



Powering Lives and Livelihoods: Scaling Productive Uses of Renewable Energy (PURE)



Handbook for Governments & Development Partners



Foreword

It is with great pleasure that we introduce the "Powering Lives and Livelihoods: Scaling Productive Uses of Renewable Energy (PURE) Handbook for Governments and development Partners." This publication arrives at a critical juncture when the world is grappling with the pressing challenges of energy poverty, climate change, food insecurity and economic inequality.

In today's interconnected and rapidly changing world, access to clean, modern, and reliable electricity is no longer a luxury but a fundamental necessity. Yet, as we stand at the forefront of technological advancements and scientific breakthroughs, it is disheartening to acknowledge that 675 million people worldwide still lack access to electricity, limiting their economic opportunities and perpetuating cycles of poverty and vulnerability.

The PURE Handbook seeks to address this global challenge by shedding light on the transformative potential of productive uses of renewable energy. By harnessing the power of renewable sources such as solar energy, we could create sustainable pathways for economic growth, social development, and environmental resilience.

The importance of productive uses of renewable energy becomes even more pronounced as we grapple with the impacts of a changing climate. Many of the communities lacking access to electricity are in climate-vulnerable regions, making them more susceptible to extreme weather events and their devastating consequences. By integrating renewable energy technologies into agriculture, small enterprises, public infrastructure, and communication systems, we can enhance resilience, unlock green growth, and ensure the provision of vital services.

Food security, clean water, and healthcare are among the fundamental pillars of human well-being. Unfortunately, millions of people are denied these necessities due to energy poverty. The PURE Handbook underscores the potential of renewable energy to address these challenges head-on. From solar water pumps providing clean water to health facilities equipped with solar-powered

refrigerators for storing vaccines and medicines, the deployment of PURE technologies can save lives, improve health, and enhance overall quality of life. The economic implications of embracing productive uses of renewable energy are vast.

The PURE Handbook serves as a call to action for governments and development partners around the world. The recommendations put forth in this publication provide a roadmap for policymakers and stakeholders to unlock investment partnerships, raise awareness, increase financial support, and promote inclusive and sustainable development. However, we must acknowledge the challenges that lie ahead. Affordability, availability, consumer awareness, and capital investment are among the barriers that hinder the full-scale deployment of PURE technologies. Taxation policies, quality assurance standards, and the need for increased coordination among stakeholders are also critical areas that require attention. The PURE Handbook confronts these challenges head on and provides practical recommendations to overcome them.

As we embark on this journey towards a future powered by renewable energy, collaboration and innovation will be our guiding principles. The PURE Handbook is a testament to the collective effort of experts, researchers, policymakers, and practitioners who have contributed their knowledge and insights to this publication. It is my sincere hope that this handbook will inspire and inform governments, development partners, and all stakeholders involved in the pursuit of sustainable energy solutions.



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Why Productive Uses of Renewable Energy?

Global challenge

675 million people still lack access to clean modern and reliable electricity, drastically limiting their economic opportunities.¹ Without energy security they are also more vulnerable to global shocks, such as climate change and growing fuel prices, which further widens the gap between those that have resources and those that do not. Without access to electricity and productive use technologies, hundreds of millions of people lack the tools to lift themselves from poverty.

Living with a changing climate

Most people living without access to power live in climate-vulnerable countries; off- and weak-grid technologies provide them with a chance to adapt and thrive. Productive uses of renewable energy (PURE) have the potential to mechanize agriculture, power enterprise and electrify public infrastructure across sub-Saharan Africa and South Asia. This will improve resilience to extreme weather events, unlock green growth and support vital communications networks needed to facilitate emergency planning and disaster response.²

Food security

In the face of skyrocketing food global prices, PURE technologies increase productivity and food security for small holder farmers. Irrigation systems such as solar water pumps (SWPs) offer access to groundwater for irrigating agricultural fields and boost food production, while solar refrigeration units (SRUs) and cold storage enable its preservation. SWPs offer water supply during dry season, while solar cooling can bring down food waste. Whilst at a nascent stage of development, agri-milling, processing, and other machinery can also boost crop yields and efficiencies. However, only a fraction of smallholder farmers can access these services today.

Clean water and health

Two thirds of health facilities in low- and middle-income countries lack access to reliable electricity and millions die each year from preventable diseases and illness; PURE technologies can rapidly improve health and water infrastructure.³ Solar water pumps can provide access to clean, potable water, minimizing the potential for illness from drinking contaminated water supplies, while health services can be rapidly improved by the addition of electricity and the use of solar-powered refrigeration units to store vaccines, samples, and medicines.

Economic development and clean energy jobs

Solar energy kits are already used to light and power 490 million people and 10.5 million enterprises globally, increasing savings, income, and welfare.⁴ The industry also supports over 370,000 green jobs in sales, distribution, customer services, and management.⁵ Almost 500 off-grid companies commercializing SWPs, SRUs and other PURE appliances and products exist in SSA alone. These organizations have the potential to create job opportunities for youth in rural areas and to pioneer radical new technology innovations that can drive green growth.⁶

1 IEA, IRENA, UNSD, World Bank, WHO. 2022. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC

2 Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors (2022), Off-Grid Solar Market Trends Report 2022: State of the Sector. World Bank, Washington, DC

3 UNDP. Accessed June 2022. Website: undp.org/energy/our-flagship-initiatives/solar-for-health

4 Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors (2022), Off-Grid Solar Market Trends Report 2022: State of the Sector. World Bank, Washington, DC

5 Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors (2022), Off-Grid Solar Market Trends Report 2022: State of the Sector. World Bank, Washington, DC

6 Market analysis undertaken by GOGLA and the LEIA program

Call to Action

Scaling up the deployment of PURE is critical for achieving energy, food, and water security, driving economic development, improving health services and adapting to climate change. In view of the challenges nascent PURE markets are facing, we call upon public sector institutions and agencies responsible for energy, agriculture, water, health and environment across sub-Saharan Africa and South Asia, and the development partners engaged in supporting them, to recognize the relevance of the off-grid solar industry to realizing their goals. Actions include:

- **Establishing government champions among ministries of energy, agriculture, water, health, and the environment.** Champions should help to facilitate well-functioning inter-ministerial coordination platforms and create a more fluid relationship with the off-grid solar and agricultural private sector and other key stakeholders, integrating actions that unlock investment partnerships and market building opportunities.
- **Developing nationwide awareness raising campaigns to inform potential consumers of available PURE products and services.** These will build trust, grow demand, and leverage support for the increased adoption of quality PURE products and services. Key stakeholders to be engaged include farmers' cooperatives, associations, and public sector or development partner programs in target sectors.
- **Increasing dedicated financial support to PURE companies, in the form of grants, subsidies and targeted tax exemptions.** These will enable PURE companies to expand further into off- and weak-grid areas, provide services that enable new livelihood opportunities, increase local agricultural production, and generate thousands of formal and informal employment opportunities.

Key Recommendations

Considering the early stage of most PURE markets, the following recommendations for governments and development partners are made to help accelerate the adoption of PURE:

- In nascent and emerging PURE markets, establish or strengthen national inter-ministerial coordination platforms and appoint leading agencies to facilitate multi-stakeholder engagement between governments, private sector, academia, and financial institutions to grow and support the sector.

- Mobilize public financing such as subsidies and guarantees to help address the affordability gap.
- Deliver tax reform studies that help understand where and how dedicated tax exemptions to specific PURE products or components can increase tax revenues through increased agricultural production and exports, or job creation.
- Facilitate technical assistance, business incubation, and mentoring services for newly established PURE companies and unlock sufficient private financing opportunities through consolidated proof of business concepts.
- Protect consumers through the design, adoption and implementation of voluntary quality standard frameworks that improve the quality of imported PURE products and components and reduce counterfeit. More mature PURE markets will need to establish mandatory quality standard frameworks.
- Pilot new high-quality PURE appliances, products, and services in hard-to-reach areas to increase awareness raising and demand among end-users. Consumer financing from PURE companies, agri-input dealers, or commercial institutions will be critical to overcome the current end-user affordability gap.
- For horizon and emerging technologies, deliver Research and Development (R&D) Funds to help new PURE companies test, prototype, and pilot innovative appliances, products, services, and business models. Near-to-market technologies tested successfully in specific countries will also need funds to be replicated (and adapted) in new geographies.
- Increase the capacity of different consumer-based associations and cooperatives, i.e., SACCOs, to enhance the knowledge needed to optimize the efficient and sustainable use of PURE appliances, products and services among their associates and members.
- In partnership with technical and vocational education and training (TVET) organizations and universities, launch technical servicing and installation training and certification programs to increase quality workforce levels.
- Establish programs and clear guidance on how to engage women and vulnerable populations with PURE solutions, ensuring inclusivity is promoted throughout financial schemes and subsidies programs.

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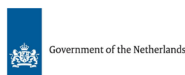
About GOGLA

GOGLA is the global association for the off-grid solar energy industry. Our 200+ Members provide millions of low-income and climate-vulnerable people with affordable, high-quality products and services; rapidly increasing customers productivity, connectivity, and resilience. To enable sustainable businesses and accelerate energy access, we provide market insights, standards and best practice, and advocate for catalytic policies, programmes and investment. With the right support, our pioneering industry can improve the lives of 1 billion people by 2030.

About WE4F

Water and Energy for Food (WE4F) is a joint international initiative of the German Federal Ministry for Economic Cooperation and Development (BMZ), the European Union (EU), the Ministry of Foreign Affairs of the Government of the Netherlands, the Norwegian Agency for Development Cooperation (Norad), Sweden through the Swedish International Development Cooperation Agency (Sida), and the U.S. Agency for International Development (USAID).

WE4F, through its Regional Innovation Hubs across 5 regions in Africa and Asia, provides financial support, technical assistance, and investment facilitation to water-food, energy-food, and water-energy-food innovations. The supported innovations impact smallholder farmers, helping them unlock missing inputs, finance, technology, and markets. By using these innovations, farmers and food companies can enhance their climate resilience and reduce CO₂ emissions.



Disclaimer:

The views in this guide do not necessarily reflect the specific policies of the respective development partners. Nothing in this guide is or should be construed as an endorsement by a development partner of any organization, product, service or individual.

Key Takeaways

Innovative PURE technologies can build on the successes seen in the deployment of solar energy kits (lanterns and solar home systems). Today almost half a billion people are benefiting from solar energy kits specifically designed to reach customers in regions with little or no access to electricity.⁷ Given this progress, stakeholders are increasingly exploring how this achievement can be enhanced using PURE appliances, products, and services in off- and weak-grid communities.

The two regions with the largest electricity deficit, sub-Saharan Africa (SSA) and South Asia have the largest potential markets for PURE products. Sub-Saharan Africa accounts for more than 80% of the 675 million people who still lack access to modern electricity,⁸ while South Asia accounts for 58% of the 775 million people connected to weak grids.⁹ These two regions are therefore the primary focus for this report.

The potential to generate socio-economic benefits via PURE products and services is vast, particularly for people living in climate-vulnerable communities. Mature PURE markets can deliver long-term dividends due to their positive impact on livelihood opportunities, green jobs, poverty reduction, food, water, and health security and by building resilience to economic and climate shocks.

Although still nascent, off-grid appliance, product, and services markets are fast growing, with Kenya, Nigeria, India, Pakistan, and Uganda considered the market leaders. These are also where most of the off-grid PURE innovation and developments are currently taking place. Beyond matured markets, such as those for solar energy kits, TVs or fans, several PURE technologies,

including solar water pumps (SWPs) and solar refrigeration units (SRUs), seen as 'emerging' technologies two years ago, are now classified as 'near-to-market', with sales growing and costs going down.¹⁰

The combined addressable market for cold storage and SWPs across sub-Saharan Africa and India is worth US\$14 billion.¹¹ However, beyond SWP and cooling, more funding for research and development (R&D) is needed to accelerate the development, testing, and deployment of other PURE appliances, products, and services for high impact needs, such as solar agri-processing solutions (i.e., solar milling, drying, or heating).

The economics of off-grid products and appliances are overwhelmingly positive for micro-small and medium enterprises (MSMEs) and smallholder farmers, with payback periods of between one and six years.¹² For example, SWPs can increase agricultural yields by 30%, and solar cold storage facilities at farmgate can bring down post-harvest losses by 30 - 40%.^{13,14}

There is increased interest for private sector companies to venture into the off- and weak-grid appliance and product markets, with over 479 PURE companies globally and over 160 based in the East African region alone.^{15,16} PURE companies have significant capacity to generate employment, but often lack experience on how to scale up businesses, requiring support to raise capital, increase distribution networks and optimise their product offering.¹⁷ User data, aggregation of annual sales, and company performance benchmarks are limited in the PURE sector.

7 [Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors \(2022\), Off-Grid Solar Market Trends Report 2022: State of the Sector. World Bank, Washington, DC](#)

8 [IEA, IRENA, UNSD, World Bank, WHO. 2023. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC.](#)

9 [Ibid](#)

10 [Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors \(2022\), Off-Grid Solar Market Trends Report 2022: State of the Sector. World Bank, Washington, DC](#)

11 [Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors \(2022\), Off-Grid Solar Market Trends Report 2022: State of the Sector. World Bank, Washington, DC](#)

12 [Lighting Global/ESMAP, ECA, ASD. \(2022\). The Market Opportunity for Productive Use Leveraging Solar Energy \(PULSE\) in Uganda](#)

13 [Rural Senses, SVT, CLASP, EST, Efficiency for Access \(2022\). Impact Assessment Framework. Solar Water Pumps.](#)

14 [CLASP, EST, Dalberg. \(2019\). The State of the Off-grid Appliance Market.](#)

15. According to the Low Energy Inclusive Appliances (LEIA) Programme.

16 Estimation by GOGLA and EA NREAs

17 [SNV, EnDev. \(2021\). Productive Uses of Solar Energy in Kenya: Policy Action Plan](#)

Key Takeaways

Some business models exist that offer end-to-end services along with the distribution of PURE products. These models aim to strengthen business viability, stimulate uptake, and build customer confidence. End-to-end services include the provision of agricultural support, climate, and digital information to prepare for unpredictable weather, or direct technical support for customers to help them to raise income, reduce risk of defaults, and ensure payments. For instance, cold storage company SokoFresh is linking aggregated agricultural produce with market off-takers.

Despite the clear benefits of PURE technologies, they are still hampered by major challenges including low affordability, availability, and consumer awareness. This is especially true for more expensive, and complex products than solar home systems. Distribution networks developed by PURE companies for the commercial sale of solar-powered appliances and products are generally found in densely populated areas, far from rural customers. There is also a lack of awareness and information. A growing number of business models targeting aggregators (farmer groups, SACCOs) or partnering with agri-input dealers and offering end-to-end services are emerging, improving the awareness, availability and affordability of PURE appliances and services. However, costs remain prohibitive. For example, only 12% of smallholder farmers can afford a SWP.¹⁸

Capital investment in the PURE industry is still relatively limited, hampering the growth of PURE off-grid companies at scale. Many more working capital, financial facilities, guarantees, insurance and other risk mitigation mechanisms are needed to bring down the risks created by the nascency of the PURE market. Concessional credit lines and debt credit agreements have been offered to some PURE companies; however, the number needs to be significantly expanded.

75% of grant funding in the off-grid sector is now going to PURE.¹⁹ Public finance is also starting to play a key role in addressing affordability, driving down the price of innovative products and services and incentivising market entry for PURE companies. However, support for research and

development of new PURE products and subsidies (such as Results-based Finance mechanisms) to help expand distribution networks into new markets or hard-to-reach areas must be rapidly scaled. Other public funding mechanisms that bring down prices and investment risks, such as tax reductions or support for the expansion of end-user credit facilities by banks and SACCOs are also critical for accelerating market growth and addressing affordability.

There is inconsistency in taxation policies for off-grid appliances and products. For example, while tax exemptions on SWPs²⁰ exist in 34% of SSA and South Asian countries, taxes are fully applied to other off-grid PURE products. Most governments are still imposing full import duties and value added taxes to products considered 'luxurious', such as refrigeration units, or to imported 'innovative' components and parts of new off-grid devices, such as milling components. This is restricting innovation and market growth for early-stage technologies. Even where clear tax exemptions exist for off-grid appliances and products, companies often face unpredictability at customs in cases where the technologies are not well understood.

