ENERGY
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Market Guide: Fishing

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Market guide: Fishing

The United Nation's Food and Agriculture Organisation (FAO) estimates that fish accounts for 17% of animal protein intake globally, with a global current per capita consumption of 20kg. In addition, fish play an important role in people's livelihoods. The fishing sector employs about 200 million people, with the majority coming from developing countries. By 2016, 85% of the global population involved in the fisheries and aquaculture sector came from Asia, 10% from Africa, and 4% from Latin America and the Caribbean. The ability to combining fishing activities with other agricultural activities, and the low infrastructural requirements, provides smallholder farmers some level of financial security. Close to half of the total fisheries workforce is made up of women, 14% of whom take part in primary fishing activities, with the rest in post-harvest activities.

The importance of the fisheries industry keeps growing as the world's population continues to rise, and as the need for food security becomes increasingly crucial. Demand for fish is expected to increase by 30% by 2030. As innovative techniques and processes emerge to bring about sustainable fishing and processing, and as a greater focus is placed on linking local produce to regional and international markets, energy access, particularly for off-grid fishing communities, will continue to play an important role.

This market guide has been developed for renewable energy companies looking to enter the fisheries value chain in Sub-Saharan Africa and Asia. The aim is to provide a general overview of the fisheries sector in these two regions, as well as challenges and opportunities for off-grid energy applications.

This guide will focus on:

- Community level fishing practices
- Energy dependent activities in the fishing sector
- Barriers in the fisheries sector and opportunities for OGE companies
- Key players in the fishing sector in Sub-Saharan Africa and Asia
- Case studies of off-grid energy businesses in Sub-Saharan Africa and Asia

Overview of the fishing value chain

In general, fishing activities can be defined by the scale of production and fish habitats. In terms of scale, fishing is carried out either at small scale and artisanal level, or at large scale commercial level. Small scale fisheries are practiced by local communities, usually for household consumption or for sale in local markets within or in neighbouring communities. Fishers employ low-level fishing technology with minimal infrastructure for fish capture and processing. Large scale fishing is carried out by established fishing companies and large businesses, and typically follows a set of local and international standards for fishing practices, packaging and quality of fish. Fishing is typically mechanised and employs advanced technology.

This guide focuses more on small scale fisheries due to their relevance to local fishing communities and local economies.

In terms of fish habitat, there are three common fishing practices:

- **Inland capture fisheries**, practiced in inland water bodies that occur naturally such as lakes and rivers, which are often fresh water bodies. About 11% of global inland fish capture comes from landlocked countries, while about 43% of the world's inland fish capture comes from low-income countries.
- **Marine capture fisheries**, practiced out at sea. Fishing activities can either be onshore (coastal) or offshore. Onshore fishing practices tend to be done on a smaller scale than offshore fisheries since small-scale fishers cannot afford the sophisticated equipment needed for offshore marine fish capture. The heavy focus on onshore fishing can sometimes lead to overexploitation of fish.
- **Aquaculture**, which involves breeding and culturing fish. This requires significant investment to produce enough quality fish for international markets. It is a fairly new practice in Africa.

Fishing in Africa

By 2016, Africa earned over $6 billion from exporting fish and fish products. In the same year, about 5.6 million people were involved in fish production activities (fish capture and fish farming), 11% of whom were women. Over 90% of the total work force is concentrated in fish capture and processing, with little activity in aquaculture. Despite the vibrant fishing activities on the continent, average per capita consumption remains low at 9.9kg per capita, which is 50% lower than the global average of 20kg. The highest average consumption is in West Africa and North Africa with 14kg per capita, and the lowest is in East Africa with 5 kg per capita.

