Greening the Cold Chain: Solar and Ice Technologies Boost Fish Trade in Nakuru County

County:	**Nakuru County**		
Sector/s:	**Fisheries and Aquaculture**	**Sub-sector/Theme:**	**Embracing Green Energy Technology to Reel in Climate Resilience**
Keywords: (for search in the online platform)	**Nakuru, Ponda Mali, Rech, Self-Help Group, Solar Powered Freezer, Ice Flake Machine, Climate Resilience, Maarifa Centre, Success Stories**		
Target Audience:	**Counties and any other Fish Value Chain Actors**		
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Introduction

Nakuru County, situated in Kenya's Rift Valley region, is a leading agricultural and economic hub renowned for its vibrant urban centers, scenic landscapes, and rich biodiversity. While agriculture remains the County's primary economic driver, the fisheries and aquaculture sectors have gained momentum in recent years as part of broader efforts to diversify livelihoods and enhance food

security.

The aquaculture sub-sector has experienced increased investment in fish farming, value addition, and market development, fueled by the growing demand for affordable and nutritious protein sources. Small-scale fish farmers and traders, particularly women, play a critical role in the local fish value chain, operating across both rural and peri-urban markets.

In 2024 alone, the fisheries sector in Nakuru generated approximately KES 248 million in revenue, with over 2 million kilograms of fish harvested, predominantly tilapia. Despite this progress, the sector continues to face challenges, including post-harvest losses, limited access to cold storage, high electricity costs, and increasing vulnerability to climate-related impacts such as temperature fluctuations and unreliable power supply, all of which threaten the sustainability and profitability of small-scale fish enterprises.

In particular, small-scale fish traders play a critical role in the County's fish value chain, engaging in procurement, processing, preservation, and retail, often under challenging conditions. These actors are not just selling fish, they are adding value at different stages, from gutting and filleting to managing cold chains and aggregating supply. However, their efforts are frequently constrained by high post-harvest losses, limited access to cold storage, unreliable electricity, and rising climate-related risks.

To address these challenges and improve fish quality, safety, and profitability, Nakuru County, in partnership with the Agricultural Sector Development Support Programme II (ASDSP II), supported the County through the provision of climate-smart technologies to preserve unsold fish, extend shelf life, reduce losses, and improve market competitiveness.

Implementation of the practice (*Solution Path*):

The Nakuru County Government, through the Department of Livestock, Fisheries, and Veterinary Services, played a key role in identifying and selecting suitable beneficiaries for the cold chain intervention. Following the selection process, the Department deployed fisheries extension officers to provide hands-on training to traders. These sessions focused on the proper use and maintenance of the equipment, hygienic fish handling, and sustainable post-harvest management practices. The training was tailored to align with the traders' schedules and needs, ensuring relevance and practical application.

The following were the interventions deployed to the traders:

1. **Deployment of a Solar-Powered Freezer**

The County supported Ponda Mali Fish Mongers Self-Help Group with a solar-powered freezer to address fish spoilage during periods of excess supply and reduce reliance on unreliable and costly electricity. The Ponda Mali Self-Help group started in 2013 with some few fish mongers who traded and fried fish on small scale at the Ponda Mali open market, while the Rech Self-Help group started in 2009 with some few women as fish traders who traded and fried fish at a small scale on the ukulima fresh market.

Based at Ponda Mali Market, the group comprises 157 fish traders (138 adult females, 17 adult males, 1 male youth, and 3 female youth) who came together to strengthen their operations and improve economic resilience. The solar-powered freezer operates by drawing energy from solar panels installed on-site, which convert sunlight into electricity that powers the freezer unit. This makes it reliable even in areas with frequent power outages or high electricity costs. For the traders, this means they can store fish at consistently low temperatures without worrying about spoilage or interruptions, especially during periods when fish supply is high, but market demand is low. In addition, using solar energy reduces operational expenses, as they do not have to depend on costly grid electricity or fuel-powered generators, while also contributing to environmental sustainability.

Figure 1: A solar-powered freezer used to keep fish fresh, cutting costs, and powering resilience in the fish value chain.

The group primarily engages in two core activities: table banking, where members meet every Tuesday to contribute and lend money among themselves, and the collective purchase of fish, previously sourced from Kisumu and Naivasha. However, more recently, many members have transitioned to individual ordering based on market demand.

Most members are also involved in small-scale fish processing, including cleaning and frying, and the solar-powered freezer has proven to be a valuable innovation. It helps preserve fish during peak supply periods, allowing the traders to store unsold stock safely while they seek out markets, and significantly reduces their dependency on grid electricity.