Different reports predict high growth in voluntary carbon markets, indicating it could be worth upward of US\$50 billion in 2030.²¹ PURE could benefit from this growth offering companies and governments a renewed opportunity to attract new sources of revenue. Following the approval of Article 6. at COP26, carbon credits offer a particular opportunity for PURE products, as PURE appliances can potentially mitigate significant carbon emissions from the displacement of diesel alternatives. However, additional resources and human capital needs to be mobilized to unlock the benefits of carbon credits, including on efforts to grow awareness among governments and off-grid companies, and provide technical support and investment into digitalized monitoring, reporting and verification tools. COP27 highlighted several venture capital investment funds set up to support clean energy innovators which may be interested in the PURE sector once the benefits are better reported and recognized.²²

18 [Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors \(2022\), Off-Grid Solar Market Trends Report 2022: State of the Sector. World Bank, Washington, DC](#)

19 According to GOGLA's 2022 data

20 [GOGLA. \(2022\). Duty tracker.](#)

21 [McKinsey. Accessed January 2021 - Carbon credits: Scaling voluntary markets | McKinsey](#)

22 The Amazon Accelerator Fund funded USD \$207 million worth climate technology investment and the EIB committed \$2.6 billion in climate action in investment with venture capital, private investors, and infrastructure funds.

Key Takeaways

Most government standards agencies have not developed specific quality assurance (QA) standards or regulations for the import of PURE products beyond traditional solar PV solar energy kits (lanterns and SHS). Standards are needed to limit growing PURE product counterfeit, maintain product quality and retain customer confidence. However, compared to traditional solar off-grid devices, PURE products are more complex and innovation amongst PURE technologies is evolving rapidly, especially for those appliances and products that are far from market maturity. This represents a challenge for standards agencies, who must explore the development stage of each product and service before defining the appropriate approach to regulation.

National electrification plans must factor in increasing market interest in off-grid agricultural appliances, products, and services, aiming to meet energy demand sustainably. For instance, cooling or water irrigation services must be considered and prioritized in least-cost electrification analysis and planning. An array of new government-led programs, supported by development partners are currently being designed and allocated to deploy PURE solutions at scale, along with support to national off-grid electrification programs. However, it is unclear how these programs will fit into the existing national electrification plans.

As PURE markets are enablers of several development areas (e.g., water, agriculture, climate, health, and energy), close coordination and information sharing between key stakeholders is needed to optimize their impact. Inter-ministerial and cross-sectoral donor coordination, along with the creation of spaces for dialogue and information sharing are needed. These can help to catalyze growing efficiencies for both PURE-related programs, policies, and strategies and for the programs, policies, and strategies in each linked sector.

Significant investment is needed to improve capacity and knowledge within PURE businesses. This includes business skills for management and the upskilling of sales agents, technical staff, and product designers. Off-grid companies, agricultural retailers or other enterprises commercializing PURE products face a huge challenge. For example, off-grid retailers need to build knowledge in their teams around specific PURE technologies (e.g., on relevant agricultural practices), while agricultural retailers need to build knowledge on solar technology and financing. Skills development is therefore crucial to enhance long-term business performance and investment readiness.

Despite evidence showing the positive impact of diversity in the workplace and on the viability of off-grid companies, the sector is still very male-dominated, with women playing a minor role in technical and senior management posts.²³ Men, reported to earn systematically more than women, represent a significant majority of CEOs among off-grid companies,²⁴ while few products are designed to specifically address the needs of women. Inclusivity will need to be actively incorporated into actions to support the PURE market to ensure that its benefits can be realized equally.

²³ PowerforAll, the Rockefeller Foundation, Good Energies Foundation, GET.Invest. (2022). Powering Jobs Census 2022: The Energy Access Workforce

²⁴ Efficiency for Access. (2002). Assessing the Inclusivity of the Solar Lighting and Appliances Sector.

About this Handbook

This handbook was developed by GOGLA, the global association for the off-grid solar energy industry, with the financial support of the German Federal Ministry for Economic Cooperation and Development (BMZ) and the European Union (EU), through the international initiative Water and Energy for Food (WE4F).

The handbook was iterated with the generous time contribution of staff from the Efficiency for Access coalition, World Bank/ESMAP, EnDev (SNV), and the African Development Bank. It reflects the shared views of these organizations on the productive uses of renewable energy (PURE) industry and includes the review of more than 70 publications and interviews with over 50 relevant stakeholders.

With this handbook, GOGLA aims to:

- Showcase the potential and value of PURE products and services to unlock new livelihood opportunities, drive employment and address challenges such as food, water, and energy security.
- Highlight key trends and innovations in the fast-changing PURE industry, including upcoming business models and successful examples that demonstrate good practice.
- Share insights on the five core building blocks needed to develop mature and sustainable PURE markets.
- Propose specific actions for governments and development partners that can optimize the design of smart policies, subsidies, and programs to scale the adoption of PURE. To that end, this handbook provides information for consideration in the design of future policies, regulations, and programs.

Five Core Building Blocks

The recommendations for governments and development partners are themed into five core building blocks. These are highlighted here and explored further in Section 2.

- **Supportive policies and regulations:** to drive stakeholder engagement, catalyze partnerships, integrate PURE into national electrification plans, and establish voluntary and mandatory quality standards (as appropriate given the maturity of different PURE technologies and services).
- **Tailored public and private funding and investment:** to support companies' capacity to grow and to provide appropriate consumer financing. Mechanisms through which financial support can be provided to PURE companies include tax and tariff exemptions, subsidies, consumer credit and working capital.
- **Targeted activities to expand technology adoption:** to help address the issues of awareness and affordability. Actions include awareness campaigns, and providing support for business models that help to aggregate purchasing power or improve the income of PURE customers, e.g., through support for shared ownership or fee-for-service business models, or initiatives that help PURE customers connect with off-takers for their goods.
- **Capacity building:** to create the foundations for a thriving PURE sector i.e., mentoring, and technical assistance for PURE companies to improve business performance.
- **Critical cross-cutting elements that build sustainable markets:** to underpin the growth of a responsible industry such as inclusivity, customer protection, and sustainable business practices.

Approach to the Recommendations

This handbook highlights the most relevant actions to be undertaken by governments and development actors under each of the five core building blocks. However, the most appropriate actions can differ depending on the maturity of the available PURE technologies. Therefore, to further refine the recommendations, three levels of PURE market maturity were identified and will be used to enhance the recommendations in Section 2.

Nascent National PURE Markets

These are typically national markets with very little or no PURE annual sales identified (e.g., <1,000 SWPs or SRUs), a low presence of PURE off-grid private sector players (<20 companies), absence of capital or consumer credit, lack of inter-ministerial coordination and/or absence of any voluntary quality standards or assurance framework. Most national markets across SSA find themselves in this market category.

Emerging National PURE Markets

Emerging PURE markets often register growing annual sales trends (e.g., >10,000 SWPs or SRUs), a thriving presence of PURE off-grid companies (>50 companies), extensive level of horizon / emerging PURE technology prototyping, inter-governmental policy coherence, multistakeholder engagement, and emerging credit lines such as PAYGo or PURE loans via MFIs. Voluntary quality standards or assurance frameworks are consolidated at this market maturity level. Countries such as Kenya, Nigeria, Uganda, Bangladesh, or India fall within this market category.

Mature National PURE Markets

These countries have a thriving ecosystem, where effective multi-stakeholder engagement exists, working capital flows are supported by catalytic financial mechanisms, and there is the provision of low interest consumer finance. To date, none of the South Asian or SSA national markets belongs within this market category.



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Definitions and Methodology

Productive uses of renewable energy (PURE) has slightly different definitions across the off-grid industry and amongst development partners and other sector stakeholders. Sometimes, they are referred to as productive uses of energy (PUE), livelihood technologies (often used in India), or productive use leveraging solar energy (PULSE), employed often by the World Bank.

For the interest of this handbook, the following definitions will be used:

Off-grid solar appliances and products

Energy-efficient and powered often by direct current (DC) and include both household and small business appliances and productive use of renewable energy (PURE) appliances. Due to the growing market interest among weak-grid geographies, off-grid appliances, products, and services capable of operating under alternate current (AC) are also included in this report.

Off-grid solar appliances and products, include:

1. Household and small business appliances and products

Solar lights and home systems, commonly sold with phone charging, televisions, fans, refrigeration units, and radios are often considered household items, but significant numbers are used in small businesses. For example, a refrigerator may be used in a shop, or a TV may be used in a restaurant. This category of technology represents by far the largest PURE market share.

2. Productive use of renewable energy (PURE) appliances and products

Enable improved or new income generating activities, often in agriculture. These products include solar-powered water pumps, refrigeration units, cold rooms, heating, and agri-processing equipment (see Figure 1).

This report will consider both typologies of appliances and products, but will focus most extensively on typology two for the following reasons:







- Markets for traditional off-grid appliances and products are more mature, appliances require less energy demand, are less expensive, and are well covered in the existing bibliography.
- GOGLA has previously released the 'Providing Energy Access through Off-Grid Solar' Guidance for Governments which covers the typology 1 market segment.
- Although PURE is not new, markets, which are in their nascency, are rapidly evolving, requiring clear guidance for key stakeholders such as policy makers and development partners to navigate them.

Nevertheless, off-grid appliances and products particularly relevant for MSMEs are still considered in this publication, such as fans or TVs. Excluding typology 1 technologies, examples of key PURE appliances and products are shown in Figure 1.

Definitions and Methodology

Figure 1: Examples of Typology 2 – Productive Uses of Renewable Energy

Examples of Productive Uses of Renewable Energy (PURE) products and appliances

Product Category	Application	Level of market maturity	Visual example
Small and portable solar water pumps (SWPs)	SWPs enhance irrigation for smallholder farmers and enable production during dry seasons	Near-to- market	
Solar refrigeration units (SRUs)	SRUs preserve perishable produce and beverages, and enable MSMEs to increase their services	Near-to- market	
Solar inverter	It provides clean 24/7 energy and allows solar kits and PURE appliances and products to connect in weak-grid areas.	Near-to-market	
Walk-in cold rooms (cold storage)	Off-grid fee-for-service cold-storage solutions to enable preserve dairy, fish, meat, fruits, or vegetables.	Emerging	
Produce transportation	PAYGo service electric vehicle transportation of agricultural produce in rural areas.	Emerging	
Agri-processing	Electric milling machines to grind the grain and produce flour or electric dryers to accelerate drying of agricultural produce like mango, coffee or banana.	Horizon	



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State of the Off-Grid PURE Sector



State of the Off-Grid PURE Sector

In the past two years, PURE technologies have advanced significantly in the off-grid industry, with the increasing availability and diversity of high-quality, more affordable, productive use appliances, products, and services. Household and MSMEs (micro, small and medium sized enterprises) in off-grid and weak-grid areas have gained access to over 10.5 million solar kits worldwide.

While solar kits for households and MSMEs have reached full commercial maturity, most PURE technologies are less developed. PURE technologies can be classified under four different maturity levels, as represented in Figure 2:

1. Commercial technologies (solar kits and DC appliances such as TVs or fans),
2. Near-to-market technologies (solar water irrigation, solar refrigeration units),
3. Emerging technologies (e-cooking, walk-in cold storage, e-mobility), and
4. Horizon technologies (milling, drying and many more).

Unlike off-grid technologies now considered to be sold as part of a **fully commercial market**, such as solar lighting, phone charging, TVs or fans, off-grid PURE technologies commonly employed in agriculture, such as solar irrigation and cooling systems, require higher energy demand, are costlier, and more complex appliances.

However, due to efficiency improvements in recent years, PURE technologies, such as solar water pumps (SWP) and refrigeration units (SRUs), seen as emerging markets several years ago, are now considered to be **near-to-market**.

E-cooking, e-mobility, and cold storage are now deemed to be **emerging markets**, where proven technologies and business models are being tested in a few geographical markets. Sales are limited at the current time, but these markets are rapidly evolving.

Finally, other off-grid PURE technologies, commonly employed in agriculture (i.e., solar milling or drying) are still in a more nascent phase of development, termed a **horizon market**, as only

technology prototyping has been developed so far.

PURE commercial market technologies

Off-grid solar kits represent the most commercial and mature off-grid solar market today. These are often sold with efficient DC appliances such as TVs, radios, fans, and hair clippers. In 2022, GOGLA affiliates' sales of TVs for households and MSMEs showed over 590,000 sales in SSA alone, while sales of fans reached almost 830,000 in the South Asian region.²⁵



Solar energy kits and DC appliances

2030 projections show that off-grid solar is expected to account for 41-55% of all connections needed to reach the SDG7 goal of universal electrification.²⁶ There is also a global market opportunity of US\$8.2 billion for TVs by 2025 and of US\$1.4 billion for fans by 2030,²⁷ with fans mostly demanded in South Asian and West African regions. Over 200 affiliate members within GOGLA, which make up 28% of the off-grid solar industry, currently commercialize solar energy kits and DC appliances in sub-Saharan Africa, South Asia, South-east Asia, and Latin America.

In addition, ICT based appliances and products powered by solar energy kits, such as smartphones, internet devices, or computers, are also supporting MSMEs by enabling them to be better connected to business opportunities and to improve the efficiency of their operations.

Evidence shows that where solar energy kits are used to support businesses such as hair salons, restaurants, and shops, they boost income generation by an additional \$52 per month on average.²⁸ However, although the potential for solar energy kits and DC appliances to support MSMEs is huge, the cost of these technologies can still prove a challenge. Most people within the target customer base for solar energy kits live under the poverty line.²⁹ Reducing costs, while strengthening income generation by MSME customers would help Research and Development Fund to address the affordability challenge.

25 [Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors \(2022\), Off-Grid Solar Market Trends Report 2022: State of the Sector. World Bank, Washington, DC.](#)

26 [Ibid](#)

27 [Efficiency for Access. \(2021\). Appliances Data Trends.](#)

28 [GOGLA. \(2019\). Powering Opportunity Series](#)

29 [Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors \(2022\), Off-Grid Solar Market Trends Report 2022: State of the Sector. World Bank, Washington, DC.](#)

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PURE near-to-market technologies

Evidence shows that the economics of SWPs and SRUs in the agricultural markets are highly attractive and that they have short-term payback periods of 1-6 years.³⁰ Combined there is a US\$14 billion addressable market for cold storage and SWPs across sub-Saharan Africa and India³¹ and they can improve the livelihoods of over 22 million³² small holder farmers across those regions.



Solar water pumps (SWPs)

42 different [VeraSol](#) quality tested SWPs are currently being offered to small holder farmers (usually up to 1 kWp and covering below 0.5-5 acres of land). These are being distributed by a range of companies, including retailers in the local distribution networks of leading manufacturers, such as Lorentz or Grundfos, and those offering PAYGo financing, such as SunCulture and Simusolar.



Solar refrigeration units (SRUs)

SRUs help to extend the shelf life of perishable products, increase their value, and reduce food waste. In Uganda, it is estimated that 20-40% of milk is wasted due to lack of timely quality cooling.³³ In areas without electricity access, SRUs are also critical for the safe storage of vaccines and medicines.

SRUs (typically below 540L), are primarily designed for income generation purposes such as cooling beverages and food in retail shops, or chilling milk for small agricultural producers. Off-grid solar vaccine storage also falls under this category, with the total addressable market for off-grid solar vaccine refrigeration in India estimated to be around USD 811 million in off- and weak-grid rural areas.³⁴

95 AC and DC refrigerators from 50 brands have been quality-tested by [VeraSol](#), including those with solar-battery-powered and solar direct drive designs (which typically convert solar energy and convert it into DC electrical energy, avoiding battery use).

PURE near-to-market technologies: Affordability challenge

Market penetration for PURE near-to-market technologies, such as SWPs and SRUs, remains low. Upfront cost of SRUs without financing is 2.5 times higher than the annual disposable income of the poorest 50% of the off-grid population,³⁵ representing one of the biggest challenges for PURE companies to grow PURE markets.