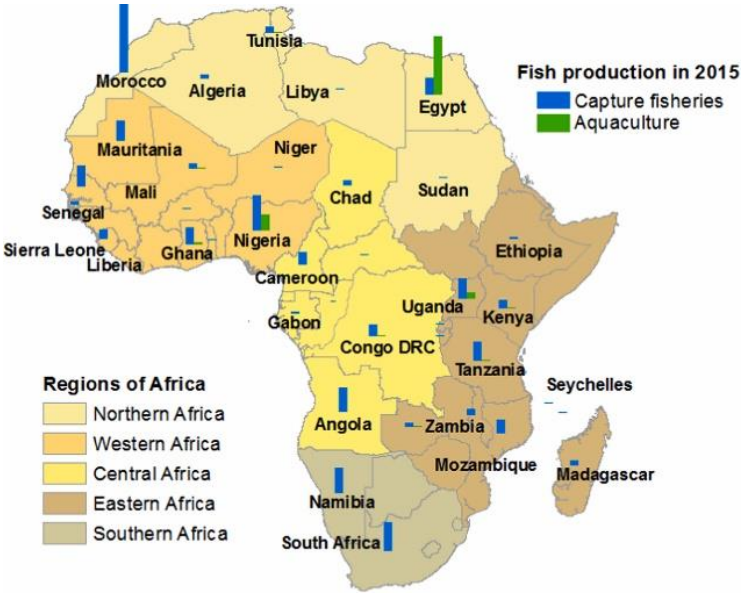

Figure 1 Fish production in Africa (2015)

Africa supplies about 24% of inland fish capture in the world. Inland capture fisheries are quite relevant for countries with large fresh water bodies. This is particularly relevant for far north, south and east of Africa due to higher precipitation levels. The DRC, Kenya, Nigeria, Tanzania, and Uganda are some of the highest producers of inland fish capture in Sub-Saharan Africa. Inland fishing in Chad, Ethiopia, Malawi, and Mozambique has also been on the rise in the past decade.

Marine fish capture, on the other hand, is more relevant for coastal countries, particularly those in West and Southern Africa. The highest producers in Sub-Saharan Africa are Angola, Ghana, Mauritania, Namibia, Nigeria, Senegal, and South Africa, though Nigeria is by far the largest producer among these seven countries.

Aquaculture is relatively new in Africa, with only a few countries carrying it out on a commercial level. Aquaculture in Africa accounted for only 2.5% of global production in 2016. However, several countries have made strides in terms of investment and policy reform to improve the aquaculture sector. Egypt, Ghana, Kenya, Madagascar, Malawi, South Africa, Tunisia, and Uganda are some of the fastest growing aquaculture markets in Africa.

Though aquaculture helps to address challenges around seasonal availability of fish, which also affect market prices of fish, the high capital and technical requirements of setting up an aquaculture business are often beyond the means of small-scale farmers and fishers.

Fishing in South Asia

Asia is a major player in global fish trade, supplying close to 60% of global fish. Fish and fish products contributed over $35 billion in export value in Asia in 2016. In the same year, the fisheries sector had employed over 50,000 fishers and fish farmers, 15% of whom were women. The workforce in post-production activities is estimated to be much more. The significance of the fisheries sector also extends to consumption. Per capita fish consumption is estimated to be 24kg, which is 20% above the global average.

Asian countries, excluding China[1], contribute 46% of global fish capture, owing to the vast biodiversity of freshwater fish, and agricultural activities that boost this diversity. In 2016, India was one of the top three producers of captured fish in the world after China and Indonesia. Fish capture in Cambodia, the Philippines and Pakistan has been growing in the past decade.

Close to 90% of aquaculture production comes from Asia. In Asia, Bangladesh, Myanmar and Thailand made the top ten list of main aquaculture producers in the world in 2016. In Bangladesh for example, aquaculture is the second-largest source of foreign exchange at $0.5 billion a year. It is also slowly becoming an important source of income in Indian and Bangladeshi rural communities.

Fishing value chain activities and energy

Value addition in fisheries and aquaculture can generally be done across the entire value chain, from production to processing and marketing.

