Number 51
2005

Sharing information and communicating knowledge

Boiling Point

gtz

PRACTICAL ACTION
Technology challenging poverty

TECHNICAL ENQUIRY SERVICE

Technical Enquiry Service

Do you have a practical problem? We may have an answer.

Drawing on our international experience of working with small-scale technologies we provide practical information and advice. Our service is free of charge to individuals, businesses and development practitioners working in the South. We aim to supply useful information directly relevant to your needs so please be clear and specific when making your enquiry. We have access to expertise in energy, agro-processing, food production, building materials and shelter, transport and small-scale manufacturing.

If you can use the internet then you can access a range of Technical Briefs – http://www.practicalaction.org/technicalinformationservice or send your enquiry by email to infoserv@practicalaction.org.uk otherwise please contact us at:

Technical Information Service (Boiling Point)
Practical Action
Schumacher Centre for Technology Development
Bourton Hall
Bourton on Dunsmore
Warwickshire CV23 9QZ

Tel: +44 (0) 1926 634468
+44 (0) 1926 634400
Fax: +44 (0) 1926 634401

Editorial Team

As you may have noticed, we have changed our name from ITDG to Practical Action . . . but don't worry – we are still keen to send you *Boiling Point*

Back issues of Boiling Point

50 – Scaling up and commercialisation of household energy initiatives
49 – Forests, fuel and food
48 – Promoting household energy for poverty reduction
47 – Household energy and enterprise
46 – Household energy and the vulnerable
45 – Low cost electrification for household energy
44 – Linking household energy with other development objectives
43 – Fuel options for household energy
42 – Household energy and the environment
41 – Household energy; the urban dimension
40 – Household energy and health
39 – Using biomass residues for energy
38 – Household energy in high cold regions
37 – Household energy in emergency situations
36 – Solar energy in the home
35 – How much can NGOs achieve?
34 – Smoke removal
33 – Household energy developments in Asia
32 – Energy for the household

In this edition . . .

This edition moves on from the theme of scaling up to one component of it that is often overlooked during the life of a project. If we know something, how do we share it? A colleague once said that 'knowledge is power, so people often keep knowledge because giving it away makes them less powerful' – an interesting point. As the world of household energy becomes more commercialised, will it be driven solely by profit, or by sharing knowledge for the common good; can the two approaches live side by side? Somewhere the line between intellectual property rights and the common good must be drawn. We are very pleased that our authors, in this, and previous editions, have chosen to share their knowledge so that our aim to reduce poverty can be advanced through sharing this vital resource.

Contributions to Boiling Point

- **BP52: Health, safety and household energy** *Boiling Point* last looked at health in BP40, and much has happened since this edition. What have we learnt? What can we tell policy-makers when they ask how to remove smoke from millions of households in their country? What are the dangers associated with fuel-gathering, particularly in crisis situations – assault, land-mines – we need to hear from anyone taking positive action to reduce these risks. Safety of children – what can be done to reduce the number of burns for children – and also women? If you can share your knowledge, this is a vitally important issue.

- **BP53: Technologies that really work** In the last five years, many effective new technologies have been developed. This edition is the first for some time that is unashamedly technology-oriented. We would like to include a wide range of proven technologies. Ideally, they should have been used in households successfully for at least several months/years, and also tested to ensure that they do what they are intended to do – reducing fuel use, reducing smoke, costing less etc. What sort of technologies? – stoves (all fuel types – that both reduce fuel consumption and smoke); lighting – using electricity, kerosene, solar, LPG; heating stoves; institutional stoves; stoves for cooking/heating in emergency situations; other cooking technologies – such as hot boxes. Ideally, each article to include: a good description; how and where it has been tested; the cost of the technology; the level of complexity for construction and maintenance; a couple of photographs; information on where people can get more details – drawings, support, further information, and permission to use the design; please include non-web ways of accessing technical drawings (if at all possible).

We're on the Practical Action website too www.practicalaction.org/boilingpoint.The good news is that the journal is visited by around 200 people per month, with over a third to a half of those people downloading articles, in addition to the 2000 copies which we send out each edition.

Articles should be no more than 1500 words in length. Illustrations, such as drawings, photographs, graphs and bar charts, are essential. Articles can be submitted as typeseripts, on disc, or by email.

All correspondence should be addressed to: *Boiling Point* editor, Practical Action, Schumacher Centre for Technology & Development, Bourton on Dunsmore, Rugby CV23 9QZ, UK or by email to Boiling.Point@practicalaction.org.uk

Boiling Point is the journal of Practical Action's energy programme. Typesetting by The Studio Publishing Services, Exeter, printing by Latimer Trend, Plymouth.

Cover photo: 'Smoke is bad for you' – theatre group in Kisumu, Kenya (photo Practical Action – East Africa)

THEME EDITORIAL

The gift of knowledge

Lucky Lowe, Director of Operations, Circles Network, Potford's Dam Farm, Coventry Road, Rugby, CV23 9JP, UK
Email: lucky.circles@btconnect.com

The primary importance of building on what people know and helping them to do it better is well accepted. Yet we still struggle to grasp how we can best create and share knowledge. So when human existence and prosperity relies so heavily on our individual and collective ability to recognise existing and generate new knowledge why is it often so hard to do well?

Data, information, knowledge, know-how, communication; these are concepts influenced by the context in which we think or talk about them. Words are not only words, but much more . . . they reflect personal values, cultural norms, commercial worth, intellectual property rights, emotions, power and more . . . the variety of purposes for which we need knowledge and ways we use it reflect the rich complexity of life.

It's a feast

One recipe for success is to take the raw materials of existing, indigenous knowledge, mix with it information from elsewhere, let it ferment with new learning, bake in the hot oven of risk taking and experimentation and sprinkle it generously with imagination and care. The result is sure to be a tasty dish fit for the palettes, and nutritious enough to sate the appetites, of all those seated at the table.

Knowledge is categorised into *implicit* and *tacit*. There is know-how that may be evident for anyone to see, but also the less tangible knowing we hold in our heads and hands. This is the know-'*who*, *when* and *where*' which is built into processes and production practices. It is what we use everyday to live, and to safeguard future generations; to produce plants, nurture and harvest; to prepare, store and cook food; to care for ourselves, families and social networks; to organise collective productivity and generate economic wealth. Knowledge is the glue that holds together everything we do from cooking on a traditional stove to manufacturing solar panels.

What's the trick?

There has been an explosion of interest in recent years about the potential of modern Information and Communications Technologies to connect us all in a global, virtual world of the Internet. Millions of dollars have been invested in pilot projects, infrastructure, ever changing hardware and software but there is stll a 'digital divide' that cuts off millions of people without access to electricity let alone the computers required to link into the Worldwide Web. Nonetheless, there is no denying the exciting potential of the Internet to cross boundaries and empower people; it is a wonderful thing to be in communication with a person (or millions of people) across the globe. The articles on HEDON and Microhydro.net demonstrate how such resources can be harnessed to capture diverse strands of knowledge to enable others to retrieve it when they need.

We all favour certain approaches to sharing and learning. Some people thrive in formal educational settings and have the opportunity to study for years, going from school to university. Many millions more people rely on the informal exchange and practical experiences that life throws at them to grow their understanding and development new skills. The success of demonstration projects, pilot schemes and incentive schemes that engage people in the opportunity to try it out for themselves highlights that seeing may be believing but doing results in learning.

People trust face-to-face communications. Our relationships, based on trust and reciprocal exchange, teach us to share what we know with family, friends and work colleagues. There are many knowledge sharing methods highlighted by the initiatives in this edition that build on this premise – building locally trusted sources, artisans and community based organisations, theatre and entertainment to create awareness and understanding of new ways.

Marketing professionals have taught us that after awareness and interest we need to create desire and action. Knowledge sharing is clearly entwined in all aspects of doing business. The lessons from Kenya, India and Sri Lanka show how producers and promoters, professionals and policymakers all need to be persuaded to share an understanding and work together to bring about change. Effective use and knowledge creation play a key role in researching markets, sourcing raw materials, enhancing skills and combining processes, distributing products and reaching out to customers. The imaginative and effective use of many media has shown to be effective in conveying messages, changing behaviours and creating new markets. People are showing that the challenges and constraints can be overcome and the immediate cost of investing in effective knowledge sharing can lead to long-term benefits. It is true that many people suffer from information poverty but most are rich and have much to share: for knowledge to grow we have to give it away.

Lucky developed a passion for international development within the building materials and shelter sector of ITDG, later running the Knowledge and Information Services Unit. She now works for Circles Network, http://www.circlesnetwork.org.uk/ which strives for social inclusion, promoting community spirit and acceptance of difference.

The Upesi rural stoves project

Vincent Okello, Practical Action Kisumu Office, P O Box 2260, Kisumu 40100
Tel 057-2022486, Fax 057-2022125. Email: itkisumu@africaonline.co.ke

The Upesi project, supported by Intermediate Technology Development Group (ITDG), was initiated in 1995 to improve the living and working conditions of women in rural households by enabling a significant and increasing number of women and their families to benefit from fuel-saving wood burning stoves.

The project's aim was to test and demonstrate the effectiveness of new approaches and technologies for commercialisation of Upesi stoves in five districts in Western Kenya. By working with women's group and involving them in the design and field-testing of the stoves, the project was able to take advantage of women potters' knowledge and experience. Besides training the women in stove production, distribution and installation, the project focused on improving their marketing skills. This has been a critical element in enhancing the ability of women to earn income from stove-related activities.

Women and children suffer the most from over reliance on limited biomass energy resources in rural areas (Figure 1). They are the main procurers and consumers of wood for domestic use and generally have very limited access to modern, clean and efficient energy technologies. Consequently they spend considerable amounts of time and energy involved in the daily tasks, and are exposed to high levels of air pollution and associated illnesses related to smoke from wood fuel fires.

Figure 1 A woman fetching firewood in Kakamega forest (*photo: Practical Action*)

Improved cook-stoves development

Following the 1980 United Nations Conference on New and Renewable Sources of Energy, many organisations began to work individually and collaboratively on improved stove development and dissemination. The organisations involved in the early 1980s include the newly created Kenya Ministry of Energy, the Appropriate Technology Centre, the Kenya Energy and Environment Organisation (KENGO), United Nations Children's Fund, Maendeleo Ya Wanawake, CARE-Kenya, the Intermediate Technology Development Group and GTZ, the German Technical Cooperation organization. Among the more popular stoves introduced were the charcoal-burning 'Kenya Ceramic Jiko' (KCJ), and the wood-burning 'kuni mbili' and 'maendeleo jiko' – known also as the 'Upesi' stove.

The KCJ (Figure 2) stove was developed through a design process spearheaded by the Ministry of Energy. The jiko stove easily found acceptance among urban stove producers who were initially offered free training and marketing support by KENGO, working with the ministries of Energy, Agriculture, and Environment and Natural resources. Although most producers and dealers of the jiko stove have been men, many women in small urban areas have benefited immensely from the technology, significantly improved their standards of living through gains in the time and income.

