

2. Commercialisation of the Solar Dryer:

There are four common drying methods/techniques, that are utilised for drying agricultural products.

a. The Old Traditional Way, The Open Air Drying

This is the present drying techniques used by urban and rural farmers. It is the old fashion drying techniques, spreading the crops on a carpet or direct on the soil in open air and exposed to the sun for drying.

b. Firewood/fuel drying

This technique is using fuel source to create the required heat for drying. It is used for tobacco drying, and is common Uganda, and is more popular in West Nile for the tobacco business.

c. Electrical drying

This technique is similar to No. 2, apart from heat, which is created by electricity as energy source.

d. PV¹ powered or simple Solar drying

The difference of this technique from the above mentioned, is that the heat is created by the sun radiation. The heat could be circulated by a ventilator powered by PV array.

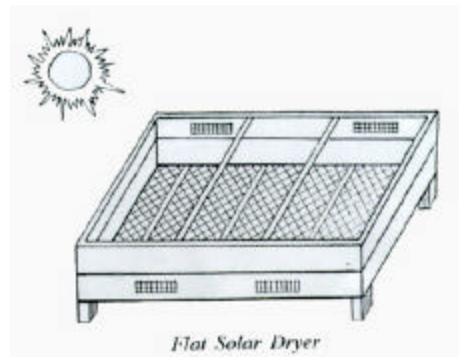
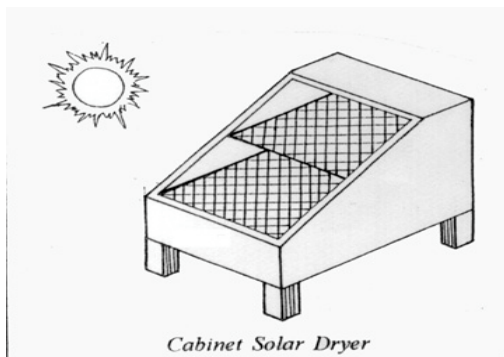
The three first mentioned techniques can be replaced by the environmental friendly drying techniques.

2.1. The Solar Dryer Technology and Utilisation

The description of the solar drying technologies will be limited to few types, which are very common and well known.

A. Low Cost Solar Dryer

The low cost dryer is similar to Nebbi type, which is presented at the case study of Uganda (*See the Annex*). There is of course different types of this kinds, such as the cabinet solar dryer, the flat solar dryer, etc.

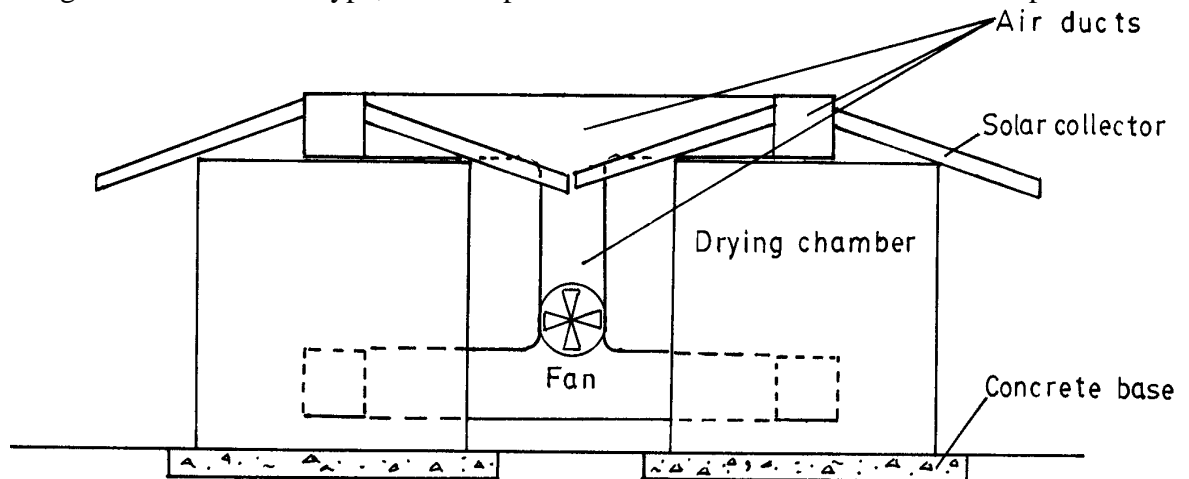


¹ PV: Photo Voltaic

The low cost dryer is the most suitable even for the small farmer, who have a very limited income. It will be possible for them to cover the investment cost. This is produced from locally available materials, and by local carpenter.

B. Electrical Solar Dryer- AC powered

This type is quite different from the low cost solar dryer, because this has a bigger size and are usually made for heavy duty, such as the tobacco, timber or coffee drying. This type is supplied by fan to circulate the hot air inside the dryer. The heating energy is provided by the sun collector placed on the roof. The following is a medium scale solar crop dryer, developed at the university of the West Indies since 1973, by Prof. Oliver Headley and Prof. Williams Hinds. The technical design for this type, is provided in the Annexes chapter.



AC-Powered Solar dryer- Designed by Prof. Oliver - Barbados

During the utilisation of this type in rural areas, the air circulation fan can be DC powered. This type of dryer, can also be supplied by an electrical heating element for providing the heat. The dryer is usually equipped with steering system to control the drying temperature, which varies according to the type of crops.