Production can be done either through fish capture or aquaculture. Fish capture, whether inland or marine, is mostly practiced by small-scale artisanal fishers using low quality tools such as nets, gillnets, hooks, or baskets[2]. Fishing is usually done in the evenings or late night. Fishermen capture the fish at night then sell them to fish collectors or traders in the early hours of the morning. Those with cold storage equipment are able to keep the fish fresh for longer, allowing more time to sell the fish at reasonable prices. Night lamps are also quite useful during the fishing process.

To produce fish through aquaculture, fish farmers either capture young fish and culture them or purchase fingerlings for breeding and hatching. Capture of young fish is more common since unreliable supply of grid power can be a challenge when breeding and hatching fingerlings. Incubators, ventilation systems, and water pump systems in hatcheries require full time power supply. There are however specialised value chain actors who breed and hatch fingerlings to sell to fish farmers, though most are not situated in rural areas. In areas with unreliable power, diesel generators are used to power incubators, which significantly increases the cost of production.

Fish culturing is often done either in cages floated or submerged in a naturally occurring water body, man-made ponds, or more sophisticated land-based water pumping systems. Cage farming is more common due to the low capital and operational costs, and the limited need for electricity. Productivity however tends to be low since there is limited control of the environment within which the fish is growing[3].

In general, given the seasonal fluctuations of fish availability, communities often combine fishing with other agricultural activities such as crop and animal farming to diversify their sources of income. The crops and animals also provide material for fish feed for those practicing aquaculture. Quality fish feed typically accounts for up to 60% of the overall cost of aquaculture fish production, so utilising kitchen waste or farm waste to produce fish feed is often a cheaper alternative for smallholder farmers.

Rice, vegetables, poultry and pigs are most commonly integrated with aquaculture. Local feed mills in communities where aquaculture is commonly practiced would not only help to reduce the cost of fish production, but also help to standardise the quality of the feed.

[1] China contributes a further 20% of global inland fish capture
[2] For more information on inland fish capture practices, please see Tables 1-4 of http://www.fao.org/3/ca0388en/CA0388EN.pdf
[3] For more details on other aquaculture methods, please see https://www.energy4impact.org/file/2097/download?token=HAPpuCJW

As aquaculture continues to grow in Africa and Asia, and as the prices of fishmeal continue to rise, there has been an increasing demand for low value/trash fish – small fish with low consumer preference and little to no direct commercial value - as feedstock for carnivorous cultured fish such salmon, Nile perch and other animal feed. Fish, therefore, have the potential to impact the animal feed processing sector. This also includes by-products from primary and secondary fish processing.

There are two main levels of fish processing: primary processing and secondary processing. Primary processing activities include gutting, drying, salting, deep frying, and smoking depending on the type and size of fish. These processes are more common in artisanal fishing and help to preserve the fish enough to be sold to local markets or to be used for household consumption. These types of processed fish have relatively low monetary value, or are used for household consumption. Fish are also sometimes fermented for local consumption. Though these processes are not energy intensive, certain energy dependent equipment could help to improve the quality of products and reduce post-harvest losses. Examples include freezing or chilling fish to keep it fresh for longer and increasing the bargaining power of fishers, using electric stoves to reduce the cost of cooking fuel to smoke or deep-fry fish, or using solar dryers or air-heated mechanical dryers to improve the quality of dried fish. Electricity could also help to introduce other value-adding activities such as baking or breading fish for local markets.

Secondary processing activities include de-heading, filleting, packaging and canning, milling to powder, or processing into paste and sauces. Such activities are typically carried out on a medium to large commercial scale to serve markets located farther from the fishing communities, such as urban areas, cross-border regions, and international markets. Though some of these activities can be done manually, mechanising them through the use of electricity would quicken the processes and standardise the quality of the products. Products from this stage tend to have a higher monetary value.