Rural stoves programmes

Over the years, improved stoves have been more difficult to introduce in rural areas because stoves cost money and

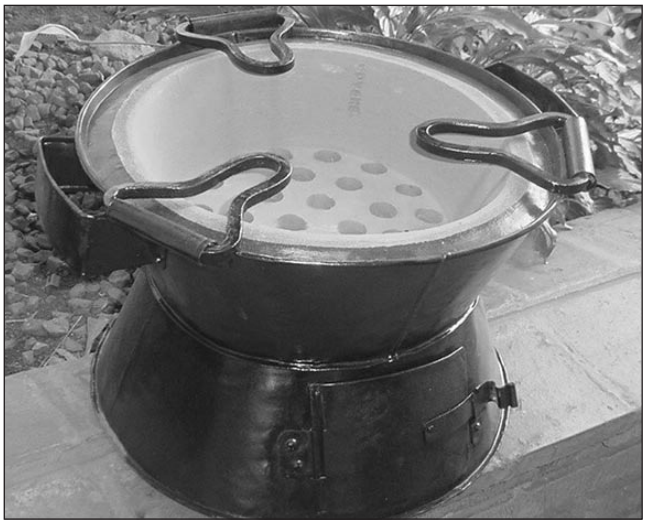


Figure 2 The Kenya Ceramic Stove (*photo: Practical Action*)

Figure 3 The Upesi Liner (*photo: Practical Action*)

the traditional three-stone cooking system is free. Rural people are generally very poor, and women and children mostly cook using fuel wood which is collected for free, so there is less incentive than in urban areas to spend money on a stove for reasons of fuel conservation. Promotions and sales of the stove have been difficult because women's groups with little or no experience in competitive marketing have conducted production and distribution of rural stoves.

In 1986 ITDG joined with KENGO to initiate a new project focusing on the stove needs of households in rural areas. The study found that the most acceptable and efficient stove was the Maendeleo or Upesi stove (Figure 3) designed and tested by GTZ and the Appropriate Technology Centre as part of the Women and Energy project of Maendeleo Ya Wanawake organisation. Groups of women potters around Kisumu were trained to produce the already successful Kenya ceramics jiko as well as the Upesi stoves. The same group were also involved in tree planting and agricultural activities for income generation.

In many rural areas, the Ministry of Agriculture extension officers in home economics and agriculture were already engaged in 'kitchen improvement' and nutrition projects. They became key promoters of improved stoves because of the health and hygiene benefits of the stoves. Through funds from GTZ, the officers bought and distributed stoves at a nominal controlled price. The price was based on an estimate of what rural women would be willing to pay. Thus was established a secure marketing channel for women's groups, a steady but small income from stove production, irrespective of the quality of the stoves. After about eight years, however, support from GTZ ended and the government's home economics officers were unable to continue their marketing services on a large scale.

Case study: Income generation through stoves liner production

Mrs L. A. is the person in charge of liner production in the group. She grew up without formal education, learning basic literacy and numeracy through an adult education programme. At the start of her involvement with stoves, she was a peasant farmer with a jobless husband, barely able to make ends meet, providing her own farm labour. Today Mrs L is a qualified production trainer and has visited Tanzania and Malawi on a training mission. She is able to pay over KShs 7,000/= per year for farm labour and inputs, and school fees amounting to KShs 2,500/=. She also employs labourers to work clay for her liners. At the start of the stove business her neighbours and in-laws despised her choice of occupation saying it was playing with clay like children. Now Lucia is a respected member of the community and several previous detractors have joined the group.

The Upesi project

In 1995, ITDG's Rural Stoves West Kenya project ended and a new phase focusing on commercialisation was initiated; called the Upesi project. The new project launched an intensive campaign to improve the sustainability of the stove-related income generating activities. The project worked primarily with eight women's groups, with differing level of marketing skills and knowledge. Some were in villages where fuel wood could be collected free, while others were in wood-buying areas. The women, who previously had been involved in various agricultural and pottery activities for income generation, took the initiative to approach development agencies working in energy and they sought technical support in developing alternative income-generating activities.

The Upesi stove was selected for production through field trial that showed it could provide fuel wood savings of up to 43 per cent compared to a three-stone fire, and appeared to have a life span of four years. Some stoves have reportedly been used for up to ten years. During the field tests, the affordability of the stove was determined on the basis that if an ordinary lady can sell bananas or chicken to afford a stove, then the price is acceptable. Thus KShs 70/- was considered an acceptable price for an installed stove. Later the Upesi project raised price to KShs 120/= to reflect actual production costs.

Keyo women's group

This group, which began with five members, got involved with stoves in 1986, after seeking technical assistance from a CARE Kenya project operating in the area. Their stoves were initially marketed through home economics officers with GTZ funding. Today, the group has approximately 28 members producing, selling and installing stoves. They have links with artisans in Kisumu town who buy their stoves in bulk. Some members have benefited from bicycle loans, which have eased their marketing efforts.

Women's participation was enhanced by having been in contact with women in the field; the home economics officers. These government extension officers may have distorted the earlier stove market trough subsidised distribution, but they were certainly key agents in the areas.

One of the primary barriers to participation by women was that they did not have enough time and could not be away from home for long periods. Because of women's many domestic and community responsibilities, it was important to ensure that any new activity was compatible with their ongoing duties. Many women became involved in the stove production activities, but needed training in marketing skills, yet any new training and marketing activities needed to fit with existing responsibilities.

Commercialisation strategies

The marketing approach for the Upesi project was developed over a period of five years. The producers' groups represented isolated focal points in vast rural areas. Most of the potential users were far from the producers, the road network was poor and motorised transport was generally unavailable. A strategy was needed to ease the transition from a controlled market to a relatively free market where the prices reflected the full costs of production marketing and provided a reasonable profit margin. The new strategy was piloted with the Keyo Women's Group after which it was adapted to the very different conditions of each producer group. The strategy was based on insights gained from a visit to an ITDG stove project in Sri Lanka, as well as a marketing study in the project area.

Identification of key stakeholders for support was an important part of the strategy. The relevant government departments, major NGOs, and existing stove producers in the area were informed of the project's intentions and its interest in developing marketing plans.

Training was seen to be critical as there were a number of different actors; intermediaries (who act as a link between manufacturers and retailers) retailers, promoters and installers. These intermediaries typically became involved in the project after seeing a stove demonstration or through others already producing or selling stoves. Producers were trained in group dynamics, stove production, costing and pricing, record keeping, building marketing links and responding to consumer demands. For retailers there was in depth training in customer relations and sales promotion as well as costing and pricing.

Promoters and installers were trained in stove promotion messages, carrying out successful demonstrations, and establishing linkages with communities. The idea was to have as many people as possible spreading information and carrying out demonstrations of the stoves. Thus a team of promoters was identified to visit homes, churches, market places, grain milling centres, schools and other public places. Other organisations such as the Anglican church of Kenya in Eldoret Diocese, the Maranatha Mission of Kenya and the Ministry of Energy were involved in creating awareness and providing potential linkages. Figure 4 illustrates typical market linkages and distribution networks for Ichingo Women's group, Mumias, West Kenya.

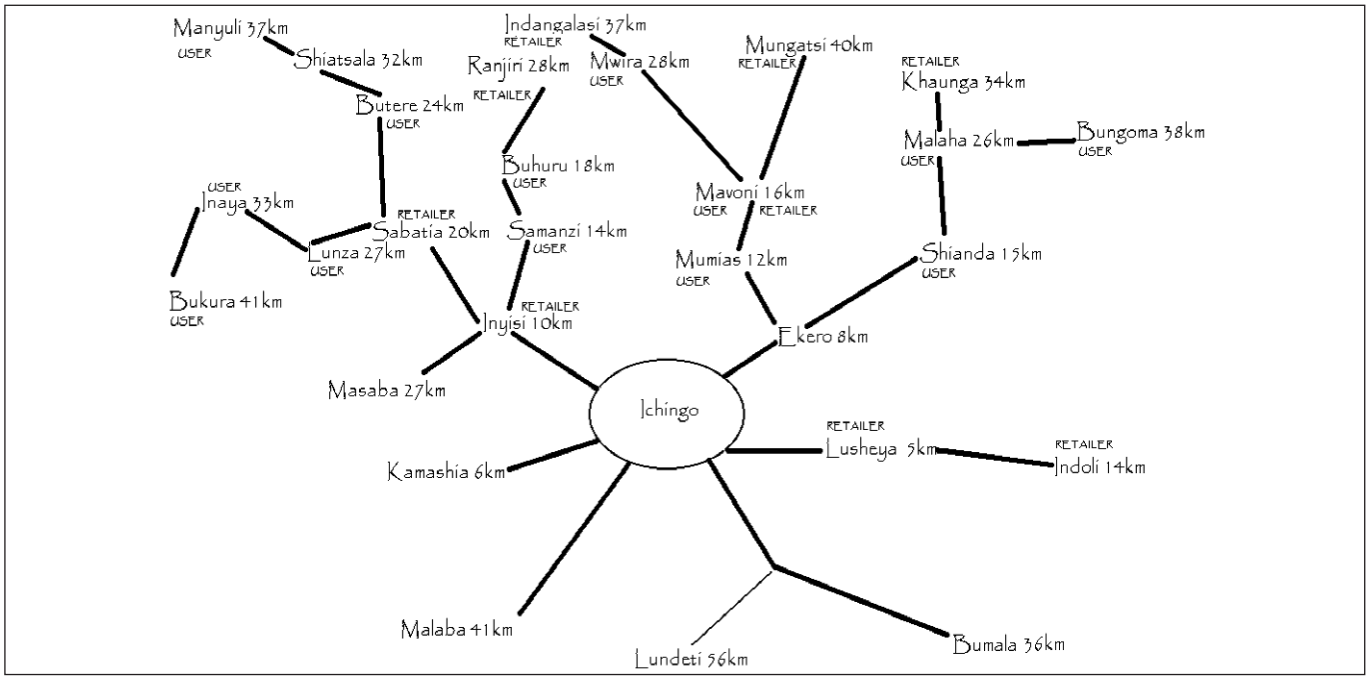


Figure 4 Market linkages and distribution networks for Ichingo Women's group, Mumias, West Kenya.

ITDG sponsored radio promotion in local languages which added value to the stoves image. Drama and songs were used for awareness creation. ITDG also provided advertising bill boards. Posters, banners and flyers were produced in collaboration with intermediaries to ensure that the selling messages were appropriate. The promotion was aimed at creating an awareness of its benefits.

Stove producers and distributors were encouraged to use non-motorised transport to link up to major roads. Over 40 bicycles were provided through mutually agreed repayment schemes. All the transport equipment carried Upesi promotional messages.

Marketing incentives included providing quality stamps for producers and promotion signs for distributors with over 150 stoves. Promoters selling 100 stoves per month were given a bicycle loan and a certificate. Other incentives included tee shirts and trophies.

Benefits to women

The primary intended beneficiaries of the Upesi project were women and their families in rural households of Western Kenya. At the final project evaluation, 16 000 stoves had been manufactured, purchased and installed. Although some of these figures are anecdotal, users of the Upesi stove have described the following benefits:

- Saving of up to KShs 7200 per year (rural wages average KShs 8000 per month)
- Perceived health cost savings of KShs 260 per year
- Time savings of about 10 hours per month
- Substantial reductions in levels of smoke
- Reduction of acute respiratory infections and conjunctivitis in children and mothers
- Women have begun to venture into male-dominated artisanal work, which diversifies their income-generating potential.

