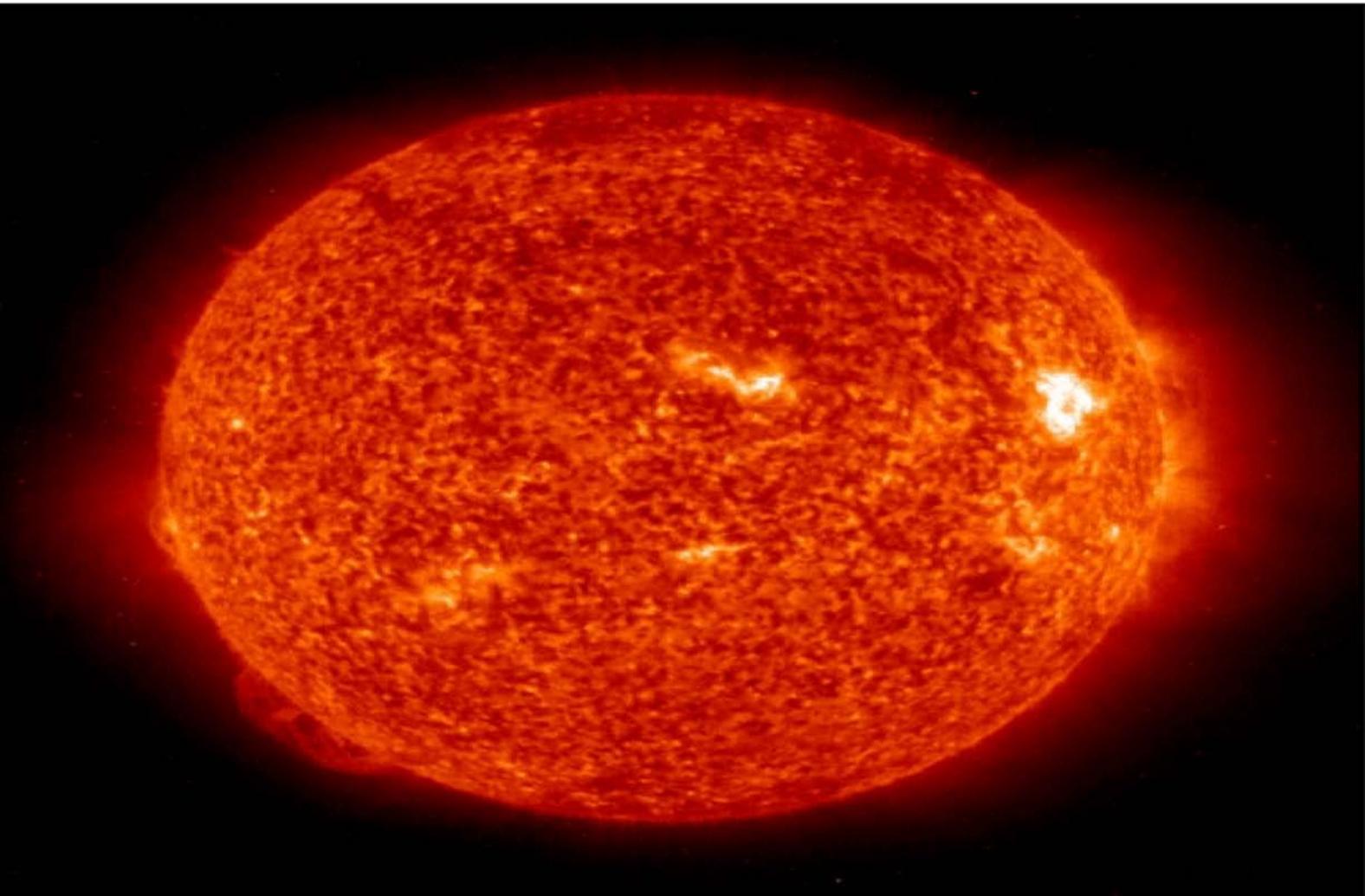


SOLAR Manual



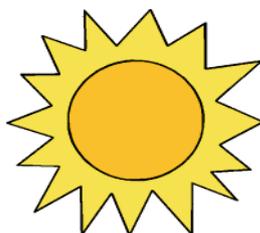
SOLAR ENERGY APPLICATIONS IN RURAL AREAS

