Solar cooking, biogas cooking and vegetable oil cooking for Nepal

July 1, 2004

A) The general description

The project consists of developing and distributing cooking and other renewable energy technology in Nepal. The cooking technology being developed is a combination to use with the same cooking equipment solar energy, biogas cookers and vegetable oil cookers.

It is a well-known fact that in Nepal there is a big demand for cheap cooking fuel and cooking equipment among rural and urban people. So that information is not reproduced here. About the most general description concerning using fire-wood in cooking, please see the author's picture in the web:

http://www.cc.jyu.fi/~hvirtane/chin1.html

The project is a continuation of the project started in Nepal in 1997. It will be continued with the implementation of the technology as described here from ? to ? (The timing will depend on funds.)

B) The Background.

1)

The original solar cooking part of the project has been described by the author at the web-pages :

http://www.cc.jyu.fi/~hvirtane/cooker/

After publishing the solar cooking web-pages the project got ISES (International Solar Energy Society) 'Best Contribution of the Month Award' in 2001.

2)

Since then the author has continued to work with his Nepali connections to develop in Nepal cheaper biogas technology than the biogas technology

installed there is at present. The new technology is based on the proven 'plastic bag' biodigester, which has been developed first in Vietnam and is now becoming popular for example in Tanzania. That technology is well documented in the Internet.

Please see the web-pages: http://www.husdyr.kvl.dk/htm/php/tune96/13An.htm

The first plastic bag biodigester included in this project in Nepal was build by Rajesh Sharma in January 2003. According to the tests done in Nepal it can produce about the same amount of biogas as a traditional Nepal style biodigester of the same size. The plastic bag biodigester is much cheaper, however.

Besides for cooking biogas can be used as engine fuel also. It can serve as the fuel for a small generator set for example. The necessary small pressure tank for the gas can be made of an used car tire. According to the tests by an Australian friend of the author even a wheel-barrow tire can hold biogas for a 3 hp engine to run the engine 1/2 hours time. This way biogas can provide electricity for single households and for small villages.

Small generators for battery charging can be made locally using as the commercially purchased parts only permanent magnets and copper wire, as it has been demonstrated by various self-builders of wind turbines and by the author. (Small-scale combustion engines are not being produced in Nepal, but they have to be purchased from abroad.)

About small home-made alternators, please see:

http://www.otherpower.com/trips1.html

http://www. tinytechindia.com

http://www.fieldlines.com/story/2004/6/2/163021/1860

3)

The vegetable oil cooking technology is based on the research as done in Germany and in India. The technology consists of modifying normal kerosene cookers to be able to use vegetable oils.

Please see the attachment. bp48_pp37-38.pdf

The author has been working as a voluntary development specialist with a leading producer of vegetable oil mills, 'Tinytech' from India since January 2003 to develop wind turbines for India and vegetable oil technologies for diesel fuels and cooking fuels. Mr. Desai from 'Tinytech' visited the author's home area in April 2004 to see simple wind turbines as produced in the local Finnish area and to discuss about the oil technologies with the author.

Please see: http://www.tinytechindia.com

According to the research done by German specialists most vegetable oils can be used with modified kerosene cookers. There are many locally produced oils available in Nepal.

The other intended use of vegetable oils is with diesel generator sets. The first diesel generator set as made in India was supplied by Tinytech to the author's coworker with the Tinytech cooperation, John Furze, Denmark in June 2004. It is one part of the project to start introducing this diesel technology in Nepal, too. With the combination of small scale hydro systems and small scale wind turbines, diesel generator sets using vegetable oils as fuel can provide electrical systems for small villages and for single households. The same small diesel engines can utilize biogas, too.

—-

C) The description of the implementation of the technology.