In addition, real sales numbers of SWPs and SRUs remain hard to estimate. Amongst GOGLA affiliates, 64,000 and 30,000 SWPs and SRUs have been sold respectively over the past three years³⁶,³⁷ with the market showing strong (63%) growth between the first and second half of 2022, driven mostly by sales in Kenya and Nigeria.³⁸

However, while affiliate data provides important insights into sales trends and dynamics, it does not include the sales numbers of a few big companies and country-led schemes, making it difficult to determine the full size of the current market. For example, official estimates show that 150,000 sales of SWPs have also been achieved recently through the PM-KUSUM subsidy program in India.

An additional challenge in respect of near-to-market technologies is that in many cases, sales are driven by projects sponsored by the government, donors, or NGOs, such as in Ethiopia.³⁹ This means that most PURE companies in Ethiopia do not stock PURE products in the country and import them only when orders are made. This illustrates that, even in countries where there is a clear focus on SWP and SRU's, significant support is still needed for them to reach full commercial viability.

30 [Lighting Global/ESMAP, ECA, ASD. \(2022\). The Market Opportunity for Productive Use Leveraging Solar Energy \(PULSE\) in Uganda](#)

31 [Ibid](#)

32 [Ibid](#)

33 [UOMA. \(2019\). Productive use of off grid energy: The business case in Uganda's dairy value chain](#)

34 [GOGLA. \(2021\). Decentralized Solar Refrigeration: Opportunities in the Livelihood Appliances Market in India.](#)

35 [Efficiency for Access. \(2021\). Appliances Data Trends.](#)

36 Global numbers for SWPs and SRUs are believed to be higher than those reported by GOGLA's affiliated companies.

37 [Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors \(2022\), Off-Grid Solar Market Trends Report 2022: State of the Sector. \(2022\) World Bank, Washington, DC](#)

38 [GOGLA. \(2023\) July – December 2022 Global Off-Grid Solar Market Report](#)

39 [GIZ. \(2020\). Market Study of Smallholder Solar Irrigation Systems in Ethiopia.](#)

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Untapping the existing market potential for off-grid SWPs and SRUs will ultimately require small holder farmers to firmly believe that the value addition provided by these appliances and products will be paid back rapidly. This can be achieved by both reducing the cost of accessing these technologies and/or in increasing the income creation benefits of using them. In practical terms, affordability can be improved through business models that include mechanisms to reduce costs such as subsidy, consumer financing, shared ownership, or fee-for-service approaches, while incomes can be increased by integrating the adoption of SWPs and SRUs with the implementation of value-adding agricultural processes, such as better farmer connectivity and linkages to markets.

PURE emerging technologies

Unlike PURE near-to-market technologies, emerging PURE markets are still in a nascent stage of development, with very low sales and business models being tested in a limited number of geographies.

However, several PURE emerging technologies, such as e-cooking, cold storage, and e-mobility, have demonstrated an exciting potential for rapid growth.



Walk-in cold rooms

According to CLASP and SEforAll, 30–50% of food losses occur due to poor refrigeration in developing countries, with 30% for cereals, 40–50% for root crops, fruits, and vegetables, 20% for oilseeds, meat, and dairy, and 30% for fish.⁴⁰

Only 31% and 14% of small holder farmer production in Kenya and Uganda respectively is currently being traded in export markets, with the lack of cooling at farmgate and in transportation a contributing factor. Given current rates of inflation, which are increasing the cost of produce and farming inputs, alongside the scarcity of food in international and national markets, finding ways to reduce food losses is paramount. Analysis by InspiraFarms suggests that early cold chain could reduce postharvest losses by 25–50%.⁴¹

Emerging cold storage technologies and business models in rural areas show strong potential to address this need. For example, walk-in cold rooms (2,000–8,000L), offer ice-making or milk-chilling services, or cooling for fish, fruit, vegetables, or meat. In India alone, the market size for cold storage technologies is estimated at US\$ 3.7 billion.⁴²

However, commercialization of cold chain technologies across SSA and South Asia remains challenging. Optimizing the cold chain involves multiple stakeholders such as farmers, aggregators, transportation companies, warehouses, processing centers, and off-takers. In addition, initial asset investment is a substantial barrier.

Despite this, solar powered walk-in cold rooms are showing promising results. For instance, SokoFresh, a company based in Kenya, has shown evidence that their off-grid walk-in cold rooms have reduced food losses from 30% to 2% and increased the income of their customers (small holder farmers) by 25%.⁴³

An estimated 15 cold storage companies in Kenya and Nigeria are testing promising business models for the installation of systems at farm gate, some of which are in initial debt finance conversations. The leading business model involves the cold storage company charging a relatively affordable fee-for-service, allowing customers to rent cold storage space.



E-cooking

E-cooking is currently being commercialized in grid, weak-grid, and off-grid areas. Value addition is higher in urban areas, where grid connected e-cooking is five times cheaper than charcoal.⁴⁴

Despite high socio-economic and environmental value, solar powered e-cooking markets are still impeded by affordability as rural customers struggle with the cost of the technology. However, e-cooking for commercial purposes could help to save current energy fuel expenses and unlock time, especially for women and girls who can then undertake other productive activities.

40 FAO. (2012). *Global Initiative on Food Losses and Waste Reduction*.

41 Shell Foundation. Accessed 2023. *The “Cold Chain” Opportunity*.

42 Ibid

43 Sokofresh. (2022). *Global Off-grid Forum & Expo*, Rwanda

44 MECS, Lighting Global/ESMAP, Loughborough University. (2022). *E-cooking market assessments in Uganda, Kenya, Ethiopia, and Rwanda*

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Existing off-grid companies commercializing e-cooking for rural and peri-urban areas offer solar-powered solutions powered by 300Wp panels which can be used in small restaurants. However, for industrial cookers or school-based kitchens, e-cookers would need to be powered by mini-grids or grid-power.

Four companies in Uganda are also exploring hybrid charcoal-rock-PV cookers which are more commercially attractive. These cookers use 80% less charcoal than their traditional counterparts (replacing it with volcanic rocks) and are coupled with small solar PV-run fans to increase the cooking power.

EXAMPLE: In Uganda, the e-cooking company ECOCA is commercializing 300Wp powered cooking devices for households. The devices can also operate using a grid connection due to an inbuilt inverter.



E-mobility

Innovative business models recently tested in Kenya are allowing e-mobility products to rapidly emerge onto the market. In particular, the growing cost of fuel and the expanding lithium-ion (Li-ion) battery market, alongside with lower consumer fees and flexible PAYGo options, are helping to spread electric motorbikes in urban sub-Saharan African cities and have the potential to spread to peri-urban and rural areas.

With a market opportunity of 1.39 million petrol Boda-Bodas in Kenya, and 100,000 in Nairobi alone,⁴⁵ these and other countries offer a great opportunity for e-mobility. Estimations suggest that e-motos create 60% cost savings when compared to petrol alternatives and sales in Kenya were estimated to hit 5,000 in 2022.⁴⁶

PURE horizon market technologies

While low intensity PURE technologies (typically <2.5 kW), such as SRUs, SWPs, e-mobility, are

becoming commercially attractive to customers in rural areas and are solving complex challenges, (i.e., increasing food security, mechanizing agricultural production, and generating local jobs), other technologies and services, commonly high intensity PURE technologies (typically >2.5 Kw)⁴⁷ are at an earlier stage of development. Nevertheless, they could unlock a powerful potential to support MSMEs and mechanize agriculture in rural SSA and South Asia.

Many companies in the R&D phase are currently venturing into PURE technologies and services such as milling, drying, husking, and threshing with the goal of improving income generation and employment by farmers and rural enterprises.

However, R&D companies engaged in early-stage innovation for new PURE technologies (i.e., solar milling or drying, egg incubators, ice machines, milk chillers, solar sprayers) require long-term grant and patient capital support. This will prove game changing. The impact of such funding can already be seen in other PURE segments which have moved from the 'horizon' stage of development to the 'near-to-market' stage. For example, solar refrigeration unit manufacturers were supported through donor-led R&D programs 3-5 years ago to create the innovations and efficiency gains we see in the technology today.⁴⁸

Another example that illustrates the power of R&D grant finance is the development of permanent magnet motors (PMMs). PMMs have the potential to transform PURE markets by significantly improving the energy efficiency, performance, reliability, and cost of motors while reducing their energy consumption by up to 42% compared with conventional AC motors. PMMs are being employed in fans, e-mobility (particularly e-motos) and washing machines.⁴⁹

International development programs, such as the Low Energy Inclusive Appliances (LEIA) research and innovation program funded by the IKEA Foundation and UK Aid, have demonstrated significant success in bringing different PURE technologies up to market maturity.

45 According to the National Transport and Safety Authority in Kenya.

46 SNV, EnDev. (2021). Productive Uses of Solar Energy in Kenya: Policy Action Plan.

47 EEP Africa, NDF. (2020). Powering Productivity.

48 Efficiency for Access. R&D Funding Efficiency for Access.

49 Efficiency for Access. (2021). Permanent Magnet Motors. Solar Appliance Technology Brief.

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Solar milling

Small-scale milling is seen as an efficient alternative to the continued widespread use of diesel engines for grain milling across sub-Saharan Africa (SSA) and South Asia. There is a projected serviceable market of \$417m in SSA by 2030 if additional cost reductions and efficiencies are undertaken.

However, value addition from these PURE technologies must still be proven, including lowering the cost of operation or creating outputs that enable PURE customers to access broader agricultural value chains (e.g., flour). In SSA, only a few companies are testing prototypes or business models for these horizon technologies, i.e., initial small-scale solar powered milling products by Agsol in Kenya⁵⁰ or by Nadjibi in Senegal. More risk-appetite and R&D funds with limited bureaucracy and efficient processes are needed to accelerate the delivery of such technologies at scale.

In contrast, in South Asia, and specifically India, local manufacturing of solar powered small-scale milling technologies has helped bringing down entry prices to the technology. This has led to the adoption of solar milling in rural areas and in contrast to other regions, the technology is deemed as 'near-to-market'.



Solar drying

Solar powered dryers and electronic thermostat drying chambers have the potential to displace traditional grain drying methods (i.e., cocoa or coffee) in productive areas of SSA, Latin America or South Asia. However, these products remain at the horizon stage.



Egg-incubator

Although still a niche market technology, PURE distributors commercializing egg incubators are growing across East African and Southern African regions. DC egg incubators can operate fully automatically with mechanized egg turning and temperature for 24 hours a day.

Other horizon technologies

Other PURE technologies, such as evaporative air coolers, solar sprayers, or solar-powered hydroponics are being tested and prototyped. For instance, air coolers use water evaporation to cool the air and could be highly effective in low humidity regions. Solar-powered hydroponics for cattle fodder growing is being tested and promoted in India.

Off-Grid Solar Crosscutting Elements

Regardless of appliance/service type, there are three crosscutting elements that must be considered when exploring the status of any PURE market: inclusivity, gender, and climate change. These are highlighted below and explored further in Chapter 2.5.

Inclusivity

A recent report by EforA⁵¹ shows that the average PURE customer has an income of above US\$3.20 a day, higher than most potential customers in rural SSA. According to the World Bank, only the highest quintile of rural Ugandan farmers can access a SWP without additional subsidy support or consumer finance.⁵²

Driving product prices down (without compromising quality) and providing financial incentives, such as subsidies or season-based loans, to support end-users and MSMEs will be critical to reach the poorest and improve the inclusivity of PURE technologies.

50 Efficiency for Access. (2021). *Efficiency for Access Research and Development Funds: Innovator Series*.

51 CLASP, EST. (2022). *Appliances for All: Assessing the Inclusivity of the Solar Lighting and Appliances Sector*.

52 Lighting Global/ESMAP, ECA, ASD. (2022). *The Market Opportunity for Productive Use Leveraging Solar Energy (PULSE) in Uganda*

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Gender

Women and girls are disproportionately affected by the lack of electricity. Multiple studies show that energy poverty has greater negative impact on their health, education, use of time, and access to information.⁵³ Ensuring that women are not overlooked in PURE markets is critical for ensuring that their impacts are optimized.⁵⁴ For instance, PURE can help to increase women's literacy and knowledge, boost their income, and empower them in their homes and communities.

At institutional and entrepreneurial level, women remain underrepresented in decision making positions and should be included as key stakeholders in planning, policy making, and leadership roles. Gender-specific policies are urgently needed to mainstream gender in PURE-related policies and regulations.

At the company level, men take up a majority of technical and leadership roles, despite evidence showing women can be very positive assets for companies.⁵⁵ Female sales agents show better engagement with female customers and have been shown to increase sales and customer confidence.⁵⁶

Some off-grid companies have tested gender transformative practices, such as Solar Sister and Frontier Markets, who provide ongoing training, mentorship, and support to female sales agents. Flexible working arrangements are also offered so that for women who work for these companies can deal with competing household responsibilities. However, a study undertaken by EforA⁵⁷ with 16 off-grid companies in India shows that there is a gender pay gap between men and women across all occupational categories, particularly among the highest-paid management and skilled workers of up to 42% difference.

Climate change

Off-grid rural populations are the least responsible for climate change, yet the most vulnerable to its impacts. Off-grid electricity and productive use assets can help to improve energy equity and climate resilience. This is especially true if they are supported as part of comprehensive approaches

to modernize agriculture, support green growth and benefit from the decarbonization of energy infrastructure. In addition, best results will be seen where efforts to mitigate any unintended consequences are addressed (e.g., the potential to overuse ground water via SWPs).

PURE technologies should therefore be properly integrated into government electrification plans as well as plans relating to climate, water, agriculture, health, and green growth.

1.1 Business Models

A variety of off-grid solar companies are operating in the off-grid sector. The arrival of PURE products and services has increased the complexity of the private sector ecosystem and seen the emergence of new types of businesses. Table 1 provides an overview of the different PURE business models, their role in product commercialization, financial support requirements, and target customers.

The business type categories used in the table are as follows:

Appliance and product manufacturers and distributors: these are those companies producing, assembling, and/or supplying off-grid solar appliances for domestic, commercial, industrial, or agricultural purposes.⁵⁸ PURE distributors often distribute appliances such as SWPs and SRUs to end-users, or other off-grid solar companies. Different types of companies exist in this broad category:

- **Manufacturers**, that undertake large-scale product manufacturing and assembly and provide business to business (B2B) sales to distributors.
- **Distributors**, that supply different off-grid solar appliances and products to consumers, including near-to-market PURE technologies.
- **Vertically integrated companies**, that both manufacture PURE technologies and supply them to consumers. Some vertically integrated companies also make B2B sales to distributors in countries or regions where they do not have their own business to customer (B2C) operations.

53 IEA, IRENA, UNSD, WB, WHO. (2022). *Tracking SD7, the Energy Progress Report 2022*.

54 GDC, Vfw, TEA. (2022). *Gender in Business: Lessons Learned for Last Mile Distributors*.

55 Ibid.

56 CLASP, EST. (2022). *Appliances for All: Assessing the Inclusivity of the Solar Lighting and Appliances Sector*.

57 OXFAM. (2023). *Energy and Women and Girls: Analyzing the needs, uses, and impacts of energy on women and girls in the developing world*.

58 GET.Transform, GIZ. (2022). *Energy for Rural Industrialization. Productive Use of Energy 2.0*.

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Service providers, provide specialized services for developing market needs. This category is composed of financial and software service providers who provide services to other off-grid solar companies. These include digital payment platform providers, and PURE rental companies who offer PURE-based services such as cooling, drying, milling, etc., to other off-grid companies and/or end-users, typically under fee-for-service business models.

- **Service providers**, commonly offer either software or financial services for other off-grid solar companies.
- **PURE rental companies**, provide PURE fee-for-service based business models to other off-grid companies and/or end-users (e.g., milling, cooling, etc.).

Research & development (R&D) innovation companies, aim to research and develop new products and services. These companies can become manufacturers, distributors, or service providers once their technology and business model is consolidated.

Due to the continuous evolution of the appliance, product, and service market, PURE distributors and rental companies continue to adjust their product offering and business models (or develop new ones).

Data shows that the longevity of off-grid companies is higher when they iterate their business models to help increase customer income generation. This is of particular relevance for PURE markets, where the up-front cost of technologies is higher than traditional off-grid appliances and products (e.g., solar lanterns and home systems). For instance, offering PAYGo for PURE products is demonstrated to be able to reach poorer small holder farmers. However, only when business models are designed to boost PURE customers' income can companies reach healthy portfolios where customers are able to pay off their loans.

