FACTSHEET 2

Productive Use of Solar Energy

SESA
Smart Energy Solutions for Africa

About the Sustainable Energy Solutions Catalogue

The Sustainable Energy Solutions Catalogue provides an introduction to the solutions deployed during the SESA project. The catalogue targets energy practitioners, policy makers and civil society, especially at local level. In the catalogue, readers can find key facts about specific sustainable energy solutions (technologies, business models, impact areas), or learn about approaches and concepts that help ensure the viability and long-term success of sustainable energy in the African context.

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1 Introduction

The term Productive Use of Energy (PUE) refers to energy use that creates value, for example in the form of increased productivity or income, employment creation, or reduced hardship (Lecoque & Wiemann, 2015; Terrapon-Pfaff et al., 2018). While definitions of PUE differ, there are two main reasons why it is pursued: first, it can improve the viability of energy access business models (for example of mini-grids in rural areas) and, second, it is a means to achieve broader socio-economic goals (Havinga & Teule, 2020).

Powering PUE solutions with sustainable energy sources, such as electricity from decentralised solar, is cost-effective and brings added benefits such as increased reliability of supply and reduced emissions. Figure 1 shows the range of possible productive uses in agriculture, industry, commerce and social/public services. This factsheet introduces different facets of sustainable PUE solutions in the African context, as well as examples of their application. It places a particular emphasis on areas of high potential for PUE in the agricultural sector, namely irrigation, cold storage and milling (IFC, 2019).

