Powering the Uptake of Climate Change Mitigating Pumps (PUMP-UP)

LEARNING BRIEF: BARRIERS TO SOLAR WATER PUMP ADOPTION AMONG SMALLHOLDER FARMERS (SHFS), WOMEN, AND REFUGEES IN NORTHERN UGANDA

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DGBP DANIDA GREEN BUSINESS PARTNERSHIPS

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Uganda's economy heavily depends on agriculture, which employs 70% of the population and contributes significantly to exports and GDP. In Northern Uganda, particularly Gulu and Yumbe districts, agriculture sustains livelihoods but is increasingly threatened by climate change impacts such as prolonged droughts, erratic rainfall, and rising temperatures. Smallholder farmers — especially women, youth, and refugees — are the most affected, yet they lack access to climate-smart technologies that could build their resilience.

At the same time, Uganda has untapped potential for solar-powered irrigation, with abundant solar energy resources. However, adoption of solar water pumps (SWPs) remains low due to high costs, low awareness, and limited supporting infrastructure.

Introduction

To address these challenges, the **Powering the Uptake of Climate Change Mitigating Pumps (PUMP-UP)** program was launched with funding from DANIDA and the Danish Ministry of Foreign Affairs. Implemented by Mercy Corps in partnership with Tulima Solar and Simusolar, the program aims to increase access to affordable solar water pump technologies integrated with climate-smart agriculture (CSA) and sustainable water management for smallholder farmers in Gulu and Yumbe. The program particularly targets women, youth, and refugees to enhance resilience, food security, and economic stability.

This learning brief shares key insights from the December 2024 Annual Survey on the barriers hindering widespread adoption of SWPs and outlines practical recommendations to inform policy and private sector engagement.

Key Findings

Despite proven benefits — including a 220.89% increase in crop yields — uptake of SWPs among smallholder farmers remains limited due to six main barriers:

1. **Limited Technical Knowledge and Support:** Many farmers lack understanding of how SWPs work, how to install and maintain them, and how to integrate them with CSA practices. This knowledge gap reduces confidence and hinders adoption.
2. **Weak Agent Networks:** There are few decentralized, trained local agents to deliver, educate, and service SWP products, especially in remote areas. This limits last-mile distribution and after-sales support.
3. **Affordability Constraints:** High upfront costs and rigid financing models make SWPs unaffordable for most smallholder farmers, particularly women, youth, and refugees with low or irregular incomes.
4. **Limited Access to Markets:** Farmers struggle to access reliable markets for their produce, which reduces incentives to invest in irrigation technologies that could boost production.
5. **Poor Access to Quality Inputs:** Many farmers rely on low-quality or counterfeit seeds, undermining the potential productivity gains from solar irrigation.
6. **Water Scarcity and Distance to Water Sources:** Competition for limited water, distant sources, and lack of infrastructure make consistent irrigation challenging and limit the practicality of adopting SWPs.

Solutions Implemented

To overcome these barriers, PUMP-UP has deployed a multi-faceted strategy:

- **Community awareness campaigns and training** to build technical capacity.
- **Partnerships with private sector actors** and agro-input dealers to expand agent networks, provide localized technical support, and strengthen supply chains.
- **Flexible financing options** through banks and microfinance partners to improve affordability.
- **Establishment of demonstration gardens** as practical learning sites showcasing SWPs and CSA integration.
- **Market linkages and value chain development** to help farmers sell produce profitably.
- **Water source mapping and infrastructure improvements** to ensure sustainable water use and reduce conflicts.

Key Recommendations

- **Design inclusive financial solutions** tailored to smallholder farmers' income realities.
- **Continue promoting community-level training and awareness** on proper irrigation practices and SWP benefits.
- **Invest in water storage infrastructure** and secure water sources to reduce conflicts and reliance on distant supplies.
- **Enhance market access and quality input availability** through robust partnerships with trusted agro-dealers.
- **Strengthen demonstration gardens and local agent networks** to scale adoption and build local capacity.
- **Encourage coordinated partner collaboration** to maximize impact.

