

PUE in Milk: Solar PUE in the Dairy Value Chain in Ethiopia and Uganda

Ethiopia



Fee for Service



Consumer Credit

Uganda



Innovation Fund



Cooling




Dairy




Quick Facts


 Solar Cooling


 GIZ, SNV

 Support scalable, innovative business cases for using renewable energy cooling technologies and services to improve production and livelihoods of smallholder farmers in the dairy value chains in Uganda and Ethiopia.




 23,274 EUR


 Phaesun GmbH, Lydetco Solar, Denkaaka dairy cooperative.

 1. Farmers: Selling evening milk (in addition to morning milk) leads to an increase of income by 25-30%. Farmers are encouraged to intensify and professionalise dairy farming.


2. Dairy cooperative: Collecting additional milk (here: evening milk, which is currently not sold) and being able to extend services to members.


3. Processor: buying high quality milk (if cooled milk is kept separate).


 Innovation Fund, Fee-for-service

 Cooling capacity installed:

- 160 L Ice based milk solar storage.
- Other: Phone charging capacity installed.


 66,200 EUR


 FRES Uganda Limited, Solar Today, Rwanyamahembe SACCO.

 1. Income Boost: Average monthly income of dairy businesses more than doubled from about 409 EUR to 962 EUR due to better productivity and lower energy costs.

Reduced Post-harvest Losses: Post-harvest 2. dairy losses dropped by 99% for smallholders and businesses adopting PUE cooling technologies.

Energy Savings: In just one year, Akajumbura 3. Dairy Cooperative reduced its operational costs by over 50% while seeing its membership grow from 60 to 105.

 Innovation Fund, Fee-for-Service, Consumer Credit

 Cooling capacity installed:

- 5,300 L bulk milk cooler installed with a 19.7 kW solar PV system, battery bank of sixty-four 150 Ah batteries and back-up 30kVA diesel generator.
- Solar deep freezers (150-400L): 1,350 L total capacity installed over 5 unique systems with 300-600W Solar PV systems and 150-330 Ah battery packs.

Summary

SEFFA aims to address the energy needs of smallholder farmers (SHFs), improve their productivity and income, and create market opportunities for renewable energy technology suppliers. In this business case, SEFFA looked at opportunities to introduce solar to the dairy chains in Ethiopia and Uganda. The SEFFA programme meticulously integrates a diverse array of financial instruments to facilitate the uptake of solar cooling technologies in dairy cooperatives and enterprises. The results from both countries show that the potential business cases for solar in milk production, collection and processing are strong.

In Ethiopia, GIZ is implementing several business cases for dairy cooling and rice processing using solar energy technology. The market linkage and spoilage issues of the milk market in Ethiopia make dairy cooling a higher demand and need for farmers. However, there is a lack of commercial providers due to low awareness of the business potential and foreign exchange issues. The cooperative Dhenkaaka was supported to operate a milk cooler, powered by a solar PV system, and for farmers to sell evening milk (in addition to morning milk) and increase income by 25-30%. The cooperative collects a small cooling fee from the member farmers to store their evening milk in the solar cooler. Education and training for farmers, local experts, and technical support were also provided to make the most of the technology.

In Uganda, SEFFA set out to introduce solar in dairy in Uganda under the following scenarios:

- Dairy Cooperative with non-renewable energy based cold storage switching to solar hybrid (diesel) energy technology.
- Dairy enterprises with unreliable or no energy source in off-grid areas using solar for cooling milk and milk products.
- Dairy farmers switching from manual milking techniques to solar powered cow milking system.

The private sector was involved in developing technology and financing options for the two cooling business cases including the implementation of energy as a service. Additionally, a private company was supported to pilot solar milking machines for off-grid dairy farmers and the trials produced good results.

Problem statement

Lack of access to affordable, reliable, and sustainable energy technologies & services for smallholder dairy farmers and related local businesses causes as much as 50% of milk to be wasted.