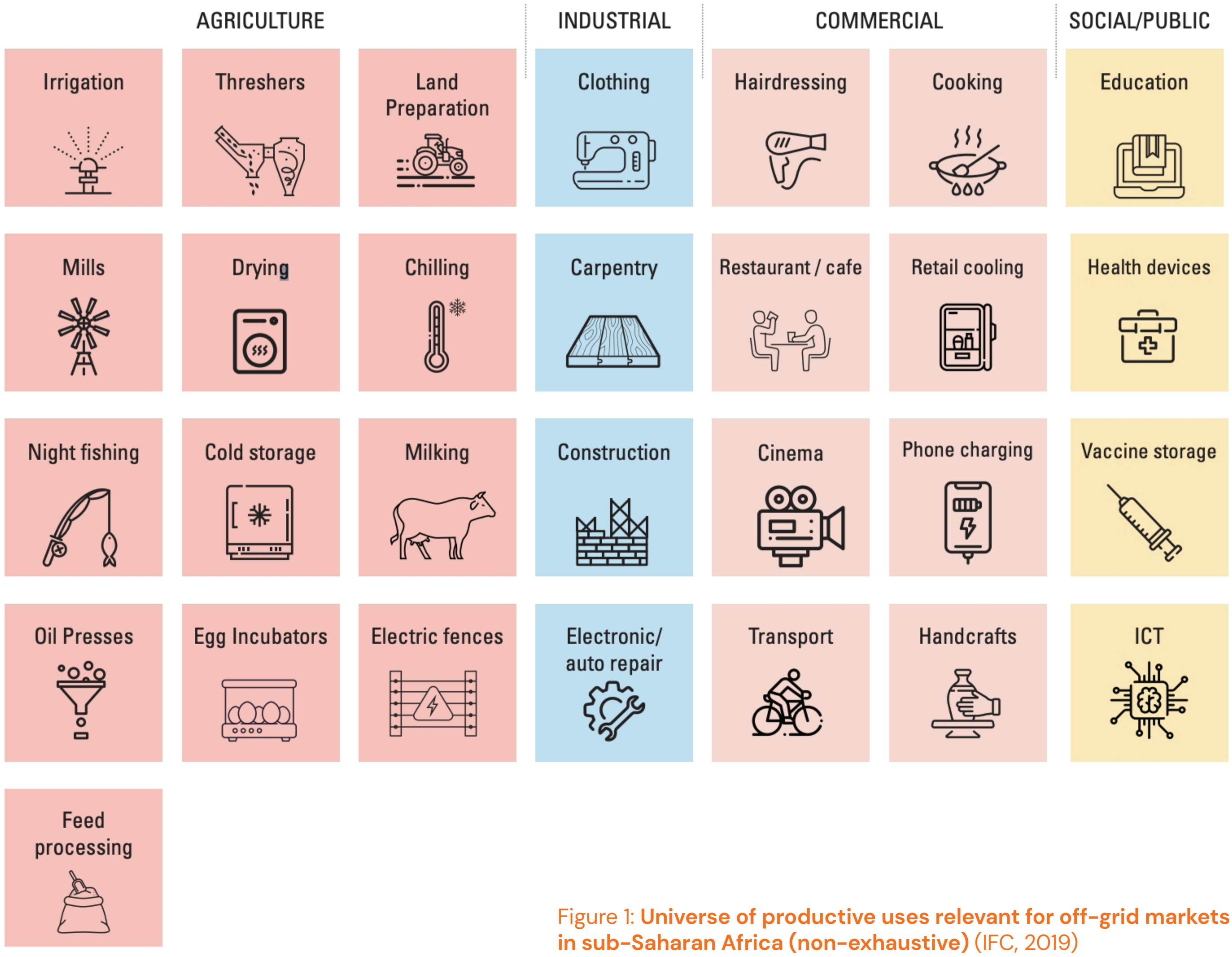


Figure 1: **Universe of productive uses relevant for off-grid markets in sub-Saharan Africa (non-exhaustive)** (IFC, 2019)

2 The technology

The technologies that enable sustainable PUE solutions include first and foremost the energy use appliances (such as water pumps and irrigation equipment, or fridges for cold storage), but also the power source (solar panels), energy storage (batteries), and Information and Communication technologies (ICT). This section reviews three key applications (water pumping and irrigation, cold storage, and grain milling), and considers two cross-cutting technology aspects of PUE appliances: ICT and energy efficiency.

2.1 Solar-powered water pumping and irrigation

The main components of solar water pumps (SWPs) and solar-powered irrigation systems (SPIS) are the power source (chiefly the solar panel and load controller), the pump, the water storage system (if any) and the irrigation equipment (see Figure 2). The solar system provides electricity to the pump, which delivers water from a well, stream, or another source directly into an irrigation system or into a storage tank or reservoir. SWPs and SPIS do not generally require a battery because irrigation typically takes place during daytime (Energypedia, 2020).

In line with the recent reductions in cost of solar PV technology, the cost of SWPs fell by 80% over the past two decades (Efficiency for Access, 2019). Over their lifetime, SWPs can bring significant savings to smallholder farmers compared to a diesel-powered pump, when considering the cost of the fuel. However, the upfront investment, even for small solar water pumps of 500 W or less (USD 600-800 in 2018), is a barrier to adoption and many business models seek to address this (see Table 1 and Business model section below).

Table 1: **Overview of typical solar water pump power and cost ranges** (based on Efficiency for Access, 2019)

	Power range	Cost range (USD, 2018)
Small	Up to 500 W	600 to 800
Medium	2-4 kW	1,000 to 3,000

In a SPIS, the irrigation appliance is customised to the type of crop, topography of the farm, water demand and water proximity (Efficiency for Access, 2019). Equipment for water-efficient irrigation (such as sprinklers, drip lines) can be capital-intensive, whereas the equipment for surface irrigation (where the entire field is flooded, or water is applied to crops via small channels) is more affordable (Bolwig et al., 2020). However, flood irrigation is 20-60% more water-intensive than drip irrigation, which might be an exclusion criterion especially in arid areas (MIT GEAR LAB, 2022).

For more information on SWPs and SPIS, please see also the Water-Energy-Food Nexus factsheet of the catalogue.

2.2 Solar cold storage

The use of solar energy to power cooling technologies has high potential to reduce post-harvest losses and expand access to markets, therefore raising revenues of farmers. Cold storage is needed for different products: fruits and vegetables, meat and fish, milk and dairy. Each product has different cold storage requirements, from -21°C for fish to 15°C for certain fruits (Efficiency for Access, 2022a).

There are three main types of refrigerating appliances that can be powered by solar energy: fridges, freezers and cold rooms. Solar direct-drive fridges and freezers can be connected to PV panels and do not need electric batteries to operate. Currently, however, vapour-compression units powered with a solar energy system with electrical batteries are more common in the off-grid solar market (SEforALL and CLASP, 2021). Cold rooms are refrigerated spaces with controlled temperatures which can be powered by multiple power sources, including solar systems. A typical off-grid walk-in cold room consists of a solar PV array, a battery and/or thermal storage unit, a cooling unit and insulation materials, and remote monitoring equipment (Efficiency for Access, 2021).