Income generation

A total of eight groups, or at least 50 women, were trained directly by the project. Others trained comprised at least 23 promoters, eight retailers and five distributors. On average, stove producers devoted two to three days a week to stove production. Every active group could sell 510 stove liners and earn KShs 115 300 in a year or KShs 12750 per month. If producers sold directly to users then they could make an extra KShs 50 per stove for installation. Stove promoters made an average of KShs 15 000 per year. As a result of stove-related activities these women were able to enjoy a significantly higher standard of living.

Acquired production and marketing skills also enabled women to travel to distant places to provide training to others. Women from the Keyo Women's group have trained producers in Tanzania on a fee basis. Active women in the producers group have also learned new skills useful for other business ventures. With increased confidence and social status several women have since became active in community development committees. Thus stove production has also provided a launching pad for realising other ambitions.

The active producer groups have also recently convened a network, West Kenya Energy Network, which has been instrumental in the setting up of other production centres and groups in West Kenya, as well as dissemination of other improved energy technologies.

Over all, wider commercialisation of stoves can have a significant impact on community poverty alleviation. With increased income, women are able to help support their families and pay for their children's school fees, thus reducing school drop out rate. This is particularly significant for girls as they are always the first casualties when parents cannot afford school fees. Children of stove producers are also learning important skills for income generation and acquiring knowledge about energy and environmental conservation as they observe and help their mothers. In addition, women producers provide employment opportunities to others to work as labourers in the procurement processing or transporting clay liners and fuel wood for firing the liners.

Environmental conservation

The issue of fuel wood shortage in Kenya cannot be overemphasised. Any technologies that improve the efficiency of fuel wood use have real benefits to society. In West Kenya the Upesi project has introduced an awareness of the need to conserve energy, not only among those households that bought the stoves, but also in many others exposed to stove demonstrations and promotional talks in public gathering and at show grounds.

In much of the project area fuelwood is harvested from live trees and sold in the market. The project evaluation revealed fuel savings of 90 kilograms per month for each household using Upesi stoves, representing 40 per cent savings in fuel use, which can have a positive environmental effect in terms of less felling of trees. The Upesi project has also influenced an international research institute to support improved stoves as part of an effort to replenish and conserve the Kakamega forest in West Kenya.

Equally important is the tree planting encouraged as part of the project, to replenish the wood used for manufacturing the stoves.

Vincent Okello works with Practical Action (formerly ITDG) as an Energy Projects Officer in Kisumu, Kenya, on its current project in scaling up pathways to sustainable interventions for reducing kitchen smoke. Vincent holds a bachelor of arts degree in sociology and economics, and has worked in the household energy, stoves and indoor air pollution NGO sector since 1994, with a bias towards social science aspects of the work. The current work draws its improved stove interventions from the previous stoves' work in West Kenya, which has been variously documented and disseminated nationally and internationally.

HEDON – the household energy network

www.hedon.info

Grant Ballard-Tremeer PhD, CEng MIMechE, MEI, Managing Director – Eco Ltd., 64C Fairholme Road, W14 9JY, London, UK Tel +44-(0)20 7386 7930 Fax +44-(0)870 137 2360 and +44-(0)70 9236 7695
Email: grant@ecoharmony.com Eco ltd website: www.ecoharmony.com

What is HEDON?

HEDON Household Energy Network is a long-established and well-respected grassroots organization of almost 600 household energy practitioners, the majority of whom are based in the South. Established in 1992, the network has grown rapidly, bringing together key players in household energy to create a powerful tool for change. If you have access to the Web, you can join HEDON – at no cost.

What can HEDON do for you?

HEDON will put you in touch with all the most up-to-date information worldwide. It gives you names of specialists, key documents, links to other organisations and websites.

What can you do for HEDON?

HEDON lets you tell other people of your successes (or failures!) reaching everyone on the network, reducing replication and saving time and money, and a regular newsletter values your contributions. Each member gets a personal webpage, which is simple to create, linking to an existing webpage or giving your organisation its first website.

HEDON at the present time

All members renew their membership each 6 months, keeping it up-to-date. There are over 100 organisational profiles, about the same number of 'active' personal profiles. There are even people who update their profile every week! The profiles are more popular for Southern partners – perhaps HEDON satisfies a need that is more acute in developing countries.

Exciting plans for the future

There are real opportunities *now* for making HEDON even more vibrant and useful; particularly special interest groups to link HEDON with specific communities of practice. These are likely to include: clean indoor air; carbon and cookstoves (CDM); scaling up household energy programmes; and one on alcohol-based fuels or biodiesel. These key topics, will allow sharing of ideas through the specialist websites and through linkages to other household energy sectors through HEDON. Other thematic, regional, or language groups will also be encouraged.

The benefits of special interest groups being part of HEDON are many:

- strengthening existing links and infrastructure for wide dissemination from specialists to the wider community (including the non-online knowledge)
- sharing resources, such as Boiling Point, to disseminate key messages to those not able to access the web
- having a reliable technical 'toolbox' which can be used by anyone with only limited computer knowledge

What is needed?

Writers

HEDON needs people close to the action to feed key information into the network. For example, if you go to market and buy kerosene in Kenya, the cost is really easy to feed into the system – but it takes someone from a different country hours to find that out. If we all put in this sort of data, then it will build up rapidly. We are keen to hear local news, events, event reports, etc. *However, if you do not live close to this information, then maybe you have . . .*

Funds!

HEDON is delighted that GTZ has recently generously committed to funding the development of the network. Up to that point, HEDON had been almost completely dependent on contributions of Eco Ltd and other voluntary contributions. Ideally, around ten sponsors are needed, each providing sustaining funding of a particular area that is of interest to them, with a modest budget over the next five years. This would allow special interest groups to be set up, meetings to be facilitated, resources to be improved, and provide funding for facilitation of the network and international activities.

How do I join?

Go to www.hedon.info and click 'Join' – you will be asked for your name and email, and will receive a 'password' to log in to the website in the future – it is all very easy.

HEDON will take you into a world full of colleagues who all share the same desire to improve the quality of life for people living in poverty through improved household energy provision.

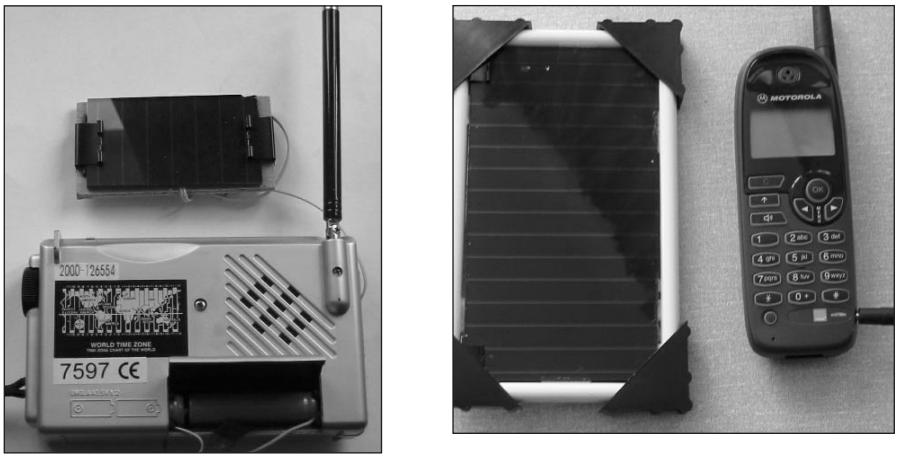
A network that lasts

HEDON has been in existence for around 13 years, and grown from strength to strength. It is now a worldwide forum which provides the perfect hub for the various networks and organisations that spring up, linking them with the wider body of household energy practitioners. If you've not been there before, why not pay HEDON a visit?

If you would like to know more, please contact Erin Boyd at: erin@ecoharmony.com

Locally-made solar panels for small appliances

John Keane c/o Boiling Point, Practical Action, Schumacher Centre for Technology and Development, Bourton on Dunsmore, CV23 9QZ, UK or Tel: ++ 254 735 28 56 93 Email: johnnykeane@gmail.com



(a) (b)

Figure 1 Solar power used for (a) radio, and (b) telephone

In June 2004, members of the Kibera Community Youth Programme (KCYP) in Nairobi, Kenya began learning how to assemble small Solar Panels which could be used to power small appliances such as radios, cassette players and even certain types of mobile phones.

The idea was simple. Solar panels, when placed in the sunlight, are capable of generating electricity. While this idea was not new in itself, what was new was that the group was learning that solar panels do not always have to be expensive and that it is possible to make a small solar panel for as little as a 1$US . . . a price quite similar to that of an everyday torch battery. The difference between a battery and a solar panel, however, is that while a battery may only last a few days in constant use, a solar panel lasts for many years, and the solar panels can be used to recharge rechargeable batteries during the day so that the users can enjoy power after dark too.

Because of the low costs involved, the solar trainer, John Keane, felt that the technology offered groups like KCYP an ideal opportunity to start a small community business. The basic idea is that the group could use low cost materials to assemble panels that could be sold at a low cost within the local community, and earn a small profit.

A few simple training sessions showed the group how to make solar panels using special solar glass and locally available materials such as wire and plywood; KCYP were ready to start production. The group managed to raise the money for the materials, and the solar trainer helped out by loaning some of his tools to the group.

Today, KCYP have produced many solar panels and Fred Ouko, the leader of KCYP, is hoping that the venture will be able to produce more and more panels in the coming year. John Keane is also very optimistic as, following time spent as a volunteer for the charity SPW in Tanzania, he arrived in Kenya with a single goal. His goal was to spread the word about what he thought was an excellent idea. The idea, which he discovered by coming across a website set up by a British inventor Graham Knight, was to introduce the concept that small solar panels, which last for many, many years, can be used to power radios in place of batteries. Once the batteries have been used, they are *useless* and only serve to pollute local environments and endanger young children if they are not disposed of carefully.

Figure 2 KCYP group making solar panels

When the sun is shining, these small solar panels can be used instead of batteries. This means less costs and less pollution. Furthermore, the panels can be assembled in Africa, for people living in Africa. This reverses the all too common situation where materials are taken from Africa and then assembled elsewhere in the world for people to make profits outside of the continent.

Since his arrival in Kenya, John has trained many individuals and groups in East Africa and has recently returned from four months in West Africa where he was contracted by the NGO, Environmental Foundation for Africa (With IUCN funding) to run a series of solar workshops in Sierra Leone, Liberia, Ghana, Benin and Senegal; all designed to raise solar awareness.

John is currently in preliminary discussions with the Kenyan Organisation for Environmental Education (KOEE), in a bid to introduce the idea of Solar Power to school children in the form of a series of lesson plans and teacher workshops. This future project is, however, dependent on funding.

For more information on the above article, John Keane can be contacted at *johnnykeane@gmail.com*

For more information on the solar technology being used, visit Graham Knight's website: http://www.biodesign.org.uk

For more information on KCYP and their work in Kibera, visit: http://www.kcyp.kabissa.org

John Keane is from Newport in South Wales and arrived in Kenya in 2004 after completing an Open University course in Renewable Energy. He is currently based in Nairobi.