Publication Data

August

2009

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RCDA / WECF 2009



Rural Communities Development Agency



WECF - Women in Europe for a Common Future

This publication was realized with the support of



Solar Partner Süd GmbH

This manual was realized with the support of 4 French students during their internship at RCDA. The students followed a University licence for Mastering Renewable Energy- Electricity at the Université de Savoie, based in Annecy, and conducted in partnership with lycée Jean Monnet in Annemasse. They benefited from a bursary « Explora » financed by the Rhône-Alpes Region. The University in Annecy also subsidised this mission.



Netherlands Ministry of Foreign Affairs and the European Commission DG development

Different Applications of Solar Energy

Solar energy refers primarily to the use of solar radiation for practical ends. However, all renewable energies, other than geothermal and tidal, derive their energy from the sun.

Solar technologies are broadly characterized as either passive or active depending on the way they capture, convert and distribute sunlight. Active solar techniques use photovoltaic panels, pumps, and fans to convert sunlight into useful outputs. Passive solar techniques include selecting materials with favorable thermal properties, designing spaces that naturally circulate air, and referencing the position of a building to the Sun. Active solar technologies increase the supply of energy and are considered supply side technologies, while passive solar technologies reduce the need for alternate resources and are generally considered demand side technologies

Architecture and urban planning

Sunlight has influenced building design since the beginning of architectural history. Advanced solar architecture and urban planning methods were first employed by the Greeks and Chinese, who oriented their buildings toward the south to provide light and warmth. The common features of solar architecture are orientation relative to the Sun, compact proportion (a low surface area to volume ratio), selective shading.



Passive solar house designed specifically for the humid and hot subtropical climate

Agriculture

Agriculture seeks to optimize the capture of solar energy in order to optimize the productivity of plants. Techniques such as timed planting cycles, tailored row orientation, staggered heights between rows and the mixing of plant varieties can improve crop yields. While sunlight is generally considered a plentiful resource, the exceptions highlight the importance of solar energy to agriculture.

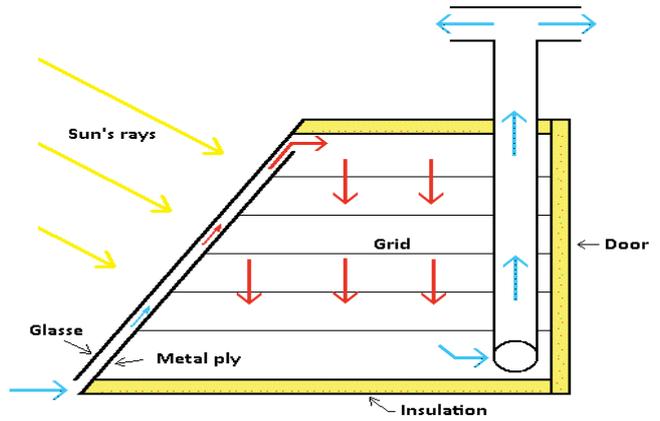
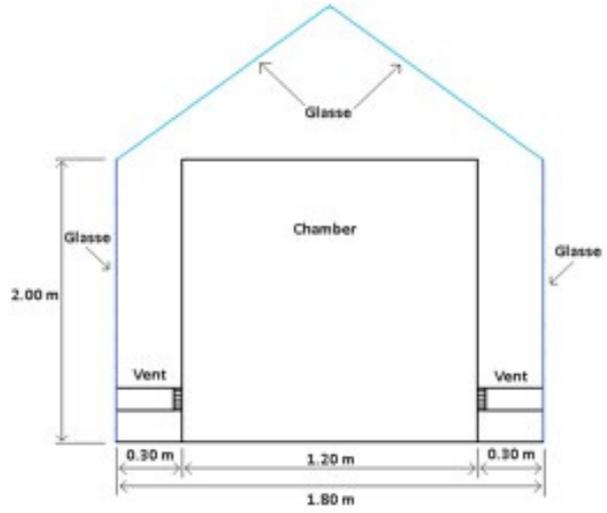
Solar energy can supply and/or supplement many farm energy requirements:

Crop and grain drying

Using the sun to dry crops and grain is one of the oldest and most widely used applications of solar energy. Solar dryers protect grain and fruits and vegetables, reduce losses, dry faster and more uniformly, and produce a better quality product than open-air methods.