The cost of the solar-power freezers was KES 1 million.

2. Use of an Ice Flake Machine

At the Ukulima Market, the County supported the Nakuru Fish (RECH) Self-Help Group, a 28-member women's association, to install an ice flake machine. The ice flake machine works by producing thin, soft flakes of ice that are ideal for preserving fish because they cover the fish uniformly and cool it quickly. The machine freezes water on the inner surface of a cooled drum, then scrapes off the thin layer of ice as flakes, which are collected and stored for use. When fish are packed with these flakes, the ice maintains a consistent low temperature around the entire surface of the fish, slowing down bacterial growth, reducing spoilage, and extending freshness. Because flake ice melts gradually, it keeps the fish moist without causing damage to the flesh, making it highly effective for storage and transportation.

The RECH Self-Help Group was formed to strengthen their operations in the fish trade and engages in activities such as table banking and welfare support. They meet every Tuesday to collect and lend

money among members, and also coordinate the bulk purchase of fish, primarily sourced from Lake Victoria and delivered by transporters. The members are involved in small-scale fish processing, including filleting, gutting, and scaling. One of the key challenges they faced was frequent fish spoilage, especially when large volumes were delivered and could not be sold within a single day. To address this, the group was supported with an ice flake machine as an innovative solution to preserve unsold fish, extend shelf life, and allow the traders to seek better market prices.

The purchase of the ice flake machine cost KES. 800,000.

After the installation of the technologies, the beneficiary groups were empowered to take full responsibility for the maintenance and operation of the equipment. The County Government ensured access to essential utilities such as water and electricity at the installation sites. This model was deliberately chosen to promote ownership, reduce dependency, and build the traders' capacity to manage their own enterprises sustainably.

The beneficiaries expressed satisfaction with this arrangement, noting that while the County Government and ASDSP II had covered the major costs, their role in day-to-day maintenance gave them a sense of control, accountability, and pride in the project's success.

Figure 2: An Ice Flake Machine installed at the Ukulima Market

The beneficiary groups continue to receive ongoing and diversified training on the operation and management of the cold chain technologies to enhance their technical capacity and ensure proper use. As part of the project's design, the beneficiaries contributed land and space for the installation of the equipment, along with in-kind support, a strategy that has fostered a strong sense of ownership, accountability, and long-term commitment. Furthermore, the County Government ensured that the groups were actively involved during the public participation processes for both the identification and implementation of the interventions.

Results of the practice (*outputs and outcomes*)-

Ponda Mali Self-Help Group

- Members are now able to procure and store an additional 500 kg of fish per week, valued at approximately KES 150,000, due to the availability of the solar-powered freezer which keeps the fish fresh.
- Previously, members spent about KES 3,000 per month on hiring freezer space (Ksh. 100 per basin). With the new freezer, storage costs have been eliminated, and the increase in fish sales has boosted their table banking savings and individual incomes.
- On average, each member previously lost about 5 kg of fish per week (worth approximately KES 1,500) due to spoilage. This loss has now been eliminated thanks to improved preservation.
- The group can now store unsold fish during periods of high supply, avoiding spoilage and enabling them to wait for better market prices.
- The use of solar energy has cut electricity expenses by 40%, from KES 4,000 to KES 2,400 per billing cycle.

Rech Self Help Group

- The group increased daily fish stock from 1,000 kg to 1,200 kg, raising their potential daily sales value from KES 300,000 to KES 360,000.
- The group now avoids spoilage of approximately 50 kg of fish per day, previously valued at KES 15,000.
- The group earns around KES 1,200 per day from selling ice flakes to members and other traders.
- Ice flakes preserve the fish's freshness and natural taste, minimizing spoilage. Even during glut periods, traders retain product quality, allowing them to sell fish at better prices and maintain customer trust.

Lessons learnt:

- Adoption of green energy technologies such as solar-powered freezers and ice flake machines is a practical, cost-effective solution for improving fish preservation, reducing post-

harvest losses, and enhancing climate resilience in small-scale fisheries.

