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# LINKING AGRICULTURE AND ENERGY IN CAMBODIA

*This series of case studies is part of a project to emphasise the energy-agriculture nexus in smallholder and small-scale commercial farming.*

## SMALL-SCALE COMMERCIAL FISH FARMER

**Province**: Takeo

## Farmer's ID card

**Name:** Mrs. Khiev Som
**Total land:** 1 ha
**Number and size of ponds:** 20 small ponds (about 300m³ each) and 1 bigger pond for breeding, together covering more than 0.5ha
**Connection to grid electricity:** since 2001
**Main source of income:** fish production
**Industry segment**: fries and fingerlings (5 different species)
**Production capacity:** 500,000 fishes per cycle
**Production cycle per year:** 1 cycle (multiple production batches)
**Duration of the cycle:** 8 months

Mrs. Khiev Som, supported by her husband, started aquaculture production in 1997 when the Asian Institute of Technology (AIT) came to finance the initial provision of five fish species (fries only). In addition to the ponds, she has two nurseries (for hatchlings). All fishes are growing within the same ponds, regardless of the species. She received numerous prizes and certificates after starting to produce fish, including a best fish farmer award certificate in 2007. She followed many trainings in Cambodia, Vietnam and Thailand.

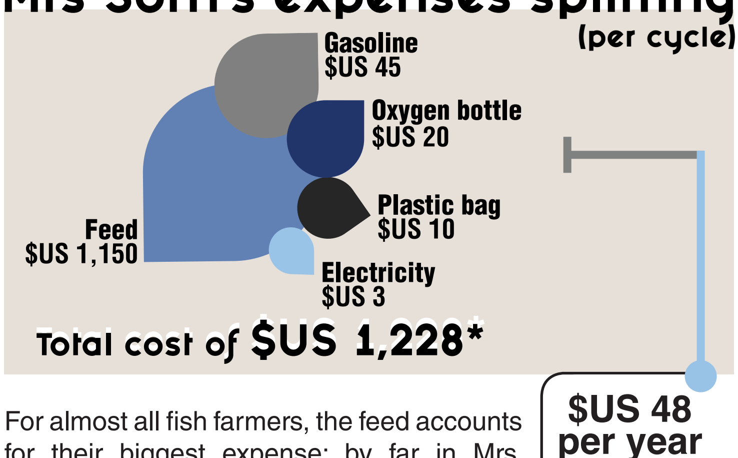
## Context

Most aquaculture production systems are classified as smallholder low or high-input systems (ponds covering between 200m2 and less than one hectare and producing 0.7 to 20 tonnes/ha/year respectively).

## Earnings & expenses

Fish farmers' net profit, expenses and energy consumption depends on when, on the fish's life cycle, they decide to sell their production. The couple sells fingerlings and juveniles and get 40 to 100 KHR (Cambodian riel) per fish, depending on its size, and the buyer (villager or distributer). Mrs. Som estimates that they can sell up to 500,000 fish every year and earn a net income of US$ 5,000 per year. Their current sale volume is about half of what they could sell a few years ago, due to the growing number of competitor small-scale fish farmers in the neighbourhood. They spend 30 minutes to 1 hour every day over the 8-month sale period to sell and deliver their fries and fingerlings to customers.

## Mrs Som's expenses splitting (per cycle)




For almost all fish farmers, the feed accounts for their biggest expense; by far in Mrs. Som's case, as it represents 94% of hers The rest of her expense are for fossil fuels, mostly for transportation purposes, but also a gasoline-fueled electric motor. A bottle of oxygen is also used to inject air in the plastic bags so that fish put inside survive during transportation.

**The initial investment for the purchase of the first fish are not included in the calculations, nor is her one-time electric motor purchase or its maintenance costs. Only regular expenses are included.*

# Zoom in: Energy Profile

To be successful in fish farming, farmers must be careful with the acidity of the water, its quality, the amount of daily feed they will give and provide a nutritious diet over the life cycle of the fish.

At production level it implies to oxygenate the ponds regularly and give food at specific moments of the day. Mrs. Khiev Som will only use one small gasoline-fueled electric motor to oxygenate fries in the nursery, and one 18W tube light during five months to attract insects. Compared to other livestock farming, fish farming does not require a lot of electricity. The farmer is not using any specific technology for pumping and draining the pond. They have a rainfed pond and, in rainy season, they just drain the ponds through a small hole, irrigating the ricefield behind. Mrs. Som's savings potential is thus very low and working around energy efficiency looks not applicable in this context.

The farmers used to have two solar panels bought at $US 200 per unit (solar kit with batteries, totalising 120 kW) but stopped using them when the shrimps production declined and eventually stopped.

**Electric motor**
used 7 days per production batch
24h/day
to oxigenate the ponds

+

**1 light tubes (18W)**
used 2-3h/day
for 5 months
to attract insects and feed the fish

**10kWh/ cycle**

electricity cost per cycle: $US 3

"We are interested in renewable energies, but solar panels are too expensive and are no longer useful to us. [...] Before we used to have 120W of solar panels for shrimps production but we stopped. Too much competition, not enough demand and you need to pay $US 100 every two years to change the battery" Mrs. Som stated."

**Mrs. Som**

## Clean energy opportunities within the fish's value chain

### For production

**Smart irrigation system using fish pond's water for plant crops**

Effluents from fish pond have relatively high nutrient concentrations and can be potential source of protein that the plants need to be healthy and grow. On the other hand, this same nutrient-rich water would be very detrimental to fish if it was not removed and replaced with fresh water on a frequent basis. The greatest advantage of using fish pond water for irrigation is the increase in yield of both the fish and the plants, especially as it provides a solid alternative to the use of costly chemical fertilisers. Using water for both uses would reduce the farmer's water costs. Depending on the production capacity and the size of the crops, a solar powered pump can also be used for irrigation and combined with SMART agriculture techniques (*e.g.* drip irrigation system).

### For processing

**Hybrid Solar Dryer**

In the past, drying fish was a preservation method to extend food's life time but now dry fish is one of the most popular food products in Cambodia. Traditionally, the fish are put on racks and dried through an open sun method (OSM). However, it requires large open space area exposed to direct sunlight and fish often dried with unstable moisture content, which is often conductive to microorganism proliferation resulting in contamination of the products or food poisoning. Hybrid solar dryer uses two heat sources of energy: solar radiation from sunlight in daytime and charcoal briquette as backup in night time, or combined together when the solar radiation is not strong enough.

Hybrid solar dryers are systems used to dry products in the drying chambers with the heat gaining from solar collectors and auxiliary heating. The indirect forced convection from the solar dryer increases the hygiene of the product, take less time than continuous drying and compared to the traditional open sun method. This system provides protection from dust, wind-blown dirt, rain, insects, rodents or other animals.