



**Selling productive
use of energy products
to last mile consumers**

Lessons learned



About the GDC

The Global Distributors Collective (GDC) is a collective of over 170 last mile distribution companies operating in more than 50 countries around the world, that reach millions of underserved customers with beneficial products. The GDC is dedicated to helping distributors improve business performance and grow, and to building a collective voice for the sector. The GDC is hosted by Practical Action, alongside strategic and implementing partner Bopinc.

globaldistributorscollective.org



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Introduction

The Global Distributors Collective (GDC) is a collective of over 170 last mile distributors (LMDs) around the world. GDC members operate in more than 50 countries, selling beneficial products such as off-grid solar products, improved cooking solutions, water filters and health products. This report is a summary of lessons that GDC members have learned in piloting and selling a nascent but rapidly growing category of products: productive use of energy (PUE) technologies.

What are PUE products?

PUE technologies cover a broad spectrum of energy-enabled products that improve livelihoods when used by customers to generate additional or new sources of income. While small-scale energy appliances - e.g., hair clippers, fishing lights and solar TVs used for village cinemas - have been proven to drive increased income¹, these kinds of products are fairly familiar to LMDs selling beneficial products, especially those that already sell off-grid solar lighting.

This report therefore focuses on those PUE products that have distinct and more complex logistical, financing and after-sales service requirements. Examples include water pumps/drip irrigation, egg incubators, fridges/freezers/ice-makers, and agri-processing equipment (e.g., mills and dryers). These kinds of products are in high demand, have a substantial potential market, and have significant potential to achieve impact as well as to strengthen business performance and improve business sustainability. A full list of the PUE products sold by GDC members interviewed for this report is in the Appendix.

Rise in the number of LMDs selling PUE products

In 2019, only 6% of GDC members were selling PUE products. As of January 2022, 35% of members are selling these technologies according to our 2021/22 member survey². The PUE category also holds the greatest interest to members, with 21% stating they are interested in selling such products in the future.

Why the growing interest in PUE?

The swell of interest has been driven by a combination of factors. These include: consumer demand and high impact potential; increasing affordability thanks to technological innovation and the growth of PAYGO; the need for companies to sell higher margin products and upsell existing customers, to ensure sustainable business models; and the drive from funders, enterprises and ecosystem enablers, such as Efficiency for Access, to translate energy access into opportunities for income generation.

Purpose of this research

Given the growth in interest in PUE products, it is unsurprising that this research piece emerged in response to member demand, as companies seek to avoid reinventing the wheel on their PUE journeys. The fundamental purpose of this report is to bring together insights and lessons learned from a subset of LMDs on how to effectively sell PUE products.

We hope this research will help other LMDs as well as inform other stakeholders in the PUE value chain; particularly manufacturers of PUE products and those working on market development programmes, to enable improved livelihoods through energy access.

Methodology for this research

This research presents insights and lessons gathered from 13 LMDs operating across 13 different countries in sub-Saharan Africa and the Indo-Pacific. Although clearly not a comprehensive overview of all PUE activities across the LMD sector, we hope that this report contributes to an improved understanding of the realities and requirements of selling PUE products to the last mile. In many places in this report, quotes have been selected to be illustrative of a particular point, rather than exhaustive; meaning that often similar points were raised by other GDC members but were not included, to avoid repetition.

The report includes a fifth section on lessons learned from running and financing PUE pilots, followed by a summary of recommendations for LMDs, suppliers, and donors and programme implementers.

Structure of this research

This report seeks to centre the experiences of LMDs, by sharing their insights and lessons learned in their own words. We have organised these insights by mapping them to different components of the value chain:



Figure 1: Productive use of energy (PUE) value chain

Overall findings

Although 35% of GDC members are selling PUE products, it remains a very nascent product category. Few LMDs have 'mainstreamed' sales of PUE products - the vast majority of LMDs selling these products are still in the testing phase. It is difficult to extrapolate key takeaways from LMD experiences, which are incredibly diverse and depend on:

- Country of operation.
- Type of PUE product sold.
- Whether the LMD is selling on-grid or off-grid PUE products.
- Whether the LMD runs a cash, PAYGO or service business model.
- Target customer (e.g., smallholder farmers, small agri-businesses, or microenterprises).

Time and time again, LMDs told us that they underestimated how hard it would be to sell PUE products, and that while the demand is there, they have not yet been able to effectively meet that demand. This is for a range of reasons, including: lack of market-ready products and underdeveloped supply chains; affordability constraints for last mile consumers, and linked to this, high consumer financing and working capital requirements; the technical complexity of PUE products and of agricultural market systems; and the high-touch nature of sales with extensive customisation, education and after-sales support requirements.

Nearly all LMDs reported that piloting and selling PUE products is too risky and expensive without some kind of subsidy. Nonetheless, all LMDs interviewed believe that PUE is a product category worth pursuing.

This is because, where sales have been successful, LMDs believe genuine impact has been achieved. Village Infrastructure Angels (VIA), for example, has seen customer time savings from solar mills of up to 10-30 hours per month, with the majority of that time being used for income generation; enabling customers to earn up to an extra US\$30 per month.

EnerGrow has seen their average customer income increase by 69% within six months of purchasing a PUE product. PUE technologies clearly have high potential - both for impact-driven companies like LMDs and for the low-income populations they serve.

But selling PUE products, and ensuring last mile consumers can realise income and productivity gains from using these technologies, is complex. We hope the learnings presented here - in GDC members' own voices - can help others to navigate this complexity.



Credit: Bopinc

1. Procurement and product performance



1.1 Identifying and procuring products

LMDs have struggled to identify appropriate off-grid PUE products

We found it really hard to identify which PUE products are on the market in Tanzania. There is no database of PUE suppliers available and we struggled to get information, and to assess how different products perform (Solar Sister).

We have tested three different PUE products in Kenya that we've been hesitant to sell - fridges, mills and drip irrigation systems. The fridges did not come with all component parts (the panels required needed to be sourced separately). The mills did not perform as efficiently as they needed to, spare parts were not readily available, and logistics was a significant challenge. Logistics was also a problem with the drip irrigation systems, plus they required extensive customisation depending on the needs of the individual farmer (Mwezi).

We simply haven't been able to find a reliable solar mill product. There is a local manufacturer in Sierra Leone that manufactures rice mills and palm oil processors. But we decided not to work with them: last year there was a death as the

mill wasn't working properly, and health and safety is a non-negotiable for us. We haven't been able to find an alternative (Easy Solar).

We have struggled to find market-ready off-grid PUE products in the Indo-Pacific, and for the most part we have ended up making (or 'hacking') our own. For example, we've designed a solar washing machine, which has effectively involved taking AC machines and replacing the AC pumps/motors with DC ones (VIA).