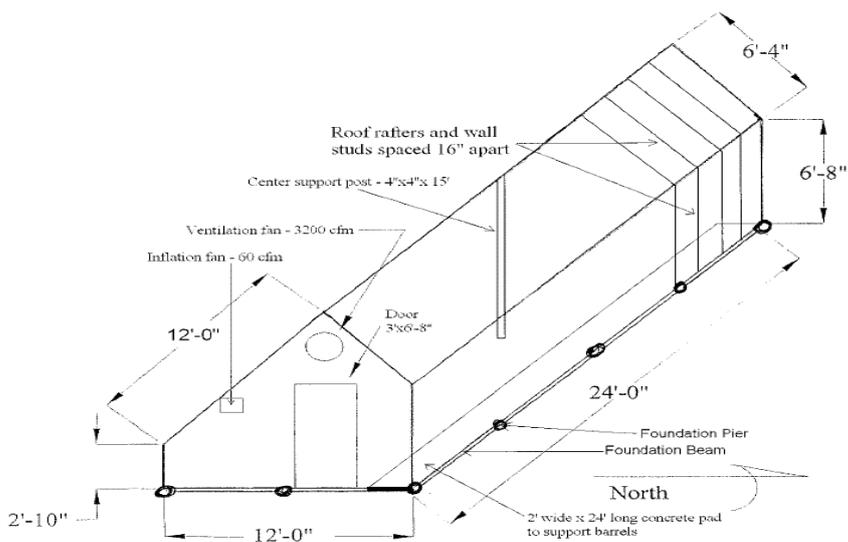
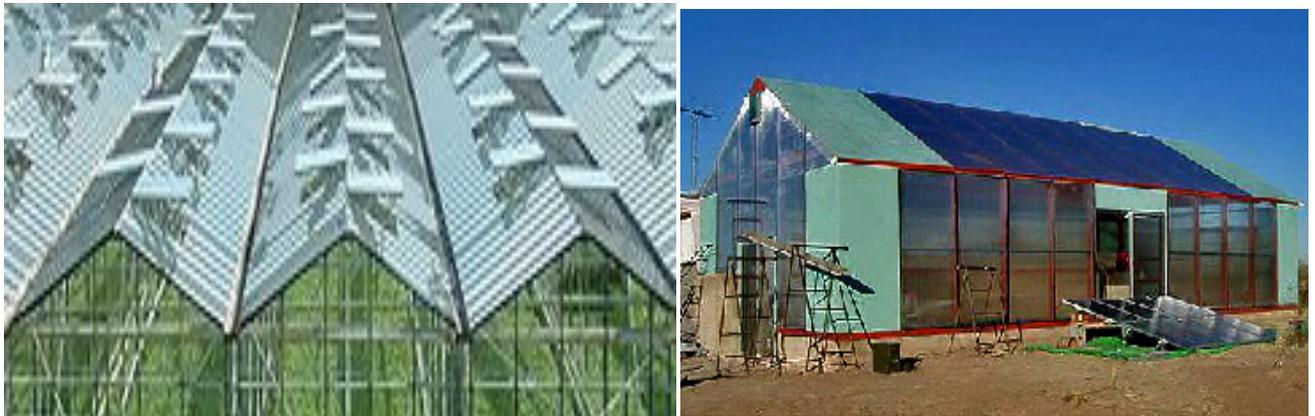
The basic components of a solar dryer are an enclosure or shed, screened drying trays or racks, and a solar collector.

In the pictures on the next page, different types of passive direct and indirect solar dryers for fruits and vegetables are presented.



Greenhouse heating

Another agricultural application of solar energy is greenhouse heating. Solar greenhouses are designed to utilize solar energy for both heating and lighting. A solar greenhouse has thermal mass to collect and store solar heat energy, and insulation to retain this heat for use during the night and on cloudy days. A solar greenhouse should be oriented to maximize southern glazing exposure.



Air and water heating in agriculture

Livestock and dairy operations often have substantial air and water heating requirements. Modern pig and poultry farms raise animals in enclosed buildings, where it is necessary to carefully control temperature and air quality to maximize the health and growth of the animals. These facilities need to replace the indoor air regularly to remove moisture, toxic gases, odors, and dust. Heating this air, when necessary, requires large amounts of energy. With proper planning and design, solar air/space heaters can be incorporated into farm buildings to preheat incoming fresh air. Dairy farms use large amounts of energy to heat water to clean equipment, as well as to warm and stimulate cows' udders. Heating water and cooling milk can account for up to 40% of the energy used on a dairy farm. Solar water heating systems may be used to supply all or part of these hot water requirements.



Solar milk pasteurizer



Water heater for animals

Solar cooling

Lack of refrigeration is perhaps a one of the problems in rural areas. Without refrigeration, food-borne diseases spread more rapidly. Farmers also can't store their crops in hopes of getting a better price. Thus, the solar devices like this could help improve health and local economies.

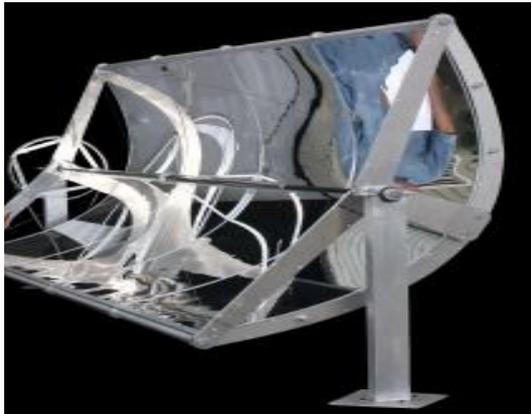
Using the sun for cooling has been considered for a long time to be an excellent application for solar energy because the air conditioning load corresponds with daylight hours. Sun concentrators shown in the picture can be more efficient and take less space than photovoltaic panels



Solar milk cooler



Solar air conditioner



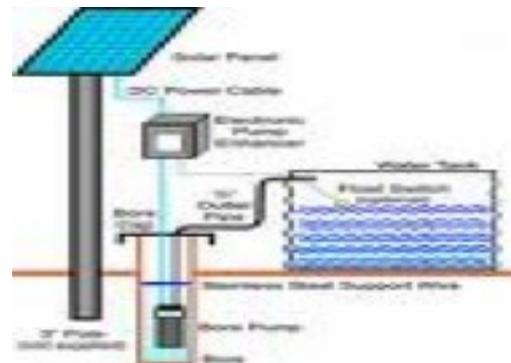
Solar refrigerator

Water pumping

Photovoltaic (PV) water pumping systems may be the most cost-effective water pumping option in locations where there is no existing power line. When properly sized and installed, PV water pumps are very reliable and require little maintenance.