Conclusion

Solar water pumps offer a transformative pathway for building climate resilience and economic self-reliance among smallholder farmers, women, youth, and refugees in Northern Uganda. However, to unlock this potential at scale, stakeholders must address persistent barriers through systemic, market-driven solutions, community empowerment, and strategic partnerships. By sustaining and expanding such efforts, PUMP-UP can help move vulnerable farming communities from climate vulnerability to sustainable prosperity.

Background

Uganda's economy is deeply rooted in agriculture. It accounts for 70% of the country's employment, provides for more than half of the county's exports, and is about one quarter of the country's GDP (World Bank, 2018). In Northern Uganda, particularly in regions such as Gulu and Yumbe, agriculture remains central to rural livelihoods, yet it is increasingly threatened by the adverse effects of climate change. Prolonged dry spells, erratic rainfall patterns, and rising temperatures have disrupted traditional farming practices, exacerbating food insecurity and economic vulnerability.

Smallholder farmers especially women, youth, and refugees bear the brunt of these impacts. These groups often lack access to climate-smart technologies, making them more vulnerable to crop failure and reduced yields. Majority of smallholder farmers in Uganda rely on rain-fed agriculture, which is becoming increasingly unreliable due to climate variability. Meanwhile, refugee populations, such as those residing in Yumbe District (home to one of the world's largest refugee settlements, Bidi Bidi), face even greater barriers to productive land, resources, and climate-resilient tools.

At the same time, Uganda holds immense potential for solar-powered irrigation. The country receives an average of 5.1 kWh/m /day of solar energy (Oting, Mwarania, Wahab, & Kpatinde, 2018), making solar water pumps a viable and sustainable solution for smallholder irrigation. Yet, access remains limited. Only a few farmers in Uganda use irrigation, largely due to cost barriers, lack of awareness, and minimal infrastructure to support widespread adoption.

The Powering the Uptake of Climate Change Mitigating Pumps (PUMP-UP) Uganda program is designed to bridge this gap by improving access to affordable, scalable solar water pump technologies and integrated climate-smart agriculture approaches among small holder farmers in Gulu and Yumbe districts. With funding from DANIDA and support from the Danish Ministry of Foreign Affairs, the program directly targets the farmers most in need demonstrating that with the right tools and partnerships, smallholder farmers can adapt to climate shocks, improve productivity, and contribute to Uganda's broader goals for sustainable development and social cohesion.

The program is implemented in partnership with Tulima Solar and Simusolar, companies committed to improving the livelihoods of smallholder farmers through the distribution and financing of solar-powered irrigation solutions. Together, they promote a range of solar water pumps tailored to meet the needs of both smallholder and commercial farmers.

Introduction

Northern Uganda's smallholder farmers particularly women, youth, and refugees are on the frontline of the climate crisis. With rain-fed agriculture becoming increasingly unreliable due to prolonged droughts and erratic rainfall, the need for sustainable, climate-resilient farming solutions has never been more urgent.

The Pump-Up Uganda program responds to this challenge by integrating solar water pumps (SWPs) with climate-smart agriculture (CSA), natural resource management (NRM), and integrated water resource management (IWRM) to help smallholder farmers build resilience and transform their livelihoods. Implemented in Gulu and Yumbe districts, the program champions high-value crops such as tomatoes, onions, cabbage, watermelons, soybeans, and sunflower for their potential to improve food security and household incomes.

This learning brief distills findings from the December 2024 Annual Survey, offering insights into the barriers hindering widespread SWP adoption. Despite clear benefits including a 220.89% increase in crop yields, uptake remains limited, with six key constraints impeding progress.

By answering the following learning questions, this brief aims to inform policy and private sector go-to-market strategies to accelerate SWP access and adoption among the most vulnerable:

1. How can private sector partnerships boost access to solar water pumps for smallholder farmers, especially women, youth, and refugees?
2. What barriers persist, and how can targeted private sector engagement help overcome them?