We haven't been able to find a good off-grid fridge or freezer product in Papua New Guinea. We've stocked them for five years and worked with a number of different suppliers. But ultimately affordability and quality don't work hand in hand, and we can't find a product that achieves both (Solar Solutions PNG).

We've installed three solar kiosks in Nigeria from two different solar kiosk manufacturers. It's described as a 'business in a box', and does include phone charging capabilities, but it's effectively just a casing. It isn't a great product and is very expensive – we wanted to do a lease model but it doesn't generate enough income for customers to afford the monthly repayments. We wouldn't recommend solar kiosks to other distributors (Sosai Renewable Energies Company).

Even when LMDs are able to identify the right PUE product, procurement is often challenging and minimum order quantities are high

In the end, the biggest barrier for us in selling off-grid PUE products has been the lack of supply chain in Tanzania. PUE suppliers are figuring things out at the same time, and it's a chicken and egg situation: suppliers aren't seeing the market demand, so aren't investing in building reliable supply chains. For many PUE products, we couldn't get our hands on a single sample product. For others, we could get a small sample of products, but it took four months to get them into the country and they'd be at prototype pricing.

These lengthy wait times did not allow us to rapidly test out products to assess market demand and viability. And then, when customers did like products, the wait to order more was too long to meet that demand. Finally, one of our main suppliers constantly had issues with keeping PUE products in stock, so we would sell things that then would take weeks or more to get hold of (Solar Sister).

We are desperate to find a solar ice-maker. But there are no local suppliers and, while we are capable of importing, it doesn't make business sense. Indonesia has a 20% import tax on renewable energy technologies to encourage local production, and importing a small number of sample products for a pilot is not economical because of high shipping costs (Sumba Sustainable Solutions).

Procurement of PUE products is more challenging than other off-grid products because the manufacturers are new players and still working out the logistics side of the business. They tend to outsource to third parties in China who are not overly reliable. Manufacturers aren't yet showing the flexibility they need to work effectively with distributors. For example, procuring solar water pumps is frustrating because we have to buy such a large volume of stock (a 40ft container) to get the best price.

This means when the manufacturer brings in a new product we can't take it on because we still have old products that need to be sold. We can't experiment with small volumes of units, and we require a lot of warehouse space which is expensive (Solar Solutions PNG).

1.2 Supporting with R&D

LMDs report that products are sometimes over-engineered for the communities they are designed to serve

We sell commodified off-the-shelf PUE products and tools - from carpentry and metalwork tools to fridges/freezers, to anything a small kiosk shop might need. A lot of funders are only interested in investing in technology companies, and want all PUE products to be PAYGO-enabled and designed specifically for Africa. But we don't need to re-create everything. There are lots of good products already on the market, we just need to make them affordable and get them into communities (EnerGrow).

The solar water pump we sell is a great product, but it's gotten too high tech by adding global positioning with remote monitoring. That might be useful in certain scenarios, but we've found that most farmers either don't care or don't need to be told how much water they're using. This has also added to the cost of the product. It would have been better if they'd packaged an irrigation set with the pump instead (Solar Solutions PNG).

We found that solar mills were used for fewer hours per day (0.5-1) than expected (2-4) and were thus over-engineered/over-sized, leading to longer payback periods than desirable. A redesign to improve utilisation would help (VIA).

Many LMDs are investing substantial resources into R&D and generating market feedback, because PUE products are not yet market-ready; but this role is rarely recognised or valued

The world of PUE is what the world of off-grid solar lighting was ten years ago. Manufacturers are still in the product development mindset – they aren't thinking yet about the realities of marketing, selling, and after-sales services. Last mile distribution is not about just putting out a technically correct product, but also a sellable product.

We (LMDs) are expected to figure out everything around the product - the market, the sales process, the financing, the warranty/repair/replacement process, etc - but with zero R&D support. It's just not realistic. And sometimes in the end it turns out some of these hot products are just not distributable, and we've shouldered all of that cost and risk (Solar Sister).

Technology-agnostic distributors like us look holistically at the needs of customers and try to meet those needs; we don't just sell the first product the market has to offer. We try to send market signals to technology providers and the wider sector about what local communities need. But our voices aren't being heard.

There is a mismatch between which PUE technologies people think customers want and are ready for, and what customers actually want and are able to buy. For example, donors are pushing to sell e-bodas, but when e-bodas are still three times more expensive than regular bodas, they just aren't sellable (EnerGrow).

1.3 Building relationships with suppliers

LMDs invest significant time in vetting suppliers and building strong partnerships, and avoid suppliers that may be future competitors



We want to build a good relationship with our suppliers, and that means we have to limit the number of suppliers we have, so we can focus on building trust and rapport. To make a decision on which solar water pump supplier to work with, we first look at technical specifications of the products and what is needed in the market. After that we look at the quality of the product and the brand reputation.

Then we look at the warranty and after-sales support. If we have someone returning a pump that is imported and is defective, and it is a manufacturer defect, how quickly will the manufacturer respond to this? It matters how quickly a manufacturer responds to emails (Natfort Energy).

We only work with manufacturers that don't have a distribution presence in Nigeria. We have been burnt before by manufacturer partners undercutting us, setting up their own distribution channels and becoming competitors. We now insist on co-branding products as much as possible with our suppliers for the same reason. We're still in the testing phase with many PUE products so this isn't yet a problem, but we are trying to lay down the law from the very beginning so we don't end up in the same position of competing with our own suppliers (Sosai Renewable Energies Company).

Building relationships with manufacturers who value their distribution partners and are responsive to feedback on product design and performance is key to success

We are currently piloting a solar egg incubator and have sold 30 to date. The first iteration of the product had significant performance issues – the sensor was not accurate enough, the airflow wasn't sufficiently stable, and the firmware needed to be improved to maintain temperature and increase the hatch rate.

We have worked closely with the manufacturer to improve the design, and they have been a great partner; spending time in the field to really understand how customers are using the product. But working through these teething issues has taken up a huge amount of time, despite having a dedicated M&E team, and has led to some farmers giving up on the product (Mwezi).

It's really important to have a supplier who is willing to take on feedback. The solar mills we are currently piloting were almost custom made for us because of the level of feedback that we shared on the first prototype, which was then integrated into the second product iteration. But this is rare; generally, manufacturers just tell us we're not using their product as intended, and are not as interested in meeting our customers' needs because we are not in Africa, which is their target market. We have found it beneficial to act as a trial partner for manufacturers with new products as that's when they are responsive to feedback (Sumba Sustainable Solutions).

