**United Nations Environment Programme (UNEP)**

**African Rural Energy Enterprise Development Initiative**
**AREED**

# Improving the welfare and increasing the income generation
# by
# the commercialisation
**OF SUSTAINABLE ENERGY TECHNOLOGY**

# Commercialisation of Solar dryer for Agricultural Products

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## EXECUTIVE SUMMARY

In Africa, agriculture is a major source of employment, income and foreign exchange. It offers opportunities to stimulate economic growth.
Capitalizing on these opportunities requires modification of agricultural processing systems and application of sustainable energy technologies. By doing so, will form the basis for the success of the commercialisation of the agricultural products and the applied technology as well.
It is widely believed that substantial amounts of the agricultural products that have been harvested by the small scale cooperatives and rural farmers in Africa have not been commercialised. The same applies for the reliable existing processing technology, such as the solar drying technology, which have not be applied to crops drying or commercialised.

In few African countries, the technology has been tested and further developed. It is was found suitable for drying the following agricultural products[1]:

1. Fruits
2. Vegetables
3. Fish and meat
4. Food crops
5. Cash crops
6. Wood products

This desk study examines the various approaches for the commercialisation of solar dried agricultural products and suitable types of the solar dryers.
Research on small business demonstrates that many potentially agricultural products remain as such and of those, which are dried, only a few are commercialised or stored for own provision during dry seasons. In addition, the rate of which these products and the dryer technologies can successfully be commercialised and improved markedly, is by providing entrepreneurs with an appropriate package of financial and other services through various policies and promotion programs.
The products and the technology commercialisation program is an innovative system designed to assist farmers and entrepreneurs to develop and increase the application of the drying technology, and further to assist them in the commercialisation of the products and the developed technology–based firms. The program seeks to effectively link viable applicable technology, capital and know how to leverage entrepreneurial talent in order to accelerate the development and new companies, and thus speed the commercialisation of the agricultural products and the solar dryer technology.
The following table shows the types of the most available dryers, the level of the end-users (farmers) and the products suitable for drying.

[1] To determine the types of these agricultural products, please see table 1.

| Solar Dryer Type | End-User Level | Product Type |
|---|---|---|
| Low Cost solar dryer | Small scale farmers | – Fruits<br>– Vegetables<br>– Cash crops<br>– Food crops<br>– Fish and meat |
| Solar Dryer PV- powered Medium size dryer | Medium size farmers | – Fruits<br>– Vegetables<br>– Cash crops<br>– Food crops<br>– Fish and meat |
| Solar dryer AC- powered | Enterprises and timber trader | – Fruits<br>– Vegetables<br>– Cash crops<br>– Food crops<br>– Fish and meat<br>– Timber and tobacco |

*Solar dryer types and its suitability to the different product types and to the End-users*

The objective of this desk study is to increase a better understanding of exploiting of all produced agricultural products either by selling them locally, nationally or to export, at the same (time) season they are harvested, or to store the products after the drying for later use during food shortage periods. Furthermore, it is to develop a better understanding among farmers of the best practices, of applying the solar drying technology-based firms. Specifically the following areas are explored:

- There is a substantial amounts of agricultural products in Africa, which need to be dried, and which will make a positive impact on the living standard of the rural and poor farmers by job creation and income generation.
- The solar drying technology incubators plays a role of technological corporations, entrepreneurial networks and associations in incubating the new technology - based firms
- The acceleration of commercialisation of the agricultural products and the solar dryer, will forge a commitment among the producers of the solar dryers and the end- users (the farmers) to break the cycle of poverty

The barriers and risks for penetration of the solar dryer among farmers in Africa are studied and the major ones are identified as follow:

**a.** Barriers

- No established effective trade payment systems, that are essential for smooth trade transaction
- Unavailable initial investment capital or loan facilities
- Limited production capacity
- Poor marketing
- Poor information dissemination
- Poor training of local entrepreneurs and technicians

**b.** Major Risks

- Lack of rainfall to produce agricultural products
- Natural catastrophes like floods and storms
- Unskilled entrepreneurs
- Failed export marked due the poor quality related to the poor hygiene during drying process
- Poor dryer quality and lack of warranty

