Adoption and use of solar water pumps in Kenya: Learnings from the SEFFA project

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Energising change

Solar-powered irrigation systems provide reliable and affordable energy, potentially reducing irrigation energy costs for smallholder farmers. Particularly in rural areas, where the cost of fuel is high and where there is no access to the electricity grid, solar-powered irrigation can provide a relatively flexible and climate-friendly alternative energy source. Surprisingly, despite the availability of such alternatives, they remain largely under-utilised.

The Sustainable Energy for Smallholder Farmers (SEFFA) project works to help farmers access sustainable energy technologies and services such as solar-powered irrigation systems. By examining the project's impact and outcomes, we aim to shed light on the transformative potential of harnessing renewable energy for climate adaptation and mitigation, ultimately empowering smallholder farmers and improving their livelihoods. Also, there are key learnings which the project has witnessed so far in its efforts to promote renewable energy technologies to farmers.


Anthony inspecting his SWP in a sand dam

Background

SEFFA is being implemented in Kenya, Uganda and Ethiopia. The project aim is to empower smallholder farmers by promoting the use of solar-powered irrigation systems. SEFFA utilises a market development approach to support last-mile distribution, making it easier for farmers to access and use these solutions for productive purposes. To achieve this goal, the project adopts a results-based financing mechanism, which provides financial support to solar water pump (SWP) distributors. Additionally, the project offers capacity building, awareness creation and technical assistance tailored to the specific needs of distributors. By combining these efforts, SEFFA strives to create a thriving market for SWPs and enable smallholder farmers to harness sustainable energy for their benefit.

Innovative uses of solar water pumps by farmers

Anthony Nzioka, a farmer in Makueni County, Kenya, has a 4-acre farm near Kaiti River. Farming has been his main source of income since 1997, despite being a resident of one of Kenya's semi-arid counties.

Rainfall in Makueni county is poor and has worsened in recent years, drying up many of the rivers. Despite this, farmers such as Anthony have devised an ingenious method of securing a water supply by digging a shallow sand dam at the riverbed. This remarkable practice is widespread among communities in the region, enabling them to access water even during periods when the river's natural flow is insufficient. Anthony remarked:

> "Rising fuel expenses used to limit the acreage I could farm. Large portions of the land you see cultivated today used to lie untouched. However, since acquiring the solar pump, I've been able to expand my farming acreage from an eighth of an acre to 4 acres, and this has brought more income for me."

Anthony had been relying on a fuel pump for irrigation until late last year when he decided to switch to an SWP. This was after he had attended a demo event organised by SunCulture, a SWP distributor. Reflecting on the transition, Anthony shared how a SunCulture technician helped him calculate the staggering cost of 500 Ksh per week that he incurred using the fuel pump. He exclaimed: "This showed me the worth of investing in the SWP, as it would save me this cost."

Rachel in her vegetable farm

Beans farmed using drip irrigation

Flood irrigation on a farm

The SWP that Anthony uses is designed to be submerged in shallow wells or dams for efficient operation. He bought the pump from SunCulture, through a pay-as-you-go (PAYGO) model, which allows him to pay in instalments.

In a move to encourage efficient water use, especially with SWPs, SunCulture promotes other water-efficient technologies such as drip kits. Due to limited funds, Anthony was only able to purchase a drip kit package to cover an eighth of an acre. However, realising how efficient they are, he aims to use the income from selling his produce to invest in more drip lines.

Since purchasing the SWP, he has been able to farm all year and grows a variety of crops, including cabbage, spinach, tomatoes, eggplants, oranges and mangoes, which he sells to the local market. This shows the determination and resourcefulness of farmers such as Anthony in overcoming water scarcity and ensuring the success of their farming.

Solar water pumps for commercial farming

Rachel Mukoruru in Kagaene, Meru County, has successfully utilised an SWP to transform her small-scale farm into a profitable commercial venture. Despite living in a remote part of the country, Rachel and her husband Laban have practised irrigation farming on their shamba using piped water from a nearby river for over two decades.

Recently, they embraced the idea of acquiring an SWP as a game-changing solution, especially since they are not connected to the national grid.

The solar kit not only provides irrigation for their farm but also serves as a source of lighting for their home. With the introduction of an SWP, Rachel seized the opportunity to diversify her farming, integrating crops such as sweet potatoes, vegetables, tomatoes, fruits and maize, as well as pig farming.

Solar irrigation has allowed Rachel to expand her farming acreage, particularly in sweet potatoes, a crop she finds to be highly profitable, generating around 60,000 Ksh from just an eighth of an acre in approximately three months. She appreciates how sweet potato farming demands less attention in terms of pest and disease control compared to tomatoes, making it a lucrative and rewarding endeavour for her. For next season, Rachel plans to venture into farming groundnuts, a venture she believes will be highly profitable:

> "I've been gathering information on groundnuts farming, and have heard they can fetch around 150 Ksh per kilogram. Once I harvest my tomatoes, I'll plant groundnuts and see how they do. One thing that has greatly helped me is the agronomical support from my daughter. She works with an agriculture support company and is in charge of training farmers around here."