The cross-sectoral nature of PURE technologies obliges distributors, manufacturers, integrators, and rental companies to interact with multiple non-energy stakeholders, in sectors such as health, agriculture, or water. This has proven challenging for traditional SHS distributors or integrators, as they need to transform their existing distribution networks, target different customers, or mobilize different financial mechanisms. However, experience shows constructive collaborations with specialized partners in other sectors opens new market opportunities for off-grid companies, and in particular for PURE distributors and PURE rental companies.

However, while business model innovations help to increase the competitive edge of PURE companies, setting up innovative business models is costly and requires a significant level of capital. Although sales of PURE technologies can provide bigger returns and higher profit margins than sales of solar lights or home systems, tight margins by PURE companies limit their ability to pilot new business models.

To test new business models, grant facilities for off-grid PURE companies are critical. Several catalytic international development programs are already providing capital to innovative PURE business models, including but not limited to: Water and Energy for Food (WE4F), funded by BMZ and EU, Sustainable Energy for Small holder farmers (SEFFA), funded by IKEA Foundation and EnDev, CleanStart by the United Nations Capital Development Fund (UNCDF), and the Efficiency for Access Research and Development Fund, funded by UK aid and IKEA Foundation. However, these funds will need to be continued and expanded to uncover the business models needed for different markets, technologies, geographies, cultures, demographics, and climates.

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Table 1 - PURE business models

	R&D Innovation Companies	Manufacturers	Distributors	Vertically integrated companies	Service providers	PURE rental companies
Description	New small companies prototyping innovative appliances, products & services	Companies producing and assembling appliances and products	Companies distributing appliances and products via a third party or their own online or physical platform	Companies with capacity to manufacturing and distributing appliances and products	Companies providing software or financial service solutions	Companies renting PURE services
Business model	Prototyping	Retailing to local in-country distributors	PAYGo Cash purchase	PAYGo Cash purchase	PAYGo Fee-for-service	Fee-for-service
Product commercialization	R&D technologies	Proprietary appliances and products	Solar water pumps, solar refrigeration units, e-cooking, inverters, e-mobility, TV, fans, etc.	Solar water pumps, solar refrigeration units, e-cooking, inverters, e-mobility, TV, fans, etc.	Metering (e.g., electricity mini grids) Digital payments platform	Walk-in cold rooms Solar-powered milling & drying Transportation Market linkages
Final customer	B2B (typically distributors, vertically integrated companies, or PURE rental companies)	B2B (typically distributors, vertically integrated companies, or PURE rental companies)	B2B (typically other distributors or vertically integrated companies) B2C	B2B (typically other distributors or vertically integrated companies distributing PURE products) B2C	B2B (typically distributors, vertically integrated companies, or PURE rental companies)	B2B (typically distributors, vertically integrated companies, or PURE rental companies) B2C

PURE commercial market technologies

PURE commercial market technologies are now prevalent across several countries in SSA, South Asia, Southeast Asia, and Latin America. The most common are solar energy kits (lanterns and SHS) often sold with DC appliances that are used within MSMEs.

However, despite the progress made in scaling these technologies, research shows that they are still too expensive for millions of homes and businesses. Awareness about solar energy kits, and their availability, is also lacking in some countries with high levels of energy access deficit, or in harder-to-reach areas of more mature markets. For example, regions that are extremely low-income, sparsely populated or affected by conflict.

A step-change in support is still needed to ensure that solar energy kits are available to all MSMEs.

Solar energy kits and DC appliances

Today, hundreds of companies distribute solar energy kits and DC appliances on a commercial basis, such as solar lights, phone charging, hair clippers, TVs, radios, and entertainment systems. These are primarily used to power homes but are also used by millions of MSMEs.

Distributors and vertically integrated companies sell solar kits and appliances to other companies (B2B), or to customers (B2C). Several companies with B2C operations provide PAYGo financing to their customers, facilitating the access to end-user credit. The PAYGo business model requires finance to facilitate the lending portfolio as well as the inventory. As an incentive to accelerate expansion into new regions or hard-to-reach areas, government and development partners have supported the solar energy kits and DC appliance market via a range of enabling interventions, such as tax exemptions and RBFs.

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PURE near-to-market technologies

As in the case of commercial technologies, the most critical barriers to the scale-up of near-to-market technologies, such as SWPs and SRUs are affordability, awareness, and access.

Companies selling near-to-market technologies additionally struggle with limited existing market data, usage data, and performance benchmarks, which help financiers, governments, and development partners to design and deploy strategies and investments to support their growth. However, knowledge of these technologies is growing, and several key stakeholders have provided critical early-stage support which has helped markets to expand significantly in the last few years.

Solar water pumps (SWPs)

Given the greater cost (and thus risk) of buying SWPs compared to solar energy kits, they are mostly sold using an up-front cash model. However, some companies are now offering PAYGo options to end-users and starting to test fee-for-service approaches. Although sales in several countries are being made under government and NGOs sponsored development or humanitarian programs, commercial sales are beginning to reach significant levels.⁵⁹

Due to the limited affordability by smallholder farmers and a broad lack of awareness around SWPs, some SWP companies are also taking a more holistic approach to demand creation. For example, many distributors employ system integration, where they match pumps with solar PV modules and irrigation kits and couple the sale of the technology with light-touch technical training.⁶⁰

Established and new appliance manufacturers such as Lorenz, Grundfos or Galo, Tata Solar, or Shakti in India, have ventured into the SWP market, commonly using a B2B model, and offering a range of SWPs to their country-based distributors.

Distributors dedicated to SWP such as SunCulture are also operating in the market, building their own networks in rural areas, and offering a range

of SWPs and end-to-end services for smallholder farmers. These companies also offer PAYGo payments models, increasing the affordability of their product.

Established off-grid solar firms with distribution networks in rural areas, and capacity to leverage their payment platforms and existing customer base have additionally begun venturing into the SWP market. These companies have historically sold solar energy kits for use by households and MSMEs, so upskilling their existing retail network to sell SWPs is key.

Finally, local agricultural input providers, with skilled personnel who understand the different agricultural use cases and types of pumps are entering the SWP market. These are companies with little or no experience in the off-grid solar space but who benefit from established and specialized last-mile distribution networks and agricultural sales agents.

EXAMPLE: In Uganda, the agri-input dealer OMIA has access to an estimated customer base of 15,000 smallholder farmers. The company has more than eight local shops and hundreds of sales agents. Through a B2B deal with Tulima Solar, it is now distributing SWPs.

Solar refrigeration units (SRUs)

Over the past two years, established off-grid solar companies have tested the integration of SRUs as part of their product portfolio. However, despite being well placed to leverage their extensive customer retail network, success has been limited.

Barriers to the scale-up of SRUs include high up-front costs (exacerbated by heavy taxation in many national markets as they are deemed luxury equipment), affordability barriers, lack of available consumer credit, lack of proven commercial business models and limited awareness among end-users. In Kenya, a SunDanzer SRU including the solar generation system, battery, and the refrigerator itself represents up to 85% of an end user's annual income.⁶¹

59 GIZ. (2020). *Market Study of Smallholder Solar Irrigation Systems in Ethiopia*.

60 Efficiency for Access. (2022). *Completed Projects* (efficiencyforaccess.org).

61 Efficiency for Access. (2022). *Completed Projects* (efficiencyforaccess.org).

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Despite these barriers, across Kenya, Uganda, Ethiopia, and Rwanda more than 20 PURE distribution companies are commercializing SRUs along with other solar-powered off-grid appliances and products. In Nigeria, Koolbox, have started operating under an end-to-end integration logic, designing their own refrigeration units, and selling them through their own retail network. In weak-grid markets, such as India, companies like Devidayal offer off-grid and weak-grid SRUs, mostly to MSMEs.⁶²

Invertors

In countries with weak grid infrastructure where customers experience frequent black outs, such as South Asian markets, distributors and vertically integrated companies have begun to sell PURE products that can work on both AC and DC to connect to either solar or the centralized grid.⁶³

With the growth of national grids across rural SSA, this hybrid approach is also becoming more attractive to PURE distributors and vertically integrated companies operating in the region. For instance, with the support from the Efficiency for Access R&D Fund, SunKing in Nigeria is commercializing hybrid invertors on a cash and PAYGo basis.

PURE emerging market technologies (walk in cold rooms, e-motos)

Key emerging market technologies profiled in this handbook, walk-in cold rooms, and e-mobility, are predominantly used on a rental basis, and are supported by a fee-for-service business model. For instance, with walk-in cold rooms, farmers pay a fee to cool a volume of produce, commonly

represented by a number of crates. In the e-moto market, an emerging PURE business model is where a driver buys or hires an e-moto so that they can provide a ride-for-hire service for which they charge customers.

In the case of e-motos, Rwandan company, Ampersand, advises that when compared to internal combustion engine (ICE) alternatives, the costs saved by avoided fuel usage can rapidly create positive unit economics.⁶⁴ Battery swapping models and infrastructure can also help to ensure that a 'recharge' is almost instantaneous, enabling drivers to get back on the road rapidly, maximizing their earning potential.⁶⁵

Companies are also exploring ways to improve their sustainability/profitability. For example, in respect of cold rooms, some operators are working to provide additional services for their customers which help them to improve their own income. This in turn increases the revenue and sustainability of the cold room, as customers can keep paying the fee to use it and may even be able to increase their usage. Examples are where companies offer either 'downstream market services', such as linking customers to new markets for their produce, or 'midstream market services' such as transporting produce to local or national markets and keeping it fresh along the whole value chain.

EXAMPLE: In Kenya, cold room company, SokoFresh, has introduced refrigerated trucks to bridge the cold-chain gap and ensure that produce can be cooled until it reaches the national market.

62 Efficiency for Access. (2022). Completed Projects (efficiencyforaccess.org).

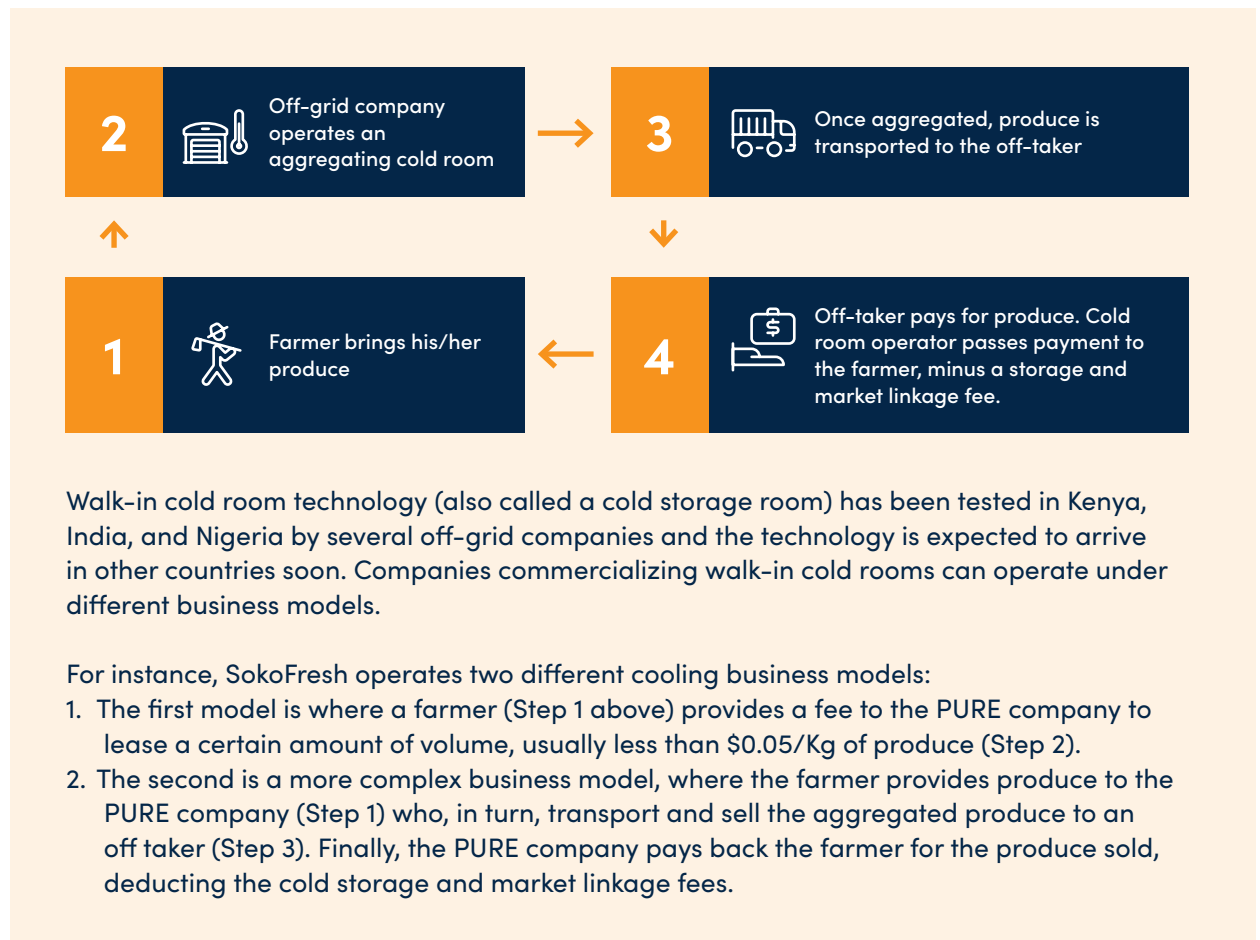
63 Efficiency for Access. (2022). Research and Development Fund: Project Spotlight.

64 Ampersand. Website accessed in June 2023. www.ampersand.solar/impact

65 PREO (2023) Charging Ahead, Accelerating E-Mobility in Africa

State of the Off-Grid PURE Sector

Figure 4 - Cooling as a business model



Walk-in cold room technology (also called a cold storage room) has been tested in Kenya, India, and Nigeria by several off-grid companies and the technology is expected to arrive in other countries soon. Companies commercializing walk-in cold rooms can operate under different business models.

For instance, SokoFresh operates two different cooling business models:

1. The first model is where a farmer (Step 1 above) provides a fee to the PURE company to lease a certain amount of volume, usually less than \$0.05/Kg of produce (Step 2).
2. The second is a more complex business model, where the farmer provides produce to the PURE company (Step 1) who, in turn, transport and sell the aggregated produce to an off taker (Step 3). Finally, the PURE company pays back the farmer for the produce sold, deducting the cold storage and market linkage fees.

“

**What can Governments
and Development Partners
do to Accelerate PURE?**

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What can Governments and Development Partners do to Accelerate PURE?

The socio-economic benefits of PURE products and services are vast, particularly for poor climate-vulnerable communities across rural areas in sub-Saharan Africa and South Asia. Evidence shows mature PURE markets will deliver long-term dividends, including new livelihood opportunities, food and water security, green job creation, greater resilience and adaptation, and improved health infrastructure. In off- and weak grid areas, they are vital for powering MSMEs, improving public infrastructure and modernizing agriculture.

However, PURE-related technologies and business models face tremendous barriers and challenges that are limiting their ability to scale. This Handbook highlights the key stakeholders that are needed to change this dynamic and the actions that are needed to unlock the transformative potential of PURE.

Critical role of Governments and Development Partners

Engagement with ministries of energy, agriculture, environment, health, and water, and development partners focused on these thematic areas is critical for accelerating PURE markets. Energy ministries, development actors working on PURE programs and private sector companies in the PURE space must seek to collaborate with those in these adjacent sectors.

In addition, several other stakeholders will be critical to the adoption of PURE, including the financial sector, agricultural networks, and community groups.

Working together, these stakeholders can drive forward the necessary building blocks to develop mature PURE markets.

These five building blocks, along with catalytic actions that can accelerate PURE, are shown in Table 2. Actions identified for each building block depend on the level of PURE market maturity: nascent, emerging, and mature.



Nascent






Emerging



Mature

What can Governments and Development Partners do to Accelerate PURE?