Theme

Sharing knowledge and spreading information using the Internet. The case of the microhydropower.net web portal

Wim Klunne, PO Box 420, 7500 AK Enschede, The Netherlands Email: wim.klunne@microhydropower.net
Website: http://microhydropower.net

microhydropower.net
your internet portal
on (micro) hydropower

Introduction

In this article Wim Jonker Klunne illustrates how the Internet can be used, by describing the role played by the *Microhydropower.Net Web Portal And Discussion Forum* in sharing knowledge and spreading information.

Background

After having worked with ITDG Zimbabwe on the rehabilitation of a microhydro plant in the Eastern Highlands, I was approached quite often with questions regarding microhydro and its applications. The questions differed from very broad requests for general information, to very detailed technical questions. The general questions could be answered most of the time with a very general response, while some of the technical queries were really beyond my knowledge.

My first approach was to provide the people that came to me with questions, with a list of preferred books to read, as there are quite a number of good resource books available on microhydro (see Useful books at end of this article). However, people kept on coming back with small practical questions. This made me prepare some standard attachments that I could send to people in response to the more general information requests. With the Internet becoming more and more available, I started my first web pages on the web server of my employer. Instead of sending people attachments, I simply referred them to my web site. Gradually this web site started to grow, and with a move to a new employer, the web site was transferred to GeoCities, one of the free web space providers on the Internet.

While the general questions could be referred to the new web site, for the more specific technical questions another solution had to be found. Several e-mail discussion groups did (and still do) exist for solar energy, wind energy and other sources of renewables, but no such group existed for microhydro. Therefore, by the end of 1998, I set up a discussion group related to microhydro using *eGroups*, which was later incorporated in the Yahoo! family of web services now called *Yahoo! Groups* (Figure 1).

The microhydropower.net internet portal

The main aim of the internet portal microhydropower.net (Figure 2) is to bring the international community on micro hydropower together. Several definitions of microhydro exist, but for the purpose of the web site no strict definition is being applied, although in general it is related to hydro systems up to a rated capacity of approximately 300 kW. The limit is set to 300 kW because this is about the maximum size for most stand alone hydro systems not connected to the grid, and suitable for 'run-of-the-river' installations.

The internet portal has the following sections:

- **Events**: this section gives an overview of events dealing with microhydro that will take place in the near future. Typical examples are, conferences, workshops and training courses. Information for

Figure 1 Part of Yahoo! Groups page

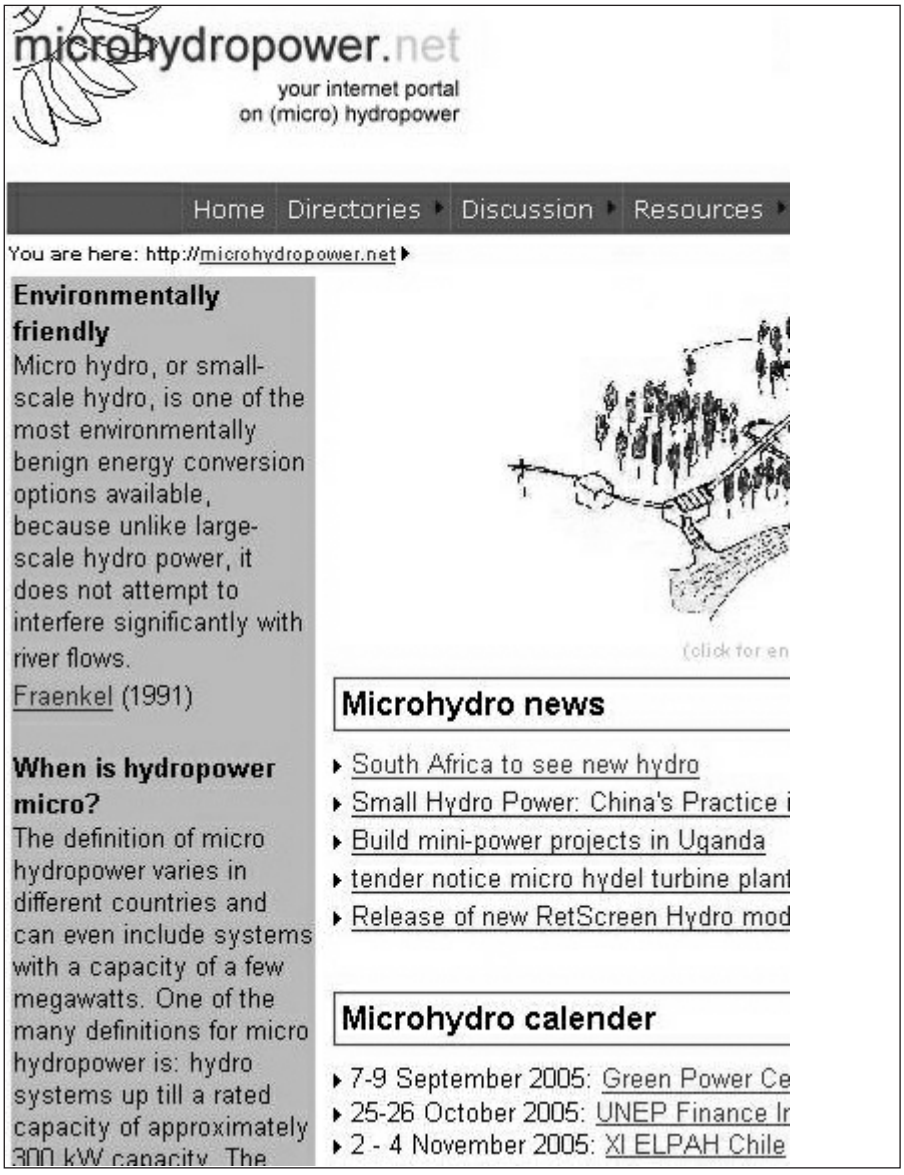


Figure 2 Part of opening page of microhydropower.net

this section is either received directly from the organisers or collected through scanning through renewable energy magazines and web searches.

- **News**: providing an overview of recent news related to micro hydropower, either supplied directly to me or collected from other newsletters, web sites and magazines.
- **Databases**: one of the main areas of the web site is the database with information on consultants, suppliers and organisations in the field of microhydro. Visitors to the website can register their company or organisation in the database and add themselves to the expert directory. Through logging in on the web site, visitors can manage their own entries on the database. To prevent misuse of the database, the webmaster has to approve all new and modified entries before they are displayed on the web site. Unfortunately this results in a delay before an entry is accessible for visitors of the site, but proves a necessary safeguard against undesirable entries.
- **Downloads**: a popular area of the web site is the download corner in which software, manuals and full books can be downloaded. In particular, the Layman's Guide on Microhydro by Celse Peche and the ITDG/ESMAP publication on Best Practices for Microhydro prove to be very popular.
- **Literature overview**: an overview of titles on micro hydropower, with a short description of the books and possible links to web sites where the books can be ordered (Amazon, ITDG publications and others).
- **Internet links**: an overview of relevant links to Internet sites that deal with microhydro.
- **Case studies** of microhydro plants, that are described as best practices from which visitors can learn.
- **Basic theoretical background** of microhydro, describing all stages from site survey to turbine selection and the electrical installations.
- **Country pages**: for a number of countries a special section of the web site is being allocated that gives an overview of the state of affairs regarding hydro in that specific country, a selection of companies and experts from the

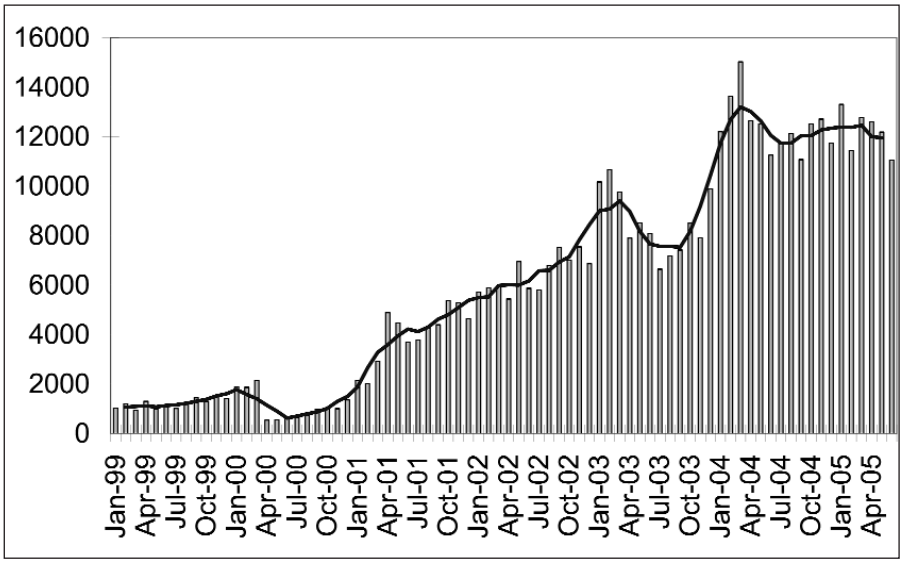


Figure 3 Monthly visitors to the web

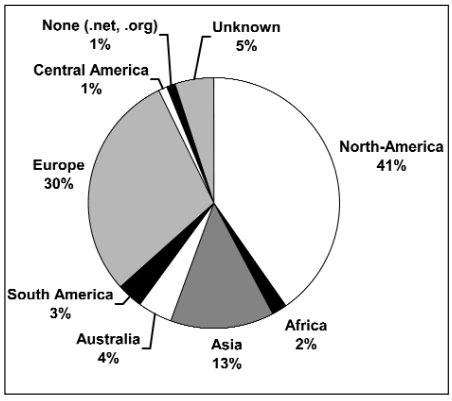


Figure 4 Breakdown of visitors by continent

country, as well as an overview of the hydro stations in the country. The section on country pages is still under development and only a few countries are available at the moment (South Africa and the Netherlands).

Approximately 400 visitors per day currently visit the web site. Figure 3 gives the growth of monthly visitors levels since the inception of the web site. A clear dip in the increasing visitors numbers was experienced when the web site was relocated from my previous employer's site to GeoCities. Clear increases of visitor numbers can be seen during the periods that I was more actively informing the participants of the microhydro forum of the availability of new resources on the web site.

At the start, the web site attracted approximately 1000 visitors per month, which is now stabilising at around 12 000. Since its inception, the web site has seen just over half a million visitors. A rough break down of the origin of visitors can be found in the Figure 4; it must be noted that the measurements on origin may be inflated towards domains in the '*.com*' domain.

Although set up with the original intention of promoting the use of microhydro in developing countries, the site and discussion forum attract considerable attention from individuals in remote areas of the United States that look to the exploitation of available hydropotential.

Since April 2001 the web site can be accessed through its unique domain name, which also facilitated a migration from the free GeoCities web hosting service to a paid web hosting provider. This move allowed the web site to be redesigned using the *php-web* authoring language, which facilitate web site maintenance and allows the use of databases.

One of the main success factors in the development of the web site has been the open nature of the site, allowing visitors to add their contact details and the ability to share information.

The discussion forum

The microhydro Discussion Forum was set up by the end of 1998, using the free services of eGroups. The Discussion Forum offers the opportunity to send emails to all associated members, who can either receive them as individual emails, daily digests or access them through a web site. Most of the group members have opted for the individual email service. To facilitate participation of people with slower Internet connections, attachments are not allowed at the Forum, but can be posted in the files section of the message archive. An associated benefit is a lower risk of distribution of viruses through the forum as these are normally transferred via attachments.