Key Barriers to and Solutions for Solar Water Pump (SWP) Adoption Among Smallholder Farmers in Northern Uganda

Limited Technical Knowledge and Support

Despite ongoing efforts through physical sensitizations, radio talk shows, and spot messages, many smallholder farmers particularly women and refugee farmers remain unaware of the availability, functionality, and financial viability of solar water pumps (SWPs). This limited understanding hinders their ability to make informed decisions about adopting SWP technology to improve agricultural productivity.

Insights from focus group discussions conducted by Mercy Corps in FGDs during the annual survey reveal a significant knowledge gap around SWP technology in both Yumbe and Gulu districts. Participants cited a lack of knowledge on how the technology works, where to access it, and how it can improve yields as a major barrier to adoption:

> "We have limited knowledge and training about the operation of SWP technology. PSAs need to demonstrate to us how the SWP operates."
>
> SMALLHOLDER FARMER , FGD , PUMP -UP ANNUAL SURVEY

Limited awareness extends to the installation, operation, and maintenance of Solar Water Pumps (SWPs), which require specialized knowledge and skills. Without the proper training and support, farmers may hesitate to invest in these technologies, fearing they will not be able to properly use or maintain the pumps. The absence of consistent training on climate-smart agriculture (CSA), Integrated Water Resource Management (IWRM), and Natural Resource Management (NRM) practices further compounds the issue. These practices are crucial to maximizing the benefits of solar irrigation systems.

"Since the PUMP-UP project came to our area, we've heard a lot about solar water pumps, but most of us still don't know how to use or maintain them properly,"

FGD PARTICIPANT, PUMP -UP ANNUAL SURVEY.

Without access to trusted extension agents or technical support, farmers may struggle to operate the pumps effectively, address malfunctions, or integrate them into broader sustainable farming strategies. This knowledge gap limits the potential benefits of solar irrigation systems, such as increased agricultural productivity and improved resilience to climate change.

Notably, smallholder farmers are often motivated to adopt new technologies when they understand the tangible benefits such as improved yields and resilience to climate change that SWPs offer.

Addressing the Gap

To tackle this challenge, the PUMP-UP program has adopted a multi-faceted awareness strategy, including:

A participant farmer in Gulu harvests cabbages grown using Climate-Smart Agriculture (CSA) practices.

- **Community awareness campaigns and outreach:** So far, the program has conducted 23 awareness campaigns, reaching 2,223 individuals (1,356 women and 867 men). These campaigns provide critical information on the benefits, use, and economic viability of Solar Water Pumps (SWPs). To ensure sustainability, targeted technical training and capacity-building programs are also being implemented, focusing on SWP installation, use, and maintenance, alongside climate-smart agriculture (CSA), natural resource management (NRM), and integrated water resource management (IWRM) practices. These training sessions are tailored to meet the needs of farmers, including women and youth, ensuring they acquire the necessary skills to optimize their use of SWPs and improve agricultural productivity.

- **Partnerships with private sector actors:** Collaborations with private sector actors such as Tulima Solar and Simusolar have enhanced the dissemination of technical information at the community level. These partners also help farmers understand product availability and maintenance. Additionally, onboard Agro-input partners play a key role in providing after-sales services and product training, ensuring that farmers receive the technical support needed for successful SWP investments and the adoption of the best agricultural practices.

- **Engagement with local cooperatives and farmer groups:** Through partnerships with groups like NUTOFA SACCO and West Acholi Cooperatives, PUMP-UP delivers tailored sensitization sessions that target underserved communities. These collaborations ensure that the information reaches the farmers most in need, particularly in remote areas.

- **Establishment of demonstration gardens:** The program has set up 22 demonstration gardens (10 in Gulu, 12 in Yumbe), with plans to expand to 24. These gardens serve as hands-on learning hubs where farmers can see SWP systems in action, gain practical skills, and explore business cases for high-value crops such as onions, tomatoes, watermelon, cabbages, and soybeans. To further support the learning process, the PUMP-UP program has established a dedicated agronomy team and Agriculture Community Agents (ACAs). These agents, who act as the frontline extension team, provide on-the-ground support to farmers and facilitate learning at the demonstration sites, where farmers can observe and practice CSA techniques integrated with solar irrigation technologies.

