way. LMDs will likely have to pay for their services or at least cover the costs of transporting the e-waste to their recycling facilities.

Repair by consumers

The most scalable, yet also the most challenging model, for the delivery of repair services is to empower customers to fix their own products. This includes making provisions for spare parts and offering repair guides in local languages that visually guide people through the repair process. LMDs could limit this approach to purely the diagnosis and repair of common faults with products that are fairly easy to repair. It is important that consumers are made aware that once they physically dismantle a product, with many manufacturers the product’s warranty will become void. Furthermore, safety precautions should be taken when dismantling electronic products. In the worst case, batteries can explode if screwdrivers are used with force.

If repair is carried out by the LMD’s personnel or by third parties in the same geography, the LMD should look up requirements for their electronics repair services to be registered with national institutions. SolarAid, for example, had to obtain a license from the Engineering Institution of Zambia (EIZ).

Tip



Compare different models for the delivery of repair services and consider the benefits and risks of each. Start small by focusing on the repair of one or two products, before tackling your entire portfolio.

□ Are spare parts and repair tools easily accessible?

Without easy access to quality-assured components, repair technicians or consumers will often use whatever is available, including salvaged parts from other products which may compromise the quality of repair services. The availability of (generic) spare parts in a country is often limited to mainstream products only, with spare parts being procured through local hardware stores, repair shops, or specialised agencies. For example, [Revivo](#), in Kenya, sells spare parts and accessories at wholesale prices on their webshop. In Honduras, LMD (and GDC member) [Soluz Honduras](#) assembles their own lithium battery packs to replace faulty batteries of their customers who are willing to pay for this service as it lets them enjoy a 10+ year product life. Soluz was not able to purchase replacement batteries from their supplier and therefore had to do it themselves.

Tip



Find out whether your manufacturer or importer stocks spare parts in your country and encourage them to provide a stock of spare parts with each new delivery based on your assumed failure rate. The willingness of manufacturers to facilitate local repair should be a key factor to consider when considering adding a new product to your portfolio.

If products are not repaired, make sure to take them back from customers

When LMDs choose not to offer repair services for post-warranty products, they could still consider taking faulty products back from their customers. This is crucial to make sure e-waste is treated responsibly, and that valuable components can be recovered for the production of new appliances. Although still a nascent industry, many countries now have e-waste recycling facilities that handle e-waste on behalf of manufacturers.

Taking back faulty products is, however, not as easy as it sounds. Besides the challenges of reverse logistics, agents will have to identify customers with broken products and convince them to let go of something to which they might be very much attached, particularly when the purchase was valuable to them (read more about take-back challenges in the [GOGLA e-waste briefing note](#), 2020). So, what can LMDs do about these challenges? First of all, communication with consumers is key, and cash or non-cash incentives to encourage customers to give up faulty products should be considered. [SolarNow](#) in Uganda found a way to make take-back efforts outside the warranty period profitable, by offering consumers vouchers which can be used to purchase a new or more superior SolarNow product. To increase the number of returns, [WeTu](#) and [d.light](#) have explored incentivising their customers or field agents. WeTu, for example, offered their customers, who are mostly fishermen, non-cash incentives such as drinking water and fishing lantern vouchers.



Photo credit: SolarAid/Jamiel Banda

Calling all governments, development partners, donors and investors!

The 'Right to Repair' movement, driven by the [European Commission](#) amongst others, advocates that products should last longer, that anyone must be able to obtain the information and spare parts they need to repair a product, and that product designs actually allow for repairs to take place. This growing global movement has focused attention on the need to create appropriate legislative and regulatory foundations to develop an effective and sustainable electronics repair economy. LMDs, with the support from regulators, could persuade suppliers to develop more durable products that are designed to be repaired at the last mile, with LMDs and their repair agents providing in-warranty repairs on behalf of manufacturers.

[Efficiency for Access](#) identified seven short- and long-term pathways to enhancing repairability in the off-grid energy access sector that are focused on standards, incentives, business models, product design, reporting and awareness raising, and research. Specifically, policymakers can incentivise repair by, for example, easing restrictions on the import of (good quality) spare parts and keeping import taxes and duties low. In their [white paper](#), SolarAid suggests more research that will help distributors of off-grid lighting solutions identify best practices for repair across different markets and national contexts. As shown by the trailblazing work of SolarAid and Solibrium, mentioned in this publication, donors can help last mile distributors de-risk the design and piloting of their decentralised repair approaches.