The study provides a viable recommendation and evaluation tool, that national and international systems (such as AREED), donors communities and NGOs could use to evaluate business ideas meant to accelerate the commercialisation of the agricultural products by accelerating the access and use of sustainable renewable technologies, such as the solar drying. The recommendation set is at section 5, page 28. This recommendation is very essential, and should be considered for the achievement of successful technology production, transfer and commercialisation.
The evaluation tool is suggested as follow:

| | | DRYER TYPE | | | | PRODUCTION KG PER DRYER UNIT | | | | OPERATING COST (US$/year) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | LCD | FWD | ACD | PVD | LCD | FWD | ACD | PVD | LCD | FWD | ACD | PVD |
| CAPITAL COST OF DRYER PER UNIT (US$) | | 100 to 200 | NA | 6000 | 500 to 1200 | | | | | 10 | | 100 to 200 | 10 |
| CATEGORY OF PRODUCE | | | | | | | | | | | | | |
| FRUITS | Mangoes | ✍ | | ✍ | ✍ | 14 Kg/week[2] | NA | | 39[3] Kg/week | | | | |
| | Bananas | ✍ | | ✍ | ✍ | | | | | | | | |
| | Oranges | ✍ | | ✍ | ✍ | | | | | | | | |
| | Limes | ✍ | | ✍ | ✍ | | | | | | | | |
| | Grapes | ✍ | | ✍ | ✍ | | | | | | | | |
| | Apricots | ✍ | | ✍ | ✍ | | | | | | | | |
| | Figs | ✍ | | ✍ | ✍ | | | | | | | | |
| | Pineapples | ✍ | | ✍ | | | | | | | | | |
| | Apples | ✍ | | ✍ | ✍ | | | | | | | | |
| | Almonds | ✍ | | ✍ | ✍ | | | | | | | | |
| | Plumbs | ✍ | | ✍ | ✍ | | | | | | | | |
| VEGETABLES | Tomatoes | ✍ | | ✍ | ✍ | | | | | | | | |
| | Cabbages | ✍ | | ✍ | ✍ | | | | | | | | |
| | Onions | ✍ | | ✍ | ✍ | | | | | | | | |
| | Peppers | ✍ | | ✍ | ✍ | | | | 49 Kg/week | | | | |
| | Potatoes | ✍ | | ✍ | | | | | | | | | |
| | Broccolis | ✍ | | ✍ | ✍ | | | | | | | | |
| | Squash | ✍ | | ✍ | ✍ | | | | | | | | |
| | Asparagus | ✍ | | ✍ | ✍ | | | | | | | | |
| | Celeries | ✍ | | ✍ | ✍ | | | | | | | | |
| | Ginger | ✍ | | ✍ | ✍ | | | | | | | | |
| | Garlic | ✍ | | ✍ | ✍ | | | | | | | | |
| | Other herbs | ✍ | | ✍ | ✍ | | | | | | | | |
| FOOD CROPS | Cassava | ✍ | | ✍ | | | | | | | | | |
| | Maize | ✍ | | ✍ | ✍ | | | | | | | | |
| | Beans | ✍ | | ✍ | ✍ | | | | | | | | |
| | Sweet potatoes | ✍ | | ✍ | ✍ | | | | | | | | |
| | Cowpeas | ✍ | | ✍ | ✍ | | | | | | | | |
| | Millet | ✍ | | ✍ | ✍ | | | | | | | | |
| | Sorghum | ✍ | | ✍ | ✍ | | | | | | | | |
| | Sesame | ✍ | | ✍ | ✍ | | | | | | | | |
| | Groundnuts | ✍ | | ✍ | | | | | | | | | |
| | Beans | ✍ | | ✍ | ✍ | | | | | | | | |
| CA | Coffee | ✍ | | ✍ | ✍ | | | | | | | | |
| | Cotton | ✍ | | ✍ | ✍ | | | | | | | | |
| | Sugar canes | ✍ | | ✍ | ✍ | | | | | | | | |

[2] One week is equal to 5 days
[3] This quantity varies depending on the weather

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tobaccos | ✍ | ✍ | ✍ | ✍ | | | | | | | | |

**LDC**=Low Cost Solar Dryer **FWD**= Firewood Dryer **ACD**= AC powered Solar Dryer **PVD**= PV powered Solar Dryer

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MEAT** | Fish | ✍ | ✍ | ✍ | ✍ | | | | | | | | |
| | Meat | ✍ | ✍ | ✍ | ✍ | | | | 32 kg/week | | | | |
| **WOOD** | Timber | | ✍ | ✍ | ✍ | | | | | | | | |
| | Other type | | ✍ | ✍ | ✍ | | | | | | | | |

Implicit in the above issues are whether the promotion of the dried products and solar drying technology is still the most effective way of commercialisation, and how the alternatives advanced by private producer or entrepreneurial networks and associations support the promotion and the commercialisation process.

In addition the study discusses the question of how the promotion and the commercialisation of the drying technology contributes to the strengthening of the agricultural growth and, hence, help meet the social and economic development challenges of the districts and the system of technology innovation.