From a technology supplier's point of view, the main problem is the lack of market demand and awareness for PUE in dairy.

Assumptions

- Farmers have the willingness and ability to invest in PUE technologies and the use of such technologies will result in economic benefits for farmers.
- Market linkage is a critical issue for the dairy farmers and in order to minimise the risks associated with it, the use of cooling technologies is vital.
- There is a market opportunity for renewable energy technology suppliers.
- Capacity building and awareness creation are necessary to drive the adoption of renewable energy technologies.

Business Case Details

In Ethiopia, a solar milk cooling machine with a capacity of 160 L was piloted together with Dhenkaaka cooperative located near Bishoftu in Oromia region. The PUE technology was placed at a newly established milk collection point of the cooperative where previously only the morning milk was collected by the processor. The solar milk cooler enabled the farmers to keep the evening milk, which was not sold, fresh until the morning for the next collection round. The cooperative charges a small cooling fee from the member farmers to store their evening milk in the solar cooler, charging the farmer 2 Birr of margin and 1 Birr of cooling fee per litre of milk stored in the cooler. The cooler is designed to keep the temperature of the milk at 4C for 14 hours and was installed with a unit that controls the surplus power, allowing the cooperative an option to offer a charging service for mobile phone or torches – a second revenue stream that will help investment in the milk cooling system.

The solar milk cooler used in the Dhenkaaka cooperative is a battery-less technology that creates ice with solar energy and used the ice to cool the milk. This provided an opportunity for local company Lydetco to demonstrate their SelfChill technology in operation and increase sales.

In Uganda, the progress with promoting solar cooling began with a demo of solar hybrid cool-



ing at Akajumbura Dairy Farmers with Cooperative Society, which bulks between 5,000– 5,300 litres (wet season) and 2500 – 3000 litres (dry season) per day.

About 30% USD 17,000 co-investment for the equipment by the Cooperative was using a Solar Loan Product, which was developed with a local SACCO with the help of SEFFA. The technology reduced operational costs by about 67% per day, as the diesel consumption reduced from 30 litres to 10 litres on average. There was also improved efficiency in managing the cooperative's operations thanks to digitalisation and strengthened capacity in governance, business planning, and management to build viable business cases for PUE in the dairy value chain.

SEFFA partnered with local company FRES Uganda for several cooling-as-a-service interventions including providing 150 L deep freezer to an off-grid milk vendor, Jane Mbabazi Ziriza. The connection between FRES and the vendor was facilitated by a match making initiative and resulted in increased profits and reduced spoilage for Jane's business, as well as a spillover effect when other vendors in her area adopted the equipment. With the "cooling-as-a-service model," the energy service provider (FRES) assumes ownership and operation of the solar cooling system, with users paying to use the service as and when they need it.

Elsewhere in Uganda, SEFFA used an Innovation Grant award to finance Ntakyie Holdings Ltd in their trial of solar milking machines at 8 demo sites across Central and Western Uganda. Their innovation boosted milk output on the pilot farm by up to 12%, reduced labour by an impressive 18%, and improved the lives of those who embraced this pioneering change. As an example at Agaba Dairy Farm, cows produced up to 16 L in under 7 minutes during milking with the new machines in the mornings, and 11 L in under 6 minutes in the afternoon.

To foster the demand for solar PV systems, the SEFFA programme in Ethiopia is committed to instigating behavioural change through diverse strategies, notably emphasising "awareness creation, capacity building training, and technical support." This entails propagating awareness among farmers and stakeholders regarding the advantages of solar technology and its potential impact on their operations. Additionally, capacity building endeavours are poised to enrich the knowledge and competencies of farmers and other stakeholders, and so facilitating the effective utilisation of the technology.