Whilst manufacturers have very logical and real reasons for retaining the 'black-box' approach for their PAYGo devices, there are areas where the industry could do more such as through interoperability, access to spare parts, and understanding common causes for failure. Manufacturers of solar products and other appliances should apply circular design strategies that aim to improve the durability of products, easing maintenance and repair, and allowing for components to be recovered and recycled ([TU Delft, Products that Last](#)). Manufacturers can leverage product failure insights that LMDs can share with them. For example, in one of their projects in Uganda, [BRIGHT](#) found that the buttons were one of the most common points of failure, which could be easily repaired. GIZ suggests setting minimum requirements for the repairability and recyclability of the equipment brought onto the market ([GIZ, 2022](#)), something CLASP will be facilitating through the creation of mandatory repairability metrics to the VeraSol standards, starting with electric pressure cookers, fans and solar water pumps.

GOGLA is working with manufacturers and, in 2021, they released a [white paper](#) and a [Connect Initiative](#) through which they advocates for interoperability and standardisation in the sector, in recognition of the problems posed by closed proprietary hardware ecosystems that have traditionally dominated the off-grid lighting sector. Also, GOGLA requires manufacturers, who are members of their association, to ensure that there are parts available locally for all replaceable solar home system components ([USAID, 2019](#)). Working with SolarAid, GOGLA plans to re-emphasise this policy and increase sector buy-in through their [Circularity](#) working group platform.

Side note: repair and the bigger picture of circular economies

Repairing products is important to help low-income consumers enjoy the benefits of their products for longer, and to minimise the number of products being thrown away or replaced; thereby reducing the volume of e-waste globally. However, we encourage stakeholders to look at the bigger picture and explore possible solutions for extended product lifetimes that go beyond just repair. Especially with the rise of non-quality verified products that tend to be of lower quality, LMDs play a role in educating consumers about the importance of purchasing high-quality and durable products that last longer. Though this may mean a higher initial purchasing cost, the expense can often be balanced out (or even reduced) over the course of the product's lifetime, due to less servicing requirements and fewer repair and replacement needs. Other emerging practices include Energy-as-a Service (EaaS) models in which companies retain the ownership of the product they rent to customers. This creates a higher incentive for the distributor to offer good maintenance and repair services over a longer period of time than a standard (PAYGo) loan as the tenure of the EaaS deal is the useful life of the product. Another practice is preventive maintenance for "smart" appliances that are equipped with sensors such as solar irrigation pumps. This lets companies such as [Futurepump](#) offer remote troubleshooting support based on device- and component-level performance data, helping to predict a fault before the consumer experiences any disruption. Although these smart products are more expensive, in the end, they have lower costs of after-sales support.

Market players to look out for

This is a non-exhaustive list that merely aims to get you started.

- Take a look at SolarAid's repair app which can be downloaded from the [Google Play store](#).
- [iFixit](#) is an online repository and community that offers more than 100,000 free repair manuals, including a number of [manuals](#) for solar lanterns.
- [Revivo](#) in Kenya has an online marketplace for spare parts and offers training to (informal) repair technicians.
- The [Kenya Solar Waste Collective](#) (KSWC), that currently consists of seven companies (Azuri, BBOX, d.light, ENGIE Energy Access, Greenlight Planet, M-KOPA, and TOTAL) and three advisors (GOGLA, KERA and Sofies), aims to develop a common strategy around the joint take-back of solar e-waste in response to new EPR regulations in Kenya.
- E-waste recyclers such as [Enviroserve](#) and [WEEE Centre](#) in Kenya, and [Hinckley Recycling](#) in Nigeria might be interested in partnering with LMDs and manufacturers. Some offer expertise in repair training or unlock networks to access (second-hand) spare parts.
- For second-life battery refurbishing, consult [Hinckley](#) in Nigeria and [SLS Energy](#) in Rwanda.

Opportunities to pursue your last mile repair ideas

- Check out CLASP and the Efficiency for Access coalition's [Solar e-waste challenge](#) (2019 – 2021).
- Keep an eye out for the Repairability Index that CLASP is developing for LMDs to assess the repairability of different off-grid-appliances, starting with electric pressure cookers, fans, and solar water pumps (this tool is expected to be available before the end of 2024).
- Explore the [GOGLA E-Waste Toolkit](#) helps off-grid solar companies and other key stakeholders address the main challenges of e-waste management, providing guidance and good practice on topics from design and manufacturing to e-waste regulation, and recycling and consumer awareness raising.
- Take a look at GOGLA's suite of ready-made [business blueprints](#) to help off-grid solar companies implement e-waste management solutions.
- Learn more from SolarAid and University of New South Wales' white paper, "[Off-Grid Solar Repair in Africa: From Burden to Opportunity](#)" and keep an eye out for their upcoming research to support LMDs with identifying viable repair approaches.

Global Distributors Collective



Transforming Energy Access

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