1) Using ready made technologies

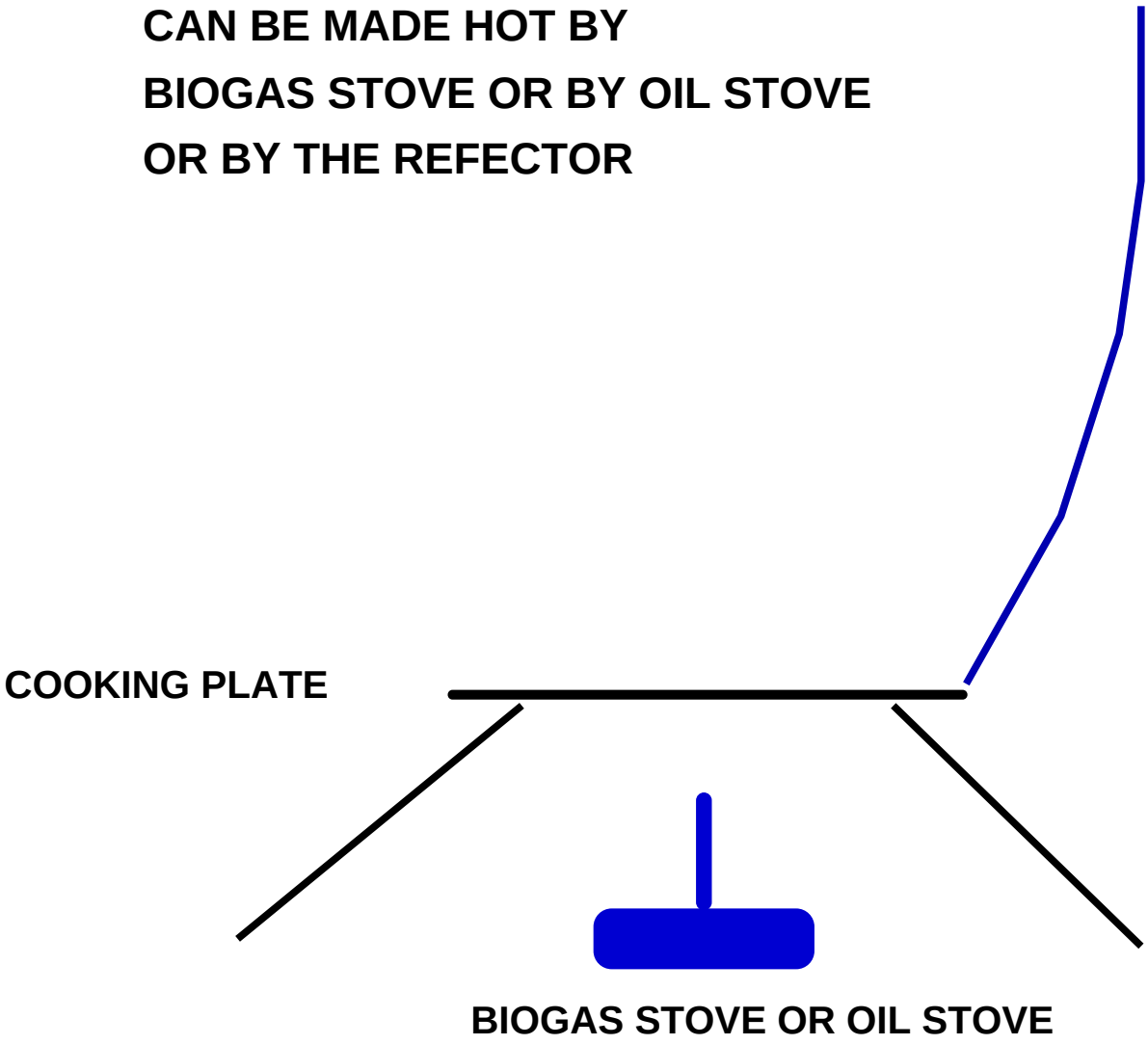
In the beginning to prove quickly the technology to be feasible, commercial ready made machinery will be used. First 5-10 pieces of ready made solar reflectors as produced by 'Cleardomesolar'

Please see: http://www.cleardomesolar.com

will be purchased to be brought to Nepal. These reflectors have not been used in Nepal earlier, but are elsewhere proved to be some of the best models now available and they are suitable to be used combined with biogas and vegetable oil cooking technologies. The cookers' cooking plates will be modified to accept standard biogas and oil cooking sets as already produced in Nepal.

About the general layout of the system please see the picture below.

THE COOKING PLATE
CAN BE MADE HOT BY
BIOGAS STOVE OR BY OIL STOVE
OR BY THE REFECTOR



Using these ready made technologies first cooking demonstrations will be arranged. Most of the cooking sets will be rented out to the customers after demonstrations. The rent will be to cover some of the costs of the purchased technology according to the calculations, how much the technology can save money from the earlier daily energy usage. One half of the saved money will be taken as the rent of the technology. Two kinds of customers will be looked for.

a) Any normal households, who are interested in trying this technology in the daily family use.

b) Small restaurant and tea-stall owners. These small-scale business running costs are high from using costly energy for cooking. So they can prove the technology's usefulness easily. On the other hand they are very good show places for the new technology.

Some similar machinery is at this time, according to the demand produced locally for people who want to start testing them.

2) Starting to produce the technologies in Nepal.

After the testing period of 2 -3 months calculations can be made, how feasible it would be to start making these things in Nepal.

A survey among the customers will be made, how much people would be willing and able to pay for this kind of technology.