Table 2 – PURE building blocks

				
Building block	Nascent PURE market	Emerging PURE market	Mature PURE market	
Policies and Regulations	Main-streaming PURE	Adoption and inclusion of PURE within national policies and plans	Adoption and implementation of PURE within national policies or plans	Integration of PURE within policies or plans Provision in sector programming and budgeting
	Multistakeholder Engagement	Provision in sector programming and budgeting	Adoption and inclusion of PURE within national policies and plans	PURE multi-stakeholder platform Inter-ministerial coordination body
	Promoting High Performing PURE	PURE quality standard framework Training and certification of technicians, installers and after sales teams Consumer education	PURE quality standard framework Consumer education	PURE quality standard framework Training and certification of technicians, installers and after sales teams Consumer education
Finance & Investment	Public Finance	Grants Results-based financing and end user subsidies Tax and tariff exemptions	Grants Results-based financing and end user subsidies Tax and tariff exemptions Guarantees and first loss layers Climate funding	Results-based financing and end user subsidies Tax and tariff exemptions Guarantees and first loss layers Climate funding
	Equity and Debt	Working capital Consumer finance	Working capital Consumer finance Carbon credits	Working capital Consumer finance Carbon credits
Market Growth and Technology Adoption	Innovative business models and partnerships building Awareness raising	Innovative business models and partnerships building Awareness raising Public Private Partnerships (PPP)	Awareness raising Public Private Partnerships (PPP)	
Capacity Building	Private sector upskilling programs Capacity building for government agencies and financial institutions	Private sector upskilling programs Capacity building for government agencies and financial institutions	Private sector upskilling programs Capacity building for government agencies and financial institutions	
Sustainable and Responsible PURE Businesses	Gender and inclusivity	Gender and inclusivity Consumer protection	Gender and inclusivity Consumer protection E-waste	

What can Governments and Development Partners do to Accelerate PURE?

2.1. Policy and Regulation

2.1.1. Mainstreaming PURE

Governments are responsible for designing and implementing policies, regulations, and programs capable of building an effective enabling environment for PURE. Development partners are also key actors who drive progress via complementary programmatic interventions. PURE policies, plans and programs will allow the market to develop and grow, enabling the private sector to deliver PURE appliances, products, and services at scale.

Yet, despite the huge interest and excitement in the PURE market, the COVID-19 pandemic, inflation, and other macroeconomic events have hampered market growth. The business models and financial innovations needed to enable access to PURE products and services are underexplored, and the potential of these technologies are still little known by key stakeholders, including policy makers, commercial banks, and potential customers.

Deliberate action by national governments and development partners are needed to catalyze PURE markets and ensure that the potential of PURE technologies to help meet development goals can be realized (e.g., in agriculture, water, enterprise, health, and climate).

Adoption and implementation of PURE within policies and plans



PURE must be integrated into a) national electrification strategies, policies, and plans, and b) the plans and programmatic efforts of all ministries and agencies where PURE solutions can help meet other development targets. Policy coherence and programmatic alignment will create efficiencies in efforts to scale PURE and boost their impact. In nascent markets, this will start with the adoption of PURE, while in emerging and mature markets efforts may be primarily focused on the implementation of PURE plans and policies.

The ministries of agriculture, water, health, trade, and environment will have to work hand in hand with ministries of energy, making sure their future

development policies and plans integrate market-based, high-quality PURE solutions. Similarly, ministries of energy will have to understand the needs of key stakeholders in agriculture, health, environment, and water, that have the capacity to boost PURE equipment uptake and distribution (e.g., agri-input dealers and agricultural intermediaries).

Recommended actions for government and development partners:

- Designate a lead unit for PURE policy design and implementation.
- Promote policies across ministries and agencies that will optimize the impacts of PURE technologies and solutions.
- Integrate PURE technologies into new and ongoing sector specific plans.

EXAMPLE: India's Ministry of New and Renewable Energy (MNRE) is expected to approve a policy framework to facilitate the large-scale adoption of distributed renewables for livelihood applications.⁶⁶ The policy includes different elements, i.e., demand creation, quality assurance, R&D, piloting, access to finance, capacity building and inter-ministerial coordination. The policy forges collaboration and coordination for on-going programs and schemes across fourteen different ministries and departments, mandating existing technical committees and working groups under relevant government programs to integrate PURE solutions and act as information sharing platforms.

Provision in sector programming and budgeting



Matching policy ambition with the right level of financial resourcing needs ministries to properly design appropriately funded national or sub-national programs to deliver approved policies and plans. These should include a well-designed monitoring and evaluation framework that allows year-on-year improvement. Coordination with the Ministry of Finance as a program sponsor is key.

What can Governments and Development Partners do to Accelerate PURE?

Development partners can also play a fundamental role in building and supporting programs that align with PURE plans by government ministries and agencies. This will help to drive the pace of access and enhance the enabling environment for PURE.

Recommended actions for government and development partners:

- Design specific PURE-related market-based programs to deliver on policy ambitions.

- Coordinate between the leading ministry and the Ministry of Finance to ensure proper sponsoring of sector programming.
- Integrate PURE solutions into development partner initiatives, recognizing their role as a nexus element across different thematic programs.
- Create new development programs that align with PURE-based policies and plans approved by government agencies or ministries.

Table 3 - Summary of proposed actions for mainstreaming PURE

Action line	PURE Market Maturity	Stakeholders involved
Adoption and implementation of PURE within policies or plans	  	Ministries of Energy, Water, Agriculture, Environment, Health, and development partners
Provision in sector programming and budgeting	 	Ministries of Energy, Water, Agriculture, Environment, Health, Finance, and development partners

What can Governments and Development Partners do to Accelerate PURE?

2.1.2. Inter-ministerial and multi-stakeholder engagement

Today, many ministries and government agencies tend to work in silos and work towards their own sector specific targets and objectives with minimal coordination and collaboration with other government bodies or sector actors.

Different government ministries and agencies are also adopting and promoting PURE differently. Ministries of water and agriculture usually focus on public service delivery, providing matching grants and technical support to small holder farmers, whereas ministries of energy are more focused on supporting PURE companies and building sustainable markets.

However, governments do not sufficiently interact or coordinate regularly with other critical market stakeholders, and in particular, with bilateral and multilateral agencies and PURE companies.⁶⁷ This is vital to streamline resources and improve efficiency. Strong interaction between governments and market stakeholders often lead to better outcomes and impacts of government-led programs, while minimizing market distortion.

Development partners also play a key role in building markets and are needed to help scale the PURE sector. For example, by establishing PURE-related multi-stakeholder engagement platforms or providing technical support to governments.

Inter-ministerial coordination



Coordination of policies, plans, and strategies for PURE among ministries represents one of the most important governmental tasks to accelerate the adoption of PURE. This includes the engagement of ministries responsible for energy, water, environment, health, and agriculture, their affiliated institutions, and their development partners.

Inter-ministerial coordination must lead to multi-sectorial integration of different PURE technologies and solutions under ongoing and upcoming programs or policies from different ministries. In addition, development of policies and regulations to support MSMEs and green jobs, address e-waste, mainstream gender, and inclusivity, and boost local assembly or manufacture, should be encouraged.



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What can Governments and Development Partners do to Accelerate PURE?

Recommended actions for government and development partners:

- Identify a lead government agency for the PURE sector and strengthen inter-ministerial dialogue with representatives from the ministries of agriculture, water, environment, health, and energy. This is particularly relevant for nascent PURE markets. Ensure that accelerating the adoption of PURE technologies and solutions is integrated into programs, policies, and plans supported by different ministries and public agencies.
- Deliver trainings to ministries in charge of policies and regulations connected to PURE, such as fisheries, agriculture, water, or environment, to improve their knowledge and awareness of PURE technologies and business models, and to integrate the technology within their programs and plans.
- Establish inter-agency coordination platforms, channels, or policies in more mature markets to connect ministry departments and representatives.

EXAMPLE: In the Philippines, the Department of Energy and Department of Agriculture announced the Renewable Energy Program for the Agri-Fishery Sector in 2021. This supports the promotion of PURE technologies for agri-fisheries through measures to boost R&D, quality standards development and enforcement, human resource development, and assistance to local manufacturers and distributors.⁶⁸

PURE multi-stakeholder platforms



Multi-stakeholder platforms help to bring market players closer, unify private sector actors, and accelerate information and data sharing.

Multi-stakeholder platforms are effective means for governments to engage with both new and more mature off-grid solar companies, farmer groups, off-takers, farming cooperatives, SACCOs, banks and MFIs. To date, few national cross-sectoral working groups or platforms exist for PURE. Where these are operating, they are usually led and managed by National Renewable Energy Associations (NREAs) across the East African and South Asian regions. Emerging and mature PURE markets should create self-reliant and effective NREAs, with the capacity to mobilize the private sector, including beyond traditional off-grid solar companies (e.g., including agri-input providers, agricultural off-takers).

Ideally, PURE multi-stakeholder platforms, such as working groups, should be co-hosted, and chaired by the leading government institution, along with other ministries, to ensure governmental engagement.

While ministries of energy are commonly seen as the best placed bodies to participate in such PURE platforms, it is critical that other ministries engage as well and become active leading members (i.e., ministries of finance, water, agriculture, or transport, among others).

With the evolution of multi-stakeholder platforms, new working groups tend to be developed, evolving overtime to more complex mechanisms and breaking down into different technology-based discussion groups (e.g., SRUs group, SWPs group, finance group, etc.). However, due to the complexity of PURE solutions, it is strongly recommended to centralize policy and program-based conversations around one overarching PURE working group that can involve several ministerial representatives, avoiding fragmented consultations.

PURE working groups exist in only a few markets to date (i.e., Ethiopia, Rwanda, Uganda, Kenya, Nigeria, and India).

What can Governments and Development Partners do to Accelerate PURE?

Recommended actions for government and development partners:

- Support and engage in the establishment and development of multi-stakeholder platforms through support to co-hosting entities (i.e., NREAs or dedicated ministerial units).
- Establish government co-hosts to lead well-functioning platforms, which include different ministry representatives and representatives from development partners and donors.
- Provide direct support to NREAs to improve private sector representation and coordination and to gather substantive market data.
- Provide financial support to enable effective sharing and engagement spaces where best practices, data, and knowledge can be gathered by governments, with a space to present and share ongoing policy and programmatic work.

EXAMPLE: Several National Renewable Energy Associations (NREAs), including the Kenyan Renewable Energy Association (KEREAs), Ugandan Solar Energy Association (USEA), Rwandan Energy Private Developers (EPD), and the Ethiopian Solar Energy Development Association (ESEDA) have recently launched or reinforced existing PURE working groups with the financial support of the Water and Energy for Food (WE4F) Program, implemented by GIZ in the East African region.

With the support of GOGLA, NREAs aim to coordinate existing PURE companies, offering them structured engagement with government and development partner representatives, as well as a space to share learnings, data (i.e., employment, sales, or climate related), and best practices.

Table 4 - Summary of proposed actions for stakeholder engagement for governments and development partners

Action line	PURE Market Maturity	Stakeholders involved
Multistakeholder platforms		NREAs, NGOs, CBOs, private sector, Ministries of Energy, Water, Agriculture, and Environment, donors, development partners, donors, financial institutions
Inter-ministerial coordination		Ministries of Energy, Water, Agriculture, Environment, and Finance

What can Governments and Development Partners do to Accelerate PURE?

2.1.3. Promoting high-performing PURE

Quality assurance (QA) and quality standard (QS) frameworks are key to a) building consumer trust and protection in PURE products, b) de-risking investments and purchasing decisions, and c) helping to reducing the presence of low-quality counterfeit materials in off-grid and weak-grid markets. Experience shows QA and QS frameworks incentivize consumption among early and late majority and laggard consumers, typically during the nascent and emerging formation of a market.

QA and QS programs are the most effective if they are designed along with other supportive elements, including:

- Training and certification of servicing technicians, installers, and after-sales teams.
- Consumer education, i.e., nationwide awareness campaigns for consumers, consumer associations, NREAs, etc.

PURE quality standard framework



The development and implementation of a QS framework should be created in support of all near-to-market PURE products and services. This should include quality norms, certifications, standardized product testing approaches, and sharing test data. The QS framework should be capable of demonstrating proven performance by PURE products and services, first in a laboratory but also in real world environments. It should also include independent third-party verification tests to ensure the quality of devices.



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What can Governments and Development Partners do to Accelerate PURE?

As specified in several publications⁶⁹ PURE markets will need different tools for quality and efficiency service provision at different stages of their development. These include test methods and voluntary standards in nascent and emerging PURE markets, and mandatory standards and labelling programs in mature PURE markets.

- **Test methods** are usually employed to measure, compare, and harmonize quality and performance of PURE products consistently, enabling accurate product quality and performance comparisons.
- **Voluntary standards** incorporate existing international standards and resources governments can build upon.

Governments could build upon existing programs such as the Global LEAP Awards⁷⁰ and VeraSol,⁷¹ both working to expand test methods, quality assurance frameworks and supporting policies for off-grid appliances and products. For integration of voluntary standards and test methods, involvement of existing key national stakeholders, including the National Bureau of Standards, and Rural Electrification Agencies will be key. By way of example, the existing certification for component-based solar PV systems (of ≤ 1 kWp) can be found within existing IEC standards, available for public access.⁷²

- Once PURE markets become mature, **mandatory standards** will be required, ensuring all products manufactured or imported into a country legally meet minimum requirements, reducing low-quality equipment. The cost of implementing and enforcing compliance with standards is high and should be done only when PURE markets reach maturity.

Recommended actions for government and development partners:

The following recommendations are designed to be used by governments to build test methods and a voluntary standards framework.

- Build a high level of political support for QA and QS and create the institutional, financial, and human resources needed to build on existing international quality standards and resources, such as VeraSol, Global LEAP and IEC.
- Deliver a market study to assess the existing quality and performance of PURE products and services.
- Deliver mechanisms (i.e., a combination of financial incentives such as RBFs, technical assistance, and training) to incrementally enhance quality in the whole market over time (avoiding crowding out smaller off-grid PURE companies).
- In parallel to the above, deliver a monitoring and evaluation program, with independent verification (site visit and remote data analysis) to review the appropriateness of system sizing, adequacy of installation and after-sales services.
- Harmonize regional quality standards and data systems to make it easier for PURE companies to venture into new national markets.
- Once clear quality standard guidelines have been approved for PURE products and services, build efficient processes to support private sector adherence to standards and third-party independent verification services.

EXAMPLE: While testing and quality assurance procedures exist for some milling components (e.g., motors), few protocols test the full assembly.⁷³ For example, grain moisture content and variety are extremely specific to geography and have a great impact on mill throughput. Rapid product testing protocols are needed to make sure PURE products are accommodated to different local contexts.⁷⁴

69 Efficiency for Access, Clasp. (2019) Promoting High-Performing Off-Grid Appliances.

70 Global LEAP (efficiencyforaccess.org).

71 Verasol.

72 IEC. Solar Home Systems Maximum Array Size (1 kWp) according to IEC System Design Guidelines.

73 Efficiency for Access, CLASP, EST. (2021). Milling: Solar Appliance Technology Brief.

74 Efficiency for Access, CLASP, Kijani Testing (2022). Rapid Product Assessment. A New Approach to Testing Productive Use Appliances

What can Governments and Development Partners do to Accelerate PURE?

Training and certification of technicians, installers, and after-sales teams



Integrating QS within professional training and certification curricula run by technical or vocational training institutions and universities is key to sustaining a healthy market. These include training programs focused on the import, distribution, service provision, installation, and/or after sales services of PURE technologies. PURE technologies cross-sectoral impacts also create a need to provide quality standards and services to traders, agricultural off-takers, or farmers in related industries, such as on post-harvest handling or around the quality of food trading. In mature and emerging markets, certification and listing of accredited technicians can ensure that end users have access to certified installers and servicing personnel.

Recommended actions for government and development partners:

- Once a QA framework is in place, and in partnership with manufacturers and learning institutions, establish company and individual-level training and certification programs.
- Mobilize funding to design and streamline PURE training in formal and informal institutions.
- Work with the relevant government agencies to enforce installation and servicing from certified technicians.
- Create awareness around the importance of certified installers and servicing technicians.
- Deliver training schemes at universities and any other academic institutions (i.e., TVETs) based on the QA framework for companies and individuals.