Due to the agronomical support that she is receiving, Racheal is able to venture into high-value crops that earn her more income, enabling her to quickly repay the cost of her investment in the SWP. This is usually not the case for most farmers, who are unable to quickly repay the cost of their investment in the SWP due to a lack of agronomical support and extension services.

SWPs: Challenges and knowledge gaps

There is a huge knowledge gap on the safe installation and use of SWPs. One major problem most farmers face with SWPs is their low capacity, which proves limiting for many farmers when compared to a fuel pump. Additionally, the issue of limited sunlight becomes a concern, as farmers prefer uninterrupted irrigation for their farms. For instance, Paul Mutie from Machakos County raised the issue of the inadequacy of his 2,500 L/hr SWP in irrigating his 2.5-acre farm. Paul uses flood irrigation with a 2.5-inch pipe, a method that used to be quick when he used a conventional fuel pump.

However, the rise in fuel prices compelled him to seek an alternative solution, which has not been satisfying for him:

> "I bought this pump last year due to rising fuel prices, as I couldn't afford to keep using the conventional one. However, I'm finding it difficult to meet my watering needs. I used to irrigate my land within 2 hours but currently I spend a whole day, especially on cloudy days. I'm currently looking for a larger-capacity SWP, possibly with a wider pipe."

Flood irrigation is one of the most water-intensive and commonly used methods to irrigate crops. Yet, with rapidly changing climatic conditions and reduced water resources, there is a need for farmers to adopt more water-efficient irrigation practices. Despite this, farmers such as Paul are still using and prefer flood irrigation, as it is quicker, saving him valuable time. Consequently, he is finding it hard to adjust and adapt to irrigation methods supported by SWPs, due to the limited water capacity.

Like most farmers in the country, Paul is unaware of farming alternatives that are more sustainable and beneficial. As a result, he and other farmers typically get frustrated when new technologies introduced to them are unable to meet their needs. A huge part of this could be the lack of proper technical training on how to install and maximise the use of SWPs, without the need for investing in an additional pump.

A lack of training is exemplified by Elias, a farmer in Murang'a County, who installed his pump in the middle of a deep-flowing river. Such hazardous installations pose a direct threat to farmers' safety, potentially leading to accidents and injuries during installation, maintenance or retrieval of the pump. In addition, unsafe locations can subject the pump to increased wear and tear, reducing its lifespan and efficiency.

Elias installing his SWP in a river

SEFFA project: SNV - Kenya

Damage caused by the force of the river's flow can also lead to frequent breakdowns, resulting in additional expenses for repairs and replacement parts.

Holistic, on-the-ground, technical support that goes beyond pump repair and maintenance is essential to ensure that farmers' expectations are met, and so that they can safely use their SWPs.

Recommendations

Farming technologies such as solar-powered irrigation systems have a lot of potential benefits for farmers. However, most farmers are unable to enjoy these benefits. Accordingly, there is a need to **provide agronomical support** to farmers who use SWPs. Adopting an SWP does not guarantee success in farming, with the majority of farmers relying on their own knowledge and experience, which is generally limited. Yet, with proper training, knowledge and encouragement, farmers can be open to diversifying their farming and venturing into more lucrative high-value crops. There is a need to incorporate such support, especially when promoting new technologies, as it gives farmers the confidence that they will achieve a return on their investment in the SWP.

Additionally, there is a need to **provide financial support** to farmers who are willing to invest in such technologies. An instance of this can be seen with Anthony, who shows willingness to invest in efficient irrigation systems such as drips and water storage, but is prevented from doing so because of a lack of funds. This is a common feature among smallholder farmers, whose income from their produce is insufficient to finance such high-cost investments. Partners such as SunCulture are among the few that provide such support through a PAYGO model. However, there is an opportunity for farmers to get more support by linking them to financial institutions that can offer a solution to their financial needs.

Finally, **proper technical training and education** are essential to meeting farmers' needs. Bridging the knowledge gap and providing farmers with proper training on the safe installation and use of SWPs is not only vital for their well-being, but also ensures the optimal performance and longevity of the SWP, thus promoting sustainable agriculture and safeguarding both the farmer and the equipment from potential harm.

Funded by:

german cooperation DEUTSCHE ZUSAMMENARBEIT

Ministry of Foreign Affairs of the Netherlands

Norad

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Agency for Development and Cooperation SDC

Co-financed by:

IKEA Foundation

Coordinated and implemented by:

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Netherlands Enterprise Agency

SNV

Published by:
Deutsche Gesellschaft
für Internationale Zusammenarbeit (GIZ) GmbH
Registered offices Bonn and Eschborn, Germany

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As of: October 2023

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Acknowledgements
This case study was written by Hannah Mwangi and edited by Irene Mutisya-SNV. The study seeks to highlight the work of the Sustainable Energy for Smallholder Farmers (SEFFA) project in helping farmers access sustainable energy technologies and services, such as solar-powered irrigation systems.