Despite their potential, solar cold storage technologies face a number of challenges such as the lack of standardisation and high investment and maintenance costs. Business models seek to bridge the affordability gap, especially for smallholder farmers (see Business Models section).

Figure 2: **Application of a solar-powered irrigation system** (SunCulture in IFC, 2019)

2.3 Solar grain milling

Mills process grains like maize, rice, sorghum or millet into flour (see Figure 3). Solar-powered mills can be purpose-built or retrofitted (replacing the diesel engine with an electric motor) and may operate with or without a battery unit. Battery-coupled solar grain mills are driven by direct current (common voltage levels are 12 and 24 V) and the system consists of PV panels, batteries, a charge controller and the mill (Energypedia, 2022). While battery-coupled solar mills meet higher health and safety standards compared to diesel-powered mills, their speed can be too low to meet peak customer demand. The main technological challenge for solar milling is to size the energy system appropriately to achieve cost-effectiveness and throughput while maintaining high utilisation rates that increase profitability (Efficiency for Access, 2020).

2.4 ICT and IoT in solar PUE

ICT (Information and Communication) and IoT (Internet-of-Things) technologies play a key role in making solar PUE applications affordable. For example, many solar water pump models include remote sensing so that the manufacturers can carry out troubleshooting more effectively, as well as give advice on optimal use of the pump based on usage data. Geospatial information tools to identify suitable areas for solar irrigation are also emerging (Maina et al., 2021). Finally, PAYGO models for solar-powered pumps also rely heavily on ICT. For example, an appliance may be remotely disconnected in case of lack of payment (see Business Models section).

2.5 Energy efficiency of PUE appliances

High-quality, efficient, and off-grid appropriate PUE appliances are key to making PUE business models viable. A number of programmes support the development of technologies to make PUE appliances efficient and suited for use with off-grid solar standalone systems or mini-grids: the Efficiency for Access Research and Development Fund (Efficiency for Access, 2018) and the Low Energy Inclusive Appliances (LEIA) Programme (Efficiency for Access, 2022b). For example, Agsol (Figure 3), a manufacturer of solar-powered agricultural machinery active in the East African market, received support from the Efficiency for Access Fund and improved the efficiency for its mill by 32%, while at the same time making it more affordable for customers.

Figure 3: **Application of the Agsol Gen2 mill** (Efficiency for Access, 2020)

3 Business and financing models

Business models for solar PUE solutions are designed to address the challenge of affordability, as the systems have comparatively higher upfront capital investments than conventional diesel-powered systems and appliances (despite being more affordable over the full lifetime). Different approaches to overcome this challenge are introduced below. However, it is important to remember that the design of appropriate business models is very context-specific and should be based on local needs assessments.

3.1 Private ownership

A combination of consumer financing (see PAYGO below), grants, long-term credit (including from rural financing networks), and tax exemptions can incentivise private purchases of solar PUE systems. Individual ownership models have the disadvantage of not always reaching the more marginalised farmers whose landholding patterns and income streams may not be sufficient to allow them to invest in PUE appliances. Depending on local contexts, shared ownership (such as co-operatives) is a viable alternative. Evidence from Zimbabwe, Benin and India demonstrates that community-ownership models have been effective (IRENA & FAO, 2021). In order to be successful and sustainable in the long-term, they require social cohesion among all involved farmers, and agreement on how to share the use of the appliance, its expenses and the responsibility for maintenance (Gebrezgabher et al., 2021).

3.2 Service provider model

In the service-provider (or "fee-for-service") model, solar PUE technology is owned, operated and maintained by a third-party entrepreneur. The entrepreneur then provides PUE services, such as solar irrigation, to users for a fee (Gebrezgabher et al., 2021). In this way, smallholder farmers can pay for irrigation or other agricultural services, for example on the basis of the water they use or the hectares they own. For instance, ColdHubs Nigeria and SokoFresh apply a pay-as-you-store fee for cold storage (see Examples box below). The technical, operational and financial risks lie with the service provider while farmers purchase the services on demand. A key advantage of this business model is that service providers can often operate and maintain the technologies more efficiently than individual smallholders. Moreover, the system is used more intensively than in the case of individual ownership (Gebrezgabher et al., 2021). Merrey & Lefore (2018) described several variants of this model implemented in Senegal, Morocco, Bangladesh and India. Moreover, it is important to note that agricultural cooperatives can also use the fee-for-service model (i.e., they do not need to own the system).

