

Solar Hybrid Cooking

Solar hybrid cooking combines three elements.

1. A solar thermal collector.
2. A cook stove, which would preferably use a renewable fuel.
3. A straw box or retained heat cooker.

The advantage of this system is that it can be used day or night under any weather conditions, and solar can make a contribution even if there is not enough insolation for direct solar cooking. In addition, food can be prepared faster, cooked more evenly, and with less effort. With the use of a straw box cooker, large quantities of food can be prepared without burning the food at the bottom of the pot. A shelter in Ukiah, California could never cook large quantities of food without burning until they tried retained heat cooking. When using a straw box cooker, the cooking requires less attention. If a pot of rice is being prepared, the brown rice will be cooked hot and ready to eat in 50 minutes, or can be left for 2 hours.

The hot water heated in the thermal collector could be used for cooking or for washing, etc. Storing this water in an insulated container will provide hot water that night or the next morning. There are other possibilities for keeping stored water warm over night. Taking a more complete system approach, I stored the hot water generated in a bag-type solar shower in a Sun Frost "Scrap Eater" composter. The composter was 140°F and the next morning the water was hot enough for a very hot shower.



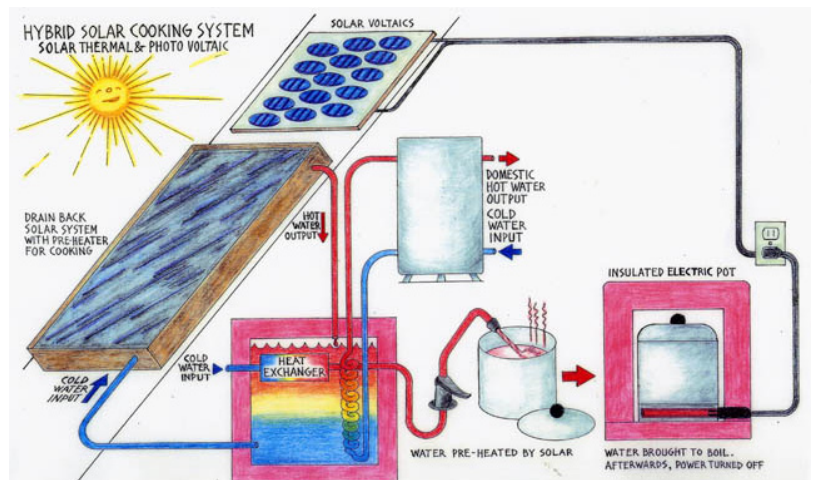
Sun Frost "Scrap Eater",
See www.sunfrost.com.

Solar hybrid cooking systems could be effective in either a developed or undeveloped country. I recently used this concept in a new home. The home



Grid-tied home utilizing hybrid solar cooking.

uses a drain-back hot water system for space heat and hot water. A separate heat exchange at the top of the storage tank skims off the hottest water. This water is dispersed through a separate faucet at the kitchen sink.



PV pumped solar hot water collector for drain-back hot water system.

On a typical summer day, 185°F was instantly available at the kitchen sink. This water could make a good cup of tea without further heating. The kitchen does not have a conventional stove. Instead of a stove, pots and frying pans with built in electrical heating elements and thermostats are used. Electricity is supplied by a grid-tied PV system. The heat in this type of pot is highly controllable and 90% of

the electrical energy goes into heating the food, when making hot water or a dish like rice. Also with electrical cooking there are no combustion gasses-from propane, wood or other fuels. With the use of per heated hot water a quart of brown rice could be cooked with only 1/20 kWh of electricity on a sunny day this can be provided by a 10 watt PV panel. In other words, you could cook 40 lbs of rice with one kWh of electricity. Baking and frying can also be easily carried out with electrical pots. We constructed a well-insulated oven and were able to cook 3 one-pound loaves of bread with 0.4 kWh of electricity. Frying can also be done in insulated pans to greatly reduce energy use. Low thermal mass pans and ovens are more efficient since no energy is wasted heating up the pan or oven.

How much energy does it take? Pushing the Limits

Assuming that a person eats 5 pounds of hot food per day on the average the energy needed to heat this food from room temperature to boiling, 212 °F, would be about 700 BTU's. (Most food is actually fully cooked at 180 ° F). This is about 1/5 of a kWh or the energy contained in 1/10 of a pound of wood. This figure seems surprisingly small because most of the energy used in the cooking process is typically wasted.

If cooking a meal heats up your kitchen, the vast majority of the energy your using is not going into your food but into your kitchen or up the chimney.

The 1/5 kWh/day for cooking could be daily cut in half with solar hybrid cooking. If the water were per heated to only 140° the energy needed for cooking a days worth of food could be roughly cut in half.

Solar Hybrid Cooking in Developing Countries

The solar thermal collector could be as simple as a pot in the sun. It could also be made more sophisticated so that higher temperatures could be attained. Insulating the solar heated water will make hot water available at night and the next morning. An efficient wood stove or a three-rock fire could supply the additional heat. The insulation for the straw box cooker pot could be made from local materials (e.g., straw, pumice, charcoal, etc.) To make the system truly efficient, optimum times for presoaking beans and rice should also be investigated.

In summary, solar hybrid cooking is a method of making well-cooked food conveniently at any time during the day with less energy.

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