EXAMPLE: ECREEE has supported the development of the regional off-grid markets by establishing a scheme for certifying the skills of solar PV installers and other sustainable energy professionals, introducing a quality mark recognized by professionals and end users in all 15 ECOWAS member states. ECREEE partners with five training institutions across the region.

Consumer education

At all stages of market development, consumer education around quality assurance is key. Awareness raising campaigns promoting PURE products and services should also include education on the importance of quality products and (where available) quality standards, whether the campaigns are focused on consumer groups, individual consumers, financial agencies, or PURE distributors. Campaigns should help to educate these groups on the value of labeling, e-waste management, customer warranties, product safety, and compliance processes.

Recommended actions for government and development partners:

- Provide third-party independent PURE-based consumer assessments.
- Ensure all key stakeholders are up to date with QA frameworks, including companies, financial institutions (banks, MFIs, SACCOs), other government agencies, and donors.
- For more mature PURE markets, support the training of well-organized consumer and advocacy groups on PURE products and services.

EXAMPLE: The SHS quality assurance program delivered in Kenya over the last decade has paid off.⁷⁵ As a result, a large majority of consumers today report being satisfied with their products across several dimensions, including price and durability.

Table 5 – Summary of proposed actions for public funding for governments and development partners

Action line	PURE Market Maturity	Stakeholders involved
PURE (voluntary / mandatory) quality standard framework		National Bureau of Standards, and Rural Electrification Agencies, VeraSol, NREAs
Training and installers, and after-sales teams		National Bureau of Standards, and Rural Electrification Agencies, TVETs, universities
Consumer education		PURE distributors, Rural Electrification Agencies, consumer groups, advocacy groups, commercial banks, MFIs, SACCOs

What can Governments and Development Partners do to Accelerate PURE?

2.2. Finance & Investment

2.2.1. Public funding

Whilst some PURE technologies are more mature than others, in most countries across South Asia and SSA, PURE markets remain nascent. For them to reach scale, there is therefore a need for public funding in the form of upfront grants, tax reforms, guarantees, and subsidy mechanisms.

Transition from grant provision into access to debt and equity funding is critical for PURE markets to evolve and for companies to grow. Public funding, along with capacity building to improve business performance and financial technical assistance on investment readiness will be critical for the future success of the PURE markets.

Public funding plays a key role in the following areas:

- Deploying grants to test new innovative technologies and business models or encourage companies to enter high-risk markets.
- Creating risk mitigation finance mechanisms to encourage investment in early-stage PURE companies, i.e., delivering dedicated credit lines and guarantees.
- Developing supply or end user subsidies e.g., through Results Based Financing (RBF) mechanisms. These can help to address the affordability gap of PURE appliances and products and encourage PURE companies to expand towards hard-to-reach communities, new national markets, and new technologies etc.
- Providing fiscal Incentives, such as tax and tariff exemptions, to help reduce the price of PURE technologies. Where technologies are mature enough, these can be focused on products that meet quality standards.
- Encouraging local currency finance lending for PURE i.e., providing first loss mechanisms to local banks. These will allow local banks to support PURE companies with liquidity at the end of their grant/loan period so that they can unlock early-stage equity or debt capital.

- Providing other concessionary mechanisms such as venture building grants or alternative sources of funding, such as climate funding to help companies in their journey to develop new products and business models and stepping in the capital continuum.

With the development of near-to-market technologies (such as SWPs, SRUs, or invertors), public funding for PURE products and services is growing among bilateral and multilateral funders. This trend is being coupled with growing interest in PURE solutions by governments across SSA and South Asia.

For example, government-led World Bank-funded programs in Ethiopia and Uganda are being designed by the ministries of energy to incentivize and develop new PURE markets in low-income rural areas. These programs include a mix of debt-finance and supply side subsidies, along with technical assistance. These programs are designed to help PURE distributors expand their distribution networks to target regions, upskill their staff, and grow their customer base.

Grants



Grant funding can support project developers facing financing challenges when initiating an innovative project. Research and development (R&D) grants for new PURE products or the market testing of new prototypes are examples of grant funding from governments, development partners or foundations. R&D funds are proving critical for improving product design and the value proposition of PURE appliances, products, and services. Other forms of grant funding can help to tackle other issues, such as early-stage financial support, business model innovation and the provision of technical assistance.

75% of total grant capital invested in the off-grid sector by development agencies and foundations in 2021 was directed at companies offering PURE.

However, given the scale of the PURE access challenge and range of technologies and business models that need to be unlocked, even more grant funding will be required to scale the PURE market.

What can Governments and Development Partners do to Accelerate PURE?

Recommended actions for government and development partners:

- Provide grant capital to support the testing and early-stage development of new innovative PURE technologies and services.
- Design R&D grant facilities to support PURE companies, with a particular focus on locally owned, or women-led, PURE companies.

EXAMPLE: The Efficiency for Access (EforA) Research and Development Fund supports early-stage companies with R&D Funding. Supported by UK aid and IKEA Foundation, it has provided grant funding totaling £5m for early-stage technology R&D, with the aim of accelerating innovation in off- and weak-grid technologies. The Fund was launched in 2018 and has since supported almost 40 companies with a key focus on sub-Saharan Africa and Southeast Asia.

Funding streams like that from EforA have supported several innovative PURE companies and business models, such as Nadji.Bi,⁷⁶ in Senegal, that developed a solar-powered millet flour mill and accompanying smart software application. Nadji.Bi's innovation helps the digital management of customer payments and data collection. The grant helped the product design development, as well as research into alternative business models and microfinancing, helping to increase the mill's affordability for customers.

Results-based financing and end user subsidies



Results-based financing (RBF) and end user subsidies (EUS) can help to address the critical challenge of affordability and their success has been demonstrated in markets for solar lanterns and home systems. RBFs use a mechanism whereby a company or service provider is given a payment upon achievement and verification of a pre-define and agreed result. They are commonly employed to overcome the financial risks typically associated with entering new or more complex geographical area, or establishing markets for new technologies.

Examples of RBFs for PURE include the 2019–2020 Global LEAP Awards,⁷⁷ a EUR 2 million program that supported appliance companies to sell SRUs, SWPs and other off-grid solar appliances such as fans to MSMEs and smallholder farmers in rural and peri-urban areas of Bangladesh, Kenya, Tanzania, Rwanda, Uganda, Senegal, and Zambia (pumps only). Another example is the recently launched Productive Use Appliance Financing Facility, with a total budget of USD\$6.5 million.⁷⁸ According to the World Bank,⁷⁹ 20% of all financing for PURE companies will be via RBFs.

End user subsidies directly reduce the end-price paid by customers of PURE products and are specifically designed to make them more affordable. EUS can be provided directly to consumers (e.g., via a cash transfer or voucher), or through companies who are then obliged to pass the saving to customers (including via an RBF mechanism).

As PURE markets remain nascent, development agencies and governments have most commonly focused on using RBFs and other supply side subsidies to strengthen the presence of PURE distributors and service providers in rural areas. However, given the acute affordability challenge in the PURE space, interest in EUS is growing and there are some significant examples, for example the PM KUSUM program in India.

However, EUS must also be approached carefully, as their use at an early stage of market development can also set a consumer expectation of a lower product cost price than companies cannot provide once the subsidy is removed.

EXAMPLE: The PM-KUSUM scheme in India is intended to rapidly increase the number of smallholder farmers that can purchase a SWP. Within the scheme, 30% of the cost is provided as a State Government subsidy, 30% as financial assistance from the Central Government (50% in Northeastern States) and 30% as a loan to the farmer who then covers the remaining 10%. The scheme has led to the adoption of over 110,000 SWP.

⁷⁶ Nadji.Bi Group (nadjibi.com).

⁷⁷ Global LEAP (efficiencyforaccess.org).

⁷⁸ Productive Use Appliance Financing Facility.

⁷⁹ Lighting Global/ESMAP, ECA, ASD. (2022). The Market Opportunity for Productive Use Leveraging Solar Energy (PULSE) in Uganda

What can Governments and Development Partners do to Accelerate PURE?

Recommended actions for government and development partners:

- Using smart design principles to limit market distortion, enable sustainability and optimize impacts, create subsidy schemes to support the scale up of PURE technologies.
- Consider the use of pilot schemes before launching large-scale subsidy programs to ensure that they meet the set objectives.

Engage all key stakeholders in the design of subsidy schemes, including relevant government ministries, development partners, NREAs and private sector companies, to ensure they are optimized for a specific goal, market, and country environment.

Tax and tariff exemptions



Tax and tariff exemptions or reductions are one of the most critical policy actions by governments to help bring down price of PURE technologies. However, despite the willingness shown by several governments to exempt solar lanterns and home systems from taxes, tariffs and import duties, PURE products are still commonly subject to taxes and charges.⁸⁰ This is particularly true for PURE appliances and products considered to be luxurious by governments, such as SRUs or cooling devices.

Some governments, such as Uganda, have removed or simplified taxes and tariffs for some PURE products, including the removal of import duty on most SWP components and VAT on SRUs.⁸¹ However, even where exemptions are in place, the application of taxes and tariffs is still inconsistent, and exemptions are not uniformly understood by customs agents and revenue collectors.

Given the potential that PURE brings in terms of increased agricultural output and exports, reductions in fuel use, and co-benefits for climate resilient development, tax exemptions for PURE should be considered.

Recommended actions for government and development partners:

- Undertake cost-benefit studies on exempting PURE products from tax and tariffs.
- Implement national tax exemptions for specific PURE products (that meet national voluntary or mandatory quality standards where technologies are mature) through rigorous Pre-Export Verification of Conformity (PVoC) processes or in-country quality verification protocols.
- Remove importation barriers and simplify the importation of new and innovative components for PURE products and services.
- Provide training for customs agents and revenue collectors to aid implementation of tax and tariff exemptions.

EXAMPLE: VeraSol is currently working with several SSA governments to improve the effectiveness of PVoC processes by providing expert guidance and practical resources. Conformity assessment programs and manufacturers can leverage several VeraSol resources and tools for the PVoC process.⁸²

Guarantees and first loss layers



In addition to tax reforms or provision of subsidies, governments and public funders can help to catalyze PURE markets by developing concessionary mechanisms geared to attracting private investment into the PURE space. These includes guarantee schemes that ensure protection to private investors such as first loss default guarantees (FLDGs), de-risking mechanisms for agricultural borrowers to overcome collateral requirements, and insurance mechanisms, to shield against unexpected events, such as climate-disasters.

A particular challenge for the industry is local currency financing, due to the high-risk perception of financiers in the energy access sector. Innovative solutions, such as first loss funds, are considered essential to stimulate capital flow and to hedge against foreign exchange risk. Other interventions such as developing programs to support loan aggregators (e.g., SACCOs) could help reduce payment defaults.

⁸⁰ [GOGLA. \(2022\). Duty tracker.](#)

⁸¹ [Lighting Global/ESMAP, ECA, ASD. \(2022\). The Market Opportunity for Productive Use Leveraging Solar Energy \(PULSE\) in Uganda.](#)

⁸² [VeraSol. \(2023\). Conformity Assessment Resources.](#)

What can Governments and Development Partners do to Accelerate PURE?

Recommended actions for government and development partners:

- Establish partial risk guarantees, such as first-loss mechanisms or FLDGs.
- Support SACCOs and cooperatives as aggregators of loan demand, reducing administrative costs and default rates.
- Deliver innovative insurance programs to de-risk private sector investments.

Climate funding



Off-grid solar PURE technologies can help climate-vulnerable communities to adapt and become more resilient to climate change in a variety of ways, including through income diversification and improving food security. PURE products and services, particularly agricultural ones, help small holder farmers increase agricultural output and/or value, adapt to unpredictable rain and heat patterns, support health interventions, and improve early-warning mechanisms.

Public-based funding mechanisms for climate change adaptation and mitigation are starting to reach governments in high energy access deficit countries. However, despite the climate mitigation and adaptation benefits offered by PURE, and the growing sales of systems distributed to end-users,

the number of companies benefiting from climate funding is still low and traditionally limited to those with the capacity to mobilize internal resources to engage with climate finance innovations.

Recommended actions for government and development partners:

- Provide support to SSA and South Asian ministries of energy, agriculture, water, and environment, to access international climate funding to support the adoption of PURE, including concessional finance.
- Develop national level frameworks for how PURE products and services are supporting adaptation and resilience in specific countries.
- Ensure the right level of accountability and civil society engagement is in place to ensure that the benefits of climate funding reach the people most vulnerable to negative climate impacts e.g., that PURE products, whose cost has been reduced through climate funding reach low-income people in areas of climate risk.

EXAMPLE: Along with the Green Climate Fund (GCF), new climate-focused fund mechanisms are also emerging, including the GSMA Innovation Fund for Climate Adaptation and Resilience, the Dutch Fund for Climate and Development, EEP Africa and Africa Adaptation Acceleration Program.⁸³

Table 6 - Summary of proposed actions for public funding for governments and development partners

Action line	PURE Market Maturity	Stakeholders involved
Grants		PURE distributors and service providers, early-stage innovators, governments, and development partners
Results-based financing and end user subsidies		PURE distributors and service providers, early-stage innovators, commercial banks, MDBs, governments and development partners
Tax reforms and measures		PURE distributors and service providers, Ministry of Energy & Finance, NREAs
Guarantees and first loss layers		Financial institutions, central banks, Ministry of finance
Climate funding		Ministries of energy, agriculture, water, and environment, National Standard Bureaus, civil society

⁸³ Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors (2022), Off-Grid Solar Market Trends Report 2022: State of the Sector. World Bank, Washington, DC.

What can Governments and Development Partners do to Accelerate PURE?

2.2.2. Equity and Debt

While some PURE appliances are relatively low cost, such as solar energy kits with hair clippers and phone charging units (typically US\$50 – 120), many PURE products and appliances are more expensive, such as SWPs and SRUs (which range between US\$600–1,000) and larger products such as walk in cold rooms and agri-processing equipment. This makes many PURE products and appliances expensive to produce, distribute and service, and to support with consumer finance.

Significant levels of private investment for both working capital and consumer credit, de-risked by public finance, is therefore required to ensure that PURE markets can be scaled. In addition, capital is needed with terms that allow PURE companies to operate sustainably and reach target markets. For example, where PAYGo finance is being offered to consumers, the interest rates must be affordable and responsible.

Existing consumer credit offered by commercial financial institutions in sub-Saharan Africa for PURE is both limited and unattractive (interest rates range between 18–25% and there are heavy requests for collateral and debt history). In South Asia and Latin America there is a more attractive variety of consumer finance options for PURE products via MFIs. However, more local finance is needed to fully unlock the PURE market in all regions. Internationally, alternative sources of finance, such as carbon credits, could help capitalize PURE companies and reduce retail prices.

Working Capital



Working capital facilities are needed for companies to grow and scale operations. Access to working capital is particularly low among female-led PURE distributors, who face greater barriers as entrepreneurs in the energy sector.⁸⁴

80% of investor members under the Household Solar Funders Group (HSFG)⁸⁵ plan to invest in PURE companies but require earlier stage investors to pave the way for increasing deal flow.⁸⁶

Recommended actions for government and development partners:

- Provide blended/concessional finance to de-risk investments and lower the cost of capital.
- Provide credit guarantees, particularly for local commercial banks, to reduce the cost of working capital.
- Establish or expand dedicated national credit companies, similar to the Uganda Energy Credit Capitalization Company (see below).
- Use gender and inclusive criteria in the design of financial mechanisms and provide TA support to local companies to build financial skills.
- Drive financial networking to help connect PURE companies with financial institutions.

EXAMPLE: The Uganda Energy Credit Capitalization Company (UECCC) was established by the Ugandan government to facilitate innovative financing products and technical assistance to companies directly, through commercial entities or to SACCOs, as the administrator of the Uganda Energy Capitalisation Trust. UECCC operates a World Bank-funded solar working capital facility through participating financial institutions such as Stanbic, PostBank, and Centenary Bank, and has currently a pipeline of \$8 million in loans to seven solar companies.

Consumer Finance



Absence of low-interest financial credit lines for PURE products, low-incomes, low levels of financial inclusion and high agricultural market risks are some of the key barriers for consumer access to finance. This is especially true in rural agricultural areas of SSA, where there are limited physical banking facilities, weak communications infrastructure, and low population density.

