Bernhard S. Müller

Kiln

Solar Dryer

Handbook for Users and Constructors

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Introduction

The Kiin Solar Dryer is an easy-to-build, ultra-economic device to aid families and small farms to dry whatever they want. Not only food can be preserved for times of scarcity, but any other commodities like e.g. firewood or self-made briquettes can be dried as well.

The Kiin Solar Dryer is very economical; it is a DIY device which can even be made from ordinary packaging cardboard. This manual is set up for plywood of 6 mm thickness the dimensions of which can be compared to single-corrugated carton.

This dryer has a powerful booster reflector.

It is not necessary to build a housing or shell for the mesh trays, saving you plenty of money and work time on this particular construction item.

The name Kiin is derived from the Maya language and means sun.

The designer, Bernhard Müller, since 1997 has constructed solar thermal devices and distributed them worldwide, including the Arctic and Antarctic. Most cookers and dryers were ordered and used in the Americas, Europe and Sub-Sahara Africa.

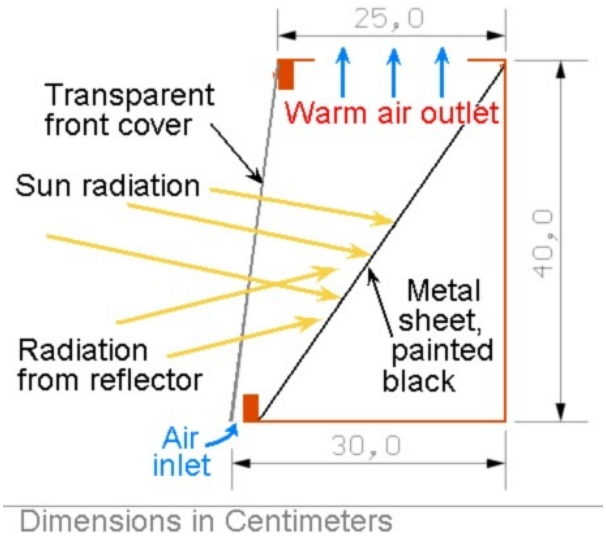
Principle

The Kiin Solar Dryer follows the known principle of solar drying: creation of a warm draught which carries the moisture away from the commodities.

It is a so-called natural draught (ND) dryer. Hence, it generates its own warm air draught and does not need a fan.

A black metal sheet absorbs the radiation of the sun and converts it to heat.

If there is anything you don't understand while studying this manual, just turn to this drawing to comprehend the function and the air flow.



The adjustable booster reflector is mounted in front of the generator compartment and can be tilted up and down. The function of the reflector is to accelerate the incoming solar radiation by directing it to the black metal sheet inside the generator, thus multiplying the radiation. The black metal sheet absorbs the radiation and transforms it to heat, thereby warming up the air inside.

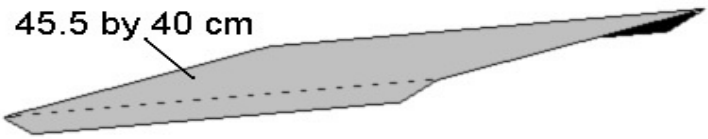
The warmed air rises upwards as it is expanding. Simultaneously, cooler air is pulled through gaps in the lower panel into the generator compartment. Consequently, the warmed air leaves the generator on the upper side. This process is self-sustaining as long as the sun shines and the dryer is directed towards the sun.

The shadow of the dryer shall always drop to the rear, while the booster reflector remains in the front. The reflector must be adjusted low at low sun and high – up to 45° tilt angle – when the sun is right above.

The picture above shows how to adjust the reflector once the sun is standing low above horizon: Low sun = low reflector = long shadow.