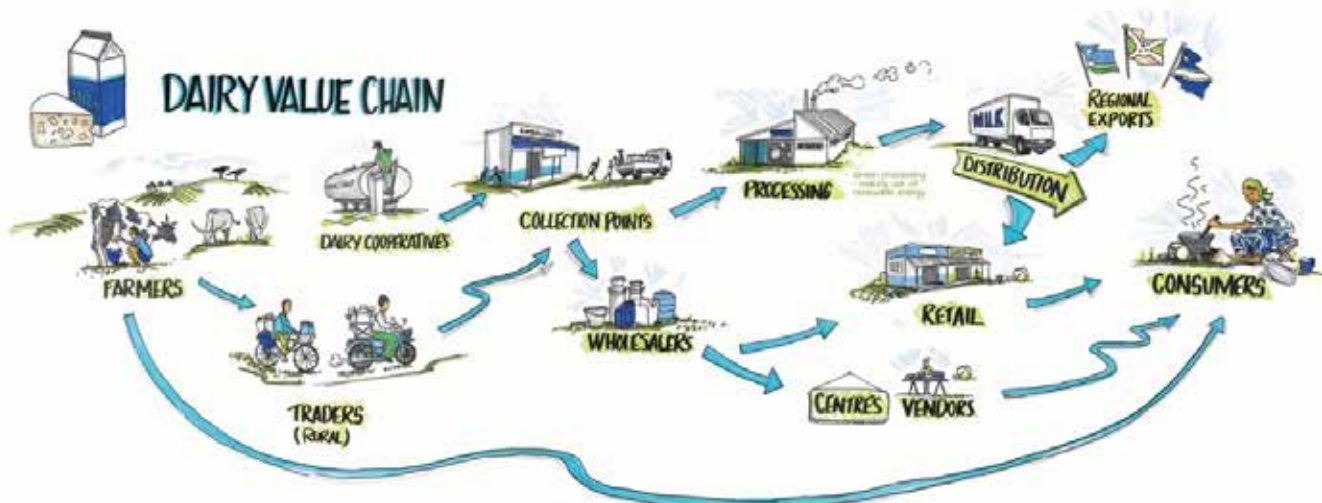


The SEFFA programme in Uganda propounds strategies for behavioural change through targeted sensitisation and training initiatives. Farmers and stakeholders are sensitised and trained on the operation and maintenance of PUE cooling technologies, precipitating a shift in behaviour towards the efficacious adoption and utilisation of solar cooling technologies.

To stimulate demand for solar cooling technologies in Uganda SEFFA adopted a similar multifaceted approach:

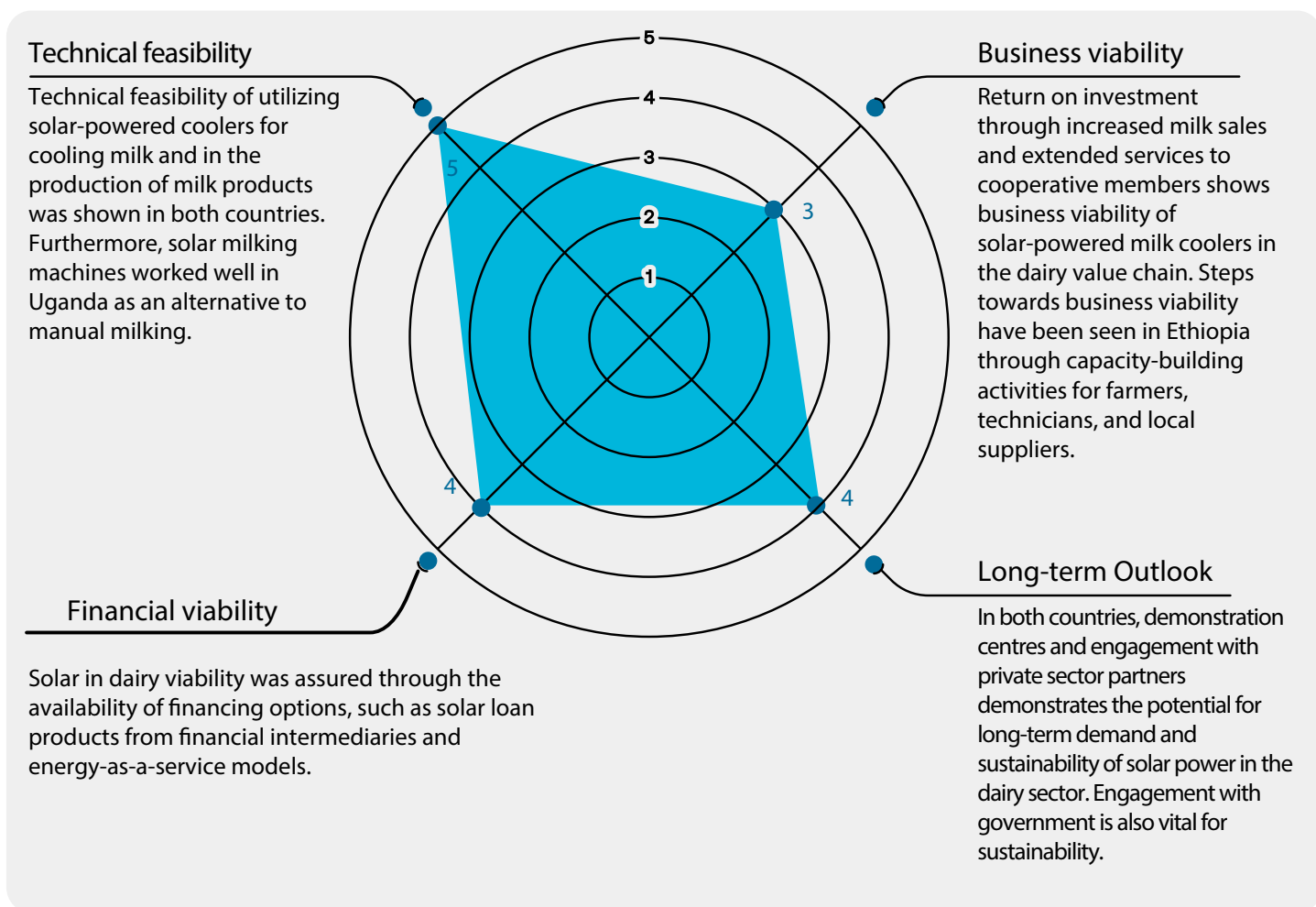
- Establishing demonstration centres to showcase the merits and functionality of solar dairy cooling.
- Supporting the private sector partners to actively engage in sensitising and disseminating information about Productive Use of Energy (PUE) technologies to farmers and stakeholders, ultimately aiming to bolster awareness and engender demand for these innovative technologies.

The SEFFA programme in both Ethiopia and Uganda is advocating for the widespread adoption of solar PV systems for dairy. By harnessing solar energy, the technology contributes to significant energy cost savings and enhances the operational efficiency of dairy activities. In presenting options such as small-scale cooling (150 L to 450 L) and large-scale cooling (up to 5,300 L) as well as solar milking machines, these technologies proffer sustainable and renewable energy-driven solutions along the dairy chain, alleviating dependence on non-renewable energy sources and enhancing the overall efficiency.





Business Case Attractiveness



Outcomes

- **Introduction of renewable energy technology:** Both Uganda and Ethiopia aim to introduce solar-powered dairy cooling technology as a solution to the challenges faced by the dairy industry, such as weak market linkages, spoilage, and lack of commercial providers. The feasibility of the technology has been proven in other countries with similar conditions.
- **Private sector involvement:** The implementation of the business cases involves collaboration with private sector companies in both countries. In Uganda, implementing partners include Solar Today and FRES Uganda Limited, while in Ethiopia, GIZ works with partners including MOWE, LDI, ECC, ATI, and FNRRTC.
- **Capacity building and technical support:** Both countries recognise the importance of providing awareness creation, capacity building training, and technical support to farmers to maximize the benefits of the technology. Additionally, district level experts and TVETs will be trained on maintenance and repairs in Ethiopia.