We're working with our manufacturer partner to develop a solar dryer that has a much higher daily turnover than their current product, so communities can produce the volumes of product needed to make the business model work (Sosai Renewable Energies Company).

2.

Sales and marketing including agent training



2.1 Knowing your customer

LMDs have learned the importance of rigorous market research, particularly to understand social and gender dynamics, and agricultural market systems

Our PUE pilots have demonstrated the importance of a well-designed research phase. Rather than just deploying products blindly, in future we will invest more in understanding what communities want, and making sure women are at the centre, to be sure we're getting the right technologies for the target community.

With our solar dryer project, for example, we underestimated what a big deal it was for women to manage this work. Even though 100 women said they were interested, in the end there were only three. The majority of women can't go out during the day because of household responsibilities or because their husbands won't allow them. So we found that one of the best ways to get across to the women is to talk to the husbands, to socialise the idea of them working. But doing this level of research needs grant funding (Sosai Renewable Energies Company).

When deciding whether it makes sense to sell a PUE product, we look at social and geographical factors to assess who has the most to gain. For something like a solar washing machine, important geographic factors are proximity to water and lack of access to reliable electricity. In terms of social factors, it's important that women's time is valued enough to use a washing machine, and that they can do something productive with the time saved from washing clothes.

But there can be unexpected social factors. For example, women are sometimes seen as lazy if they aren't doing washing by hand. And in places where clothes are washed in a river, the labour is part of an important social ritual - women travel to the river together and are often joined by kids who swim and play together (Sumba Sustainable Solutions).

We undertook a pilot to sell freezers, which produce ice to maintain temperature. Initially demand outstripped supply. But we realised halfway through the pilot that customers just wanted an ice-maker. In practice, the product didn't really have the right panels and batteries to properly function as an ice-maker, and this hadn't been effectively communicated to the customers. We had to put the pilot on pause

and wait for an additional container from the manufacturer with additional panels and batteries to convert the freezers into ice-makers. That being said, we learned an important lesson about communicating the benefits and use case scenarios of PUE products (Easy Solar).

Our biggest lesson is to make sure there's a match between the technicalities of the product and the market need. When we started with solar water pumps we hadn't done a proper market survey to understand what customers wanted and needed, and what they could pay for. We bought 100 pumps, but due to the product being a bad market fit we failed to meet sales targets. The problem was a technical mismatch, as the pumps we bought could only pump from a depth of 6m, but the boreholes used by smallholder farmers in Zimbabwe range from 15m to 60m deep (Natfort Energy).

Understanding and managing customer expectations from the very beginning is essential for LMDs

We were getting lots of enquiries from customers about solar water pumps, but when we started to sell them we found uptake was extremely low. We soon realised there was a misalignment around customer expectations and ability to pay. The customers who could afford the pumps were those with bigger farms, but they needed bigger systems than the pumps we were offering. These customers often had experience of diesel pumping and were unhappy with the flow rate of the solar pumps. On the flip side, the customers with smaller farms, for whom the pumps were more appropriate, found the payment plans too expensive (Easy Solar).



It's important to be clear with clients what's involved when you're working with them to test products. In our egg incubator pilot, we gave a handful of egg incubators to customers for free so we could do field-testing, and told them if they liked the product they could purchase it later. But we also sold the product to other clients, which raised confusion amongst Mwezi staff about why some people were having to pay for the product and others weren't. We also should have done more to manage customer expectations around performance, as the product still had technical issues that needed to be resolved, and some customers were disappointed (Mwezi).

We learned that it is essential to be very clear about what products are available at what prices at the time of a needs assessment/market demand analysis. We hadn't yet identified this at the point of our needs assessment, so when customers were asked "would you buy this product", they said yes. But we found that this wasn't the case at the price points suppliers were offering and not if the customers had to take on credit risk to make the purchase (Solar Sister).

LMDs have learned the importance of knowing what PUE products are competing with / seeking to replace, and targeting customers accordingly

If you're trying to sell a solar water pump, don't try to compete with a diesel pump; if you're trying to sell a solar mill, don't try to compete with a diesel mill. They're just not going to perform as well. You need to get as far away as

possible from diesel alternatives. PUE products are competing with manual labour, and saving people time spent travelling to access diesel alternatives (VIA).

2.2 Marketing to customers

It is important for customers to 'experience' products before purchasing, but this is risky and logistically difficult with large, high-value PUE products

Marketing high-value assets like PUE products is hard. We have a blend of permanent sales staff, based out of district centres, and commission-based agents, based in rural areas. Our customers are mostly off-grid farmers, for whom our district centres are not very accessible. But it is risky to leave a high value product like a solar water pump with an agent, and a lot of work to train an agent on the technicalities of the products to ensure an effective demonstration. And with over 500 agents, it is also not viable to do this at scale. So how do we actually expose our customer base to these products to drum up demand? (VITALITE Zambia).

We distribute flyers with information about PUE products, and once we have interest from two to three people, we will leave a sample product as a demonstration. But we have very strict requirements for the agents, because of the risk involved in handing out such an expensive product. We check weekly to assess whether the product has been sold, and if it's not moving we quickly repossess the equipment (ENRAPOWER).

It's too high risk for us to give agents solar water pumps, so demonstrations are done by supervisors rather than the sales agents themselves (Powerlive).

We have fridges in our shops, but we need to actually get customers in the shop to see them. Right now, we're targeting fisherfolk and fish traders, so our sales teams are going into fishing communities and organising a vehicle once a week to bring potential customers to the shop. We're hoping that after we make our first sales and get fridges into the community that these visits won't be necessary (SolarWorks).

We need to do more to allow customers to test out PUE products so they understand and trust how they work, before making an investment. We used roadshows and product fairs to build consumer demand and give people the chance to touch and feel products. Demand increased temporarily, but tapered off when our marketing activities came to an end and we struggled to convert leads into sales.

We also tried sightsellers - product booklets for entrepreneurs with talking points and photos to use in sales - but, again, this didn't work; it was too much information at once and customers still wanted to see the product. Videos could be an option to demonstrate products and share testimonials from early adopters, but most entrepreneurs and last mile consumers don't have smartphones, and even when they do, touching/feeling the products is still the best. Having a local supplier to support marketing activities, lead product shows and demonstrations, and give out samples could in the future help to stimulate sustained demand for PUE in last mile markets (Solar Sister).

2.3 Selecting and training entrepreneurs/agents

Having the right entrepreneurs /agents is key to success, with some LMDs finding that PUE products require specialised sales teams

The more expensive the product, the more important it is to get agent selection right, so this is particularly key when selling PUE technologies. We have three criteria for agent selection, which have been developed and refined through hard experience. First, the agent must be a woman, because in the communities we work in, women are accustomed to managing small amounts of money. Secondly, she needs to have finished at least junior high school so she has basic literacy. And finally, she needs to run a small shop or kiosk, so she knows which customers are creditworthy and how to deal with people who don't pay their bills. When we enter a new village, we ask the village head to create a list of people who fit these criteria and choose agents that way. This approach also means that if things go belly up, the village head can help us follow it up as they feel some responsibility (Sumba Sustainable Solutions).

To make the solar dryer model work, we have a dedicated PUE team. They work intensively with customers, manage the solar drying hubs, and also work closely with manufacturers, investing a lot of time in building expertise in different technologies (Sosai Renewable Energies Company).

For every product, we have specific teams with specialist technical skills; like in irrigation or refrigeration. Different types of customers have different needs so this is the best way to meet those needs (SolarWorks).

Right now, all our agents sell all products in our portfolio. But as we enter new sectors, to sell more specialist technologies like e-bodas and agri-processing equipment, we will need to build dedicated sales teams (EnerGrow).

LMDs are needing to provide more extensive technical training for their entrepreneurs/agents, and expect support from suppliers to do so

We introduced a submersible pump but hadn't anticipated how much customisation is involved: each borehole needs to be individually appraised and the pump matched to flow rates. We failed to assess our technical support gaps and find solutions for these gaps, and didn't build our team's capacity to specify and install the pumps and deliver post-installation maintenance. Once we'd realised how much additional resources would be required to offer a really good customer experience, we had to take the decision not to offer the pumps to our customers (VITALITE Zambia).

We created our own video installation guides for fridges, but we feel this is something that should have come from the supplier. On the other hand, the training support from our solar water pump supplier has been superb - when we started selling their pumps, they sent out a representative for a week to train our team (Solar Solutions PNG).

Training our entrepreneurs in the PUE sales process (which is more complicated), the after-sales process (which is more complicated), and a number of new complex technologies all at the same time was too much. It seemed to overwhelm them and demotivate them from making sales.



As a result, they decided to stick to selling the cash products that are easy to sell quickly and that customers know and love. In hindsight we should have simplified the training, focusing on one product at a time, and given entrepreneurs more time to practice their new skills (Solar Sister).

LMDs have found that ongoing training is essential, with field and group training reported as being most effective; while digital training receives mixed feedback

Refresher training and ongoing mentoring is important to reinforce learning from primary training. Many of our entrepreneurs indicated the desire for additional training; especially regarding how to apply the connected selling process they already use for selling pico and solar home systems, to selling PUE to ensure that customers are appropriately paired with products that meet their needs.

We found it helped to provide our entrepreneurs with space to share best practices/lessons learned about selling PUE products during in-person group meetings. Entrepreneurs did not find virtual training done during the pandemic (via voice or video call) helpful, with most preferring one-on-one mentorship and field visit training. Follow-up visits by field staff to mentor and support entrepreneurs, and to help them build skills and confidence as they start selling PUE, are also key (Solar Sister).

We try to ensure the technical team goes into the field at least once a week to provide ongoing training to sales agents (Powerlive).

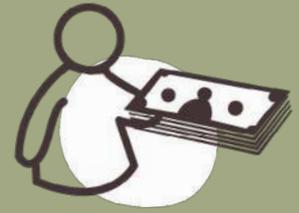
We've found that group training works a lot better than 1:1 training. Group training allows agents to learn from each other, and also to get to know other agents operating in their area. They are also more formal than 1:1 training, as trainers are much less likely to follow a strict training protocol with an individual. This is especially true if it's an agent that the trainer has a rapport with, or if it's at an agent's house with interruptions like kids running around.

Moving forward we plan to create videos with basic maintenance instructions, because of low levels of agent literacy and the complexity of the solar mill product. Most agents have access to YouTube but for those who don't we can put videos on memory cards for agents to put into their phones (Sumba Sustainable Solutions).



Credit: Solibrium

3. Affordability and consumer financing



3.1 Financing models

Most LMDs adopt lease-to-own models and manage financing in-house, and unsurprisingly face significant working capital constraints

We're an asset financing company, so to grow we need huge amounts of working capital. We have not yet been able to raise debt, because a) we lack track record as a young company, b) we started just before Covid so haven't yet been able to demonstrate reliable repayment rates, and c) we are constrained by our debt to equity ratio - lenders need assurances that we have enough capital to stay in business after they give us a loan (EnerGrow).

Some LMDs are adopting service models (i.e., perpetual lease models) for PUE products, with mixed success

We have set up a 'drying for sale' model with the INNOTECH solar dryer product. We have set up eight hubs with 22 dryers, managed by 80 women. We own the solar dryers perpetually and the women who manage the dryers pay us a flat

fee per month. They do packaging as well as drying, which is more lucrative, and means they generate revenue outside of season. Now they are producing products of their own, like carrot and sweet potato flour (Sosai Renewable Energies Company).

We are starting to set up solar PUE centres comprising multiple mills, cookers, water pumps and water purification services. This will be combined with solar home systems for basic home use around the centre, and a recharging point when solar home systems don't work in rainy weather; perhaps with a generator. This is much cheaper than a mini-grid or grid extension. We would own the products and rent them out to customers – we want to take a long-term view and forget about loans and default rates. We aim to have 20 of these centres in place by the end of the year, starting in Liberia and Indonesia.

When selling solar mills in future, we'd opt for perpetual leases with discounted cash sales of depreciated (ex-rental) assets; with at least some minimum activity required each month to be able to keep using the product. If this wasn't met, we'd re-claim the product straightaway, rather than waiting for a 90-day default (and removing "default" as even a real issue, as it doesn't apply to a perpetual lease) (VIA).

A number of LMDs are either unable to offer consumer financing because of the market, or are not prepared to do so given the level of risk involved

We only sell products on cash. PAYGO is not viable in Papua New Guinea due to limited mobile coverage, the lack of mobile money, and high costs of phone calls and data. And it's not the kind of place where you would go into a community to try to repossess a product (Solar Solutions PNG).

We piloted our own consumer credit mechanism which we thought would have high uptake, given that Solar Sister already has a trusted presence in communities. However, in the end, we had only three customers apply for Solar Sister credit, because the base product prices were just too high. Adding interest rates onto that to manage risk only further discouraged customers from buying.

Last mile customers are risk averse in general and hesitant to take out loans for products they aren't familiar with as they fear they won't get a good return on investment. More work is needed to educate customers around the business case for investing in PUE so they understand the benefits of taking out credit for these products (Solar Sister).