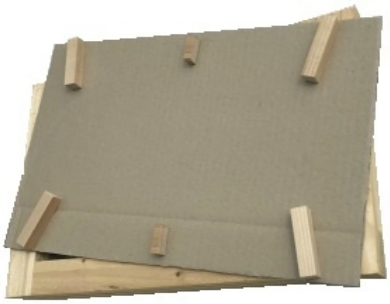
To adjust the reflector, just do it with a chain or a cord with burled loops which are fixed with hooks or screws at the chassis and the reflector frame.

The reflector is fixed with screws onto the skeleton of the dryer’s chassis. Drill the holes in the reflector frame a little bit bigger than the screws’ diameter for easy operation, but drill the holes in the skeleton small to hold the screws tightly.



The black metal sheet is placed diagonally in the generator compartment (see drawing in chapter “Principle”). It is the heat generating device; the heart of the system. Preferably, take scrap metal or used aluminium sheets from offset printing companies who sell the plates at scrap metal prices. You will find that the metal sheets are sometimes too floppy and bend easily. To keep it straight, fold the side edges down by 90° to obtain utmost stability (see drawing above). The metal sheet can either be put loosely inside the compartment or fixed with screws on the upper and lower end. If your dryer is made of carton, the metal sheet should either be glued onto the carton with a multi-purpose glue or fixed with a twisted wire.

The empty space behind the metal sheet warms up during operation, too. If your location is in the cold zones of the world, like Norway, Sweden, Finland, Alaska or northern Russia, you may free to fill up the empty space behind the reflector with crumpled paper, wood wool or similar insulating material. In my test location at a latitude of 50° N the air draught temperature of 47°C was obtained at clear sky and at an ambient temperature of 15°C. At an ambient temperature of 30°C, the air draught reached 57°C. These results indicate that it is not necessary to insert insulation material in the empty space behind the metal sheet. Moreover, temperatures of above 60°C should be avoided for good drying results.



The lid needs distancers of max. 1 cm thickness glued/mounted onto it, to allow the warm air draught to escape the system through the lateral gaps. If you dry firewood you won’t need the lid. Just let the warm air draught leave the system via the gaps between the wood branches.

The Kiin system is constructed to make a case or shell for the drying compartment obsolete. The mesh trays are fitting perfectly onto one another and force the air draught all the way to the top, where the air outlet is located. The mesh trays can also be stored easily in shelves if they have the same size.

The wind vulnerability of the Kiin solar dryer can be neglected. The pyramidal shape and the tilted reflector direct the wind around the dryer. If the wind comes from the sides, there is a smaller surface to be attacked. Moreover, the weight of the mesh trays provide stability. Just the lid can be blown away. Therefore put some weight on top of the lid in case wind blows or make it from metal to become heavier.

In a Nutshell

The Kiin solar dryer

- Can be made with local materials with little mechanical skills.
- Can be constructed very inexpensive. The carton version costs less than $ 10.
- Dries with a naturally generated, self-sustaining warm draught. No electric parts required.
- Does not need sophisticated reflector materials because the existing construction reaches the necessary temperatures even with household aluminium foil.
- Does not need a housing for the drying compartment; the mesh frames are accomplishing this goal.
- Does not require insulation material behind the collector's metal sheet.
- Can hold up to 7 stacked mesh frames.
- Can dry anything: food, firewood, briquettes, etc.
- Can be controlled easily by the reflector.
- Can serve as a room heater in the winter, if you have a large window towards the sun.
- Is harmless for children and animals. The heat is generated inside.
- Is surprisingly stable; tested at wind speeds of above 10 m/sec.
- Needs re-positioning of reflector and chassis towards the sun. Take care that the shadow is always behind the dryer and that the reflected sunlight shines into the heat-generating compartment by tilting the reflector up or down.
- Needs to be covered with a towel or similar item on the reflector if the temperature gets too high. Alternatively raise or lower the reflector to achieve that less sunlight is directed into the heat-generating compartment. Highest temperatures are obtained when the sun is between 40° and 70° above horizon.
- Is easy to clean and maintain.

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