According to a survey on solar dryers for drying food and wood in Ghana, made by the Danish Technological Institute and the Danish Institute of Agricultural Sciences, there is definitely a need of food and wood drying. 20 to 25% of the crops are lost due to insufficient drying or maltreatment of the crops. The survey revealed a need for drying of maize, rise, chilli pepper, cassava, cocoa, etc. Maize, cassava, and chilli pepper being the most relevant for the present project. These crops achieve an improved quality by an effective and quick drying process.

In order to increase the value of the agricultural products and decrease complaint from the export market, it is very important to able to dry the products properly.

**The Desk Study:**

The study covers the topic of "The commercialisation of the solar dryer". It is based on information collected from literature, and on information collected from different institution or experienced persons. Literature covering the issue of commercialisation was limited. And despite the short time given to complete this study, the available literature and information was deeply studied and incorporated in this report.
However, the study is also based on my experience gained from Africa (such as Uganda), and my involvement on income generation activities and creation of job to the rural poor.

**Glossary and Abbreviations:**

AC : Alternating current
AREED : African Rural Energy Enterprise Development
CRS : Christian Rural services
DANIDA : Danish International Development Agency
DC : Direct Current
FED : Forum for Energy and Development
GDCP : Ghanaian Danish Community Programme
GFA : Gukwatamanzi Farmer Association
HNSDA : Hoima Nursery schools Development
HTDC : Health Technology Development Centre
MS : Danish association for International cooperation (mellemfolkeligt Samvirke)
UNFA : Uganda National Farmers Association
UNEP : United Nations Environment Programme

## I. Introduction to the Agricultural Harvest Potential and Importance

The favourable soil conditions and climate have contributed to the agricultural success of the five countries, Botswana, Ghana, Mali, Senegal and Zambia[4] (to be covered by this study). Most parts of the countries receive adequate rainfall for the production of arable crops.
Although in some countries there is only one growing season each year, and the irrigation is required for crop production during the dry season.
In the majority of the countries, temperatures vary only a few degrees above or below 25°C, but are moderated by differences in altitude. These conditions have allowed continuous cultivation in the different parts of the countries. Although population growth has created pressures for land in a few areas, land shortages have been rare, and still a part of the estimated area of arable land is not under cultivation.
The main food crops have been plantains, cassava, sweet potatoes, millet, sorghum, corn, beans, and groundnuts. Major cash crops have been coffee, cotton, tea, and tobacco.
Vegetables, fruit and food crops which are suitable to be processed for later use are mainly tomato, green and red paper, cucumber, mango, oranges, banana, grape fruits, etc.
Although, many farmers can not sell the food crops to meet their short-term expenses and generate income.
Technological improvements had been delayed by economic stagnation, and agricultural production still used primarily unimproved methods of production on small, widely scattered farms, with low levels of capital outlay. Other problems facing farmers included the disrepair of the nation's roads, the nearly destroyed marketing system, increasing inflation, and low producer prices. These factors contributed to low volumes of export commodity production and a decline in per capita food production.

## II - The Case of Commercialisation

### A. Description of the Commercialisation

Commercialisation of the agricultural products and the processing technology involves any possible configuration or scheme that allows those who invest in the production or in the technological innovation - such as small scale farmers/producer, private firms/companies or others, to capture some of the economic benefits generated by their innovation or their produced agricultural products.

### B. Adoption of the Commercialisation

The focus of this Desk study is on farmers/producers and the processing of agricultural products by using a transferred or local produced processing technology and their ability to appropriate economic benefits from the end-users of this processing technology and the processed agricultural products.
The adoption of the technology by the farmers and the processed agricultural products by consumers, can contribute to raise a required amount and a source to generate income for sustaining the agricultural production and a continuous development of the technology.

[4] For example in Zambia approximately 48 million hectares could be considered suitable for the agricultural purposes. Large parts of this, while subject to some limitations, have the capacity to produce a variety of arable crops on a sustainable basis.

And for that reason commercialisation is part of the sustainable seed provision or risk capital through loans or taking shareholding in a company – *the AREED approach*.

The AREED approach is focused on the income generation from the agricultural harvest and the developed and applied processing technology. However, this desk study treats the commercialisation, which is the most focused in the sense that is an on-going process, which involves numerous diverse activities.
The commercialisation contributes to the improvement of the following:

- The production efficiency,
- The development of the technology and it's transfer

Such efficiency gains can be significant and can assist to:

- The long-term sustainability of the AREED program,
- The ability of the farmers long term cultivation and production planning
- The further development of the applied technology.

The commercialisation is meant to open new possible ways to explore the possible markets, such as the local market, the regional/national market and the export market.