	Production	Local Processing	Marketing
PUE Activities	• Animal feed production • Ice supply • Aquaculture operations • Battery charging for general appliances and lanterns • Cooling/freezing	• Drying • Cooling/freezing • Packaging	• Cooling/freezing • Packaging
Machinery	• Feed milling machine (2.2 kW) • Feed pelleting machine (1-4 kW) • Ice making machine (1.5-6 kW) • Water pump (4.2 kW) • Aeration system (14 kW) • Ventilation (0.07 kW per ventilator) • Charger (200 W) • Freezer (23 kW)	• Dryer (1.5 kW) • Freezer (23 kW) • Ice making machine (1.5-6 kW) • Packaging/canning machine	• Refrigeration (fridge/freezer) • Packaging/canning machine

Figure 1 Energy dependent activities along the fisheries value chain

Marketing activities include transportation of the fish to processors or distant markets, freezing, weighing and packaging, as well as cooking, frying and backing for local markets. Market prices of fish are often dictated by the type of fish, the form in which they are sold (fresh, frozen, dried, salted etc), the target market, the distance from the point of production and processing, and the seasonality (lean vs production season). The most preferred and highly valued fish form globally is fresh or chilled fish, followed by frozen fish, then preserved and cured fish (salted, dried, smoked, fermented etc).

Significant losses occur at this stage, especially for communities located far from key national or regional markets and where transport infrastructure is inadequate. This means that most of the fish that do not make it to other markets have to be consumed internally. Fish that is not properly preserved would therefore go to waste.

Barriers and opportunities for off-grid energy companies

The table below highlights the main barriers to fishery development at the local level, along with opportunities that off-grid energy companies can adopt to improve local fishing value chains. These opportunities are not all directly related to providing energy access, but would play an important role in improving the entire local fishing value chain.

The low fish consumption is the result of a number of interconnected factors, including population increasing at a higher rate than food fish supply; limitations in expansion of fish production because of pressure on capture fisheries' resources and a poorly developed aquaculture sector; low income levels; inadequate storage and processing infrastructure; and a lack of the marketing and distribution channels necessary to commercialise fish products beyond the localities where they are captured or farmed. However, it is also important to mention that in Africa, actual values may be higher than indicated by official statistics in view of the under-recorded contribution of subsistence fisheries, some small-scale fisheries and some cross-border trade.

Table 2 Main challenges in the fisheries sector and opportunities for off-grid energy companies

Main barrier	Description	Opportunity for off-grid energy companies
Poor production practices and post-harvest losses	• Lack of proper landing facilities and inadequate cold storage infrastructure are the major causes of these losses at production level. In Africa for example, over a quarter of fish is lost post-harvest. The situation is exacerbated by the tropical climate in most African countries. • Lack of quality inputs or limited knowledge on where to get quality inputs. Examples include fingerlings to culture, poor quality fishing gear, or the wrong fishing gear for certain types of fish. • Capture of fish before they have matured, which leads to over-exploitation of water bodies and fish waste. • Poor environments for aquaculture e.g. poor water quality leading to the spread of bacteria and disease among fish. • Quality fish feed is often too costly for fish farmers. Most resort to using domestic organic and agricultural waste to prepare fish feed with little consideration of nutritional requirements. The resulting feed is usually of low quality leading to production of poor quality and less fish.	• Providing power for stand-alone freezers or producing ice and selling it to fishers and fish traders to chill or freeze fish. Several mini grids in Western Kenya and Lake Victoria islands in Uganda are providing these services to local fishermen. See case studies below. • Setting up local incubators and hatcheries in collaboration with local experts and supplying quality fingerlings to fish farmers. In Sierra Leone for example, the WorldFish Centre implemented a project in Tonkolili District, where they facilitated a public-private partnership (PPP) to encourage the involvement of the private sector in feed and fingerlings production. A PPP was piloted for the continued operation of the state-owned Makali hatchery. • Rural support services such as education to fishing communities on proper fish capture practices e.g. best equipment to use, quality of fish to capture or harvest, or best practices for aquaculture.
Unreliable power supply for electricity-dependent fishing practices.	• This leads to the use of inefficient and costly off-grid energy alternatives such as diesel generators for aquaculture and milling of fish feed, or using dry cell batteries for torches at night during fishing. • Aside from poorly developed policies and regulations, unreliable power supply is one of the main reasons why the aquaculture sector in Africa has not picked up.	• Replacing diesel powered mills with electric motor-driven mills to be powered by micro or mini grids. This can be done either by retrofitting the diesel mills or acquiring new electric ones. • Providing solar lighting solutions such as solar lanterns to aid in fishing at night. A solar company in Kenya is providing solar lighting solutions for local fishermen in the Lake Victoria region. See case studies below. • Powering or setting up aquaculture facilities locally.