- Community ownership and participation are critical to the success and sustainability of development interventions. Involving beneficiaries from the planning to implementation stage fosters accountability, relevance, and long-term commitment.
- Youth engagement in the management of storage and processing facilities can promote job creation, enhance local capacity, and support innovation in the fish value chain.
- Accessibility to shared infrastructure, such as centralized cold storage, increases operational efficiency, reduces individual burdens, and enhances profitability for informal traders.
- Proper scheduling and coordination of training activities are essential to ensure participation, especially for informal traders who operate on tight and unpredictable schedules.
- Gender inclusivity in value chain development remains a challenge and requires targeted efforts to encourage balanced participation and equitable benefits.
- Operating in informal market settings exposes traders to risks such as displacement and delayed service delivery, underscoring the need for formalized market infrastructure.
- Inter-departmental collaboration and timely approvals are key to smooth implementation of projects. Delays in administrative processes can stall progress and reduce impact.

Recommendations (*Conclusion*)-

- Align training schedules with traders' regular meeting times to improve participation and ensure effective knowledge transfer without disrupting daily business activities.
- Allocate formal, designated spaces for fish traders within County markets to enhance tenure security, improve hygiene conditions, and support sustainable business operations.
- Promote the use of green energy technologies, such as solar-powered freezers and ice flake machines, to lower energy costs, reduce post-harvest losses, and strengthen climate resilience.
- Encourage inclusive participation in the fish value chain by sensitizing and building the capacity of men to engage in what is often a female-dominated sector, promoting gender balance and shared economic gains.
- Support the formalization of informal markets by partnering with county governments to develop appropriate infrastructure and policy frameworks that protect traders from sudden

displacement or disruption.

- Streamline approval processes by ensuring that all necessary permits and authorizations are secured in advance to avoid delays and ensure timely project implementation.
- Ring-fence funding for critical infrastructure, such as cold chain facilities, to safeguard against budget reallocations or disruptions, ensuring that key interventions are fully implemented and impactful.

Further reading:

ASDSP II Innovations report,Nakuru County.

https://drive.google.com/file/d/18cVtooTs7UL6pHUepv2RZMjp3VipMUXF/view?usp=sharing

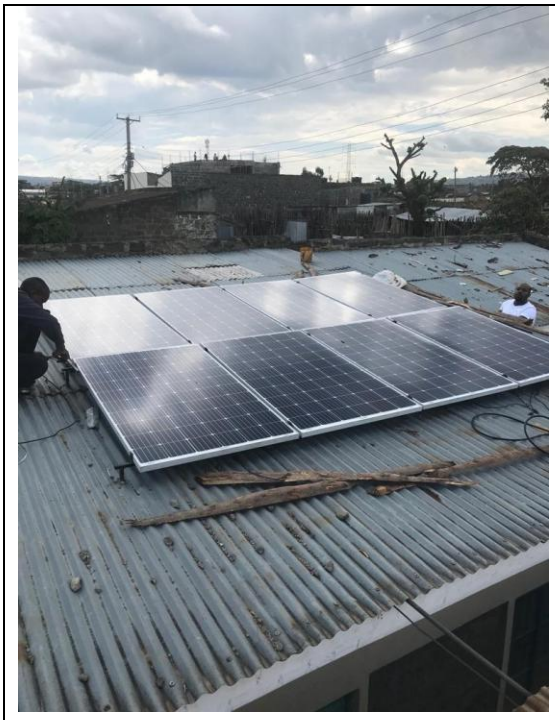

Figure 3: Solar Panel at Ponda Mali Market

Figure 4: Solar Inverters at Ponda Mali Market

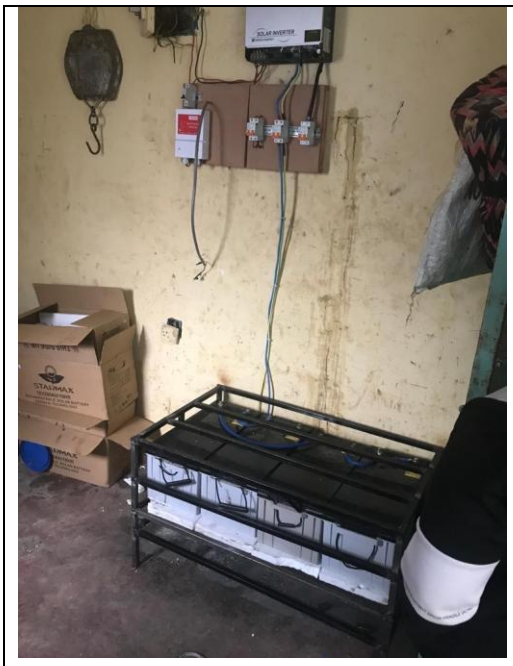

Figure 5: Solar Inverter and Controllers at Ponda Mali Market

Figure 6: Ice Flake Machine at Ukulima Market