Solar water pump

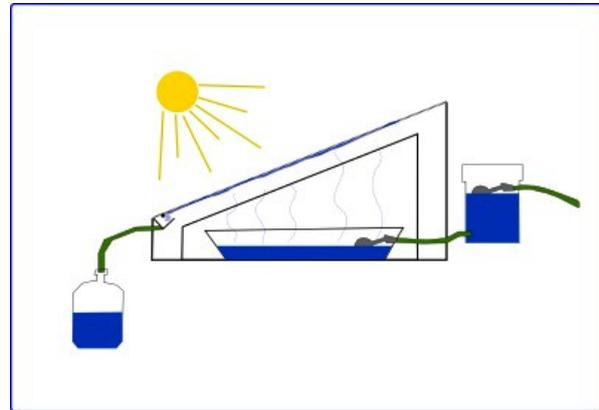




A solar powered water pumping system for livestock

Water treatment

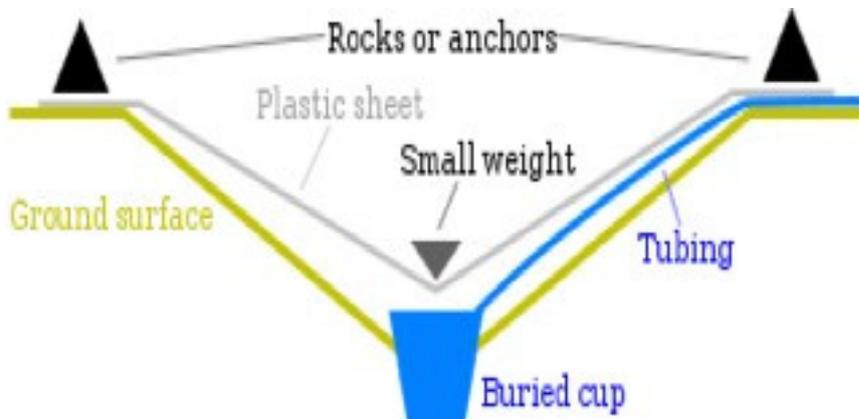
Solar energy can be used for water distillation, water disinfection, and water stabilization to treat waste water without chemicals or electricity, for detoxification of contaminated water via photolysis, sewerage treatment at the community level.



Solar water distillator

Solar Still: The sun is allowed into and trapped in the still. The high temperatures produced destroy all pathogens. The water evaporates, and in this process, only pure water vapor rises in the still, only to condense on the glass. There are no moving parts in the solar still, and only the sun's energy is required for operation.

These stills can operate in passive, active, or hybrid modes. Double-slope stills are the most economical for decentralized domestic purposes; while active multiple effect units are more suitable for large-scale applications.



Solar still built into a pit in the ground

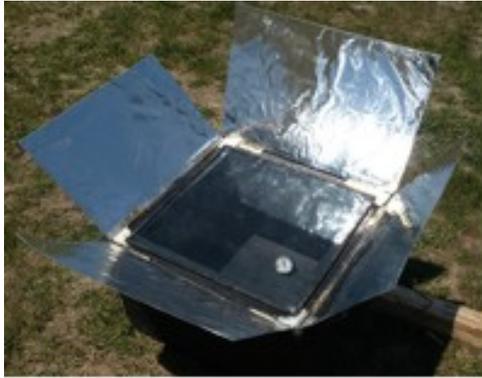
Electricity supply

Solar electric, or photovoltaic (PV), systems convert sunlight directly to electricity. They can power an electrical appliance directly, or store solar energy in a battery. A "remote" location can be several km or as little as 15 m from a power source. PV systems may be much cheaper than installing power lines and step down transformers in applications such as electrical fencing, lighting, and water pumping.



Cooking

Solar cookers use sunlight for cooking, drying and pasteurization. They can be grouped into three broad categories: box cookers, panel cookers and reflector cookers



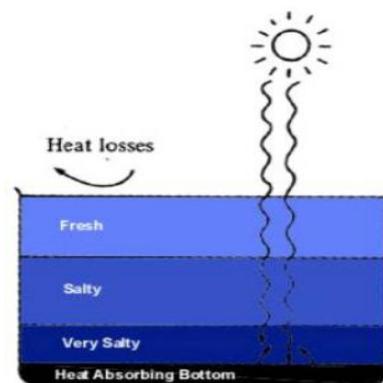
Solar box cooker



Solar Reflector Cooker

Solar ponds

This is large-scale solar thermal energy collector with integral heat storage for supplying thermal energy. A solar pond can be used for various applications, such as process heating, desalination, refrigeration, drying and solar power generation.



Solar chemical processes

Solar chemical processes use solar energy to drive chemical reactions. These processes offset energy that would otherwise come from an alternate source and can convert solar energy into storable and transportable fuels.

Afterword

Taking energy from the sun is a natural process. Plants absorb the sun's rays and store the energy; animals and people eat the plants, taking the energy. Solar power is the term for using the sun's energy to power a device or an electrical system. When solar systems/devices are properly positioned -- on [Earth](#) or in space -- they can be very effective. With many environmental concerns and changes, we are in the midst of a world-wide movement to protect our eco-system with energy saving technologies, recycling, and the protection of natural resources.

It will take concentrated efforts and continued education to develop sustainable livelihoods today to help protect the generations to follow.