Limited access to markets	• This often results from poor policies that do not include small-scale fisheries in cross-border and regional trade. • Informal cross-border fish trade is prevalent, particularly in African countries, but the monetary value of these activities is not well documented. • Fish produced locally may not always meet required standards in high-value markets such as regional and international markets. Farmers are usually not able to afford the cost of meeting compliance for these markets e.g. licensing, certification of products, or adoption of certain production and fish handling techniques. • Poor aggregation of captured/produced fish due to large geographical distribution of fishers, or due to poor coordination between local farmers and other value chain players. • Inadequate infrastructure to enable effective transportation of fish for processing or to distant markets, e.g. lack of proper and hygienic landing centres, limited aggregation to reduce the unit costs of transportation, limited of cold storage facilities e.g. ice, ice plants and cooling boxes for refrigerated transport, and poor roads.	• Implementing business models that incorporate small-scale fishers into the fishing value chain. Models that apply include micro-franchising by medium to large-scale fishing companies, joint ventures between local fishing cooperatives and off-grid energy companies, and collaboration with local regulators to certify and label quality fish. Good examples of micro-franchising models include cage-culturing of tilapia in Bangladesh by Shiblee Hatchery & Farms Ltd., setting up of Aqua Shops to sell basic aquaculture inputs in Kenya by Farm Africa, and oyster and mussel farming in South Africa. • Setting up information centres or mobile applications to convey updates on market prices, weather updates, and other market-related information. Public and private sector players in countries in West Africa and Southern Africa utilise mobile phone technology to inform local farmers on policy, regulation and market prices. • Helping to streamline quality standards for fish to meet local and international standards e.g. by signing purchase contracts with rural fishers, fish farmers or fish traders that supply quality fish, or sourcing fish from local cooperatives. Care should however be taken not to exit or downgrade the functions of other small-scale farmers who are not part of this supply chain. Purchase contracts and contract farming are common in countries such as South Africa, Thailand, Vietnam and Uganda. • Off-grid energy companies can take up the role of aggregating fish from fishers, farmers and traders, and provide transport services to processors or distant markets using transport facilities with cold storage equipment. • Alternatively, there could be potential to set up processing facilities close to fishing communities, provided the annual fish supply is sufficient enough to service the facility throughout.
Limited access to finance for smallholder farmers	• Local financial institutions still consider the fisheries sector to be new territory. Suitable financial products to suit smallholder farmers and other players in the local fish value chain, including medium to larger-scale market players, are therefore very limited. • Smallholder farmers are not able to meet the requirements for accessing credit, e.g. owning an account, collateral requirements, servicing debt regularly due to seasonal fluctuation of production.	• Working with local credit providers, e.g. micro-finance institutions, to develop loan products for smallholder fish farmers.
Climate change vulnerabilities	• Droughts, floods, storms, and salt water intrusion due to rising sea levels highly affect production in communities that rely on fish capture, leading to a loss of income and livelihoods. Low-lying coastal countries such as Bangladesh and Senegal, and countries susceptible to droughts and storms such as Mozambique, Zambia and Zimbabwe, would be highly affected. • Fish markets are highly sensitive to economic fluctuations. Prices will therefore likely change based on availability of fish, which exposes smallholder farmers to market shocks.	• Several companies provide insurance services for agricultural products. The National Agricultural Insurance Company of Senegal (CNAAS) for example provides subsidised insurance services to farmers, e.g. insurance for fishing vessels. • There is potential to promote other agricultural activities along with fishing to supplement income for small-scale fishers and farmers. Rice, vegetable, poultry and pig farming could also help boost fish productivity through aquaculture. • There is also a lot of potential to add value to these agricultural products e.g. solar irrigation of rice and vegetables, rice hulling and milling, and egg incubation.