3.3 Incentives to multiple use

Some solar PUE systems, such as irrigation pumps, tend to be used only during the growing season. Incentivising multiple uses for the systems can improve their overall economics while bringing a wider range of development benefits. For example, in Bangladesh, excess electricity generated by pumps is used for mechanical processes such as husking, threshing, cold storage or aquaculture (IRENA & FAO, 2021).

3.4 Consumer financing

Several approaches are used to facilitate the initial investment in a solar PUE system. In the PAYGO model, customers pay 10-20% as upfront cost and the rest in instalments over a period of 1-2 years. This financing approach is already common in the market for Solar Home Systems for households and small businesses, and is increasingly used to support the purchase of solar PUE equipment in certain contexts (IFC, 2020). In Kenya, "pay-as-you-grow" models adapted to farmers' income cycles are being deployed to improve accessibility and affordability (EEP Africa, 2021). Microfinance is a common approach in rural areas where financial services are limited and appropriate loan products for agricultural lending are not available. In Egypt, the SAIL (Sustainable Agriculture Investments and Livelihoods) project includes a micro-loan facility to enable small enterprises to make climate-smart agriculture investments, including solar-powered irrigation (IRENA & FAO, 2021).

Examples of application in the African context (1)

SokoFresh (Kenya)

The idea: Provision of off-grid, mobile cold-storage as a service and support to access markets to Kenyan smallholder farmers.

The technology:
- Powered by solar PV
- Complemented by online market linkage platform

The business model:
- Pay-as-you-store: the farmers/traders pay for storage on a kg/day basis

The impact:
- Reduction of post-harvest losses
- Increase of income due to higher amounts of harvest sale

For further information visit:
→ https://sokofresh.co.ke

4 Socio-economic and sustainability impacts

Productive use of solar energy for agriculture not only has the potential to improve the viability of energy access business models but is also a means to achieve broader socio-economic goals. In particular, it has the potential to capture more economic value within rural areas (Johnstone, 2021).

The use of solar PUE in agriculture can result in extended operating hours, mechanisation, product preservation, higher productivity, improved working conditions as well as improved food security. For example, a Kenyan farmer cooperative saw USD 75 incremental income gains per farmer per month following the purchase of a solar milk cooler (IFC, 2019; Lecoque & Wiemann, 2015). A larger cooling plant led to an extra 2 litres of monthly milk consumption per family per month. A survey on the uses and impacts of off-grid refrigerators in Kenya, Tanzania and Uganda concludes that 72% of the interviewed people experience increased income and business growth after using off-grid refrigeration (Efficiency for Access, 2022c).

Solar PUE systems also bring environmental benefits, as they can achieve a similar level of performance as fossil fuel-powered appliances without the carbon emissions associated with them. For example, the Futurepump SF2 solar water pump is found to save 196 kg CO_2 per year compared to an equivalent petrol pump (REEEP, 2018). Moreover, many PUE applications can potentially reduce farmers' water consumption when used in conjunction with more efficient irrigation techniques (see Climate Proofing section).

Finally, Promoting PUE can improve the viability of solar mini-grid projects, by increasing demand for energy and providing stable demand during the day time.

Realising the positive impacts of solar PUE requires taking a holistic approach that ensures quality capacity-building and access to markets (Johnstone, 2021; Terrapon-Pfaff et al., 2018). The solar-powered mini-grids on Lake Victoria islands in Tanzania provide an example of an integrated approach to fostering PUE in minigrid projects. The operating company, Jumeme, identifies existing economic activities in the communities that can be boosted with the power from the minigrid, while at the same time fostering new economic activities, facilitating access to outside markets and attracting new investments into the communities. Such an approach requires significant resources and expertise, as well as strong community engagement (SEforALL, 2020).

