# At the forefront of fighting food scarcity

## A new way of solar drying food in the remote areas of the Himalayas

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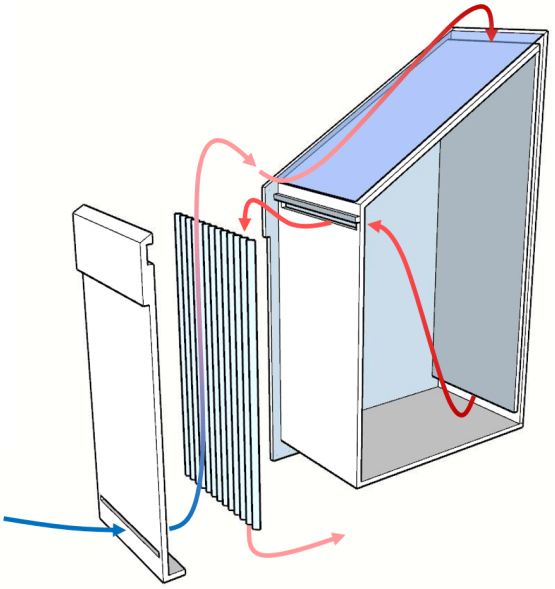
**Food scarcity is a common occurrence for farmers in the rural Himalayan regions. As fruits and vegetables are a crucial part of most farmers' diet, food deficiency can become evident in between harvesting periods, when there is no fresh supply. A lack of proper storage facilities and preservation methods further amplify this as the commodities that are stored can start to rot. The farmers do the best they can to store the greens, relying on drying the food in the open air with the help of the sun. This is tedious work and requires constant care while the result is still not satisfying. The welfare of farmers can thus be improved remarkably with the introduction of a more efficient solar dryer.**

Imagine being on a remote mountain where your only food source for the next four months are some fruit and vegetables. The need to store them and keep them from rotting suddenly becomes crucial for your survival. Sadly, this is the reality that many farmers face during the winters in the Himalayas. Without proper storage, the greens start to rot rapidly and food scarcity becomes evident. To prevent this, farmers have to rely on the earliest and most primitive preservation method.

Drying greens extends their shelf life, reducing the risk of food shortages. If dried properly, greens can be kept for a long time without losing their nutritional value. Unfortunately though, many rural Himalayan regions lack modern drying techniques resulting in unsatisfying drying. Farmers need to rely on the primitive method of open air solar drying, where the food is placed directly in the sun so the heat can evaporate the water, slowly drying it. The method leaves much to be desired as it is labor intensive and takes days to dry the food. The greens are also constantly exposed to weather and wildlife which lowers the quality and nutrient values. These issues can be resolved by using a solar dryer.

Solar dryers can be seen as a box with a glass ceiling that allows solar radiation to penetrate inside of it to heat it up, similar to a greenhouse. Many different solar dryer designs exist but they are all fundamentally flawed as the drying process is uneven and takes days. This makes drying a labor intensive work as care is needed to ensure all samples are dried simultaneously and to protect the greens during the night.

To battle these issues a next generation solar dryer has been developed. The new design increases the temperature and drying performance of the dryer with the help of a metal sheet and fans. The metal sheet, called a heat exchanger, helps reduce the drying time and works similar to a radiator that releases heat to the surrounding air to raise the temperature in the room. In the design, the warm air exiting the solar dryer is used to heat the air entering the dryer. This means that the incoming air is preheated and that heat that otherwise would be lost is reused.



**The new solar dryer design makes use of a ribbed metal sheet to preheat the incoming air. The arrows indicate the direction of the airflow. The blue and red color scheme shows the gradual increase of the air's temperature.**

The new design is also fitted with fans inside the drying compartment. Just like laundry dries faster during windy conditions, food dries faster if the airflow is higher. So by having a higher airflow, or wind speed, the drying time is shortened even further. The drying process also becomes more uniform. Since all the samples dry at the same pace, the farmers do not have to shift the product around manually. This decreases the locals' work load.

To validate if the design works, prototypes were built in Sweden and Nepal and experiments were performed out in the field. Here it was found that the heat exchanger indeed improved the thermodynamics of the system and increased the drying temperature. It was also found that using two fans and letting the warm air enter the drying chamber from the top shows faster drying whereas an inlet placement at the bottom of the chamber, with only one fan, results in the most uniform drying process. The results indicate that the use of a heat exchanger and internal fans has the potential to improve the drying process both by speeding it up but also by making it more uniform.

It is important to keep in mind that to make the design attractive to farmers it not only needs to be efficient, it also needs to be simple and easy to use. An important part of the project is to involve the local communities at an early stage and listen to their requests before sending them a prototype. These findings are only the first steps in the project 'SolarFood: Reducing post-harvest losses through improved solar drying'. The project is coordinated by Dr. Martin Andersson and Dr. Henrik Davidsson of Lund University with the help of professors at Universities in, among others, Nepal, Bhutan and Norway. Hopefully these results can be further developed and lead to a final product that will benefit farmers in the poor and rural areas of the world.

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If interested in knowing more, have a look at following reports:

*"Development and Testing of a Novel Solar Dryer Design with an Incorporated Heat exchanger - For use in the himalayan regions"*
- Adam Probert

*"The impact of induced airflow on the drying process of apples inside a solar drying chamber - A study on food preservation conducted in Nepal"*
- Marion Karlsson Faudot