Other opportunities to explore include:

- Local production of quality fish feed and other animal feed. This would help to reduce the cost of fish feed in countries where small-scale aquaculture is picking up e.g. Nigeria, Uganda, Bangladesh and India. It is also a good opportunity to utilise trash fish for feed production.
- Setting up facilities to locally produce fishing equipment e.g. fishing nets, hooks etc. There is also potential to introduce electric fishing boats in island communities.
- Secondary processing of fish to make paste and sauces, therefore diversifying the value of fish. This is especially useful in West African and Asian countries.
- Supplying locally processed fish to the ever-growing urban markets. The high population density in urban areas makes it easy and cost effective to distribute and market fish and fish products. The available infrastructure also helps to better store and preserve the fish. Some products from primary processing, though not eligible for international markets, can be a good source of protein, particularly for the urban poor.
- Mechanising certain processing activities e.g. cleaning and packaging fish.
- Leveraging on national policies and strategies around fishing and fish trade to upgrade local fish production.
- Setting up appliance financing schemes for cold storage and local feed milling equipment for use by individual farmers and traders or local cooperatives.

Case studies

Case Study 1: Jumeme: Opening up markets for local fishing communities in Tanzania through the Key Maker Model

Jumeme is a solar mini grid developer powering local communities in the Lake Victoria islands in Tanzania. Jumeme is also one of the early adopters of a productive use business model known as the Key Maker Model.

Through this model, the developer aims to streamline the fishing value chain in these communities and link them to high-value markets within the country. It has done this by localising fish processing.

The company purchases Tilapia from local fishermen at attractive rates, and locally cleans and freezes the fish using electricity from their mini-grid system. Jumeme packs the frozen fish in cooler boxes and transports them via ferry to the mainland and then in lorries to Dar es Salaam, one of the major cities in Tanzania, where the fish is sold to wholesalers at a premium price. This model not only allows local fishermen to earn a fair income by selling their fresh produce to Jumeme, but also reduces the cost of processing and transportation since all the processing is done onsite, and aggregation reduces the unit cost of production. In addition, the model enables the fishermen to sell their fish to more distant markets that they otherwise would not have reached.

As of 2019, Jumeme delivered about 800kg of fresh Tilapia to Dar es Salaam every day. The company aims to deliver 1 ton per day from the islands. In the future, Jumeme plans to extend this model to more islands in Lake Victoria and Lake Tanganyika.

To preserve the local ecology, Jumeme is also piloting aquaculture of Tilapia through cage farming so as to prevent overfishing in the islands. The company uses locally sourced material to produce fish feed, and works

For more information about Jumeme, please visit http://www.jumeme.com/

with local and international fish farming experts to develop the aquaculture system. This is the first Tilapia cage farming business in Tanzania.

Case Study 2: Kalangala Infrastructure Services and GRS Commodities: Partnership to deliver ice to fishing communities in Uganda

Kalangala Infrastructure Services (KIS) provides ferry, power, road maintenance and water services to Bugala Island, one of the islands in Lake Victoria in Uganda. The company runs a 1.6 MW solar-diesel mini grid which serves over 4,000 customers on the island. GRS Commodities provides renewable energy solutions in rural communities in Uganda, one of them being the production and sale of ice flakes to local fishermen.

In 2017, KIS partnered with GRS Commodities to supply ice to local fishermen in Bugala Island. GRS Commodities operates and manages an ice making and flaking machine with power supply from the mini grid. The machine produces about five tonnes of ice per day, serving over 60 villages within the island.