Fostering solar PUE also involves a series of risks, especially those that are linked to unequal impacts on employment and income generation. It is vital to explicitly design PUE initiatives and business models so that they achieve equitable impacts and benefit the poorest and most vulnerable, and to monitor that they do so. One way to do this is by assessing the involvement of specific actors in economic activities in the community. For example, Simusolar takes an active approach to understanding the specific needs of female customers with regards to their PUE products, in order to boost the participation of women farmers in the market (Power Africa, 2022).

Examples of application in the African context 2

ColdHubs (Nigeria)

The idea: Provision of 24/7 off-grid storage and preservation of perishable foods via a "plug and play" modular, solar-powered walk-in cold room.

The technology:
- Solar PV installed on the roof-top of the cold room

The business model:
- Pay-as-you-store subscription model: farmers pay a daily flat for each crate of food they store
- The reusable crates are provided by ColdHubs and fit the shelves of the cold rooms

The impact:
- Extension of shelf life of perishable food from 2 to 21 days, resulting in a reduction of post-harvest loss by 80%
- Increase of annual income by 25% due to larger amount of harvest to sell

For further information visit:
→ https://www.coldhubs.com

5 Scaling-up

The agriculture, forestry and fishing sector accounts for 18.5% of total GDP in sub-Saharan Africa (World Bank, 2022). About 65% of land is still tilled, ploughed or weeded manually, resulting in low farm yields (World Bank, 2019). Solar-powered agricultural appliances have the potential to drastically increase productivity and food production while reducing post-harvest losses. Generally, the opportunities for solar-powered PUE vary across different African markets according to the maturity of the off-grid solar sector, the nature of the agricultural sector, and the strength of incumbent products (IFC, 2019). Table 2 illustrates the high market potential for scaling up key solar PUE use cases in Sub-Saharan Africa.

Table 2: **Estimated serviceable market potential for solar PUE technologies in sub-Saharan Africa** (IFC, 2019)

	Total estimated serviceable market (number of farmers in 2018)	Projected increase of serviceable market until 2030	Number of projected serviceable farmers in 2030	Estimated market value in 2030 (USD)
Solar-powered water pumps	701,000	12.3%	2.83 million	1.633 billion
Cooling & Refrigeration	225,000	17.4%	1.55 million	1.32 billion
Agro-processing	54,000	13.9%	257,000	417 million

Examples of application in the African context 3

SunCulture's RainMaker (Kenya)

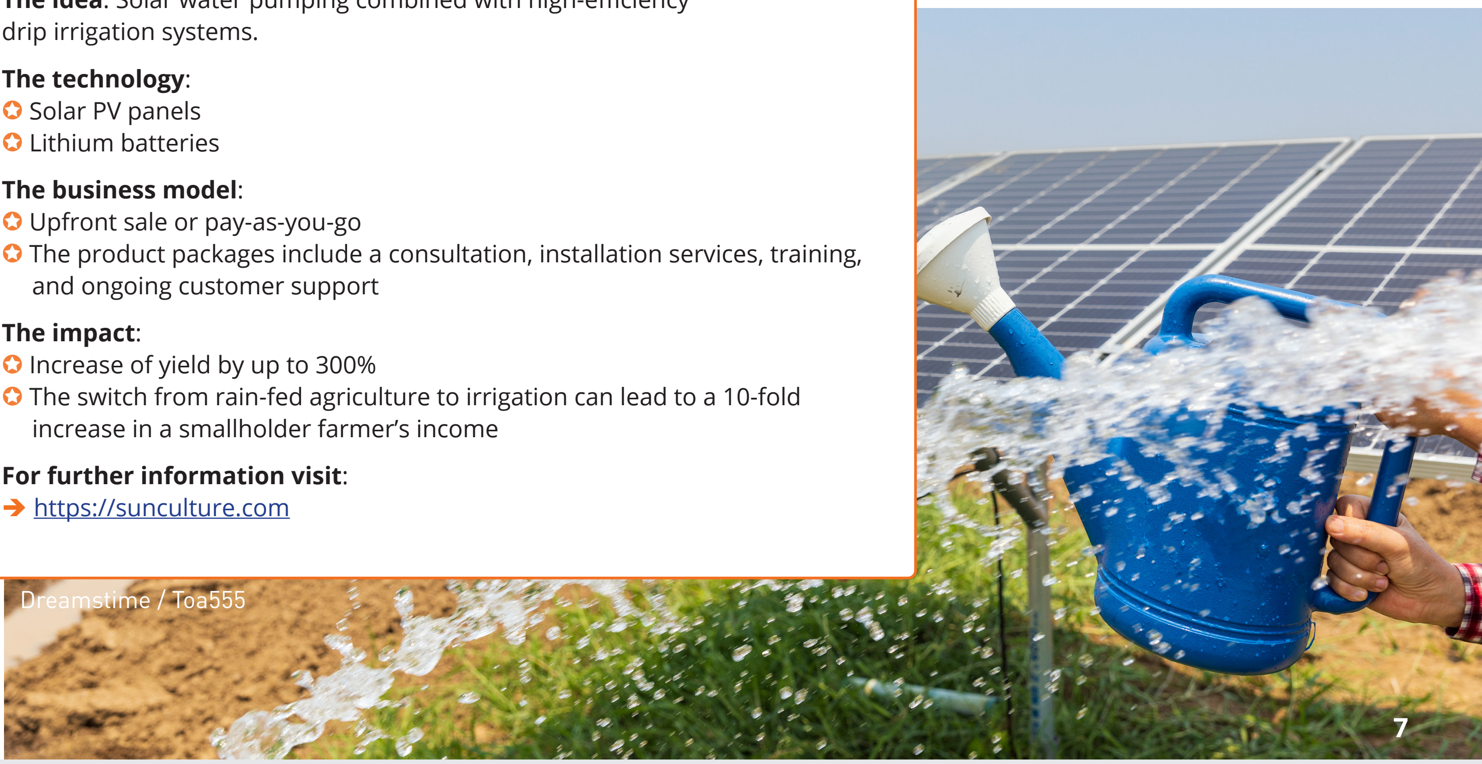
The idea: Solar water pumping combined with high-efficiency drip irrigation systems.