We aren't yet comfortable offering PAYGO for large numbers of customers with fridges, so have been selling cash only until recently. We are still building our expertise in how to sell the product and support customers. If in the end the customer doesn't want the system or doesn't fulfil their contract, we have conditions to re-possess the item - but we don't want to run before we can walk.

We are running a grant-funded project that aims to sell 52 fridges in fishing communities in south Mozambique using PAYGO, and we hope after this project we will have sufficient experience to offer PAYGO for this product moving forward (SolarWorks).

Many LMDs have tried to outsource consumer financing to third parties; while a handful have been successful, the majority have not

We are working with an MFI partner that gives farmers loans to buy PUE products from us. We think this is important not just because these products are more costly and people can't afford to pay upfront, but also because we ourselves might not have enough in-house skills to educate farmers about the associated credit risk.

We are a for-profit organisation and have to manage credit risk and cushion ourselves - but impact matters. MFIs are in a better position to do rigorous customer vetting, education and follow up (Natfort Energy).

We work with microbanks. We display our products and distribute brochures there, and it's up to the consumer to get the loan. But only a very small number of products are financed that way - in PNG only 8% of the population is in the formal economy (Solar Solutions PNG).

We've been trying to find a financial service provider that is prepared to take credit risk for smallholder farmers. We have not had any success with this yet, because the rates of interest they wish to apply to the loan are inappropriate for smallholder farmers (VITALITE Zambia).

We have tried to build partnerships with MFIs, to tap into their networks and share the credit risk, but have not had success with this yet. MFIs are not interested in PUE products like solar mills and solar water pumps, because the repayment periods are too long. We've also explored working with banks to help customers access small business loans, but we need to convince them to use the equipment as collateral. So, for now, we're managing finance in-house, which is very intensive (Sumba Sustainable Solutions).

It has been a huge challenge to find financial institutions willing to provide loans, and those we did find had prohibitively high interest rates. In the end our supplier was able to provide a line of credit, which was hugely valuable; however, many customers were only willing to take out loans for products they were more familiar with, like TVs or larger solar home systems or solar lanterns (Solar Sister).

3.2 Diversifying payment options

LMDs have adopted a range of strategies to diversify payment options and overcome affordability barriers associated with PUE products, including:

Non-cash payments

Non-cash payments can be effective in markets where affordability is a barrier, and were particularly useful during Covid when cash dried up. We ask customers: how much time are our products [agri-processing equipment] saving



you, and can you make something with that time that we can barter? We have bought mats, handwoven baskets and jewellery from customers to sell. In this way customers are buying access to the PUE via paying with non-cash products (VIA).

We swap solar products for bamboo. That means no PAYGO, which keeps operational costs low and products affordable. We go into a village with a product, and come back with 50 poles of bamboo, with no further interaction with the customer unless they need help. We are now piloting solar mills, and aim to take yearly payments in bamboo if customers can't pay cash. Bamboo is not something customers can generally sell in the market, so it doesn't have as much value to them³ (Sumba Sustainable Solutions).

Seasonality of farmer incomes affects our default rates, so to lower our portfolio at risk ratio we have been using a 'pay as you grow' model. Agents were reporting that while some customers didn't have cash, they had produce or livestock they were willing to barter. We accept these products, as we can easily find markets for them. We agree on a fair price with the customer and sign a contract, so it's formalised (Natfort Energy).

Longer and/or more flexible loan periods

When we were thinking about selling solar water pumps, we chose an area in Mozambique and spent time with customers in that area to understand their incomes, what they produce, how much they produce, and how much money they have left over after their basic needs are met. That helped us to work out how much customers could afford to pay, and we designed a PAYGO model around that. Customers have the most money at the beginning and end of a harvest, so they make three to six payments a year over a one to two year period, rather than on a monthly basis (SolarWorks).

We looked into seasonal payments to mitigate unsteady customer incomes but couldn't make this model work. Instead, we just lengthened payment periods and reduced the size of instalments. Some PUE products cost as little as US\$10 a month, and most cost \$50-60 a month, sold over ten to 12 months. We have also done instalments via cooperatives, where people can vouch for each other (Powerlive).

We had to extend the loan period to ensure the egg incubator was affordable. Our initial loan period was nine to 12 months, but we had to move to a 17 month loan. Customers have the flexibility to pay monthly or weekly. We use Angaza to manage loans, and Akida to send customers payment reminders and informational messages. We had some defaults in the early stages of the pilot, because the design of the product needed improvements and customers were dissatisfied. But we expect the default rate to be low moving forward, now that product improvements have been made (Mwezi).

Our average repayment period for an average loan of US\$300 is 12 months, but this is longer in poorer communities. We try to be flexible with repayment periods, so we can work with customers' budgets and ability to pay, and we do everything we can to mitigate defaulting loans. To date only 3% of overall loans have resulted in a situation where we've had to restructure the loans (EnerGrow).

We generally offer three to six year loans for solar mills and other PUE products. The numbers suggest that a shorter loan period is not viable, as it leads to costs that are too high. An early buyout option (and cash sale option) is also possible, with significant discounts to encourage it (VIA).

Bundling products to increase revenue generation opportunities

We struggled to work out a good repayment model for solar mills that only process staple crops. This is because of the limited number of times people plant and harvest per year, which means the mill is only really busy for two to three months and then not used at all.

So we couldn't put in place monthly repayments, because what happens in the months they're not milling? We worked closely with our manufacturing partner to design new solar mills that have multiple attachments, including a coconut grader, grinder, and oil expeller, which allow villagers to use the mill to process different commodities throughout the year (Sumba Sustainable Solutions).

4.

Customer training, after-sales support and market linkages



4.1 Training customers

Mapping out the ideal customer experience can help with building the right training and support package

We could do better at clarifying what the ideal customer experience is for each product, and then defining a standard operating procedure for how to engage and support the customer. With an egg incubator, for example, it would help customers to be really clear what happens after day zero when they put fertilised eggs into the incubator: what experience they will have, and what actions they need to take. We also need to look at customers that are 'overachieving' in terms of realising PUE benefits, and understand what they are doing differently (VITALITE Zambia).

We are constantly asking what more we can do to help customers get the most out of the solar dryer product. Our PUE team liaises with the manufacturer to understand best practices, and then train women customers. This is an ongoing process as our model evolves. For example, we tried to dry mangoes but they didn't dry

properly, so we worked with the manufacturer to understand what we did wrong and how we can use the dryer differently to get a better output (Sosai Renewable Energies Company).

More customer training is needed for more technical products, and to help unlock the potential benefits of PUE

We provide customer training on the egg incubator at the point of sale, and give them technical guides for reference. We've started sticking instructional materials on the incubator so customers can troubleshoot issues themselves, and are also planning to roll out online learning for customers (Mwezi).