- **Localized technical support:** Tulima Solar has recruited localized technicians who work directly with farmers to build their capacity in maintaining and repairing solar pumps. These technicians provide ongoing support, ensuring that farmers have access to expert assistance when needed, which helps maintain the longterm functionality of the solar pumps. In addition, the program collaborates closely with District and Sub-County Production Teams to ensure farmers receive consistent support and guidance. These local teams help ensure that farmers are equipped with the knowledge on best agronomic practices, enabling them to maximize crop yields while adopting CSA and IWRM techniques.

By combining these efforts, the PUMP-UP program is addressing the knowledge gap and ensuring that smallholder farmers, especially women and refugee farmers, have the skills, support, and resources needed to adopt SWP technology and improve their agricultural practices.

Limited Agent Network for Private sector actors

One of the key challenges in scaling up solar water pump (SWP) technologies among smallholder farmers is the lack of a well-established and decentralized agent network to support last-mile delivery, user education, and after-sales services. This challenge is particularly pronounced in remote rural areas, where farmers often struggle to access reliable vendors, receive technical support, or obtain maintenance services. As a result, many smallholder farmers are hesitant to invest in SWPs, fearing breakdowns, poor servicing options, and limited support in case of operational issues.

This gap significantly undermines farmers' confidence in technology and hampers its wider adoption. In many cases, even when farmers are aware of the benefits of solar-powered irrigation, the absence of local, trusted agents who can guide them through product selection, usage, and servicing becomes a major deterrent. For refugee and host community farmers in districts like Yumbe and Gulu, the situation is compounded by geographic isolation and limited access to formal markets.

Private sector actors such as financial institutions, agro-input dealers, and technology providers need to establish a sustainable network of local agents to act as intermediaries between commercial service providers and smallholder farmers. These agents, including trained "Agriculture Community Agents" (ACAs), play a crucial role in promoting solar irrigation technologies by providing hands-on support, sharing technical knowledge, and facilitating access to products and services. Their presence at the community level can help demystify the technology, improve farmers' trust in it, and ensure timely support, ultimately contributing to increased adoption and long-term success of SWPs in rural Uganda.

Addressing the Gap

To tackle the challenge of a limited agent network, the PUMP-UP program has adopted the following approaches:

Ambassador Idro explaining the role of PSA actors — including financial institutions (FIs), off-takers, and agro-input providers — in improving smallholder farmers' access to markets and finance, during a recent event at the Mercy Corps office in Gulu.

- **Collaboration with private sector actors:** PUMP-UP is working with private sector actors, including financial institutions, agro-input dealers, and technology providers, to expand the agent network and establish decentralized distribution channels. This includes leveraging sales officers from private sector actors, Government Agricultural Extension Workers, and Agriculture Community Agents (ACAs) in Gulu and Yumbe districts to help farmers access affordable and high-quality solar water pumps (SWPs).

- **Engagement with agro-input dealers:** Agro-input dealers such as Omia Agribusiness Development Company and Agrigate are essential to the program's success. These dealers play a crucial role in making SWPs available to farmers through their established networks in the region. Their strategically located agro-input shops are stocked with solar water pumps for demonstration, and they offer capacity-building sessions to ensure farmers understand the technology and how to acquire it.

- **Establishing a sustainable agent network:** PUMP-UP recognizes the importance of incentivizing local agents to promote solar water pumps and support farmers. The program has implemented a commission-based model, ensuring that agents remain motivated to engage with farmers and assist with the adoption of agricultural technologies. ACAs and local agents are also instrumental in providing financial guidance, helping farmers access credit through partnerships with financial institutions, and facilitating affordable investment in solar irrigation solutions.

- **Strengthening partnerships for a last-mile network:** Through collaboration with energy service companies, financial service providers, and farmer groups, PUMP-UP is laying the foundation for a sustainable, scalable last-mile network that will enhance access to solar water pumps. This network not only improves adoption rates but also strengthens the overall ecosystem needed to support climate-resilient agriculture.