Key Takeaways



Project Design

- Consider conducting further assessment and refining of data for commercial viability, as suggested in the project design in Ethiopia.
- Ensure that the project design aligns with the outcomes of baseline studies and market assessments, as seen in the selection of business cases in both Uganda and Ethiopia.
- Emphasise the importance of awareness creation, capacity building training, and technical support for farmers to effectively utilise the technology, as highlighted in Ethiopia.



Overcoming Financial Barriers

- Energy-as-a-service and solar loan products are effective in removing financial barriers for solar in dairy.
- Collaboration with financial intermediaries to develop financial products, provide financial literacy training, and promote solar financial products to end-users is helpful.



Overcoming Logistical Barriers

- Coordinating with private sectors suppliers and their financial partners can help remove logistical barriers.



Overcoming Farmers' Barriers

- Prioritise farmer engagement by providing awareness creation activities, capacity building training, and technical support to maximise the benefits of the technology.
- Train farmers, district level experts, and TVETs on maintenance and repairs of the technology to ensure sustainability, especially where private sector is weak.



Overcoming Technology Specific Barriers

- Promote the adoption of solar-powered dairy cooling technologies by highlighting their benefits such as increased income, improved productivity, and quality of milk, as seen in the business cases in Uganda and Ethiopia.
- Ensure that the technology is appropriate for the local context, taking into consideration factors like energy needs assessment, quality assurance, and warranty services.



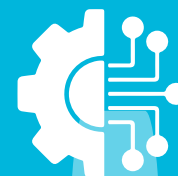
Overcoming Value Chain Specific Barriers

- Enhance integration along the dairy value chain by facilitating market linkages, improving market access for dairy products, and reducing spoilage.
- Foster collaboration among stakeholders in the dairy value chain, including farmers, cooperatives, processors, and technology providers, to create a sustainable and efficient value chain for dairy products.

Understanding the Context of SEFFA: Farmers' experience

Several layers of barriers to the adoption of PUE technologies.

Technologies



Financial Barrier



Logistical Barrier



Farmer Internal Barrier



Farmers



Iconography

Financial Instruments



Result-Based Financing



Innovation Fund



Fee-for-Service



Consumer Credit



Lease-to-Own

Types of Barriers



Farmer



Logistics



Technology Related



Financial



Value Chain Related

Agriculture Chain



Dairy



Horticulture



Irrigation



Cooling



Drying

Technologies

Other



Total Budget



Farm Size

Location



Ethiopia



Kenya



Uganda



About SEFFA

The Sustainable Energy for Smallholder Farmers (SEFFA) in Ethiopia, Kenya and Uganda project was designed by leveraging over 15 years of practical experience of EnDev. The strategic partnership identified lack of modern energy access as one of the critical development barriers in rural areas since it undermines agricultural productivity, exacerbates pre- and post-harvest loss, and makes it challenging to store and process produce. The IKEA Foundation has provided an €8 million grant to support EnDev's efforts. Learn more about the project [here](#).

About the IKEA Foundation

The IKEA Foundation is a strategic philanthropy that focuses its grant making efforts on tackling the two biggest threats to children's futures: poverty and climate change. It currently grants more than €200 million per year to help improve family incomes and quality of life while protecting the planet from climate change. Since 2009, the IKEA Foundation has granted €2 billion to create a better future for children and their families. In 2021 the Board of the IKEA Foundation decided to make an additional €1 billion available over the next five years to accelerate the reduction of Greenhouse Gas emissions.

Learn more at: www.ikeafoundation.org or by following them on LinkedIn or Twitter.

About EnDev

EnDev improves the lives of the most vulnerable by providing access to sustainable energy in 20 countries worldwide. Currently, EnDev is funded by Germany, the Netherlands, Norway, and Switzerland and coordinated jointly by GIZ and RVO. The strategic partnership is working with experienced implementers, with SNV being one of the most prominent partners. Learn more at www.endev.info or by following them on LinkedIn.

Funded by:



Co-financed by:



Coordinated and implemented by:

