Why the Global Alliance for Clean Cookstoves must adopt Integrated Cooking

Those of us involved in the promotion of solar thermal cooking technology do not advocate a solar-only solution**.** Since the sun does not always shine, we understand that people must also use combustion (wood burning, ethanol, LPG, biomass) stoves.

However, since the sun does shine a lot in most of the developing world, we believe that people in those countries should have access to one of the simple solar thermal technologies that will allow them to tap into this endless supply of free, zero-emissions energy for cooking and heating water.

We advocate the combined use of three cooking devices (solar thermal, combustion, and retained heat) to achieve maximum smoke reduction and fuel efficiency, and we urge the Global Alliance to promote this system, known as *Integrated Cooking* or *Solar Plus* cooking.

Those of us in the west with modern kitchens and easy access to electricity and natural gas use multiple cooking devices in our kitchens every day. With adequate training and follow-up, women in the developing world (especially those without electricity) can also learn to use several cooking devices in a coordinated fashion to achieve maximum fuel efficiency and smoke reduction.

Tens of thousands of Darfur refugee women in Chad are already employing the integrated cooking method with the combined use of solar CooKits, hand-made retained heat cooking baskets and German-made Save 80 wood burning stoves provided by GTZ.

The key fuel-reducing principle of integrated cooking is to refrain from burning precious fuels in combustion stoves during the day when you can use free, zero-emission sunlight with an appropriate solar thermal cooking device.

The second principle of integrated cooking is to use a retained heat container with both combustion stoves (to do the simmering) and solar thermal stoves (to keep food cooked during the day, piping hot until after dark).

There are various types of integrated cooking systems already in use around the world that employ two or all three of the devices I mentioned above. A number of these are combining solar cookers with LPG or biogas. One example is the solar taqueria in Mexico, a commercial project, which might attract investors through the Alliance. These devices are ideal for cooking many ethnic foods in urban settings around the world. They have an LPG back-up.

Bangladeshi woman cooks with solar cooker during a flood

There have been discussions among GACC fuel experts about how to cope with wet wood or other combustibles that are not completely dry. After a big storm or hurricane, when everything including fuel is soaked, the sun usually comes out within a day. If women understand integrated cooking (and if they have

the proper equipment) they can use solar and retained heat cooking devices until their fuel is dry like the woman pictured in Bangladesh is doing as she cooks a meal on the roof of her flooded house with a parabolic solar cooker. Even though her house is flooded, she can also provide her family with safe drinking water safe by boiling it in this device.
There are many examples of integrated cooking, including one in India that combines the use of solar cookers and biogas-makers. Here's a link to a short video from Indian TV on the smokeless village project, which has used these two technologies to eliminate the burning of wood and charcoal. If you watch the video you will see that people are even ironing their clothing using the heat of the sun. When I attended a solar cooking event in India two years ago, I bought one of those irons and tried it out in my backyard with a parabolic solar cooker. It worked great as you can see in this short video, which also shows how I made tea with my parabolic cooker during the blizzard of 2010.

One of my box cookers, the Sun Oven, a highly insulated version made for campers and ice fishermen in Illinois reached 300° F (150° C) while sitting on a snowbank between storms during that same blizzard. My electricity was off for two days and when the sun was out, this was how I cooked.

During a presentation on institutional cooking at the February 2011 PCIA conference in Lima, solar thermal energy was dismissed as impractical for institutional cooking, but the only solar cooker shown in the presentation on institutional cooking was the one-pot, cardboard and foil solar CooKit, which is intended for use by low income families. Scheffler Community Kitchens are used in India, Afghanistan, Haiti, Mexico, Egypt, Argentina, Namibia, Burkina Faso and elsewhere to provide heat and steam for large-scale cooking systems with LPG or woodstove backups for cloudy days. The larger systems even have heat storage capacity for nighttime use. A BBC report about the Global Alliance featured a video clip of a Sheffler, which the reporter described as "the cleanest of all stoves".

Heat-retention cooking in India

An example of integrated cooking on an institutional level can be seen at the Barli Development Institute for Rural Women in Indore, India. They use three Scheffler reflectors, which allow their students to cook during the day inside a clean smoke-free kitchen using only the light of the sun. Inside the kitchen, the women also have large, wooden retained heat cooking boxes in which they store institutional sized pots of cooked food that can be served hot in the evening. They also have a wood burning stove, which is used as a back-up.