The group has currently over 1600 members who have a personal and/or professional interest in microhydro. Issues discussed in the Forum vary from very general 'new person' questions on how to assess the potential of a hydro site, to very high level technical questions related to the operation of hydro installations. Nearly all issues tabled at the Forum will get an answer.

The Hydro Forum offers an ideal medium for matching projects with potential suppliers, consultants and contractors.

The Forum not only offers the option of sending out emails to all subscribers, but also features an impressive archive in which all past messages can be found. Usually a search in the archive provides answers to a large number of questions.

In order to avoid the dilution of the discussion at the Forum, all messages are inspected by the moderator to ensure that they really relate to the topic, do not include viruses, and are not unsolicited emails (SPAM). This moderation process takes quite an effort from the moderator and might result in some delay in delivering the messages to the group; however it has proved very effective in keeping the members at the Forum and the Discussion focused.

Future

As already described in the section on the web site, continuously new content is being provided, as well as new entries into the databases, making the web site an excellent tool in spreading the word and disseminating information on microhydro.

Based on the success of the Microhydropower.Net Web Site and Discussion Forum, Wim Jonker Klunne is now setting up similar initiatives related to the use of renewable energy in Africa at http://renewables4africa.net

Internet links

Microhydropower portal: http://microhydropower.net
Microhydro discussion forum: http://microhydropower.net/mhp_group

Useful books

Harvey, *Micro-hydro Design Manual, A guide to small-scale water power schemes*
Fraenkel, Paish, Bokalders, Harvey, Brown, Edwards, *Micro-hydro Power, A guide for development workers*

Wim Jonker Klunne is working as an expert on sustainable energy and climate change and has a background in Civil Engineering and Management with specialisation into (renewable) energy in developing countries. Wim has worked on education, research and consultancy projects around the world. He has worked on implementation of renewable energy in southern Africa on behalf of the Energy research Centre of the Netherlands (ECN), the World Bank, UNDP, GEF, Danida and the private sector.

Currently Wim is working with the African Development Bank as Principal Renewable Energy Expert responsible for the ADB FINESSE Africa project. Detailed information about Wim at: http://renewables4africa.com/klunne/.

Promoting solar cookers through the Solar Cookers International

Ramon Coyle, Information Exchange Specialist, Solar Cookers International, 1919 21st Street, Suite 101, Sacramento, CA 95814, USA Tel: 916–455–4499, Fax: 916–455–4498, Email: ramon@solarcookers.org Website: www.solarcookers.org

Guide to building and using simple solar cookers

When Solar Cookers International (SCI) formed in 1987, an early action was to publish a simple, illustrated guide to building and using simple solar cookers (Figures 1 & 2). These cookers require less than 16 Euro worth of supplies to make. They enable families in many countries to reduce their use of firewood, charcoal and kerosene for cooking by 30 to 60 percent per year.

Now in its 10th edition, the booklet includes diagrams of models that can be built for less than 4 Euro in supplies. Many thousands of copies of the booklet have been sold. Free copies have been sent on request to ten thousand organizations worldwide – small self-help organizations, schools, women's organizations, health and development groups, local governments, and national government agencies in countries suffering the effects of deforestation.

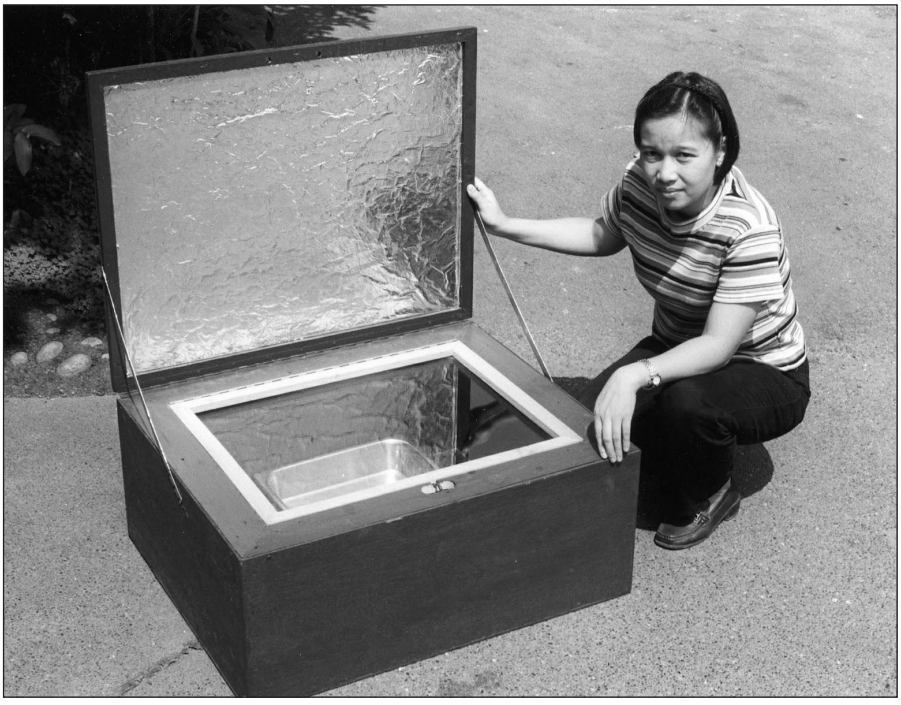


Figure 1 Solar box cooker (*photo: SCI*)

Figure 2 Solar cookers can save valuable fuelwood (*photo: SCI*)

Cooker dissemination

Another booklet is being distributed to help people evaluate whether a given community is likely to embrace solar cooking. This booklet describes steps to a successful programme to spread solar cooking, potential obstacles and ideas for recruiting allied organizations with needed skills and resources. As thousands of requests for information flow into our office, we sent out the booklets – available in several languages – and provide additional answers to specific questions.

SCI newsletter

From its beginning, SCI has published a newsletter three times per year. We began sending it to all the people in the developing world who contacted us. We then began receiving reports of new solar cooking activity started by people who had received our booklets.

Feedback

SCI repeatedly asked this growing international audience for feedback, sometimes through formal surveys. Over time, the system of adding new contacts to the newsletter mailing list, providing them with self-help guides, and asking for feedback has enabled SCI to identify hundreds of small- and medium-scale solar cooking projects worldwide. SCI also has made contact with at least 50 other solar cooking promoters in the developed world and

with representatives of solar cooking programs in China and India–two countries in which more than 500,000 solar cookers have been distributed.

International directory

We added all these names to our newsletter mailing list. From this large list, we extracted the names and contact information for those who reported solar cooking activity. This list of the world's solar cooking promoters was published and distributed as an international directory.

SCI archive on the web

In 1996, a volunteer established a Web site – The Solar Cooking Archive at www.solarcooking.org It posted key resources from SCI's expanding library of international solar cooking information. Other solar activists were encouraged to provide articles, project reports, studies relating to cooking fuel, deforestation (Figure 3), smoke-related lung disease, and global climate change, etc. Our international directory was added to this web page, as were SCI's newsletters.

The Archive is a blend of voices from around the world in dialogue about the promise and practice of solar cooking. Information exchange is multi-directional. Meanwhile, feedback from the world of solar cooking promoters appears in our newsletters in ever-greater amounts. One recent issue included updates from 20 different countries.

Information exchange

The newsletter, directory and Web site enable and encourage hundreds of promoters in developing countries to contact each other to share information. These promoters can serve as independent sources of expertise for others in their district, country or region. They already do serve as models for countless others – both in their communities and through their influence on our newsletter and web page.

SCI has grown with time and pursues other programs as well – including management of field projects in eastern Africa and sponsorship of international and regional conferences on solar cooking. Information sharing services, like the ones discussed in this article, are being developed in a regional centre in Nairobi, Kenya.

Impacts

Our main information sharing system – despite its simple nature – has yielded profound results. For example, with SCI information, a group in Uganda helped 9000 families obtain solar cookers. A project in Haiti, using SCI information, has helped 5000 families make their own cookers. A project in Madagascar has served 2000 families, while one in Turkey has passed the 1200 mark. One promoter in West Africa who borrowed the idea of our lowest-cost cooker has spread the idea to several other organizations, and one of these organizations in turn is spreading it to more groups.

In addition to those 17 000 cookers disseminated, more than 100 other projects that have made use of our services have helped 10 to 20 thousand additional families in developing countries to obtain solar cookers. (Our information services account for another 20 000 or more cookers produced in the USA and some other industrial countries.)

Financing dissemination

This system has not cost much to run. Most non-profit organizations in the United States have newsletters, web pages and someone to answer questions from the public. Much of our information sharing system was grafted on top of these basic services, raising costs only incrementally. The cost to SCI of these many thousands of cookers disseminated in the developing world has been under 15 Euro per cooker. This cost per cooker will continue to fall as more promotion groups form and grow. The low cost to SCI is explained by the fact that the work and funding for these projects are provided by a host of other people and organizations in many communities. Yet the power of practical solar cooking information is proven.

Genius is found in the design of the various solar cookers. The information system, however, is made up of simple, obvious parts. The only slightly difficult thing was the persistence – to answer *every* request for information, to add *every* appropriate name and address to our database, to gradually add features and improve services and to persist in gathering, studying and sharing feedback.

Ramón maintains SCI's database of contacts, responds to inquiries, and maintains relationships with solar cooking practitioners from across the globe. He puts individuals and groups working in the same region in touch with one another. Ramón has an extensive knowledge of the history, technical assistance and information exchange functions of Solar Cookers International.

Ramón has a Bachelor of Arts in English Literature and a certificate in Teaching English to Speakers of Other Languages. He has travelled extensively and reads and writes Spanish. He joined SCI in the summer of 1990.

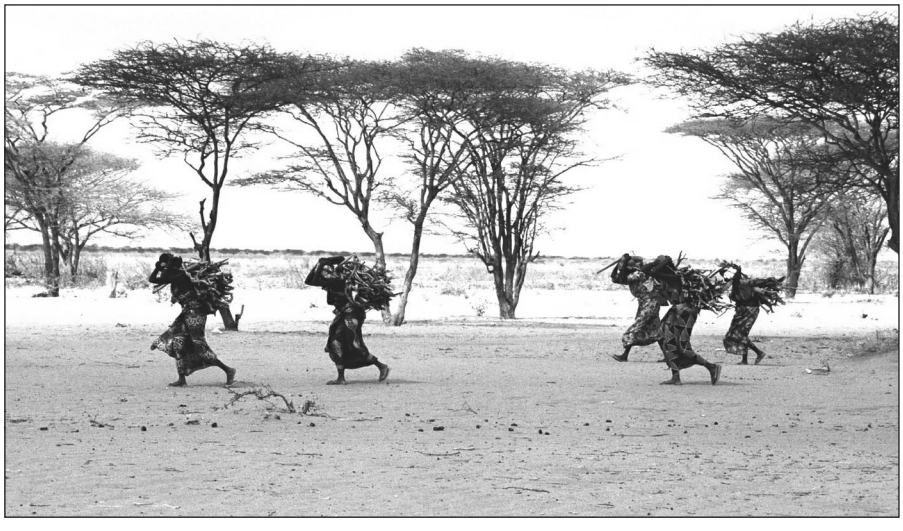


Figure 3 Collecting fuel becomes increasingly difficult with deforestation (*photo: SCI*)

Improved cookstove technology for rural livelihoods for women: sharing experiences from Haryana – India

R C Pal and K S Sethi, The Energy and Resources Institute,Darbari Seth Block, India Habitat Centre, Lodhi Road, New Delhi-110003, Tel: +91–11–24682100/24682111 Fax: +91–11–24682144, rcpal@teri.res.in

Background

In India, the State of Haryana comprises a total of 6759 villages, and an area of 44 000 km^2. The majority of rural households in Haryana use fuels such as wood for cooking and heating, and kerosene for lighting. In addition, fuels like dung cake and crop residues (mustard, Guar and cotton stalks) are used widely.