The technology:
- Solar PV panels
- Lithium batteries

The business model:
- Upfront sale or pay-as-you-go
- The product packages include a consultation, installation services, training, and ongoing customer support

The impact:
- Increase of yield by up to 300%
- The switch from rain-fed agriculture to irrigation can lead to a 10-fold increase in a smallholder farmer's income

For further information visit:
→ https://sunculture.com



Dreamstime / Toa555

Some solar PUE products are particularly ready to scale. Solar water pumps, for example, are currently affordable even in small farms. They can increase yields for farms starting as small as 0.5 hectares (IFC, 2019). The expected 10-15% future reduction in prices of solar water pumps from 2018 to 2030 will drive the market growth further (IFC, 2019). The solar cooling and refrigeration market will continue to be dominated by small refrigerators in the short term, as walk-in cold rooms are still relatively expensive. Agro-processing appliances such as mills are expected to remain outside the affordable price range for most smallholders in the short term, though prices in this market are likely to decrease within the next decade (IFC, 2019).

To realise the potential in the PUE sector, policies, market development, and innovative partnerships between the energy and agriculture sectors are required. Despite the importance of PUE to rural productivity and overall economic development, productive use appliances are often not included in national policies. Figure 4 illustrates key areas of intervention for the development sector and government actors to support the solar PUE market.

Figure 4: **Areas of intervention for development sector and government actors to support solar PUE** (own illustration, based on IFC, 2019)

1. **Demand generation/aggregation**
   Support selected value chain aggregators through technical assistance and finance
2. **Technology & innovation**
   Technical assistance and investment to support technology upgrading and skills transfer
3. **Access to finance**
   Patient capital, seed capital, working capital and grants to support set-up, growth and scaling
4. **Business development support**
   Work alongside PUE innovators to provide business management, market entry and growth strategy advise
5. **Quality assurance**
   Develop minimum product standards, especially for emerging DC appliances and service levels for post-sales support
6. **Market intelligence**
   Develop detailed use cases across a range of products, provide annual PUE surveys and market details
7. **Consumer education**
   Work with existing value chain actors and donors to expand the awareness of solar product, focused on emergent products
8. **Policy development**
   Policy papers, research and lobbying to enhance regulatory environment at interface between off-grid and agriculture

Dreamstime / Shantanay P Chitnis

6 Productive Use of Energy in SESA

Implemented in nine African countries, the EU-funded SESA project is developing and testing solutions to accelerate the energy transition in Africa. The focus of the project is on the exploration of innovative technologies and services in urban and rural contexts. SESA partners in various countries are working on productive use of solar energy. Their activities are briefly outlined below.