To realise the income generation potential of PUE products, customers need to know how to run a business. So we offer microbusiness training focusing on topics like book-keeping, customer service, marketing, and inventory management. We don't want our sales agents to think of themselves as salespeople, but as business builders; their job is not to sell, it's to help customers grow their businesses. This is a mindset shift we're trying to bring into all elements of our company (EnerGrow).

During customer training, LMDs tend to place heavy emphasis on the terms of the warranty to limit product tampering

When training customers on the solar water pumps, our biggest priority is to reinforce that the warranty is only in effect if they don't tamper with the product. We have to hammer it home that if a customer encounters a problem or isn't sure of anything, they need to ask. Customers will always try to fix a problem themselves and look for help afterwards, so we still have to do remedial measures. But we've found that focusing on the warranty during the sales process really helps since customers don't want to have their warranty voided (Powerlive).

4.2 Providing after-sales support

After-sales support is often more complex and intensive for PUE products

We get a higher volume of customer calls about the solar water pumps than our other off-grid solar products, because of the technicality of the pumps. This is especially the case for those customers who use and store the pumps in different locations - some take components off their pumps and leave them at home when not in use, because they're worried about security (Powerlive).



We've started selling small fridges, but we've had to be conservative despite high levels of demand. Fridges require a different level of technical capacity than we're used to. It's not like selling solar home systems – we're specialised in that, with a repair centre and technicians who can fix problems with systems and batteries and panels. It's different to have fridges in warehouses for so long doing repairs.

In future we would like to send technicians to service products on site, so if a customer faces issues they can get in contact through our call centre, the help desk will support the customer to identify the issue, and, if needed, a technician can be dispatched. But it will take time for us to be fully equipped to manage this. We went through the same process when we started selling solar water pumps, but now we're comfortable with the product, our team is fully trained and we can easily service pumps with support from our supplier (SolarWorks).

LMDs need to clarify upfront responsibilities for after-sales support and the warranty process

PUE products require in-country after-sales support. We don't have the technical capabilities to provide after-sales service - specifically for repair - on many PUE products, but found that suppliers would not put a person in-country for this purpose unless we could demonstrate the market demand. This created a chicken and egg problem, because we couldn't drum up demand without being able to assure customers that we could service the product. We also had challenges negotiating the warranty process with PUE suppliers. Suppliers who were not in the country were unwilling to bear the shipping costs related to repairing faulty products;

nor were they willing to give us extra products to have on hand, in case of warranty issues. Without having replacement products on hand, customers also ended up waiting a long time, which further stymied demand (Solar Sister).

4.3 Building market linkages

A number of LMDs are proactively building market linkages to support customers

We are working hard to find ways to get dried products to market. We have had success with finding markets by advertising on social media and sharing samples of dried products, and are leaning on all our contacts to find export markets – if we're going to be producing 2000 tonnes of ginger every week, we need to have a ready market for it. But to be successful we have to make sure we meet the standards of the National Agency for Food and Drug Administration and Control, so we're hoping to have that in place soon (Sosai Renewable Energies Company).

We are well connected with local markets so we want to help farmers build market linkages. But it's important to make sure the market is credible so farmers don't get shortchanged by unreliable middlemen. That would obviously be damaging for the farmer, but would also ruin our brand name. As we dive more into PUE we are seeing that we will need someone dedicated to this work, who can build reliable and fair market connections, and who can vet crops for quality and cattle for sicknesses, to give them a proper value.

We are also building partnerships with telecom providers to send out climate resilience information and best practices in agriculture via SMS to farmers (Natfort Energy).

Our customers are farmers who already have access to local markets, so they aren't requesting market linkages from us. However, we recognise that this may change in the future so we are being proactive and hosting workshops to help farmers meet players along the value chain (particularly those that buy chicks) and are building lists of places where farmers can source inputs (Mwezi).

The mills we are piloting represent a real opportunity for value addition via coconut oil. But the local market is small, so we are trying to build more market linkages. We have spoken to some local hotels who have said they're happy to buy what's produced for the trial units, but we will need to do more than this if the pilot is successful, otherwise there will be no market for the product (Sumba Sustainable Solutions).

Other LMDs are seeking to outsource this role to third parties, or find that customers can access new markets without additional support

As we start to sell agri-processing equipment, we are thinking more about how we build market linkages. We're building partnerships with FAO and an agri-input company, but, unbelievably, neither of these organisations currently work with off-takers, so making these partnerships work will take a lot of time and energy (EnerGrow).

Market linkages are important, but generally we find customers can manage this themselves, and are good at capitalising on opportunities for value addition. For example, some of our customers have used our grinders to make dried cassava flour, which they can vacuum pack in high densities, reducing the unit price of packing and transport compared to cassava roots.

Being vacuum packed, the shelf life of the product is also extended (from one day to one year), which meant the product also became an emergency food item when the cyclones hit. Other customers have made pumpkin powder, sweet potato powder and lemon grass powder; or have started grinding coffee in the machines instead of flour. We sometimes support by bringing products from the village back to the city, since otherwise we are coming back empty handed, but this is done informally: we are literally throwing sacks of corn on the back of motorbikes (VIA).

For some LMDs, access to markets is a pre-condition to sales and a way to assess customer creditworthiness

Market access is something that we take into account when we are deciding whether to give a loan. We need to be sure customers will generate income so they can pay back the product. Our sales teams do provide advice to customers on an informal basis about where they can access new markets to increase their incomes, but this isn't done systematically (SolarWorks).

5.

Running and financing PUE pilots



5.1 Financing PUE pilots and ongoing sales

Nearly all LMDs reported that selling PUE products is too risky and expensive without some kind of subsidy

Even with PAYGO, customers can't afford the full cost of a solar water pump, so we can only sell them with a subsidy. Only some geographic areas of Mozambique are eligible for results-based financing. So, even though we have shops all over the country, we can only sell pumps in those areas where we can receive incentives that enable us to offer the product at a lower cost (SolarWorks).

For smaller distributors thinking that PUE is going to quickly mean positive cash flow – be careful. PUE products are hard, and you have to take on a lot of new risks; in particular, taking on credit risk when you don't have a solid supply is a recipe for disaster.

The minute the product doesn't work and you don't have a reliable supplier to fix the problem, the customer is going to stop paying the instalments and they will blame you, even though it's not your fault. If business capital is

tyed up in this experiment (as opposed to grant funding), it could be really dangerous for the company (Solar Sister).