⁸⁴ IEA, IRENA, UNSD, WB, WHO. (2022). Tracking SD7, the Energy Progress Report 2022.

⁸⁵ The Household Solar Funders Group (HSFG).

⁸⁶ ACE, Tetrattech. (2022). Scaling Productive Use of Energy Technologies in Sub Saharan Africa: Learnings and Recommendations.

What can Governments and Development Partners do to Accelerate PURE?

In the solar home systems market, PAYGo has played a key role in addressing some of these challenges and extending access to products, especially in SSA. PAYGo services are now being offered by some off-grid PURE companies with the capacity to mobilize international investors to support their receivables financing. Typically, PAYGo financing covers up to 80% of the total cost of the appliance, with the remaining 20% paid up-front by customers.

Companies that offer consumer financing for PURE in sub-Saharan Africa include SolarNow, SimuSolar, M-Kopa and ENGIE Energy Access. However, far more consumer finance is needed to scale PURE technologies in the region. In addition, mechanisms to ensure robust credit risk management and consumer protections are needed to ensure that customers accessing PAYGo for PURE are not overburdened by payments.

The need for consumer financing to expand the reach of PURE is also significant in South Asia, Latin America, and Southeast Asia. However, as these regions have a long and broad tradition of consumer lending via MFIs or commercial banks, these financial actors may take a more proactive role in the provision of consumer credit.

Research also shows many PURE customers borrow money from rural saving groups (better known as VSL groups) or SACCOs to buy their products. Risk averse PURE customers, particularly smallholder farmers, still turn in big numbers to VSL groups due to lack of trust in the commercial banks or a preference to pay for products using cash.⁸⁷ The provision of consumer finance via VSLs and SACCOs may therefore provide another key route to addressing the availability and affordability of PURE technologies.

Recommended actions for government and development partners:

- Earmark lending portfolios of commercial financial institutions, MFIs, SACCOs, and off-grid companies, to offer low-interest credit lines and longer lending periods, allowing customers to acquire PURE products.

- Provide low interest credit lines to PURE distributors.
- Raise awareness among potential PURE customers on existing and new PURE technologies (beyond SWPs and SRUs) along with financial support and guarantee provision schemes.
- Support the expansion of credit institutions, usually established in rural areas, with capacity to provide financial training and inclusion to small holder farmers and businesses.

EXAMPLE: Building on years of experience and collaboration with its national distributors, SWP manufacturing company Lorentz is offering credit lines with low interest to hundreds of the national distributors to boost their SWP sales. The credit line is meant for national distributors to provide consumer credit at a low interest rate.

EXAMPLE: In Kenya, GIZ is providing training to commercial banks to increase awareness on existing near-to-market PURE solutions, aiming to grow the offering of low-interest rate credit lines adapted to rural customers interested in acquiring PURE equipment.

Carbon credits



Where PURE solutions replace the use of fossil fuel alternatives such as diesel generators, carbon credits can also provide a key source of finance for the PURE sector. For instance, a small-size solar powered milling machine could provide 3.2 tons/year CO₂ reduction if replacing an existing diesel milling machine, along with other co-benefits, such as absence of smoke discharge and lower noise levels.⁸⁸

⁸⁷ CLASP, EST. (2022). Appliances for All: Assessing the Inclusivity of the Solar Lighting and Appliances Sector

⁸⁸ PowerforAll. (2020). Harnessing the Power of Solar for Agro-processing. Policy Brief

What can Governments and Development Partners do to Accelerate PURE?

However, despite their potential of carbon credits to provide a new income stream, very few PURE distributors are currently commercializing such credits. This is due to several barriers, including:

- Little capacity by off-grid companies to design and submit carbon credit project proposals.
- The limitation of technology for monitoring, reporting, and verification of the replacement of diesel and kerosene by off-grid solar. (Although some companies are now exploring how they can use real time usage data from PAYGo systems to help with carbon credit measurement, reporting and verification).
- The high costs involved in the design and accreditation of carbon credits, which are unreachable for most off-grid companies.
- A lack of awareness amongst off-grid PURE companies on how to access carbon markets. (As demonstrated by a recent survey by the Ugandan Solar Energy Association, which showed that most members were keen to explore carbon credits, but over 90% of them do not know enough about them to do so.)

However, different national and international specialized carbon credit companies are now offering free technical support to help companies design and implement their carbon credit schemes and intermediaries are emerging who offer carbon credit services to off-grid solar companies for a fee.




While carbon credits are the most mature climate finance available today, it is also worth noting that resilience and adaptation finance and distributed renewable energy certificates (D-RECS) could also play a role in monetizing the benefits of off-grid PURE technologies in the future.

Recommended actions for government and development partners:

- Support companies to develop a measurement framework that goes beyond financial and output-based measurements.⁸⁹
- Provide funds to support NREAs with technical assistance to help their members catalyze carbon credit markets.
- Establish of a portfolio of national and international specialized carbon credit companies with experience in off-grid solar to support individual companies to accredit their carbon credit emissions.
- Ensure that emerging opportunities to monetize the climate impacts of the PURE sector, through resilience and adaptation finance and D-RECs, are explored as they gain prominence.

EXAMPLE: Different companies such as SunCulture and SunKing are in the process of issuing or have issued carbon credit emissions in the international Voluntary Carbon Markets.

Table 7 - Summary of proposed actions for debt and equity funding for governments and development partners

Action line	PURE Market Maturity	Stakeholders involved
Working capital		Commercial banks, MDBs, state-based commercial financial agencies
Consumer finance		Commercial financial institutions, MFIs, and PURE distributors and vertically integrated companies, PAYGo integrators
Carbon finance		NREAs, OGS distributors, carbon finance institutions and consultancies

What can Governments and Development Partners do to Accelerate PURE?

2.3. Driving Technology Adoption

The affordability gap and lack of awareness and access are considered the greatest challenges to the rapid growth in demand for PURE products and appliances. More action is needed to ensure logistics and retail costs are brought down and that target customer groups are aware of PURE technologies and can access them.

Without interventions to address affordability, very few small holder farmers or MSME will be able to afford PURE technologies. In Uganda, for instance, only 5-10% of rural households can afford PURE products today.⁹⁰

One common mechanism used to address affordability in the off-grid sector is the pay-as-you-go (PAYGo) business model. This provides a way for customers to spread the cost of PURE products over time. However, even where PAYGo is available, affordability continues to be a hurdle. For instance, according to 60 Decibels, 61% of SRUs customers found product repayment to be a burden, with 42% having to make unacceptable sacrifices.⁹¹

Besides PAYGo, very limited consumer credit exists. Where end-user credit lines do exist, they are usually not designed specifically to provide finance for PURE appliances and may not provide affordable terms or appropriate conditions. For example, commercial banks and credit entities providing credit to rural and low-income customers tend to lend at high-rate interests, typically over 15%.⁹²

Building on the recommendations in the finance and investment chapter of this handbook, additional recommendations designed to address affordability and rapidly increase the adoption of PURE technologies can be found in this section.

Scaling PURE technologies is also hindered by a lack of awareness among potential customers in rural and peri-urban areas. Nationwide awareness campaigns, exhibitions or roadshows organized by governments and development partners will also be critical to spread knowledge about different PURE appliances and services within hard-to-reach communities, and to extend access to them.

Innovative business models and partnership building



To increase affordability, PURE distributors, vertically integrated companies, and PURE rental companies will need to find new, innovative business models that reduce the cost of appliances, or expand the early-stage fee-for-service models that are being currently tested (e.g., walk-in cold rooms).

In addition, attracting customers will be paramount. For this, offering end-to-end services can be a good strategy for PURE companies. For example, the NGO, Ayuda en Acción, agri-input dealer OMIA and off-grid PURE company Tulima Solar are working together to offer small holder farmers technical support as well as PURE agri-products to improve the impacts of the technology intervention and boost affordability.

B2B partnerships can also help PURE distributors growth their reach as they enable different actors to focus on specific business areas where they have expertise, leaving other activities to their partners. For instance, effective partnerships are starting to emerge between established agri-input providers in remote off-grid agricultural areas and PURE distributors in peri-urban and urban areas, with agri-input providers able to extend the reach of their distribution partners.

Government agencies, development partners, along with NREAs, will play a key role in convening PURE distributors, manufacturers, agri-input providers, off-takers, or other off-grid service providers (such as mini-grids or walk-in cold rooms), to help create partnerships that can more efficiently address capacity issues and share best practices for business replication in nascent and emerging PURE markets.

90 Lighting Global/ESMAP, ECA, ASD. (2022). *The Market Opportunity for Productive Use Leveraging Solar Energy (PULSE) in Uganda*.

91 60 Decibels, *Efficiency for Access*. (2019). *Use and Benefits of Solar Water Pumps*.

92 Low interest credit line offered in 2022 by the Equity Bank in Uganda.

What can Governments and Development Partners do to Accelerate PURE?

Recommended actions for government and development partners:

- Along with NREAs, organize private sector partnership building events, and support pilot projects that include innovative partnerships that can optimize business models.
- Provide reliable third-party information about PURE products, services, and suppliers.
- Deliver business mentoring programs for entrepreneurs and early-stage innovators.
- Encourage partnerships between market ecosystem actors, including linking up farmer groups with commercial banks, MFIs, and energy-sector stakeholders.⁹³
- Develop market linkages between PURE customers and agricultural off-takers, to stimulate more avenues for the sale of produce to increase income.

EXAMPLE: One acre fund in Rwanda is piloting the integration of SWPs into its portfolio of 800,000 small holder farmers by training ten sales agents. Commercial relationships with PURE distributors have been built to provide different SWPs and technical assistance to the new local agents.

EXAMPLE: In West Nile, Uganda, despite existence of agricultural land and demand for horticultural produce, 90% of vegetables are imported from Kampala each month. Local host and refugee small holder farmers do not have access to specialized horticulture cooperatives, resulting in the absence of dedicated technical and financial support. Establishment of rural agricultural SACCOs (formed and managed by knowledgeable farmers) to address this problem can offer dedicated technical support and tailored consumer credit lines.

Awareness Raising



Road shows, fairs, exhibitions, social media campaigns, provision of free testing units for influential community members, and other similar activities can help drive product uptake across potential end-users.

Interventions that raise awareness are usually implemented by organizations that are actively engaged in consumer education, including farmers cooperatives, SACCOs, local and international NGOs and public and private agricultural extension services. In nascent PURE markets, where potential customers have little or no awareness of PURE products and appliances at all, demand stimulation may prove fundamental to create interest in PURE technologies from potential end-users.

In addition, customers groups and SACCOs will require continuous knowledge sharing and awareness raising (through public or private campaigns and messages) to increase the general understanding of PURE products, appliances, and services. Many PURE companies engage already in this type of training and campaigning, but existing efforts are still insufficient. For PURE emerging and mature markets, campaigns addressing end-users should include elements including compliance mechanisms, quality standards and certifications, and access to financial support.

Given the complexity of using PURE technologies, awareness interventions must also include educational elements that help potential customers understand the behavior changes needed for them to successfully adopt the new technologies. For instance, existing farmer groups operating diesel pumps will have to learn how to shift their existing water irrigation schedules to adapt to new water flow schemes (explored further in Section 2.4: Capacity Building).

What can Governments and Development Partners do to Accelerate PURE?

Recommended actions for government and development partners:

- Support National Renewable Energy Associations (NREAs), local government authorities and other groups (i.e., NGOs) to undertake regular exhibitions, fairs, and road shows in peri-urban and rural areas.
- Design and undertake national awareness campaigns in rural areas, and among specific agricultural value chains.
- Design and launch behavior change campaigns in cooperation with SACCOs, off-takers, NREAs, and PURE companies.

EXAMPLE: In India, the government has mandated the formation of 10,000 Farmer Producer Organisations, where farmers' group work as a small organization, under which they gather and sell produce and undertake other commercial activities. Although not directly selling PURE products and appliances, these kinds of groups could drive awareness and knowledge around PURE technologies.

Public Private Partnerships (PPPs)



PPPs can be used in emerging and mature markets. These can be used to drive first mover uptake of PURE technologies and help increase awareness and sales. For example, government agencies can help increase sales of PURE by guaranteeing credit for PURE purchases to public servants. One way of doing so is through salary sacrifice schemes under which civil servants choose to buy an appliance and pay back the credit from their public salary monthly. Another instance could be where governments mandate the use of PURE technologies within their own services such as the use of e-vehicles by government officials.

While the role of governments is different in nascent PURE markets, where they sponsor projects through typically grant-based bidding mechanisms, that role can evolve vastly over time and help the market to reach the next stage of development.

Recommended actions for government and development partners:

- Enable public servants to easily adopt PURE technologies.
- Use PURE technologies in the government's own procurement and services.

Table 8 - Summary of proposed actions for driving technology adoption for governments and development partners

Action line	PURE Market Maturity	Stakeholders involved
Innovative business models and partnership building		PURE rental companies, PURE distributors and vertically integrated companies, NREAs, development partners
Awareness Raising		National Renewable Energy Associations (NREAs), local government authorities, Ministry of Energy, and other groups (i.e., NGOs), SACCOs, farmer groups
Public Private Partnerships (PPPs)		PURE distributors, off-takers, ministries, and public agencies

What can Governments and Development Partners do to Accelerate PURE?

2.4. Capacity building

Scaling PURE will require upskilling several groups including technical and managerial staff, PURE customers, financiers, and government agencies,

In Kenya, the most active off-grid solar market in East Africa, over 100 PURE distributors exist, including at least 30 distributing SWPs.⁹⁴ Several companies are also commercializing emerging PURE services, such as walk-in cold rooms.

While a growing ecosystem of private sector companies will help to lower prices, increase competition, and drive demand for quality products and services, PURE distributors are facing a multitude of challenges. PURE products are much more complex and expensive than traditional off-grid equipment and need an extensive range of skills to support their sale, installation, maintenance, and after-sales service provision. National certification and in-house training programs will be critical to prepare enough professional installers and technicians.

Consumer education will also be paramount, both to ensure that customers understand, and feel comfortable making PURE purchases, and so that they know how to use their product or services appropriately. For example, ensuring that SWP customers know how to optimize the use of their pump to irrigate specific crop types and do not overuse the available water supply.

Government representatives, financiers and other key stakeholders will also need to be upskilled. This includes government representatives at ministerial and rural agency levels, and staff in development agencies, electricity utilities and financial institutions.

EXAMPLE: In India, the Bharatiya Vikas Trust has upskilled 15,000 financiers and 50,000 entrepreneurs, giving them the knowledge and confidence to lend to renewable energy enterprises.

Private sector upskilling programs



PURE distributors and service providers are expected to improve the customization of products and services and provide professional and quality services (such as installation or after sales services).⁹⁵ In addition, they are expected to deliver end-user awareness and business tuition through their extensionist teams.

Some PURE distributors, such as SimuSolar, or SolarWorks are building localized SWP-specialist technical teams. This involves dedicated training to their local staff, an investment that not all companies can afford.

PURE sector growth needs to be aligned with the growth of the skilled workforce at all levels, including in key business areas such as sales, logistics, installation, maintenance and repair, management, investment, customer service and sustainability.

Recommended actions for government and development partners:

- Design and establish a standardized certificated technical training for installation, maintenance, and repair of PURE products, ensuring high quality standards by training providers.
- Provide grant funding and technical assistance for PURE distributors and PURE rental companies to run small-scale pilots and build in-house technical capacities.
- Provide training through NREAs, academic institutions or specialized agencies to PURE companies, which cover key areas such as sales, marketing, leadership, and organizational structure.
- Provide financial support to boost informal and decentralized access to training and jobs, to ensure that rural and marginalized communities, especially women, can access training opportunities.
- Design ICT solutions to bring employees and potential employers together and bring down geographical and economical barriers.

⁹⁴ SNV, EnDev. (2021). Productive Uses of Solar Energy in Kenya: Policy Action Plan.

⁹⁵ SEforAll. (2022). Five Hurdles to getting productive uses of energy to the last mile.

What can Governments and Development Partners do to Accelerate PURE?