6.1 Kenya Living Lab

SESA partner WeTu is developing innovative solutions for productive use of energy as part of the SESA Kenya Living Lab. The main objective in this Living Lab is to demonstrate sustainable energy access solutions that are relevant for both urban and rural contexts in Africa, centred around solar PV off-grid electricity generation for multiple uses (including PUE and e-mobility), e-waste management, and integration of local Info Spots for digital access to information on energy, climate change and digital skills.

The Living Lab comprises two project sites: Kisegi, a rural village in Homa Bay County, and Katito, a peri-urban community in Kisumu County. The solar charging hub in Katito uses a lead-acid battery bank and conventional inverter system, while Kisegi tests a hybrid inverter system with Li-ion storage and "hot swapping" system. The generated energy is used for a range of needs within the local communities. Solar PUE solutions tested in the Kenya Living Lab include fisher lantern charging systems, solar water pumping and water purification systems.

Examples of application in the African context — 4

Koolboks (Nigeria, Kenya, Ghana, France)

The idea: Affordable off-grid refrigeration solution that can cool for up to four days, even in the absence of power and limited sunlight.

The technology:
- During the day when sunlight is available, ice is created in special compartments
- The ice batteries are complemented with integrated Lithium-ion batteries

The business model:
- PAYGO in the form of lease-to-own: small weekly or monthly payments to eventually own the system
- Multiple uses: the unit can also power lighting

The impact:
- Reduction in cost of owning an off-grid solar refrigerator by almost 40%
- Lowering of the barrier to access financing

For further information visit:
→ https://www.koolboks.com

Examples of application in the African context — 5

Agsol (Kenya, among others)

The idea: Solar-powered mills that are designed for off-grid farming communities in the East African market and specifically for maize and cereals milling, the most important staples in the region.

The technology:
- Energy efficient design
- Can be powered by standalone solar PV, solar mini-grid, grid electricity, or e-bike
- Li-ion LFP battery technology

The business model:
- Customers can purchase the solar mills under a PAYG model in less than two years

The impact:
- Income generation
- Increased productivity

For further information visit:
→ https://agsol.com

7 Climate-proofing

Climate proofing is a term that refers to the process of mainstreaming climate change into mitigation and/or adaptation strategies and programmes (Climate Policy Info Hub, 2022). The goal of climate proofing is to ensure that climate-related risks and opportunities are integrated into the design, operation, and management of products and infrastructure. In order to do this, projects have to be screened for climate risks, vulnerabilities and opportunities early in the design stages.

The climate-proofing of solar PUE solutions will depend on the specific location and context. However, some general guidelines include:

- In the agricultural sector, climate adaptive solutions are required at every phase of the value chain (Dolan, 2021). Solar PUE solutions can enhance climate change resilience, if applied correctly. However, there is a risk of negative impacts, for example, as a result of excessive water pumping (Johnstone, 2021).
- With regard to cold storage, heat stress is expected to increase cooling demands, requiring appropriate design of solutions to face growing needs.
- The technologies that enable sustainable PUE solutions include the power sources, batteries, and Information and Communication technologies (ICT). These can also be vulnerable to climate change and need to be designed in line with climate conditions in their location. Further guidelines for climate proofing of these solutions can be found in the Climate Proofing factsheet of this catalogue.

Examples of application in the African context 6

Smart Energy Enterprise (SEE) (Karonga, Malawi (Company selected in the "SESA Call for Entrepreneurs 2022")

The idea: Solar powered irrigation systems for smallholder farmers on a loan basis.

The technology:
- Innovative solar-powered irrigation
- Complemented with customised advisory services and access to markets for smallholder farmers

The business model:
- Target smallholder farmers who cultivate rice
- Three-year loan recovered through water user fees and farm produce
- SEE mobilises farmers into cooperatives who become owners of the irrigation systems once loan is repaid

The impact:
- Increased affordability of irrigation technology, reduced dependence on rainfed agriculture
- Increased resilience to drought and climate change related water shortages

For further information visit:
→ https://seed.uno/enterprise-profiles/smart-energy-enterprise-see