The photos below show the Barli students making *chapatis* on top of an indoor, solar-powered oven. The third photo shows the hole in the wall of their kitchen where concentrated sunlight enters. The Scheffler reflecting mirror is on a weighted timer, which tracks the motion of the sun automatically. The fourth photo shows a Scheffler reflector outside a solar bakery in the altiplano of Argentina.




One of the Scheffler reflectors at Barli Institute heats a storage unit, which allows cooking at night.

Women at the Barefoot College in India are using their new welding skills to build their own Scheffler reflectors for community kitchens in their villages. How's that for women's empowerment?


In India, a country that is blessed with abundant sunshine, engineer Deepak Gadhia has taken the Scheffler reflector to a commercial scale, with massive rooftop solar thermal arrays that can

cook tens of thousands of meals each day. He also bundles these projects for carbon credits using the clean development mechanism.

The selection of a particular solar cooking device depends upon the cuisine, the income, the degree of solar insolation in the region and the size of the family. I disagree with the argument that solar cooking does not work where people have to 'beat the hell out of their food". The reason they have to beat their *ugali* and other boiled grains when cooking over an open fire is because the food will burn if it is not stirred vigorously. Ugali can actually be made quite easily in even the simplest and cheapest of all solar cookers, the Cookit as you can see in this video on Solar Cooking in Africa. The ugali cooks slowly and evenly like polenta in a solar box or panel cooker. When the food is cooked and the steaming pot is opened, the woman whips it with a spoon for about thirty seconds to give it that familiar mashed potato consistency, and it's ready to eat. The pot is also very easy to clean since there is no heat concentration at the bottom of the pot, thus less water needed for washing.

This model allows apartment dwellers to cook on their balconies

Some have argued that solar cookers are not suitable for urban settings. They actually work just fine even in small patios as long as they receive at least three hours of mid-day sun. They can be used by men like an urban dweller in Pakistan who is cooking his lunch. Solar cookers can be used to cook food on the ground, on a table top, and even on the top of a car in the middle of a city. There is no fire danger with panel and box solar cookers since, unlike parabolic cookers, they do not reach combustion temperatures. Also the reflectors never get hot, they only bounce sunlight onto the cooking pot. Another solar cooker that can be used in urban (even high-rise settings) is the 3/4 parabolic solar cooker pictured here.

Some people assume that solar cookers use photovoltaic (PV) power. They do not. Solar cookers use only direct solar thermal power. PV is not appropriate for solar cooking especially in rural areas since a one burner hot plate needs a 100 square ft. rooftop solar panel to generate enough electricity to reach cooking temperature.

I have found that within the fuel efficient stove community there is also minimal interest in retained heat cookers, which are also known as hay box cookers, fireless cookers and wonder box ovens. These devices are even more efficient when used with a pressure cooker . One of the times I demonstrated an integrated cooking system at the Pentagon, some Special Forces members told me that they learn retained-heat cooking as part of their survival skill training. It allows them to cook their food during the day, bury it in a hole stuffed with leaves and grasses, and then dig it up at night so they can have a hot meal without lighting a fire that might give away their position.

The only barrier to the widespread use of retained heat cooking is the need for intensive education, training and follow-up, since these devices (which can cut fuel use by more than 1/3)

can be made from found materials, have no moving parts and will never wear out. The use of retained heat cooking eliminates the need for a simmer function (and the need for breakable moving parts) on biomass stoves since once the food it brought to a rolling boil it can be placed in the retained heat cooker to complete the cooking cycle.

One complaint heard frequently about solar cookers is that they take too long to cook. It's true that panel and box solar cookers heat up slowly and cook food like a crock pot. However, if the time needed to gather fuel, cut it into small pieces or press it into briquettes, get it lighted and burning on its own is compared to the time it takes to slow cook food in a solar cooker, the time factor becomes somewhat more equal. Parabolic solar cookers on the other hand cook as fast and as hot as an open fire although with zero emissions and free fuel. They can roast meat and even boil snow.

Tea shops like the many I saw in Afghanistan are ubiquitous throughout rural China, India and in the Islamic world. In order to keep their pots simmering all day long these shops burn up mountains of wood and charcoal. The use of a parabolic solar cooker on sunny days can dramatically reduce fuel consumption for these shops and can save tea shop owners many of whom are women, hundreds of dollars each year.

Portable parabolic solar cookers made of bamboo, yak wool, and Mylar are being developed by One Earth Designs for use by herding communities in the Himalayas.

I hope that the Global Alliance for Clean Cookstoves will find the above information of use as we move forward with our very exciting mission to provide 100 million homes with clean cookstove technology by 2020.