According to a well-known research done by GTZ from Germany in South Africa, there would be in South Africa customers to buy solar cookers, if they would be made locally. A similar survey is needed in Nepal. (Actually before the GTZ program in South Africa was started and I had learned about it, I already suggested with my Nepali friends a similar research about solar cooking to a local GTZ representative to be done in Nepal, and applied for a grant with my friends in Nepal from GTZ to do the research there. The answer at that time by the GTZ representative was that 'the technology is not yet fully developed'. In South Africa it was anyway quite 'fully developed' four weeks after that discussion.)

According to these studies (originally in Germany designed) SK14 cookers are working well, they are suitable for families' use and quite easy to construct in workshops using hand tools. The main reason, why these machines haven't already become more popular in South Africa or in Nepal is the price of the reflectors of the cooker. According to the research done jointly by Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH and Palmer Developing Consulting (sub-contractor) there are good opportunities to produce this type of cooker commercially in South Africa in limited scale.

http://www.solarcookers.co.za/

——-

Here is the relevant extra from the test by GTZ:

Concerning the end-user acceptability as turned out in this test the following is of interest:

The key messages from Phase I of the Project are: Solar energy is a promising option capable of being one of the leading energy sources for cooking. The high use-rate of solar cookers, at par with wood and above other fuels, indicates acceptance of solar cooking by families.

Each type of cooker has its own supporters.

An obvious universal, single choice does not emerge. However, clear user preference for certain cooker types is evident and thus provides a sound basis for the selection of solar cookers to be promoted during Phase II of the Project.

Considerable fuel and time saved by the use of solar cookers generate reasonable pay-back periods except for the most expensive cookers.

The willingness to buy test cookers suggests a viable market for solarcookers; this is confirmed by the findings of an independent market study.

While causing a shift in cooking times and a re-organization of household labour, the use of solar cookers does not disrupt social relationships.

Macro-economic impacts are positive.

The questionnaire methodology concerning family use has proven sound. For institutions, direct observation by the project staff was used

All test cookers needed technical improvements and have undergone a first adaptation; the adapted cookers could serve as a basis for local production.

http://www.solarcookers.co.za/

please see also the attachment

bp48_pp30-32.pdf

——

We have been working with quite similar machines in Nepal building them with skilled handicraftsmen directly on the field and in local workshops and we have published in the Internet general design and building instructions for this kind of cookers.

http://www.cc.jyu.fi/~hvirtane/cooker/

—-

For the oil cookers almost the only thing needed is to calculate the costs of suitable vegetable oils. Kerosene cookers, which can easily be locally modified for vegetable oils are already produced and used in Nepal. Oil pressing mills are as well available.

Biogas digesters and biogas cooking have been quite successful in Nepal. The problem with the traditional biogas digesters is the cost of the digesters. Plastic bag digesters are much cheaper and can find new customers with less purchasing power.

It has been as well already proved that solar cookers can be successful in Nepal. For example German designed SK14 cookers are produced in small numbers in Nepal. The author with his Nepali friends has as well already built other kinds of solar reflectors to prove that producing these machines in village conditions in Nepal is not very difficult.

One problem with for example Chinese solar cookers and German designed SK14 cookers has been the price of the products. Another problem is that these cookers cannot be used all the time, sometimes there is no sunshine.

This technology is an attempt to provide an answer to these problems. Similar reflectors as produced by 'Cleardomesolar' can be made quite cheaply in Nepal. The added biogas and oil cooking sets are there to answer the problem to cook at the time, when there is no sunshine. With this cooking platform as well small electric stoves can easily be combined if electricity for example from small hydro generators, from biogas combustion engine generators or from diesel vegetable oil generators is available.

Some reflections.

In principle the new cooking technology has to able to beat the old technology not only with the comfort of the use but with the price also. For many people in rural areas kerosene oil and kerosene oil cookers are too costly. Fire-wood is sometimes also costly. In these cases a combined solar, vegetable oil and biogas cooking set can be an answer. If the reflector is made of cement and glass mirror pieces it will cost only about 100 Rs. for the materials. A plastic bag biodigester with the necessary tubes and the burner would cost 300 Rs. - 600 Rs. for the materials. This cost is too much for small poor households to be paid quickly. The only feasible way would be to pay the cooking systems little by little by saving the energy as compared to the earlier energy costs. If and when this can be done the project has proved its sustainability.

C) Publishing plans and results

The author has been already more than a year working voluntarily with a group of self-builders of renewable energy technology from various parts of the world. The discussion group of these people has been extensively publishing their built and planned machinery at an Internet web-site,

http://www.fieldlines.com/

The author's contributions at the site can be found here:

http://www.fieldlines.com/user/hvirtane

The author has started to publish his own diary about other technologies, which he has been building and planning at that site at the address:

http://www.fieldlines.com/story/2004/6/2/163021/1860

This project will be published there as well.

It will be published in relevant scientific publications and in relevant magazines such as 'The Boiling Point', too.