Dreamstime / Andrii Shevchuk

8 Relevant tools and capacity building materials

PREO Knowledge Hub

The Powering Renewable Energy Opportunities (PREO) Knowledge Hub is an open-access library collecting information related to productive use of energy. The resources aim to close critical knowledge gaps in sub-Saharan Africa's PUE market to support the uptake of the solutions. The knowledge hub is organised in various sections such as case studies, mini-grids, agri-processing, cold-storage and others. Its content is updated regularly.
→ www.preo.org/category/knowledge-hub

Productive Uses of Energy in Ethiopia (2021)

The 240-page study aims to create a shared understanding of and a common language to assess opportunities for productive use in Ethiopia and comparable contexts. In particular, it identifies opportunities to electrify agricultural productive uses today, how they can be developed through feasible business models, and the strategies and initiatives that stakeholders can use to overcome barriers to deployment.
→ https://rmi.org/insight/productive-uses-of-energy-in-ethiopia

Power Africa's off-grid productive use of energy (PUE) catalogues (2020)

The Power Africa's off-grid productive use of energy (PUE) catalogues aim to increase awareness and uptake of off-grid PUE appliances that are available in the sub-Saharan African market for agriculture, fishing, livestock, and poultry. It provides stakeholders such as manufacturers, suppliers or policymakers with insights into PUE products and innovations. The catalogues include product technical specifications, manufacturer information, distribution channels, local distributor details, product payment methods, quality standards and links to related sources. Catalogues are available for the following countries: Cameroon, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Niger, Rwanda, Senegal, Tanzania and Uganda.
→ www.usaid.gov/powerafrica/beyondthegrid/off-grid-solar-market-assessments#PUEcatalogs

Rapid Product Assessment: A New Approach to Testing Productive Use Appliances (2022)

In cooperation with Kijani Testing, VeraSol developed the Rapid Product Assessment framework. This framework offers a cost-effective and time-saving way to quality verification for nascent PUE technologies. The framework should help to access reliable data and information about the performance, durability, and safety of PUE to enable market stakeholders to make informed decisions and identify high-quality, energy-efficient technologies. Egg incubators were selected as a first trial product for the Rapid Product Assessment approach.
→ https://efficiencyforaccess.org/publications/rapid-product-assessment-a-new-approach-to-testing-productive-use-appliances

Productive Use of Energy (PRODUSE) user manual

The manual provides step-by-step guidance for designing and implementing productive use of energy activities in electrification programmes. It comprises six modules, each describing practical tasks to be conducted in every project phase, as well as references and links to other publicity available tools. The manual is updated regularly.
→ www.produse.org

A2EI Productive Use Report & Productive Use Assessment Tool (2020)

The report evaluates solar-powered agricultural technologies for productive-use applications. The assessment tool which supports the design of business models that incorporate productive use in the agricultural sector, for example oil pressing, maize shelling or spice grinding. Based on evidence collected in Tanzania, the spreadsheet contains technological, business and energy assumptions and can calculate revenue, operational costs, and gross profit margin on a per-hour basis. Due to its simple structure, the tools allows the values and calculations to be changed easily according to the operating environment.
→ https://a2ei.org/resources/uploads/2020/09/A2EI_Productive_Use_Report_Agricultural_Technologies.pdf

Energypedia Productive Use Portal

The productive use portal provides an overview of the articles related to productive energy use on Energypedia. The articles are divided in various categories, including for example climate change and productive use, energy technologies and PU, or promotion, financing and business models for PU. The portal is updated regularly.
→ https://energypedia.info/wiki/Portal:Productive_Use

Productive Uses of Energy Hub Mozambique

The PUE Hub Mozambique, developed by Energypedia, gathers information on productive uses of energy such as irrigation, drying, cooling and other applications for Micro, Small & Medium Enterprises in Mozambique. It describes the market potential and the opportunity for private sector involvement in the PUE area. Information is updated regularly.
→ https://energypedia.info/wiki/Mozambique_Productive_Uses_of_Energy_Hub

Solar Pumping Toolkit (2020)

The Global Solar and Water Initiative developed the Solar Pumping Toolkit which is accessible at Energypedia. The toolkit is made up of four chapters related to solar pumping, including Guidance, Design, Installation and Monitoring.
→ https://energypedia.info/wiki/Solar_Pumping_Toolkit_-_The_Global_Solar_%26_Water_Initiative

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FACTSHEET 2

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