TERI has implemented an improved cookstove project under the Haryana Community Forestry Project to enhance the income level of the local communities, to promote the use of biomass in a sustainable manner and to mitigate the adverse affect of poor indoor air quality. During this project, 234 improved cookstoves were constructed in four villages in two districts of the State.

Selection of villages

The four villages selected (in consultation with the sponsoring agency) were Haluhera, Nathera, Bhojawas and Gudha, all situated about 60 km away from Delhi. The population and the households of these villages are illustrated in Figure 1.

Fuel consumption pattern

In the four villages, a mix of fuel was found to be in use for cooking in most households, while for lighting, kerosene was used. The study found that the maximum energy consumption for cooking in villages Haluheda and Gudha was 182 MJ/day and 168 MJ/day respectively. The lowest energy consumption for cooking was seen to be 122 MJ/day in the village of Bhojawas. Most people used dung-cakes and crop residues as these are available in abundance. Kerosene was used for lighting. In all the villages, LPG was only used as an alternative fuel for cooking and for rapid heating, e.g., preparing tea or refreshment for guests.

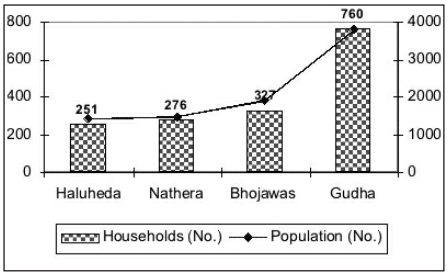


Figure1 Number of households and population in the villages

The need to involve local women

In rural areas, women play a significant role in procuring and processing fuel for domestic cooking. However, the men in the family make decisions regarding all financial matters such as construction or renovation of kitchen, installing of new devices such as improved cook stoves, cattle, etc., while women are responsible for positioning the cook stove in the kitchen, collection and selection of fuel wood species for use, cutting it in small pieces and storing, etc. (2).

A shortage of fuel in the rural areas, due to deforestation, increasing population, and several other reasons, has encouraged participation of women, who are experienced in the drawbacks of traditional stoves in terms of health and environment. The involvement of women was expected to be advantageous in two ways:

- improving their skills to maintain their improved stoves and help other users
- providing them with an opportunity for enhancing their income level through installation and maintenance of improved stoves in and across the villages.

Awareness generation

Awareness generation comprised technology demonstrations, dissemination of pamphlets, sharing technical write-ups, and open discussion forums, which provided for community knowledge sharing and helped in clarifying doubts and benefits, etc. This ensured that the community clearly understood the project rationale and improved their participation in implementation.

Village meetings

Village meetings were seen as an entry point to introduce the programme, interact with the households, develop rapport, and foster confidence among the local community. As a result of a meeting for village women, they were convinced that the use of improved cook stoves would result in efficient utilization of fuel wood and forest conservation, would have a positive impact on family health and result in more time for other activities (income generating as well as leisure).

Dissemination of pamphlets

Pamphlets in the local language were distributed in the villages, describing the basics of the improved stove, and how it is used.

Demonstration and dissemination of models

A demonstration of different models of improved stoves was carried out in the village. Under the programme, TERI trained 50 members of Women User Groups (WUGs) and 9 masons in construction, repair and mainten improved stoves (1). Members of the groups were trained to conduct household surveys for assessing the potential of improved stoves, and fuel consumption patterns.

Building local institutions

For building institutions that have the capacity to plan and manage an improved stove programme, it was necessary to encourage and involve those women who were to be more proactive and involved. Two women were selected who had prior experience in community participation and

formation of groups. These women were trained intensively to select suitable locations for construction of improved stoves within the kitchen, identify raw materials (quality and quantity check), construct improved stoves, and motivate beneficiaries.

Formation of groups

Women User Groups (WUGs) for improved stoves were formed. These women benefited from co-operation, coordination and in planning the future activities of the project. Within the WUGs, only a few women were literate. A literate woman member was delegated responsibility for managing group activities and maintaining records of meetings, etc. Activities focused around improved stove installation, which would generate income and ensure sustainability for the group. The literate women in the group were trained to conduct village and household surveys, while other women assisted during the course of survey. The involvement of all members ensured that everyone had ownership of the group activities. It also helped control any bias among the group members.

The project took into consideration the need to ensure that the stoves were properly used, and built local capacity through the WUGs, so that the local community could address the issue of repair and maintenance.

Through this process, the group members learnt more about the project activities in the village and were paid for conducting the survey. This activity built capacity within the group and infused confidence so that they could help in any subsequent village level activity in any future programme.

Performance evaluation of improved stoves

To assess the performance of improved stoves, a kitchen performance test (3) was conducted in the village of Nathera. The test compared fuel consumption of traditional stoves with that of improved stoves in the same 4 households. The results showed that fuel saving through improved stoves was about 15%, and a time saving of 0.5–1.0 hour per day as indicated in Table 1.

Table 1 Comparison in energy consumption

Type of cookstove	No. of households	Daily per capita energy consumption (MJ)	Saving over conventional stove (%)
Traditional stoves	4	22.00	—
Improved stoves	4	18.75	14.77

Table 2 Evaluation of stove by stove users

	Yes	No	Same as traditional stove
Is the improved stove in use?	27	0	0
Ease in use	27	0	0
Fuel saving	27	0	0
Time saving	26	1	0
Smoke removed from kitchen	23	2	2
Cough	2	19	6
Eye burning	0	26	1
Irritation	3	20	4
Usefulness of IC as against TC			
Safety considerations	27	0	
Hand burning incident		18	9
Good food cooking efficiency	27	0	
Good roti baking	27	0	

An evaluation survey of improved stoves, involving 27 interviewees, gathered information related to the performance of the stove as well as its impact, was gathered after five months of installation. The responses are shown in Table 2.

Conclusion

- The study indicated that users required around 15% less fuel. Significantly lower smoke emissions were reported.
- The installation of 234 improved stoves reduced the burden for collection of fuelwood; the estimated fuelwood saving is around 78 tonnes per annum for these households, which in economic terms amounts to about Rs 117 000 (cost of wood ~ Rs.1.5 per kg).
- The ownership of cookstove technology lies with women. Hence, the involvement of experienced women who spoke the local dialect played an important role in rapid assimilation of the technology by the community.
- 50 WUG members and 9 masons were trained to assess potential, construct, repair and maintain improved stoves at the village level, increasing the capacity of the stakeholders. This should assist the long-term sustainability of the technology and help in establishing a mechanism to meet future demand.
- The study demonstrated that an appropriate technology, backed by local institutional mechanisms, could open new avenues for income generation activities for the trained WUG members.

References

1. TERI report .2005. Introduction of improved cookstove technology in the villages of Haryana. TERI Report No. 2004IP06, The Energy and Resources Institute (TERI), New Delhi
2. Preeti Malhotra, et al. 1998. *Participatory Rural Energy Planning – A Handbook*. TERI, New Delhi.
3. Volunteers in Technical Assistance, Inc. Testing the Efficiency of Wood burning Cookstoves: International Standards, Arlington, VA, 1985.

Mr R C Pal is working as a Field Manager in TERI (The Energy and Resources Institute), has more than 18 years of experience in the field of specialisation includes research & development and dissemination of biomass and renewable energy technologies.

Mr K S Sethi has more than 15 years of experience in various aspects of forestry. He is working as a Fellow in TERI, where his field of specialisation includes biomass based energy technologies.

Improved cookstove dissemination: Experience from Andhra Pradesh, India

C K Jalajakshi, Associate Fellow, Southern Regional Centre, The Energy and Resources Institute, Bangalore, India.
Email: ckjalaja@teri.res.in

Introduction

The National Programme for Improved Chulhas (NPIC) programme was launched in the year 1984–85 to help conserve fuelwood, check deforestation, alleviate smoke in kitchens, reduce drudgery for women and children, and create employment in the rural areas.

Background to the stove programme in Andhra Pradesh

The main agencies disseminating improved cook stoves in Andhra Pradesh are NEDCAP and KVIC. The number of improved stoves disseminated by APCOST is somewhat less. In the State, more than 20 000 cook stoves have been installed annually since 1993–94 (Table 1); NEDCAP disseminates improved cook stoves in all the 22 districts in Andhra Pradesh whilst KVIC has covered about eight districts. About 2.5 million improved stoves were disseminated in the State by the end of 2000.

Key organisations involved in stove dissemination

NEDCAP: The Non-Conventional Energy Development Corporation of Andhra Pradesh is the nodal agency implementing the NPIC Programme since 1983–84.
KVIC: The Khadi and Village Industries Commission (KVIC) started disseminating cook-stoves in Andhra Pradesh around 1989–90.
IREP: The Integrated Rural Energy Programme, is a centrally sponsored Scheme of the Ministry of Non-Conventional Energy Sources, Government of India.
APCOST: The Andhra Pradesh State Council of Science and Technology, Govt of Andhra Pradesh also disseminates improved cook stoves under the Integrated Rural Energy Programme.

Table 1 Improved cook stoves dissemination in Andhra Pradesh

	NEDCAP	KVIC
Year of initiation of IC dissemination	1984–85	1994–95
Districts covered	22	8
Total improved cook stoves installed (by 2000)	2 385 500	162 478

Source: TERI 2001

Overview of stove development in Andhra Pradesh

The design and development of the improved stoves started with the establishment of the Technical Back Up Support Unit at the Regional Engineering College, Warangal in 1990–91. Before the establishment of this unit, other models that had been developed by other regional centres were being disseminated in the State.

Method of implementation

NEDCAP identifies and trains self-employed workers (SEWs) at the district level and conducts user-training programmes in each district. Some of the SEWs are entrepreneurs who have formed Chulha Development Agencies (CDA). The CDAs are the entrepreneurs who invest in purchasing material for construction of cook stoves, have masons working under them, and take responsibility for identifying the beneficiaries and installing the cook stoves.