It's not possible to use debt to fund PUE work yet, at least for service models. Distributors should look for grants as much as they can. It's too dicey otherwise. To set up a successful business model for solar dryers you need to source the right people from communities, invest in training, give them the right processes, and provide continued support. All of that is expensive, but without it the project will fail (Sosai Renewable Energies Company).

We've funded our PUE sales through grant funding. Overall, it will likely take five to ten years for many PUE products to become commercially attractive at current resourcing levels, which we consider very low given the importance PUE products have for poverty reduction compared to solar lights and TVs VIA thinks solar water pumps offer probably the best acceleration option, but probably still mean 18 month to three year payback periods once default, revenue collection costs and cost of capital are taken into consideration. Early numbers from washing machines/laundromat pilot projects suggest they could potentially have shorter one to two year payback periods (VIA).

Grant funding and technical assistance (TA) are essential to run new product pilots. It is difficult to raise investment until you've got concrete results to present to investors. TA helps make sure we're asking the right questions in our market assessment and making informed decisions about which products to sell (Natfort Energy).

5.2 Running PUE pilots

Most LMDs emphasise the importance of rigorous pilot methodologies and good M&E

We don't want to introduce products to the market without a controlled pilot. It should be a Ready - Aim - Fire, as opposed to a Fire - Aim - Ready approach. So we are developing standardised methodologies for introducing new products and managing pilot-related decision-making. The key is to set really clear questions, e.g., which is the highest performing sales channel, what is the most effective sales method, what is our capacity to manage customer expectations, what is our capacity to support customers so they get the outcomes that the product claims to offer?

Having internal alignment on these questions is essential before pilot design takes place. We have also realised the importance of strong project management during the course of a pilot: clear roles and responsibilities, a workplan to show what activities take place over time (and the interdependencies), ways to capture lessons learned, and so on. And of course, having a pre-set formal go/no go in place, to mark the point you transition from pilot to business-as-usual activity (or not) (VITALITE Zambia).

We have developed a standardised pilot methodology (pilot objectives and key results, pre-pilot survey, and post-pilot survey), which is followed by a recommendation to the sales team whether or not to commercialise the product (Easy Solar).

For piloting complex new products paired with new processes (e.g., around referrals or consumer financing), process-oriented M&E is key, rather than just impact measurement. Early on, Solar Sister decided to conduct monthly surveys with both our entrepreneurs and customers to really understand what was and wasn't working with the PUE products and processes.

This gave us valuable insights that allowed us to iterate as the project rolled out, versus just finding out at the end that it didn't work and not fully understanding why (Solar Sister).

Focusing on a single product, geography and/or customer segment is important when starting out

We tried to test too many products at the same time – we were trialling nine new products simultaneously! For every one of those products, we were trying to build supplier relationships, navigate complex supply chains, and train staff and entrepreneurs on product specs, the business case/ROI for customers, and how to apply connected selling skills to that particular product. And all while adopting an entirely different selling process, since we were also trying to introduce consumer financing.

This seems crazy in hindsight; we should have just picked one product and run with it. The next phase of our pilot will be teaching entrepreneurs about just one new product (fishing lights) in just one geography where we know the product will be popular (the Lake Zone). We hope that this will mean our entrepreneurs are not having information

overload, and can build confidence when they make a few initial sales. This will also allow us to identify a strong supply chain for each new PUE product we add to the basket, including a reliable supplier, market-ready prices, financing options, and a good warranty process (Solar Sister).



Recommendations

For last mile distributors

Starting small

- **Invest in building your understanding of agricultural market systems** in your countries of operation. This will give you a sense of what type of farmers to target, which crops to consider, and how market linkages can best be facilitated.
- **Start with small-scale pilots** that help you figure out the right suppliers, products, pricing model, and approach to sales and after-sales service.
- **Look for grants or patient equity investors** to cover the high upfront costs and risks of undertaking PUE pilots. Technical assistance in the design and implementation of PUE pilots can also be valuable.
- **Take time to design a rigorous pilot methodology**, with clear KPIs and strong M&E systems that provide real-time information on what is/isn't working. This data is essential to give you - and potential funders and investors - confidence in your ability to scale up.
- **Focus on a single product category, geography and customer segment** to manage the scope.

Selecting products and suppliers

- **More nascent PUE product categories still face challenges around durability and performance**, which may need to be addressed through repair, replacement under warranty, or manufacturer design modification. See the [Efficiency for Access 2021 Solar Appliance Technology Briefs⁴](#) for more information.
- **Third-party product information** is available from [Verasol⁵](#) for more mature PUE categories such as refrigerators and solar water pumps.
- **Look for suppliers that meet key criteria:** they provide sample products, value feedback on product design and are prepared to make modifications, and ideally have in-country presence.
- **Consider the risk that suppliers might end up as competitors** if they also sell through their proprietary distribution channels. Seek exclusivity or non-competition agreements if necessary.

Sales and marketing

- **Help customers 'experience' products** before purchasing. Work with suppliers who will support you in creating market demand through product fairs, demonstrations, marketing materials, trainings, etc.

- **Do consumer research** to inform selection of appropriate products⁶, understand what your competition is, and design the right sales and marketing strategies. Ensure that you have all the information customers will need (including around pricing and financing) so you can accurately assess not only interest in PUE products, but also willingness/ability to pay and take out credit.
- **Manage customer expectations**, so that they know exactly what the product can and cannot do.

Affordability and consumer financing

- **If providing financing in-house**, be clear on how much working capital you will need and where this will come from. Longer and more flexible repayment plans, non-cash payments, and bundling of products/services to increase revenue generation can help to overcome affordability barriers and manage consumer credit risk. CGAP's Getting Repaid in Asset Finance⁷ might be of interest.
- **If financing is provided by a third party**, make sure customers will be eligible for loans and interest rates will be acceptable to them. Power Africa's Guide to Microfinance Loans for Off-Grid Solar Products⁸ might be of interest.
- **Service or leasing models**: For larger, higher-value assets, or when seeking to reach particularly low-income households, consider service or leasing models which don't require consumer financing.

After-sales service

- **Map out the ideal customer experience** to understand what training and support is needed for customers. Consider what information to provide at each stage of the customer journey and how to deliver this.
- **Assess what support** customers need to fully benefit from a new PUE product. For example, a farmer might need inputs from a different input provider, advice on how to grow a different crop, or a different off-taker to purchase the finished product. Consider partnering with other local organisations to provide tailored training/support if you lack capacity to do so.
- **Be clear on your supplier's responsibilities (and timelines) in case of product failure**, including on-site repair, product take back, and replacement under warranty – and be aware of which costs your supplier will and won't cover.
- **Ensure entrepreneurs/agents are sufficiently trained and supported**, leveraging your suppliers as much as possible, and consider building specialised sales teams for different PUE product categories.