EXAMPLE: In Kenya, Solar PV installers and designers are legally required to be qualified and licensed by the Energy Regulation Commission (ERC). In addition, manufacturers, importers, vendors, and contractors are also required to be licensed. The training and certification curriculum, provided by over 16 accredited technical training institutions,⁹⁶ were developed in collaboration with the Kenya National Industrial Training Authority (NITA) in the Ministry of Education.

EXAMPLE: Instollar, based in Nigeria, is implementing a digital network for technicians matching solar PV installation needs with certified technicians in the geographical area of interest.

Capacity building programs for government agencies and financial institutions



Along with training to private sector companies, other critical stakeholders will need dedicated training and programs, including Renewable Energy Agencies, utilities and the ministries' of energy, agriculture, water, health, and environment. Training programs will build knowledge on existing PURE solutions, QA frameworks, and financial tools and mechanisms to boost PURE delivery.

In-depth knowledge and expertise on PURE related products and services are often still scarce

and financial institutions such as MFIs, commercial banks, national development banks, or SACCOs will also require dedicated capacity building to prepare more professionals on PURE-related risk analysis and dedicated credit lines, while providing access to off-grid PURE catalogs.⁹⁷

Recommended actions for government and development partners:

- Deliver market research to assess existing skills, trainers' providers (i.e., universities, technical schools, certification courses, in-house training schemes), and internships or apprenticeships programs.
- Provide training to financial institutions on the design of dedicated credit lines and financial mechanisms for PURE and to government agency representatives to help raise awareness and integrate PURE technologies and services within ministerial plans, programs, and policies.
- Design and deliver education programs for customers through consumer or advocacy groups, and SACCOs.
- Deliver and disseminate PURE technology catalogues and other market-related information and materials.

EXAMPLE: The Green Skill Development Program (GSDP),⁹⁸ a program launched in 2017 by the of the Ministry of Environment, Forest, and Climate Change (MoEF&CC) in India, has upskilled about 7 million youth in environment, forestry, wildlife, and climate change sectors by 2021, a similar approach could be taken for PURE.

Table 9. Summary of proposed actions for capacity building for governments and development partners

Action line	PURE Market Maturity	Stakeholders involved
Private sector upskilling programs		PURE distributors and service providers
Capacity building programs for government agencies and financial institutions		Commercial banks, SACCOs, MFIs, ministries, REAs, NREAs, donors, MDBs, SACCOs, consumer groups, advocacy groups, religious institutions, CSOs, NGOs

⁹⁶ Malabo Montpellier Panel. (2019). ENERGIZED Policy innovations to power the transformation of Africa's agriculture and food system.

⁹⁷ PowerAfrica: Off-grid Solar Market Assessments & Additional Resources | Power Africa | U.S. Agency for International Development (usaid.gov)

⁹⁸ Green Skill Development Programme

What can Governments and Development Partners do to Accelerate PURE?

2.5. Sustainable and responsible PURE business

While PURE technologies and business models continue to evolve and new appliances and products are developed to respond to the needs of off-grid and weak-grid customers, companies will need to adapt to existing and new challenges.

The development of a responsible and sustainable PURE sector will require attention to critical themes vital for any emerging industry of its type, such as inclusivity, consumer protection and e-waste.

Gender and inclusivity



Numerous reports and research pieces have demonstrated that inclusivity is good for business.⁹⁹ However, gender is not yet mainstreamed in existing PURE companies. Women tend to be hired for sales and marketing departments, while men occupy leading positions and are usually employed as technicians.¹⁰⁰ Men also have more chances of accessing technical and managerial trainings and have often been able to attain a higher level of education in STEM.¹⁰¹ PURE companies can also be intentional about the design of products and services that meet the needs of women, who typically occupy different parts of agricultural or productive value chains than men.

In Uganda, for instance, only three female CEOs exist among 200 solar companies,¹⁰² which leads not only to unequal opportunities between men and women but can also lead to gender-biased product promotion and business decisions. Inclusivity can widen access to previously untapped groups, expanding new customer bases¹⁰³ and gathering a more enriching level of product and service feedback.

Inclusivity of forcibly displaced persons, into electrification plans and consideration of the energy needs by refugees and internally displaced population is also paramount. According to the Global Platform for Action (GPA) latest report,¹⁰⁴ 102 million forcibly displaced people (FDPs) remain displaced in 2022, with the vast majority

of them unable to access to affordable, reliable, sustainable, and modern sources of energy. 94% of displaced people in camps do not have access to electricity, while 81% rely on firewood and charcoal for cooking.

Rural FDPs have an enormous potential to increase agricultural outputs. Programs stimulating energy consumption among FDPs represent a growing opportunity to generate livelihood and job opportunities for FDPs and host communities, a new energy market for off-grid solar companies, and growth in PURE electricity demand that can help improve the sustainability of electrification projects.¹⁰⁵ The GPA has recently launched the Humanitarian Energy Data Platform 1.0., a first step towards gathering important data that can be used to help uncover effective ways to support FDPs to access PURE and contribute to rural economic growth.¹⁰⁶

Recommended actions for government and development partners:

- Design policies, regulations, and programs that integrate support mechanisms for marginalized groups to access PURE products and services, i.e., digital services and solutions.
- Create innovative financing solutions for women, as consumers and entrepreneurs, integrate gender criteria across funding windows, and link gender and inclusivity quotas to program incentives.
- Deliver technical assistance to improve skills for women-led PURE companies.
- Train PURE companies to integrate tools and strategies that mainstream gender and inclusivity.
- Provide direct cash assistance, cash for-work schemes, and affordable financing options for FDPs in electricity access projects.

EXAMPLE: Simusolar in Tanzania underwent a Gender Analysis project with USAID. The company developed and implemented a Gender Action Plan that looked at the workforce and customer base. This analysis included sex disaggregated data, which was used to refine and improve operations.

99 GDC, Vfw, TEA. (2022). *Gender in Business: Lessons Learned for Last Mile Distributors*.

100 ACE, Tetrattech. (2021). *Women in Solar Energy: Managerial, Operational and Artisanal*.

101 The term STEM refers to Science, Technology, Engineering, and Mathematics.

102 ACE, Tetrattech. (2021). *Women in Solar Energy: Managerial, Operational and Artisanal*.

103 CLASP, EST. (2022). *Appliances for All: Assessing the Inclusivity of the Solar Lighting and Appliances Sector*.

104 GPA, UNITAR. (2022)

105 WB. (2022). *Leaving no one behind: Rethinking Energy Access Programs in Displacement Settings*.

106 GPA. (2022). *Introduction to Humanitarian Energy Data Platform 1.0.*

What can Governments and Development Partners do to Accelerate PURE?

Consumer protection



PURE products have a significant impact on consumer's lives and livelihoods, but may also introduce product, financial and service risks. Good standards of consumer protection are therefore critical to mitigate these risks, safeguard impact and ensure responsible business growth.

As PURE products are tied to consumer livelihoods, consumer protection standards are especially important to ensure that customers are satisfied, that they understand how to use and maintain the equipment, and that they can access aftersales services quickly and easily. Where products are sold on PAYGo terms, consumers should fully understand the payment terms and be helped to calculate their ability to make repayments over the contract term.

Data from across the off-grid solar industry shows a positive link between high customer satisfaction, low product maintenance issues and higher rates of PAYGo repayment. However, over-indebtedness and external factors may result in customers not being able to continue repayments.¹⁰⁷ Focusing on high standards of consumer protection can also help create profitable and impactful PURE businesses.

Recommended actions for government and development partners:

- Incorporate the Consumer Protection (CP) Code¹⁰⁸ as a baseline requirement for all PURE funding or support programs.
- Provide technical assistance to companies to help build capacity to understand and overcome consumer protection risks across all organizational levels.
- Provide funding for the implementation of services to help companies and investors measure, monitor and improve their performance in consumer protection, including for example, the CP third party assessment and consumer verification via Lean Data CP surveys.

- Encourage National Renewable Energy Associations (NREAs) to endorse the CP Code to raise awareness and adoption of the minimum standards at national market level.

EXAMPLE: SunCulture, a solar water pump distributor in Kenya undertook a Lean Data consumer protection survey to verify their performance across the six Consumer Protection Principles. The resultant report highlighted strengths and gaps, informed an action-plan for improvement, and gave them new ways to communicate their performance with investors and other stakeholders. 60 Decibels and Agsol also ran a customer satisfaction analysis, showcasing the impact of their solar mills.¹⁰⁹ The analysis indicated levels of customer satisfaction and key suggestion actions to improve the business model.

E-waste



Unregulated off-grid solar markets have traditionally led to the entry of low-quality products. This includes PURE products which have a lower lifetime than their high-quality counterparts (usually less than 4 years).¹¹⁰ In addition, due to limited distribution networks and tight margins, most PURE distributors do not often offer extended warranties to their customers, hence limiting the lifespan of the PURE products.

Volumes of waste from PURE products are expected to increase significantly once PURE technologies reach market maturity. It is therefore important to start designing and implementing streamlined QA programs to improve product durability, support capacity to repair, refurbish, and repurpose PURE equipment, and build country-level e-waste strategies.

¹⁰⁷ 60 Decibels. (2022). *Why Off-grid Energy Matters.*

¹⁰⁸ The GOGLA CP Code has been designed for the off-grid solar sector and is product and business model agnostic. All PURE companies should make a Commitment to the CP Code and endeavour to meet the de facto industry standards. See www.gogla.org/consumer-protection.

¹⁰⁹ 60 Decibels. (2021). *Agsol, Kenya*

¹¹⁰ University of Manchester, University of La Rioja. (2022). *Off-grid Solar Waste in Sub-Saharan Africa: Market Dynamics, Barriers, to Sustainability, and Circular Economy Solutions.*

What can Governments and Development Partners do to Accelerate PURE?

Recommended actions for government and development partners:




- Establish regional QA frameworks including integration of minimum e-waste requirements for PURE companies and end-of-life' management processes.
- Support companies to prioritize circularity within their appliance and product design phase, factoring in modularity and replaceability, reducing the use of hazardous materials, and forging collaborations to create standardized, interoperable components^{111,112}
- Implement centralized repair and refurbishment centers, built on collaboration from across the sector, to deliver quality and cost-efficient waste facilities and end-to-end e-waste refurbishment and recycling services for PURE companies.
- Generate skills and capacity across the industry. This includes the expertise in existing informal repair economies, as well as in formal institutions, providing staff with maintenance, recycling, and dismantling skills.

- Refurbish and reuse components to increase affordability and sustainability for PURE products.

EXAMPLE: Enviroserve Rwanda Green Park¹¹³ is a private company based in Kigali, Rwanda, dedicated to electronic and electrical waste recycling, collecting old or broken batteries (under or after guarantee) for testing, refurbishment/repack and recycling and returning them back to the market. This includes lithium-ion battery products.

Another example includes the WEEE centre¹¹⁴ (together with Aceleron)¹¹⁵ in Nairobi, demonstrating that establishing an e-waste recycling centre can provide socioeconomic benefits to the local community while acting as a catalyst for the private sector companies to use the facilities for their own battery refurbishment.

Table 10 - Summary of proposed actions for sustainable and responsible PURE business for governments and development partners

Action line	PURE Market Maturity	Stakeholders involved
Gender and inclusivity		PURE distributors, PURE rental companies, ministries in charge of gender, social, and/or migrant affairs, MDBs, financial entities and commercial banks, humanitarian NGOs and institutions
Customer protection		PURE distributors, DFIs and other funding partners, National Renewable Energy Associations (NREAs)
E-waste		PURE distributors, e-waste facilities, National Bureau of Standards, and Rural Electrification Agencies, VeraSol, NREAs

111 [GOGLA. \(2023\). Blog: the Future is not linear. Circular Business Models and Innovations are Taking Off.](#)

112 [Efficiency for Access. \(2019\). Compatibility and Interoperability. Technology Roadmap.](#)

113 [Enviroserve Rwanda Green Park.](#)

114 [WEEE Centre.](#)

115 [Aceleron.](#)



Conclusion



Conclusion

Advancing PURE markets has been identified as a critical area of work by national governments across sub-Saharan Africa and South Asia to create new livelihoods, generate green jobs increase energy, water, and food security and drive resilience against negative effects of climate change.

Most PURE national markets remain nascent, with major challenges identified, including but not limited to the need to improve the affordability gap, raise awareness of PURE technologies, and establish financial incentives and funding vehicles to help stimulate access to private investment and end-user finance. However, demand by end-users, SACCOS, agricultural cooperatives and MSMEs for PURE products and services is broadening.

This has led to the emergence of a thriving ecosystem of off-grid solar and agri-input private sector companies, and new promising business models that offer more affordable PURE equipment, finance, and services to customers in off-grid and weak-grid areas.

Governments and development agencies are fundamental to scaling national PURE markets and supporting these companies to grow to serve millions of customers: generating new livelihoods, building resilience, and improving national energy, food, and water security and enhancing health and education services.

Based on its experience across several PURE markets and engagement with hundreds of stakeholders, GOGLA has suggested in this Handbook specific actions for governments and development partners to consider as they look to accelerate PURE national markets. We look forward to working with them to unlock the opportunities presented by this transformational sector.

In short, while PURE companies require more support for financing and demand acceleration, building blocks including creating the right policy and regulatory environment and capacities will be critical to advance PURE markets. In addition, integrating cross-cutting elements, such as gender, e-waste management, and customer protection, into the new and growing PURE companies will be critical to achieve sustainable PURE markets.



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Annex 1: Summary Table of Recommendations

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Table 11 - Summary of proposed actions

Building block	Action line	PURE Market Maturity	Stakeholders involved
Policies and regulations	Mainstreaming PURE	Integration of PURE within policies or plans	Ministries of Energy, Water, Agriculture, Environment, and donors
		Provision in sector programming and budgeting	Ministries of Energy, Water, Agriculture, Environment, Finance, and donors
	Multi-stakeholder Engagement	Multi-stakeholder platform	NREAs, NGOs, CBOs, private sector, Ministries of Energy, Water, Agriculture, and Environment, donors, development partners, donors, financial institutions
		Inter-ministerial coordination	Ministries of Energy, Water, Agriculture, Environment, and Finance
	Promoting high performing PURE	PURE (voluntary / mandatory) quality standard framework	National Bureau of Standards, and Rural Electrification Agencies, VeraSol, NREAs
		Training and certification and servicing technicians, installers, and after-sales force	National Bureau of Standards, and Rural Electrification Agencies, TVETs, universities
Finance & Investment	Public finance	Grants	PURE distributors and service providers, early-stage innovators, governments and development partners
		Results-based financing and end user subsidies	PURE distributors and service providers, early-stage innovators, commercial banks, MDBs, governments and development partners
		Tax reforms and measures	PURE distributors and service providers, Ministry of Energy & Finance, NREAs
		Guarantees and first loss layers	Financial institutions, central banks, Ministry of finance
		Climate funding	Ministries of energy, agriculture, water, and environment, National Standard Bureaus, civil society
	Equity and Debt	Working capital	Commercial banks, MDBs, state-based commercial financial agencies
	Consumer finance	Commercial financial institutions, MFIs, and PURE distributors and vertically integrated companies, PAYGo integrators	

Annex 1: Summary Table of Recommendations

Driving Technology Adoption	Innovative business models and partnership building				PURE distributors and service providers, off-takers, manufacturers, and agric. Input providers
	Awareness Raising				National Renewable Energy Associations (NREAs), local government authorities, Ministry of Energy, and other groups (i.e., NGOs)
	Public Private Partnerships (PPPs)				PURE distributors and services providers, agricultural off-takers, ministries, and agencies
Capacity building	Private sector upskilling programs				PURE distributors and service providers
	Capacity building programs for government agencies and financial institutions				Commercial banks, SACCOs, MFIs, ministries, REAs, NREAs, donors, MDBs, SACCOs, consumer groups, advocacy groups, religious institutions, CSOs, NGOs
Sustainable and responsible PURE business	Gender and inclusivity				PURE distributors, PURE rental companies, ministries in charge of gender, social, and/or migrant affairs, MDBs, financial entities and commercial banks, humanitarian NGOs and institutions
	Customer protection				PURE distributors, DFIs and other funding partners, National Renewable Energy Associations (NREAs)
	E-waste				PURE distributors, e-waste facilities, National Bureau of Standards, and Rural Electrification Agencies, VeraSol, NREAs

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