There are about 5–10 Chulha Development Agencies in each district. The Khadi and Village Industries Commission depends on the Technical Backup Support Unit at Warangal, which identifies the CDAs and SEWs and sends them to the Technical Backup Support Unit for training. The Khadi and Village Industries

Table 2 Overview of NPIC programme in Andhra Pradesh

Key stakeholders		
Funding agency:	Ministry of Non-conventional Energy Sources and the State government	
Main nodal agencies:	NEDCAP and KVIC	
Technical support	Technical Back Up Support Unit at the Regional Engineering College, Warangal	
Users:	Traditional biomass stove users in rural and semi-urban settlements; low and middle income households	
Suppliers	Self-employed workers (SEWs) some of whom have formed themselves into Chulha Development Agencies (CDAs)	
Stove type	Fixed	Portable
Fuel efficiency	20–40%	25–29%
Stove life – Mud IC	2 years	5 years (metallic)
Cement	5 years	
Primary benefit	Reduced smoke in kitchen and wood saving	
Artisans		
Fixed stoves	Rural stove builders called masons	
Stove parts	Urban based manufacturers of AC pipe	
Potters	Traditional potters in rural areas	
Portable stove	Local manufacturers urban based	
Dissemination		
Stove installations from 1984–2000 (cumulative)	About 2.5 million improved stoves through Chulha Development Agencies (CDAs)	

Theme

Table 3 Improved stoves disseminated in Andhra Pradesh

Type of Improved stove	Efficiency (%)	Life (yrs)	Price* (Rs)	Yr installed	No of pots	Chimney	Pottery liners	Damper	Grate	Mud	Cement & brick	Metal
Aravali	22–24%	2	100	1991–93**	2	√	√		√			
Sahyog	>20%	2	NA	1984–89	2	√	√	√		√		
Sukhad	20–22%	2	105	1989–2000	2	√	√			√		
Gayathri	20–28%	5	230	2000–	2	√	√				√	
Gayathri Jr. – see Figure 1	20–28%	5	172	2000–	2	√	√				√	
Gramalakshmi	25–28%	2	52	1996–98	2		√		√	√		
Grihalakshmi	20–24%	2	60	1993–96	1		√		√	√		
CPRI type I and II***	25–30%	5	160–250	1983	1							√

*no subsidy **about 8000 improved cookstoves were installed *** portable
Source: Various annual reports of TBSU, Warangal

Commission also disseminates through some NGOs.

Target beneficiaries

The target beneficiaries are rural households of whom 30% must be communities with major social and economic problems (Schedule castes and Schedule Tribes). The implementing agencies give the targets to the identified Chulha Development Agencies; the targets are based on the previous year's performance and their ability to execute the programme. Wherever the State subsidy is claimed, NEDCAP identifies the villages coming under these schemes and provides the list to the Chulha Development Agencies for dissemination of improved stoves in these villages.

It is mandatory that the masons constructing stoves should have undergone training under NEDCAP or with the Technical Backup Support Unit, Warangal. The Chulha Development Agencies claim subsidy from the implementing agency after installation of the stoves. The subsidy is released after 100% checking by the implementing agency. The method of implementation is given in Figure 2.

Marketing of stoves

The Chulha Development Agencies take initiative to promote the improved stoves among potential users. They identify the local leaders, local committees such as women's groups, watershed committees, panchayath members etc. and engage their help to create awareness among potential buyers. The brochures and pamphlets prepared by the Technical Backup Support Unit are distributed in the village. The stove builders play a key role as motivators by talking to people. It is part of their job since their income depends on the number of people who install improved stoves.

NEDCAP and the Technical Backup Support Unit conduct user training sessions where the benefits and maintenance requirements of improved stoves are explained. Women are encouraged to participate in such

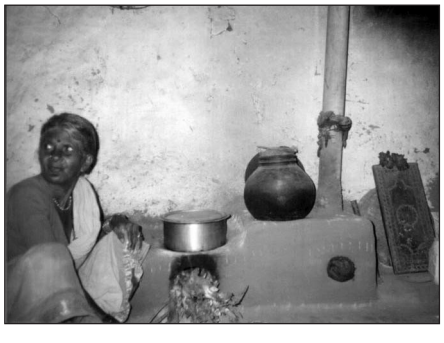


Figure 1 Gayathri Junior Cookstove in Mahabubnagar district of Andhra Pradesh

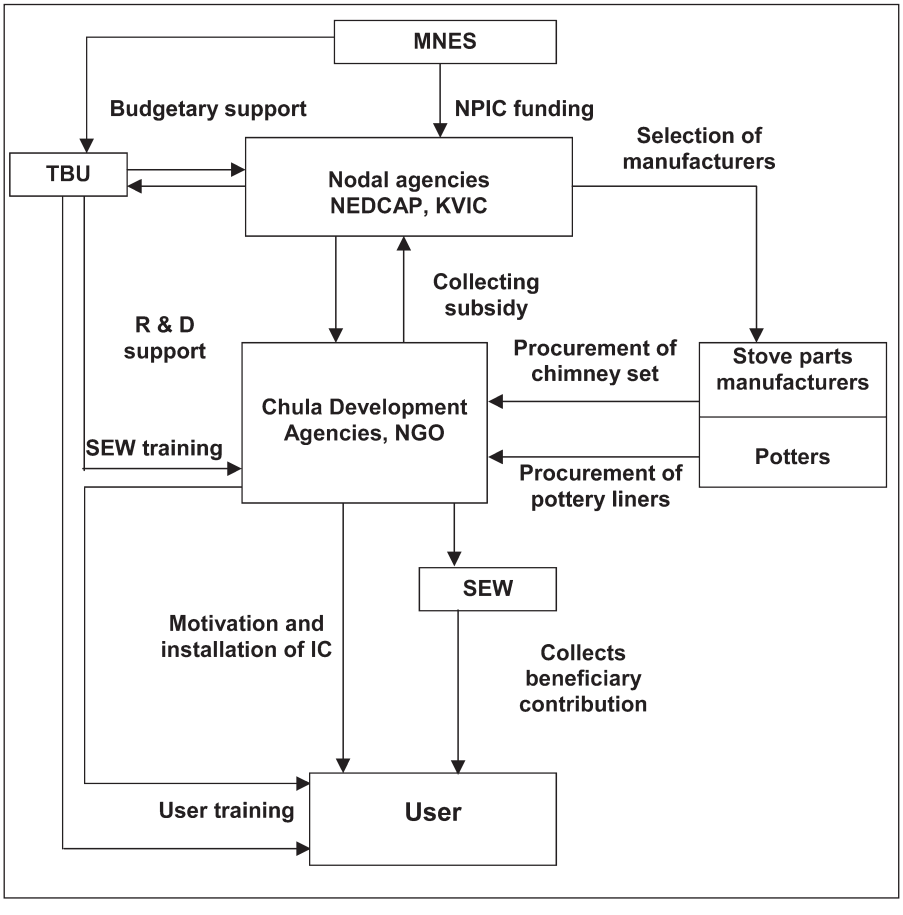


Figure 2 Institutional structure of National Programme for Improved Chulhas in Andhra Pradesh

meetings. Videocassettes explaining the importance of improved stoves are played during such campaigns. However, there are insufficient meetings for the number of districts and blocks in the State.

The government is the sole purchaser of portable improved stoves. NEDCAP purchases directly from the manufacturer. Government bodies, such as the Housing Corporation and the Forest Department purchase from NEDCAP and disseminate the product to beneficiaries under their own schemes.Local manufacturers are involved in the production of portable stoves. The Technical Backup Support Unit tests and certifies prototype portable metallic cook stoves.

Training and interaction

The Technical Backup Support Unit and NEDCAP are involved in conducting training programmes to different stakeholders involved in the NPIC programme. NEDCAP is involved in conducting user training and SEW training. The different types of training given by the Technical Backup Support Unit, such as SEW training, provide ten-day skill development training courses. User training and entrepreneurship training is also given by the Technical Backup Support Unit. The funds for conducting training are given by MNES.

Training to women

Women are encouraged to take part in the training programmes conducted by NEDCAP and the Technical Backup Support Unit. In 1999–2000, 58 per cent of the participants were women, in the SEW training programme conducted by the Technical Backup Support Unit (Table 4). Older women are willing to stay in the villages for 15–20 days during construction of improved stoves. Younger women come from far off villages only if their husbands or brothers accompany them.

Table 4 Training programmes – Technical Backup Support Unit, 1999–2000

	Male	Female
SEW training programme	78	121
Trainers training programme	14	25

In 1997–98, a woman-only entrepreneurship-training programme was conducted to encourage them to take part in the National Programme for Improved Chulhas programme.

Increasing the market for improved stoves

A study conducted by The Energy and Resources Institute (TERI) indicated that transition of poor households from biomass to modern energy sources (LPG and Kerosene) will take many more years to achieve. Improved cook stoves are a better option for poor households than traditional stoves. Traditional stoves are constructed by women using locally-available material and at no cost, so efforts should be made to create awareness among woman on the benefits of improved cook stove usage to encourage adoption.

There are various players in the programme such as self-employed workers, potters, chimney manufactures and entrepreneurs. Efforts can be directed towards tapping the market potential through commercialisation of improved cook stoves, by strengthening the existing stakeholders (suppliers such as potters and pipe manufacturers) and entrepreneurs.

Since subsidy has sent out the wrong signals to consumers in the past, entrepreneurs can be given initial support. Women self-help groups are doing well in the state; the programme can be linked to micro-credit for access to improved stoves for very poor households. The improved stove dissemination in the State is solely a government programme. The large number of stoves disseminated is due to the subsidy towards stove cost. The subsidy given under NPIC is 50% towards stove cost. This programme has been effective in that it has managed to reach the rural households for whom it is intended.

Consumer satisfaction

Women have stated that walls in the kitchen are their cooking vessels are cleaner because of smoke removal. Women living in one-room houses described how reduced smoke in the kitchen enables their children to study even while they are cooking. The women expressed how removal of smoke in the kitchen has reduced the burning of their eyes, and that there is less coughing because they do not have blow the improved stove to supply the primary air for burning. Over 70 per cent of the respondents stated that there is time saving in cooking on an improved cook stove. The convenience of heating water or cooking vegetables on the second pot with residual heat was perceived as one of the benefits of the stove.

Conclusion

The success of the improved stove programme in Andhra Pradesh was due to the institutional linkages developed between various stake holders and the stress given on training and stove development to meet the requirements of the user. The programme has not been implemented on a large scale since 2003, since there is no subsidy towards the stove cost. The efforts so far in training skilled manpower and the network created can be used to commercialise the improved cookstoves. The entrepreneurs trained over the years can be given initial support to take the programme forward and the effort towards stove development and availability of various models in the state can be utilised effectively to meet the demands of the rural women.

References

1. Barnes D F, Openshaw K, Smith K R, Van der plas R. 1994
   What makes people cook with improved stoves?
   A comparative international review of stove programme No 242
   The World Bank, Washington DC USA.44 pp
2. Annual Report 1991–92 to 1999–2000
TBSU, Regional Engineering College, Warangal
3. TERI.2001. Successful practices for improved cookstoves in India: A case study of Andhra Pradesh.

C K Jalajakshi has a Masters degree in Agricultural Economics and working as an Associate Fellow in The Energy and Resources Instititute, India. She is involved in research into natural resource management with a focus on rural and renewable energy.

HERA – your GTZ support for Household Energy

Verena Brinkmann – GTZ

They are evergreen topics: Household Energy (HE) and energy efficient cooking stoves!

While technologies are developed, tested and applied, the required strategies for large-scale implementation and up-scaling have only been implemented in a few individual cases. There is a need to further mainstream these strategies.

HERA is the new Household Energy Programme of the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, funded by the German Ministry for Economic Cooperation and Development (BMZ). HERA formally started in December 2003 and is scheduled to end in November 2007. The programme follows in *HEP's footsteps*; the widely acknowledged former GTZ Household Energy Programme – with renewed energy!