These efforts are addressing the gap in agent networks by improving the accessibility of solar water pumps, ensuring reliable support for farmers, and driving long-term adoption of climate-resilient technologies.

Limited Affordability

The high upfront cost of solar water pumps estimated at approximately UGX1,800,000 remains a significant barrier for smallholder farmers, particularly women, youth, and refugees, who often lack the capital to invest in these technologies. While awareness of the benefits of solar irrigation is steadily increasing, affordability continues to hinder widespread uptake.

> "The costs of purchasing the SWP is high, and we as small holder farmers normally have limited money for buying the SWP"
>
> SMALL HOLDER FARMER , DURING THE ANNUAL SURVEY FGD .

The financial challenge is further compounded by long payback periods, limited access to affordable credit, and systemic barriers to financial inclusion especially in rural and displacement settings. Many do not earn enough to meet the payment requirements under current financing models. For instance, the PayGo model offered by Tulima Solar requires a 40% upfront deposit (approximately UGX 756,000), followed by monthly payments of UGX 195,670 over six months. Given that many smallholder farmers earn less than UGX 150,000 per month, this model remains out of reach for most.

This situation is even more challenging for refugees, women and youth, who often lack collateral and face social and institutional barriers to accessing loans. Yet, there is a clear willingness and desire among these groups to adopt the technology, given its potential to improve agricultural productivity, income, and climate resilience.

The persistent affordability barrier underscores the urgent need for more inclusive and flexible financing solutions ones that reflect the income realities of smallholder farmers and offer alternative repayment structures to facilitate broader adoption of solar irrigation technology.

Addressing the Gap

The PUMP-UP program team poses for a photo after a meeting with Centenary Bank, Gulu Branch, to discuss collaborative solutions for unlocking access to solar water pumps for underserved farmers.

To bridge the affordability gap, the PUMP-UP program is actively working with financial service providers to design and offer accessible, flexible financing models that meet the unique needs of smallholder farmers, including women, youth, and refugees. These financing solutions reduce the financial burden of purchasing solar water pumps and make adoption more feasible for vulnerable populations. The program has established partnerships with the following institutions:

- **Housing Finance Bank:** provides financing to both individuals and groups, with an interest rate as low as 1.5% per month. The bank offers seasonal repayment options that align with farming cycles, enabling farmers to repay loans after harvest when they are more financially secure.
- **Vision Fund:** extends loans at a 3% monthly interest rate. Farmers are required to pay an initial deposit of 10% of the loan amount. Repayment periods range from 10 to 18 months, with monthly installment options that provide flexibility based on the farmer's income flow.
- **Enventure:** offers asset financing specifically for registered farmer groups. It requires only a 10% upfront payment and supports seasonal repayments every three months. The annual interest rate stands at 12%. This model is especially beneficial for farmers engaged in vegetable farming, as it aligns repayment schedules with harvest periods, giving them a grace period before the first payment is due.

- **Cycle Connect:** delivers solar water pumps through an asset financing model with monthly repayments and an interest rate of 3.2% per month. This consistent and predictable model caters to farmers who prefer structured monthly payment plans.

- **Tulima Solar:** in collaboration with PUMP-UP, offers a Pay-Go model designed for last-mile farmers. Under this model, farmers pay a 40% deposit upfront, with the remaining balance spread over monthly installments within one year. While this model increases access for some, it remains financially out of reach for refugees and other low-income farmers earning below UGX 150,000 per month.

In addition to expanding access through flexible financing, the Kilimo Kwanza solar pump, promoted under the PUMP-UP project, is recognized for being one of the most cost-effective and user-friendly solar irrigation solutions on the market. However, for extremely poor and displaced smallholder farmers, affordability remains a critical issue.

To further scale access, PUMP-UP advocates for targeted financial support mechanisms for private sector suppliers of SWPs. By addressing their working capital and liquidity constraints through instruments such as low-interest concessional loans, recoverable grants, and convertible debt, in combination with government subsidies, suppliers can offer even more flexible payment plans and reduce the end-user cost. These mechanisms would de-risk last-mile distribution, improve affordability, and ensure that solar irrigation technologies reach even the most financially constrained farming households.