Makerere University – Kampala - Uganda developed a similar dryer for timber drying, but without any electrical equipment or Sun collectors. This type is functioning as a greenhouse.

C. Solar Dryer - DC Powered:

This type is similar to the above mentioned AC powered, but a small size and developed for drying only food crops, cash crops and fruits. The dryer consists of:

1. Sun collector panel for air heating
2. Drying chamber
3. Fan for the hot air circulation
4. Moisture and temperature sensor
5. PV- panel for powering the fan



DC powered solar dryer, designed by Giulio Pozzoli Solar Dryer – Italy

This type is also applicable in rural area, if the quality of the dried products is required. It is a bit expensive than the low cost types.



This type is developed and tested in Niger in collaboration with Giulio Pozzoli -Italy

2.2 Suitability of the Solar Drying Technology for Commercialisation

a. The Product

From the table Nr.1, there is a clear indication of the need for the adoption of the solar drying technology in the agricultural sector. The technology gap in Africa is due to the lack of the availability of the suitable processing techniques for the produced agricultural products, which can be adopted to local and the export market. The technical innovation are not limited to farm-level production, but plays an important role in all stage of the agricultural system. The challenge for the entrepreneurs in the area /district, is to develop the solar drying techniques, that are cost-competitive within the prevailing environment, and affordable for the end-users (the small scale farmers). The earlier described solar dryer types are suitable can be used by all farmers, but limited to the level of farmer.

Solar dryer type	End-user Level	Product Type
Low cost solar dryer	Small scale farmers	All types suitable for drying
Solar dryer DC-powered	Medium size farmers	All types suitable for drying
Solar dryer AC-powered	Enterprises & timber traders	Used most for Timber drying

Table 2. Target groups of solar dryers and suitability

b. The Materials

The locally available materials are an obligation to produce a competitive and an affordable product to all farmers having different levels/status.

c. Production and Marketing:

A locally produced solar dryer, is the most suitable to be exploited locally. This is because, the new technique does not require:

- Sophisticated introduction to local entrepreneur
- Long time adoption period to local end-users (easy to adopt, because it is produced of a locally well known materials and techniques)

The commercialisation and the marketing of the processing technology would therefore, encompass widespread distribution, adoption and acceptance of the given solar drying technology by the key actors, in the production of food agricultural post-harvest. The commercialisation of the solar dryer should not necessary be restricted to profit making operations. Certainly, the sustainability of the introduced technique and its contribution to social values in producing self-sufficiency food, should be taken in consideration.

Cost Comparison:

Solar dryer type	Initial investment	Maintenance and operation costs	Total cost ²
	US\$	US\$/year	US\$
Low cost solar dryer	100 to 200	10	
Solar dryer PV-powered	500 to 1200	50	
Solar dryer AC-powered	6000	100 to 300	

Table 3. Cost comparison of the dryers

2.3 The Advantage and Disadvantage by Using the 4 Techniques:

The following table shows the comparison of the 4 techniques:

The applied Drying Technique	Advantage	Disadvantage
Old traditional way - Open air drying	<ul style="list-style-type: none"> ⊘ No investment is required ⊘ No fuel is required 	<ul style="list-style-type: none"> - The product is exposed to various risks, such as dust, animals, ants, rain, etc.. - It takes time to dry - It requires labour to survey the crops - The quality of the drying is not good (exposed to dust)
Firewood/fuel drying	<ul style="list-style-type: none"> ⊘ Quicker than the open air type 	<ul style="list-style-type: none"> - Requires investment in fuel - Requires investment in building or dryer box - Pollution and forest degradation - The quality of the dried product, can be affected with smoke - Not easy to control the drying - Requires labour for operation and maintenance
Electrical drying	<ul style="list-style-type: none"> ⊘ The drying is quicker, than both the above mentioned ⊘ The drying of the crops is well controlled ⊘ The quality of the dried product is excellent, depending on the type of the dryer 	<ul style="list-style-type: none"> - The dryer is costly - It is expensive to run and operate the dryer - The dryers require energy, which is not available in rural areas - It is not affordable for small farmer and even co-operatives - The dryer has to be installed in building - further investment - The drying is not environmentally friendly – if powered by a generator - Require labour for operation and maintenance - Requires introduction to the technology
Solar Drying	<ul style="list-style-type: none"> ⊘ Very cheap investment 	<ul style="list-style-type: none"> - Requires introduction to the techno-

² This cost is depending of the loan and the various expenses

	<ul style="list-style-type: none"> ✍ Very easy to maintain and operate ✍ Does not require a specialised manpower ✍ Well controlled drying ✍ Quicker drying ✍ The crops are well protected during the drying process ✍ Can be produced locally, and from local available materials ✍ Affordable to every body ✍ Environmentally friendly ✍ Does not require fuel 	<p>logy</p> <ul style="list-style-type: none"> - The dryer should be operated properly to reach the good quality of the dried products - Requires a small investment
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Table 4. Advantage and disadvantage of the dryer

From table 4, there is a clear indication, that the solar drying is the most suitable for the small scale farmers to cover their needs, during the processing of cash crops. It is also suitable for drying the available fruits and vegetables in the region, to generate income and feed the population through out the whole year.