For suppliers

- **Don't underestimate the time it takes to build a strong LMD partnership**. Identify a small number of LMDs to work with to test and refine your product, and to develop your organisation's approach to partnership. Seek to build trust with LMD partners by being responsive and following through on commitments.

- **Be transparent with LMDs regarding your own distribution plans.** Don't choose a partner in an area where you are looking to build your own proprietary distribution.
- **Be prepared to provide LMDs with extensive support** in areas such as assessing market demand, provision of sample products, sales and marketing content, entrepreneur/agent and customer training, and after-sales service. This may require having a local presence.
- **Be prepared to adapt your product design** based on feedback from LMDs.
- **Make sure your partnership agreement is clear on roles and responsibilities regarding after-sales support.** If you do not intend to provide this, make sure the LMDs have everything they need to play this role.

- **Support LMDs to build their knowledge of agricultural market systems.** This will give them a better sense of what type of farmers to target, which crops to consider, and how market linkages can best be facilitated.
- **Support peer learning amongst last mile distributors:**
 - » **LMDs have expressed a desire for more frequent exchange of information and experience** regarding specific products and suppliers, as well as successful business strategies.
 - » **LMDs also asked for useful resources to be collated online in an easy-to-use knowledge hub.** Existing resource hubs focused on PUE are considered too difficult to navigate and primarily focus on serving technology companies.
- **Generate and share third-party product and supplier information:**

- » **Open-source third-party product information** from both laboratory and field testing.
- » **Support platforms where suppliers can share information with LMDs** about their products, their support offer for LMDs, and typical pricing and terms of sale depending on order volume and destination country / region. An example is the [PUE product catalog series](#)⁹ developed by Power Africa which includes technical specifications, suppliers, quality standards and contacts; and the [virtual PUE product trade shows](#)¹⁰ delivered by GDC and Efficiency for Access.

For donors and programme implementers

- **Create flexibility within funding mechanisms** for small-scale piloting of new products and the ability to pivot as you go.
- **Support distributor-led field testing of PUE products**, providing grant funding and technical assistance to LMDs to conduct thorough needs assessments and undertake rigorous new product pilots. This would generate in-depth consumer insights that suppliers need to inform product design, whilst helping LMDs develop the business strategies and supplier partnerships needed to roll out PUE at scale.

Appendix

Resources

1. Stottlemeyer, J., (2018), “What we mean by ‘productive’ use - and what it matters”, (Power for All). Retrieved from: <https://www.powerforall.org/insights/technologies/what-we-mean-productive-use-and-why-it-matters>
 2. GDC (2022), Last Mile Distribution: State of the sector update 2022. Retrieved from: <https://infohub.practicalaction.org/bitstream/handle/11283/622892/GDC%20State%20of%20the%20sector%20update%202022.pdf?sequence=1&isAllowed=y>
 3. Hobgen S., (2021), “How a Pay-as-You-Go Solar Project Reaches the Poorest Households”, (Development Asia). Retrieved from: <https://development.asia/explainer/how-pay-you-go-solar-project-reaches-poorest-households>
 4. Efficiency for Access (2022), “2021 Solar Appliance Technology Briefs”. Retrieved from: <https://efficiencyforaccess.org/publications/2021-solar-appliance-technology-briefs>
 5. VeraSol (2022), “Product Database” (webpage). Retrieved from: <https://data.verasol.org>
 6. GDC (2022), “How to expand your product basket in a strategic way”, from the GDC how-to-guide series. Retrieved from: <https://globaldistributorscollective.org/knowledge-hub>
 7. Waldron D., et al (2021), “Getting Repaid in Asset Finance: A Guide to Managing Credit Risk”, (CGAP). Retrieved from: <https://www.cgap.org/research/publication/getting-repaid-asset-finance-guide-managing-credit-risk>
 8. Power Africa (2022), “Microfinance loans for increasing access to off-grid solar products”. Retrieved from: <https://www.usaid.gov/documents/power-africa-microfinance-loans-increasing-access-grid-solar-products>
 9. Power Africa (2021), “Off-grid productive use of energy catalog”. Retrieved from: <https://www.usaid.gov/powerafrica/beyondthegrid/off-grid-solar-market-assessments#PUecatalogs>
 10. GDC and Efficiency for Access (2021), “Product roadshow: Refrigerators and solar water pumps”. Retrieved from: <https://globaldistributorscollective.org/product-roadshow-refrigerators-and-solar-water-pumps>
- GDC and Efficiency for Access (2021), “Product roadshow: off-grid fans and TVs”. Retrieved from: <https://globaldistributorscollective.org/product-roadshow-off-grid-fans-and-tvs>

Code:
E - Currently exploring
P - Actively piloting
S - Actively selling
X - Previously piloted

LMDs interviewed and PUE products sold

LMD and focus country	Water pumps, drip irrigation	Egg incubators	Mills	Dryers	Cooling fridges, freezers, icemakers	Solar washing machines	Carpentry, metalwork tools	Other
<u>Easy Solar</u> Sierra Leone Liberia	P		E		P			Exploring solar generators
<u>EnerGrow</u> Uganda			E		S		S	Selling sewing machines, juice machines / blenders, hair clippers; exploring e-bodas
<u>ENRAPOWER</u> Zimbabwe	S							Selling 1kW, 2kW and 5kW solar systems for customers to power their own AC equipment (fridges, sewing machines, etc)
<u>Mwezi</u> Kenya	X	S	X		X			Selling solar barber kits, solar TVs for village cinemas
<u>Natfort Energy</u> Zimbabwe	P				E			
<u>Powerlive</u> Zimbabwe	S				P			Piloting solar hair clippers; selling solar home systems for poultry farming
<u>Solar Sister</u> Tanzania Nigeria	E	X						Previously piloted barber kits, phone charging hubs, security lights, sewing machines, solar home system entertainment packs, solar torch/phone charging lamps; selling fishing lights
<u>Solar Solutions PNG</u> Papua New Guinea	S				S			Piloting a barber package, phone charging package
<u>SolarWorks</u> Mozambique	S				P			Selling solar TVs for village cinemas, solar home systems for markets, phone charging packs
<u>Sosai Renewable Energies Company</u> Nigeria	E		E	S	P			
<u>Sumba Sustainable Solutions</u> Indonesia	P		S			P		
<u>Village Infrastructure Angels (VIA)</u> Vanuatu Indonesia Honduras	x		S *	P	P	P		
<u>Vitalite Zambia</u> Zambia	S	P						

* **Note:** Includes maize shellers, flour grinders, rice hullers, rice polishers, cassava and coconut grater, meat/kava mincers and oil expellers.