Limited access to market for produce

Despite the proven business case for investing in solar water pumps (SWPs) to support the cultivation of high value crops such as vegetables, limited access to markets for produce remains a critical barrier for smallholder farmers particularly women, youth, and refugees in remote or displacement-affected areas.

Smallholder farmers often lack reliable, consistent access to formal or structured markets where they can sell their produce at fair prices. In many cases, farmers are forced to sell within their local communities, where demand is low, and prices are unpredictable. This lack of market certainty discourages investment in SWP technology, as farmers remain unsure whether they can recover their production costs or generate a sustainable income.

Insights from focus group discussions conducted by Mercy Corps in Gulu and Yumbe revealed that farmers are reluctant to expand production or adopt irrigation due to limited market linkages. Many participants cited the absence of aggregation points, long distances to markets, and limited information on pricing and demand trends as key factors that hinder their ability to profit from vegetable farming.

> ''Mercy Corps supported us a lot on how to apply the skills of CSA like mulching of our crops, spacing and inter cropping, we were able to produce good tomatoes, but we failed to get ready market that made our tomatoes to get spoiled in the garden,"
>
> SHF, PAICHO SUBCOUNTY, DURING THE ANNUAL SURVEY

Without access to strong and predictable markets, farmers face challenges in realizing the full benefits of solar irrigation. The risk of producing a surplus with no ready market can lead to losses, limiting their motivation to adopt or sustain investment in SWPs. Strengthening market linkages is therefore essential to ensure that solar-powered irrigation translates into improved incomes and resilience for smallholder farming households.

Addressing the Gap

Smallholder farmers' produce stocked at the Omia Agri-business wholesale shop in Gulu City.

To address this challenge, Pump-Up is:

- **Strengthening agricultural value chains:** PUMP-UP supports farmers by linking them to viable market opportunities through partnerships with private sector actors like Enventure, Omia Agribusiness Development Company, and Agrigate.

- **Facilitating market linkages:** The project connects farmers to cooperatives, buyers, and aggregators to enable the bulk sale of produce at competitive prices, improving profitability and reducing post-harvest losses.

- **Market systems development approach:** Mercy Corps plays a facilitative role, bringing together various market actors to address supply and demand constraints, ensuring a smoother flow of goods from farm to market.

- **Community sensitization on market opportunities**: Regular sensitization meetings are held to provide farmers with key information on market demands, pricing trends, and buyer preferences, enabling informed decisions on production and investment.

- **Promoting aggregation and access to off-takers:** The project supports the establishment of aggregation centers and connects farmers to off-takers and regional markets, expanding their market reach beyond local boundaries.

Limited Quality Inputs

Access to high-quality agricultural inputs, particularly seeds, remains a significant barrier to productivity for smallholder farmers. In many rural and refugee hosting areas, markets are saturated with counterfeit, low-yielding, or disease-prone seed varieties, leaving farmers unable to achieve optimal crop performance.

This directly affects farmers' willingness to invest in technologies like solar water pumps (SWPs), as they fail to see substantial returns from their irrigated crops. Without reliable access to quality seeds, the benefits of solar irrigation such as improved yields, year-round production, and income stability are not fully realized.

As a result, adoption of solar irrigation systems remains low, and the broader goal of transitioning to climate-smart, high-output agriculture is undermined.

Addressing the Gap

An outlet of the Omia Agribusiness Development Company Limited stocked with certified seeds, fertilizers, and agrochemicals in Gulu City.

- **Partnering with trusted Agro-input dealers:** PUMP-UP collaborates with reliable Agro-input suppliers such as Omia Agribusiness Development Company Limited, Cephas Agro Vet, Agrigate Agro Input, and Jeroma Agro Input to ensure farmers have access to certified seeds, fertilizers, and agro-chemicals tailored to their specific needs.

