Solar food processing by drying in an off-grid system in Kenya
The project SolCoolDry

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In coastal Kenya, lack of cold storage facilities and appropriate technologies result in losses of harvested and fresh products. Coastal fishermen as well as farmers suffer from this situation as they are forced to sell their produce as soon as possible fresh, to dealers or at uneconomical prices. The warm weather in the region also hastens spoilage, especially of fish. Sun drying on open grounds is prone to contamination and produce poor quality fish that cannot gain access to high value markets.

Aim of the project

The project SolCoolDry supports fisherman and farmers by the development and set-up of a 100% solar powered, off-grid system for drying beside the production of ice. The system using solar thermal energy is designed to provide a 24-hour operation of the solar tunnel dryer. Degradation processes of the productl to be dried during night hours can therewith be avoided. Two solar tunnel driers have been set up – one with solar thermal support for optimized night operation and the other as conventional stand-alone solar dryer.

New concept of night heating support

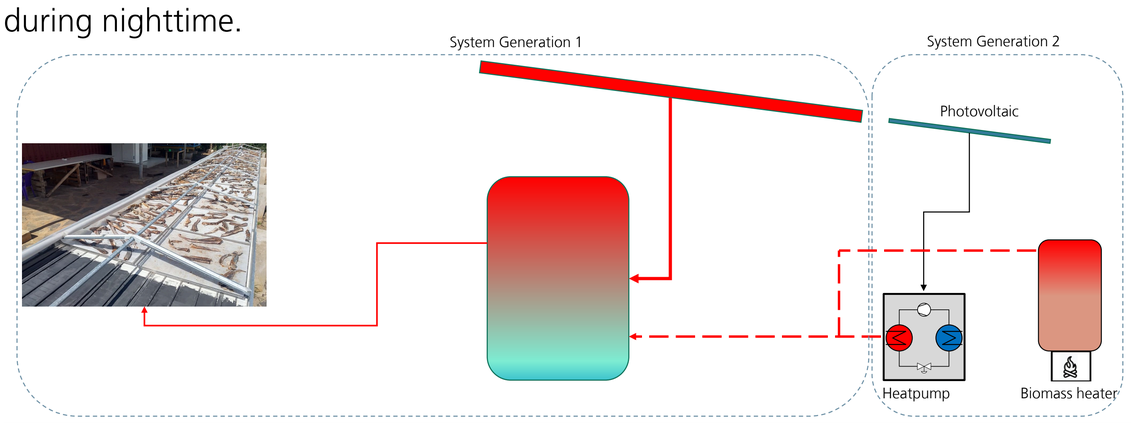
With both dryers, excellent product quality could be achieved for various types of fish and several fruits and vegetables, while drying time was significantly reduced compared to traditional methods. By means of a novel concept of loading, the capacity of the installed dryers can be increased up to double, which also allows larger drying batches. In the test runs, it was shown that the overnight heat supply is effective: the heat was transferred to the product and the drying process could be continued throughout the night at 5-10 Kelvin above ambient temperature.

Loading of the Solar tunnel dryer

Different dried products

Solar night heating support

12 m² solar thermal collector system produce hot water during the day. The storage tank of 2000 l is heated up and a second circuit provides the hot water to one of the driers during nighttime.

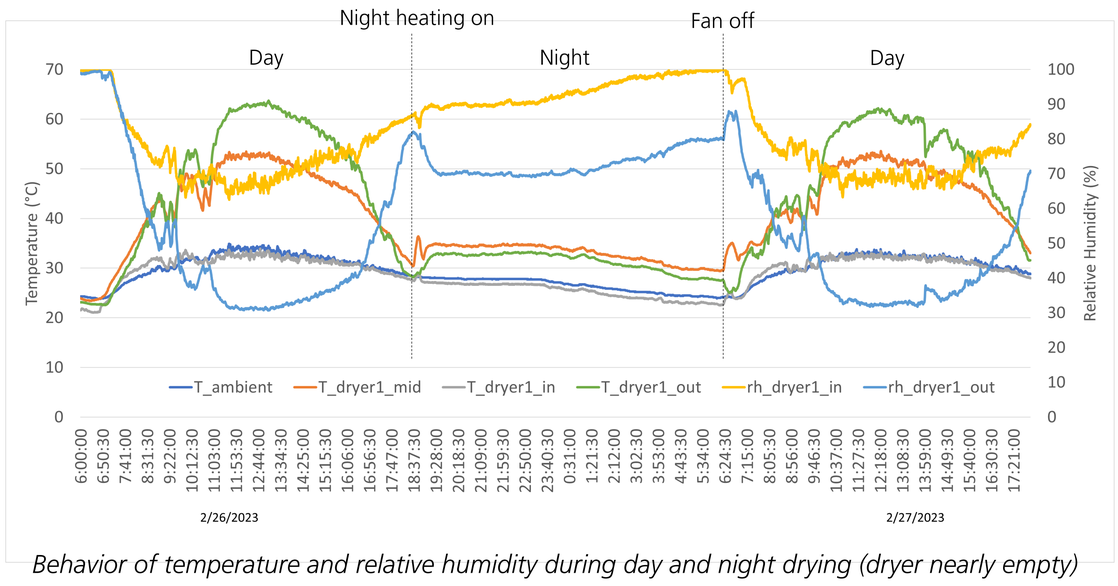


Overview of some of the most dried fishes

Dried good	Raw moisture	Residual moisture	Drying time
Sardine	62%	8 – 31%	21 – 32 h
Parrot fish	75%	38 – 46%	-
Kimarawali	75%	15 – 31%	24 h
Rabbit fish	65%	13 - 36%	36 – 71 h
Squid	80%	40 – 52%	22 – 93 h

Optimum drying processes and conditions

The following diagram shows the temperature and humidity curves for two days and the night in between. The ambient conditions are represented by the inlet parameters: temperature and relative humidity of dryer1_in. T_dryer1_mid gives the temperature in the middle and the values at the outlet show the state of the air leaving the dryer. During night, the main parameters are the temperature (green) and relative humidity (light blue) at the outlet compared to the ambient/inlet conditions (grey and yellow).



Behavior of temperature and relative humidity during day and night drying (dryer nearly empty)

Advantages of night heating support

As solar drying processes depend on solar heat during daytime weather has a significant influence on the drying time. Furthermore, goods with high amounts of water in the raw material cannot be dried completely in one day. The heat supply to the dryer during night times keeps the temperature high enough to avoid a drop below the dew point and a continuous air flow over the goods preserves them from rewetting and damages by insects, especially flies.

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