Agricultural and various food products have been dried by the sun and wind in the open air from generation to generation. The purpose is either to preserve them for later use, as in the case with food: or as an integral part of the production process as with fruits, vegetables, fish, meat products, spices, medical plants, tea, coffee, maize and timber.

Ti Customs Ltd as an engineering solutions company is providing innovative solutions in agricultural engineering and energy.

Trans Nzoia and Uasin Gishu Counties in Kenya are the leading producer of maize in the country. However, farmers in the region experience difficulties finding storage facilities and maize dryers. Most of the
maize ends up contaminated through poor storage and drying systems because farmers are still using conventional maize sun drying that cause common problems such as:

- Wet maize due to short rains during harvesting season leaving farmers with no choice but to store their maize without proper drying causing the maize to rot and spreading aflatoxin
- Storing the maize without drying makes the farmer purchase pesticides which keep the maize free from bacteria but the total cost incurred on farmers using pesticides increases
- Rejection of maize from millers because of poor quality of maize

SOLAR MAIZE DRYER FOR TRANS NZOIA COUNTY IN KENYA

Since traditional storage and direct sun drying is not suited for shelled maize, Kenyan farmers may need to consider a new kind of solar type maize dryer. Farmers only store marketed maize for a short period of time, until they could arrange delivery to the marketing board. As we have seen in the global agricultural presence, liberalization of farmers has been faced with a wider variety of marketing situations. If there is a buyer that can sell their maize immediately and not worry about storage but if there is no buyer then they have to store their maize until such time as they can arrange sale. Moreover, Kenyan farmers may deliberately want to hold on to their maize for some months in the hope that the price will rise.

Storage requirements have changed significantly from the days when the farmer only has to worry about storing his own food requirements and some seeds for the next planting season. This is nearly always a local variety of maize and stored on either the cob, with or without the use of pesticides, in a closed store (solar type/hybrid dryer). However, maize for marketing is now mainly hybrid maize which, because of its shorter and looser husks, should ideally be stored shelled in a closed store with the use of pesticide. In fact, the spread of the Larger Grain Borer in the region makes the use of good storage essential.

Maize reaches physiological maturity between 130 and 160 days after planting, depending on the variety At this stage the crop has a moisture content of about 30 percent, and can be harvested provided that adequate Solar drying facilities are available. However, small-scale Kenyan farmers often harvest their maize long after it has reached physiological maturity, largely because they lack suitable drying facilities. Harvesting may be delayed by up to two months in order to allow the maize to dry. In some countries it is also common for the cobs to be left in the field for a further period, on piled, cut maize stalks.

Delayed harvesting leads to many problems. In general it can be said that the longer maize stays unprotected in the field after it has reached full maturity, the higher the losses. Reasons for this are:

- It is exposed to attacks by termites, rodents and domestic animals;
- It can be infested by insects.

Advantages of a Solar Food Crop Dryer
· Dried foods are tasty, nutritious, the nutritional value and flavor in food is only minimally affected by drying
· Dry foods are high in fiber and carbohydrates and low in fat making them healthy food choices
· Vitamin A is retained during drying
· Storage space is minimal; Easy to store
· Transportation costs are reduced i.e dried products weigh only about a sixth of the fresh food products
· The energy input is less than what is needed to freeze or can
· Easy to prepare; Solar food drying is a very simple skill
· Protection of the dried products from contamination by animals or insects
· Protection from rain
· Protection from pollution by dust particles
· Reduction of drying time (reduces changes through spoilage)
· Longer storage of dried products (because of more complete drying)
· Good production quality can open new markets and is a good start up technology
· You can have up to more than 50% more productivity in agriculture but more expensive than with direct sun drying

Practice oriented results in original language:
NA

Concrete problems addressed by project (original language):

Problem Statement

· Inadequate infrastructure in Kenya
· Insufficient processing capacities
· Growing market difficulties by intensifying competition in the worldwide agricultural market
· Improve population income and supply situation
· The main problem with an automated Solar powered dryer is the fan. The fan should be inexpensive, durable and produce high flow rates at a high pressure while having a low power consumption in order to keep the price of the solar crop dryer down and at the same time ensure an efficient drying process.

Strategic Goal Alignment

· Effective in reducing pathogen numbers to a safe level
· Adequately develop innovation in food processing to address various variations in product environment or process conditions
· Integrate food security and nutrition technology processes to address acute malnutrition and food insecurity among valuable populations in Kenyan regions that are hunger stricken
· Protect the environment by using efficient Solar and Biogas energy mechanisms
· Improve the quality of life and diversification of the rural economy
· Combat solar and weather change effects
· Deliver growth and job opportunities
· Lower greenhouse gas emissions to 20%, generate 20% of energy from renewable such
REASONS AND NEEDS

1. Maize is physiologically mature, that is it ceases to grow and accumulate more dry matter, when the grain moisture content ranges between 30 and 35 percent. At this stage, the grain is still a living organism and, as such, it respires.
2. Respiration causes the production of heat, carbon dioxide and water. The higher the temperature and moisture content, the higher the respiration rate and the higher the loss of dry matter.
3. The ideal moisture content for storing maize is below 13 percent. For every 1.5 percent of moisture content above that grain deterioration doubles.

An appropriate Solar drying facility for use by small farmers should:
4. Enable the farmer to avoid field drying by permitting adequate drying of maize with a starting moisture content of around 30 percent.
5. Utilize locally available building materials where possible.
6. Protect the maize against termites, rodents and other animals (pest control).
7. Protect the crop against rain.
8. Not require too much skill to construct.

Target group (original language):
1. Farmers in Trans-Nzoia and Uasin Gishu counties in Kenya
2. Business owners such as millers and food product warehouse owners.
4. Non-profit organizations.

Main expected outcomes (fill in if the innovative action or project is still ongoing):
1. Efficient and sustainable Solar dryer energy mechanisms. 2. Most of the outcome is heavily constructed around the innovative step in building customized control systems. 3. Cheap DIY (Do-It-Yourself) product installation. Ti Customs Ltd wants to help its target group in saving finances for building a convenient solar maize dryer.

Main activities to obtain the objectives:

Project name of innovative action or project (English):
Solar Maize Dryer for Trans-Nzoia and Uasin Gishu Counties in Kenya

Additional information:
NA
Description in english:
An automated solar drying system uses methods of using the sun's energy for drying but excludes the open air sun drying. The justification for solar dryers is that they may be more effective than sun drying but have lower operating costs than mechanized dryers. A number of designs are proven technically and with none yet have widespread use in Kenya and the optimism about their potential. The only potential problem is equipment that is expensive and requires substantial quantities of fuel and electricity for operation.

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