Ice is sold through three main models:

For more information about KIS, please visit http://www.kis.co.ug/pages/view-page/Power-Services

For more information about GRS Commodities, please visit https://www.grscommodities.com/index.html

1. Direct sale to fishermen in 100kg sacks. Fishermen use this ice in their boats during fishing and landing. Fishermen prefer ice flakes as they are easier to handle, cool a larger surface area, and are not damaging to the fish
2. Providing cooling services to locally fabricated cooling boxes lined with ice flakes
3. Cooling of aggregated fish for transportation to local markets

Fishermen from nearby areas also come to the island to purchase ice.

Case Study 3: Mwezi Solar and Simusolar: Providing solar solutions to fishing activities in East Africa

Mwezi Solar is a company offering off-grid energy solutions to communities in Kenya. The company transitioned into solar products from clean cook stoves in 2016. Simusolar is an equipment company that offers productive use appliances for off-grid energy use. The company operates in Tanzania and Uganda.

Fishermen in East Africa rely heavily on kerosene lamps as a lighting source for fishing activities at night. These not only expose the fishers to fire risks, but are also harmful to water bodies due to kerosene spillage.

Mwezi Solar and Simusolar have each developed business models to supply solar lights on a PAYGO payment model to replace the use of kerosene lamps. There has been great success in selling these fishing lights. Mwezi Solar, for example, sells the lights directly to boat owners and fishermen through their on-ground network of agents, or sometimes through fisher cooperatives known as Beach Management Units (BMUs). Payment is scattered over a period of up to six months. The digitalisation of daily transactions frees up to 50% of customers' time.

For more information about Mwezi Solar, please visit https://mwezi.org/

For more information about Simusolar Commodities, please visit https://simusolar.com/

Simusolar has provided first time access to solar lights to all its fishing customers. The company has also made it easy to monitor the performance of its customers' equipment and gather feedback through a digital platform. The PAYGO model allows for flexibility in payment, which fits fishers' seasonal cash flows, thereby minimising rates of payment defaults. The fishing lights have the potential to double farmers' income in under a year.

Case Study 4: The international Development Enterprises: Improving rural aquaculture in Bangladesh by powering fish hatcheries

The international Development Enterprises (iDE) is a non-profit organisation that provides human-centred solutions to improve agricultural value chains in rural communities in developing countries. The organisation is currently active in 11 countries in Africa, Asia, and Central America.

In 2017, the organisation partnered with Renewable World and Rahimafrooz Renewable Energy Ltd (RREL) to develop two micro grids for fishing communities in the Ganges delta in Bangladesh. These systems not only provide power to about 100 households, but also power water pumping systems for two hatcheries in the area. The water pumping systems were previously powered by diesel engines. The organisation is testing innovations in technology and financing to develop a sustainable community-based model for maintaining and operating the micro-grids.

The micro-grid systems are currently co-owned by the two local hatcheries and RREL. RREL operates the systems and sells power to the hatcheries and surrounding households through a mobile based billing and payment system. Once the company has recovered its investment, the hatcheries will take full ownership of the micro grid systems and will continue selling power to the households.

iDE and Renewable World are supporting the local hatcheries and RREL to attract private sector investment to ensure the continuity and sustainability of the project beyond the six years of co-ownership.

The introduction of the micro-grids has led to a marked improvement in the aquaculture business in these communities. Farmers now have continuous water supply even during dry seasons, and have incurred significant savings on diesel for water pumping and kerosene for lighting the hatcheries at night. The continuous supply of clean water has led to an improvement in production of fingerlings, which has led to higher sales for the hatcheries. On the end of RREL, having an anchor load such as the hatcheries has not only ensured better utilisation of electricity supply, but also a steady flow of income for the business.

For more information about iDE, please visit https://www.ideglobal.org/

For more information about Renewable World, please visit https://renewable-world.org/

The organisation plans to introduce other services, such as water pumping for irrigation or domestic fish ponds.

References and further reading

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