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Some Remarks on Stove Technologies

see also: http://solarcooking.wikia.com/wiki/Dieter_Seifert

To contribute to the discussion, I want to propose some remarks on the dissemination of stove technologies:

A) About cooking in closed rooms

A1) Stoves that are operated with solid fuels need a chimney or they are to be operated under a hood.
A2) Electric ovens can be operated in closed rooms.
A3) Gas stoves need regular ventilation of the room.
A4) Solar cookers produce no emissions, but the operation in closed rooms requires indirect use (with heat carrier) or a deflection of the radiation from outside. The operation of the solar cooker outside the house is usually acceptable if the cooker doesn't have to be turned often to follow the sun, e.g. box cookers and concentrator cookers with "deep focus" with high power like SK14 which may be quickly orientated towards the sun every 20 minutes.
A5) Stoves that operate with kerosene as fuel should be used outdoors because of the fumes.
A6) Synthetic fuels can be expected to be developed/disseminated that can be operated in ventilated interiors.
A7) Thermos technology (a.k.a. fireless cooking, heat-retention cooking) produces no emissions and can be used in enclosed spaces.

B) Conditions for the dissemination of a cooker technology

B1) The desired cooking tasks can be carried out.
B2) The necessary "fuel" is available and affordable.
B3) The operation is simple, easy-to-learn and safe. Inhalation of fumes has to be avoided.
B4) A safety analysis (e.g. HAZOP) should be performed regarding the application conditions.
B5) The stoves are affordable resp. accessible.
B6) There are no insurmountable "cultural obstacles".

C) Notes on acceptance of various stove techniques:

C1) Cooking with firewood with an open fireplace has been accepted for centuries as the standard cooking method.
C2) Firewood stoves and coal stoves with an oven plate (possibly with included oven for baking and a hot water tank heated by the exhaust stream), with stovepipe to the chimney, has been accepted for centuries[1] . However, these may have a higher fuel consumption than open fires.
C3) Coal stoves cause serious environmental pollution (smog, etc.).
C4) Charcoal stoves are mainly used in urban households in Africa (and Haiti). Charcoal can be transported over hundreds of kilometers. The deforestation caused, however, has terrible consequences.
C5) Acceptance of electric cookers and gas stoves (LPG in pressurized cylinders) is probably the highest.

[1] see: http://www.ofenmuseum.de/index.php/fachkundliche-beitraege/fotostrecke-zum-bestand

With gas stoves, a safe technique and a supply system for the pressure cylinders are essential.

C6) Petroleum stoves are unpopular due to the odor and the risks, but these are widespread.

C7) Acceptance of solar cookers is highly dependent on the local conditions (sufficiently high number of annual sunshine hours, demand for boiled water, importance of food preservation, problems with fuel supply, etc.) and are of interest to those running school programs. Acceptance of solar cookers of low power and a short lifespan will not be long-lasting.

C8) The acceptance of "Thermos Technology" (retained-heat cooking; fireless cooking) is high. The problem seems to be the information, because the heat-retaining container (hay box, hay basket, wonderbag, etc.) can be prepared almost everywhere at a low cost. See also: http://solarcooking.wikia.com/wiki/Heat-retention_cooker.

C9) Combination of different cooking technologies is advantageous and may be necessary.

C10) Acceptance is usually not affected by concerns about environmental or climate change, because long-term consequences are usually not considered. To bring about a sea change to sustainable techniques, permanent institutions and programs (Innovation Institutes, Innovation Workshops, TV programs, etc.) promising millions of jobs in developing countries are needed.

Acceptance of a stove technology of course depends on a variety of influences. One of these points is to impart practical skills for successful application. This may be done by the education system. For solar cooking this is a fantastic opportunity because the solar cooker can be used as a part of many school subjects.

D) Remarks on ecological effects

D1) If millions of stoves are to be adopted by the world's households, it is important that these meet high environmental objectives.

D2) Climate damage occurs when tree populations decrease due to their use as fuel. The burning of 1 kg of wood produces a CO_2-emission of 1.68 kg (with data from IPCC[2]). Soot particles on glaciers accelerate their melting because the albedo of the glacier surface is reduced (the reflection of the sunrays is reduced; the sun warms the glacier surface).

D3) The use of the stove should not cause environmental damage, in particular, no deforestation, as this almost always occurs by conventional charcoal stoves. An efficiency of more than 30% should be achieved (the default value proposed from UNFCCC[3] for three stones fire is 10%).

D4) Only solar cooking and heat retention cooking are totally clean cooking technologies.

D5) The traditional three-stone fire can be improved through the use of a grate and an metal ring that surrounds the pot causing the heat of the fire to flow directly along the sides of the pot. The Ben-Stoves[4] have a tripod as the pot support instead of three stones so that a round shell on the tripod can be arranged, which works as combination of efficiency ring and wind shield. The simple construction of the Ben-Stoves and the ventilation of sheet metal parts provides for a sufficiently low temperature to avoid high temperature corrosion, without requiring special-purpose steel.

D6) In community kitchens higher standards may be realized.

D7) In the design of the stove, all the criteria of Perma-technology should be met. Perma-technology is a generic term for devices and associated methods for environmentally friendly products based on renewable or reusable materials, using renewable energy when possible. When using materials from non-renewable raw materials, the products should be durable and then recyclable.

[2] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf

[3] http://cdm.unfccc.int/filestorage/5/e/HSVPWKBG6X7Q8YEFMOT214IA3R0ZDL.pdf/EB%2068_repan22_Rev_AMS-I.E_ver05.0.pdf?t=NVh8bzc3eGo5fDC_c8kKqqecHyU_pp2BipZ7

[4] http://solarcooking.wikia.com/wiki/Ben_3_Firewood_Stove

E) Criteria of Perma-Technology

Products and processes should satisfy the following criteria as far as possible:

1) they improve the living conditions of the population;
2) use renewable resources (renewable materials, renewable energy) and only totally recyclable non-renewable resources;
3) cause no danger under normal operation;
4) do not cause severe danger in case of faulty operation;
5) operate as independently as possible
6) are easy to use; are fault tolerant, even if operated under sub-optimal conditions;
7) have a long service life; can be repaired easily and at low cost;
8) can be adapted to local conditions if necessary;
9) can be developed iteratively if required;
10) they are beautiful.

E.F. Schumacher wrote in his famous book[5]: "Ever bigger machines, entailing ever bigger concentrations of economic power and exerting ever greater violence against the environment, do not represent progress; they are a denial of wisdom. Wisdom demands a new orientation of science and technology towards the organic, the gentle, the non-violent, the elegant and beautiful."

F) About Thermos Technology[6]

If 2 billion people annually consume approx 400 kg firewood per person, and if thermos technology (cooking by retained heat) saves 25% or more, then 200 million or more tons of firewood could be saved per year by thermos technology. Simultaneously, emissions and the health and financial burdens decrease.

It is so easy to convey this simple technique in the classroom and in the media. It is inconceivable that this opportunity is virtually untapped. The firewood crisis[7] and other causes of poverty in the world are surmountable with appropriate technology and its diffusion through Innovation Institutes with participation of the educational system and the media.

K. Schulte,
Rotary Sveden:
Project Nepal,
Solar Cooker SK14
with
thermos flascs

example
“hay basket”

[5] E.F. Schumacher: Small is Beautiful - A Study of Economics as if People Mattered
https://en.wikipedia.org/wiki/Small_Is_Beautiful
[6] http://solarcooking.wikia.com/wiki/Heat-retention_cooker
[7] See e.g. http://solarcooking.wikia.com/wiki/Dieter_Seifert