- **Provision of after-sales services:** PUMP-UP contracts these Agro-dealers to go beyond product delivery by offering crucial after-sales services. This includes supporting farmers with the proper usage and maintenance of agricultural inputs, including solar water pumps, to ensure optimal performance and longterm productivity. The Agro dealers also provide practical training sessions and demonstrations to farmers on seed selection, handling, and storage.

- **Integration of CSA and quality inputs:** Through advocacy and training on Climate Smart Agriculture (CSA), PUMP-UP supports farmers to adopt environmentally sustainable farming techniques, maximizing the impact of quality inputs and solar irrigation technologies.

- **Enhanced productivity and income:** By combining solar irrigation with certified inputs and CSA practices, farmers are now able to cultivate more land including previously unirrigated plots and achieve higher yields, resulting in increased incomes.

- **Promotion of sustainable farming practices:** The program encourages efficient water use, reduced reliance on unsustainable irrigation methods, and resilience to climate change through integrated agricultural solutions, setting the stage for long-term agricultural and economic sustainability.

Water Scarcity, Competition, and Distance to Water Sources

Water scarcity remains a significant challenge for smallholder farmers in Northern Uganda, especially those engaged in horticultural farming. In many areas, this scarcity is due to either limited or seasonal water sources, while in others, economic water scarcity the lack of investment in water infrastructure prevails.

Farmers and livestock owners often rely on shared water points, creating competition that can lead to conflict, particularly during the dry season when water becomes even more scarce. This tension over access reduces the amount of water available for crop irrigation, leading to lower yields and threatening food security in the region.

The reliance on shared and distant water sources hinders the adoption of technologies like solar irrigation. To ensure sustainable agriculture and reduce tensions, improved water infrastructure and management are urgently needed, along with efficient irrigation solutions that maximize available water and minimize wastage.

Addressing the Gap

A smallholder farmer sets up his Solar Water Pump (SWP) beside a self-constructed dam

- **Water Source Mapping Exercise:** The program conducted a water source mapping exercise to identify and assess available water points in the operational districts. This mapping ensures that interventions target areas with reliable water sources, meeting community needs effectively.
- **Intensified Sensitization and Awareness:** In partnership with commercial partners, the program has intensified sensitization efforts in targeted areas, emphasizing solar irrigation as a cost-effective, sustainable solution. Demonstration sites have been established within farmer groups near water sources to showcase the effective use of solar pumps.
- **Distance to Water Sources Mitigation:** Delivery pipes connected to solar water pumps are designed to facilitate irrigation at distant gardens. This innovation allows farmers to access water from shared or distant sources, reducing the distance challenge and improving reliability in irrigation.
- **Holistic Water Management Approach:** The program integrates sustainable water management practices with efficient irrigation systems, ensuring better use of available resources.

Conclusion

The adoption of solar water pumps (SWPs) in Northern Uganda offers a transformative pathway toward building climate-resilient, productive, and economically vibrant agricultural communities. For smallholder farmers especially women, youth, and refugees, solar-powered irrigation hold the potential to unlock year-round farming, diversify livelihoods, and reduce vulnerability to erratic weather patterns.

However, the widespread uptake of SWPs is currently hindered by a combination of financial barriers, limited access to reliable water sources, lack of knowledge and technical capacity gaps. These challenges require a coordinated, systems-based response from development actors, private sector partners, and government institutions.

By implementing the practical solutions outlined in this report such as strengthening market systems, improving access to quality inputs and financing, and promoting community-level awareness and capacity, the PUMPUP program continues to cultivate an enabling environment for sustainable adoption of SWPs. This will not only enhance food security and agricultural output but also empower smallholder farmers to become active contributors to local economies and agents of climate adaptation.

Through intentional collaboration and investment, the future of agriculture in Northern Uganda can shift from vulnerability to resilience paving the way for inclusive, sustainable growth in one of the country's most underserved regions.

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About Mercy Corps

Mercy Corps is a leading global organization Powered by the belief that a better world is possible. In disaster, in hardship, in more than 40 countries around the world, we partner to put bold solutions into action — helping people triumph over adversity and build stronger communities from within. Now, and for the future.

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