HERA's objectives

The main objective of HERA is to further mainstream sustainable HE management into relevant projects and programmes to ensure basic energy security for households and small businesses. Basic energy security, in the context of HERA, covers thermal energy for cooking, baking, heating and productive use. The beneficiaries of the project are households and small businesses – low-income groups – with a special focus on Africa. The intermediaries for integration of basic energy security are projects and partners in development, linked through cooperative working in the areas of energy, environment, rural development, food security and health.

HERA workshop

To further specify the role and responsibilities of HERA in a participatory way, an initial workshop was held in June 2005. For international GTZ project staff, and partners from other organisations, this workshop provided the opportunity to exchange experiences. Focus of the workshop was an inventory of proven tools & instruments for sustainable HE management and scaling-up. Over 30 participants defined their requirements for tools and instruments for support and large-scale implementation of sustainable HE measures.

HERA is working at four different levels:

- Lobbying for HE
- advising on projects
- co-ordination of knowledge management and networking
- further development of HE concepts and strategies.

HERA's lobbying activities

To highlight the relevance of HE, HERA is promoting and lobbying this topic, producing and distributing documents such as fact sheets and presentations. Topics include, among others, HE and health effects, HE and environment/forestry, HE and the economy. The exchange of experiences and lessons learned with other energy-, health-, environment-related projects is facilitated. HERA also lobbies relevant international organisations such as the World Health Organisation (WHO) or US Nations Environment Protection Agency (USEPA).

HERA's advisory activities

At the end of 2004, GTZ was mandated by DGIS to scale up household energy initiatives, especially in selected African countries with a budget of approximately 18 million Euro over four years. This partnership is coordinated by the GTZ project 'Energising Development' (EnDev). Senegal, Benin, Burkina Faso, Mali, Uganda, Ethiopia and Kenya are the first to scale up household energy under the programme; it is envisaged that other countries will follow.

HERA provides advice primarily to GTZ projects, co-funded by the Dutch Directorate General for Development Cooperation (DGIS).

- *Ethiopia*: promotion of the *Mirt Stove* (for Injera baking). So far more than 50 000 stoves have been sold. The Shell Foundation co-funds current scaling-up in Tigray. With DGIS support, scaling up of production and marketing for another 220 000 stoves is planned.
- *Malawi, Tanzania, Mozambique, Zimbabwe:* promotion of clay stoves (Upesi type, portable or inbuilt). More than 30 000 stoves have been built so far. With current BMZ funding and co-funding from DGIS, scaling up production and marketing for another 50 000 stoves is envisaged (more information at www.probec.org).
- *Uganda:* promotion of rocket stove (Lorena- type stove). More than 30 000 household stoves have been built. With co-funding from DGIS scaling up production and marketing for another 60 000 stoves is scheduled.
- *Malawi, Tanzania, Mozambique, Lesotho, Uganda*: Rocket stoves for large scale cooking are being promoted. More than 500 stoves have been sold to schools and prisons; scaling up is planned with DGIS co-funding.
- South Africa: more than 4000 solar cookers were sold over a period of 3 years (visit www.solarcookers.co.za for more information).
- In *Burkina Faso, Mali, Benin, Senegal and Bolivia* the promotion of production and marketing of

stoves with DGIS funding is in the initial phase.

HERA supports the conception and design of new projects and plans, implements and monitors on-going projects. Guidance for HE-related baseline development, project planning, implementation and monitoring is in preparation.

HERA's activities in coordinating knowledge management and networking

Information on household energy technologies, experiences as well as fuel types is provided by HEDON Household Energy Network. Therefore HERA supports HEDON as an important information and knowledge source.

Information for the support of interventions is going to be provided along three pillars:

- policy level
- supply side management
- demand side management

Networking activities have already started with Practical Action (formerly ITDG), Gender and Energy Network Energia, Global Village Energy Partnership (GVEP), WHO and HEDON as well as with the different GTZ projects. In future, HERA meetings with all network partners will be held on a regular basis.

HERA's development of HE concepts and strategies

Strategies and concepts used will be analysed through case studies. Successful strategies and best practice will be taken-up by other projects.

HERA is a dynamic and interactive project that really wants to make a difference to the HE situation in its partner countries with concrete ideas and strategic support. The programme aims at supporting the exchange around HE. Even though the webpage is still under construction, we hope it contributes to facilitating this exchange.

Please contact us

HERA – Household Energy Programme, GTZ Deutsche Gesellschaft für Technische Zusammenarbeit GmbH, Dag-Hammarskjöld-Weg 1–5, 65760 Eschborn
Dr. Marlis Kees: marlis.kees@gtz.de; tel: +49–6196–79–6430; fax: +49–6196–79–806430
Verena Brinkmann: verena.brinkmann @gtz.de; tel: +49 6196 79–1361 fax: +49 6196 79–806430

The ROCKET is launched in Southern Africa!

Paul Mushamba, Ecosynchron plc, Energy and Environment Consultants, No. 1 Orange Grove Drive, Newlands, P. O. Box GD 652, Greendale, Harare, Zimbabwe
Tel: ++263–4–496723 Fax: ++263–4–495628 Email: pmushamba@yahoo.co.uk

Background

With field tests confirming up to 90% wood savings, coupled with a near smoke-free kitchen environment, the rocket stove has revolutionalised cooking in schools, hospitals and other large scale catering institutions in Southern Africa. This is not so strange considering that an ideal rocket stove, which is correctly dimensioned and constructed with suitable materials (including proper insulation), is known to achieve energy transfer efficiencies of up to 35% or more (1). In July 2004, biomass stove designers, builders and promoters met in Mulanje, a small town in southern Malawi to exchange experiences on efficient institutional stoves. They toured and observed cooking practices at the tea estates where rocket stoves have displaced the open fire in the preparation of meals for thousands of workers.

Objective of workshop

The major objective of the July workshop was to bring representatives from different stove projects in East and Southern Africa to exchange experiences on fuel-efficient institutional cooking technologies and marketing strategies, as well as address challenges that impede large scale dissemination. The workshop coincided with the week long International Trade Fair in the city of Blantyre, where the different efficient stove designs were exhibited and demonstrated to the public.

Criteria for a good fuel-efficient institutional stove

After presentations were made by different stove designers, builders and promoters, there was a long discussion to consider basic criteria or guidelines to which a good fuel-efficient institutional cook stove that burns biomass fuel should conform. These criteria were developed taking into account the requirements of key stakeholders in institutional cooking, that is cooks, catering managers, financiers/buyers, wood suppliers and stove producers. The recommended criteria are listed below (not in any order):

- User friendly, safe and easy to handle.
- Effective smoke removal.
- Should conform with proper kitchen design, plan or layout.
- Affordable price for the intended target users.
- Durability. Should last 5 years before requiring major repairs or replacement.
- Efficiency. PHU of not less than 30%.
- Time and wood savings.
- Return on investment.
- After sales support.
- Guarantee/warranty.
- Minimal maintenance requirements.
- Provision of user training package.
- Appropriate for intended pot sizes.
- Stove capacity sufficient for number of people to be served.
- Appropriate to the cooking requirements of the institution in consideration of the types of commonly cooked foods.
- Appropriate for use with the commonly used/available fuels.
- Standardisation of stove and replacement parts for compatibility.
- Rocket stove design should have insulation of thickness not less than 5 cm.

Rocket stove takes the lead

Over the past year, the rocket stove

has taken the lead among competing designs of efficient biomass stoves and has taken root in several projects supported by ProBEC/GTZ in Lesotho, Malawi, Mozambique and Zimbabwe. An expert stove builder from APPROVECHO is now attached to ProBEC/GTZ and is training interested stove builders (see article by Peter Scott, *BP50*, p. 7).

Priced at about US$100 for a 100 litre-pot stove (which is far below that of competing technologies) hundreds of units have been marketed in the different countries, mainly in schools. For example, the World Food Programme has financially supported a number of schools in the region to purchase stoves under the School Feeding Programme.

Stove production and marketing is in the hands of trained artisans, with ProBEC/GTZ playing a vital role in supporting these functions. Suitable mentoring organisations were identified in each country to offer technical and management advice to the stove artisans. For example, ITDG plays such an advisory role in Zimbabwe, while in Lesotho and Mozambique, structures of the German Development Service (DED) offer support to the technicians.

Despite the large strides made so far however, a number of challenges of both technical as well as related to business administration need to be addressed. Most of the artisans still need strengthening in terms of technical capacity and financial resources. At the technical level, the identification of suitable materials, especially insulation which are locally available, have good thermal properties and are not too expensive still remains a challenge.

Recommendations and future plans

At the end of the workshop, participants identified 3 key areas of activity requiring follow-up.

- The first one (which was considered to be very critical for the further promotion of efficient stoves to catering institutions) involves increased support to artisans/stove producers in technical skills as well as business and marketing know-how. A strong recommendation was made to assist stove producers in doing market assessments, followed by the development of realistic business plans and marketing strategies. Whereas it is envisaged that organisations such ProBEC/GTZ and others have a role to play by availing or leveraging funding for such activities, raising of seed money from in-country sources is strongly recommended. The mentoring organisations should help in linking artisans to relevant support organisations in their respective countries.
- The second major activity for follow-up is the expansion of the rocket stove to other districts in the existing project countries and to new countries in the region. This constitutes a major challenge for the training function and more experts need to be qualified to cope with the increased scope of work. Already participants from new project countries (Zambia and Tanzania) undertook to go back and immediately do baseline surveys to judge the level of interest in the rocket stove and at the same time gather relevant information, e.g. common pot sizes in catering institutions and businesses, and assessment of available materials for stove construction and insulation.
- Finally, participants recommended concerted efforts to search for suitable insulation material within the activities of the different projects. This would entail doing trials of insulation materials and compiling a shortlist of recommended or proven ones. Thereafter, the shortlist should be circulated to interested projects & individuals. A discussion forum of the rocket stove has been started on the ProBEC/GTZ website and all are welcome to give their contributions on this topic.

References

Scott Peter, The Rocket Stove Principle – A Presentation at the Stove Designers' APPROVECHO/GTZ, Johannesburg, 2003.

New Rocket stove design from Uganda

Peter Scott 78590 Echo Hollow Lane, Cottage Grove, Or 97424, USA Email: apropeter@hotmail.com

This article contains some photos and a little update regarding this beautiful little Rocket stove that we put together in Uganda (Figure 1).

The stove will retail, at first, for about 16US $ which is a little higher than we wanted but the thing is such a beauty that our customers keep raising the price that they are willing to pay for the stove. Besides the usual nearly smokeless operation and its attractive appearance (done with the colors of the Ugandan flag) here are a couple of the other highlights

The skirt

One fixed skirt with a 1 cm gap maintained between the *sides* of the pot and the skirt as well as *between* the top of the skirt and the pot by 10 mm round bar. The stove will also be sold with an optional removeable skirt to accommodate smaller pots. Fortunately, pot sizes are quite consistent in Uganda so many households already own a standard medium size pot (Figure 2)

Pot supports

Three pot supports around the combustion chamber and the top plate are made from used oil drum lids (0.5 US$ each)

Combustion chamber

Cut pumice blocks laid up with with 2 parts fine grog 1 part fine clay and 10% sodium silicate

Top plate insulation

This is made from fine clay, exfoliated vermiculite and sodium silicate

Shelf

A 2 mm metal shelf is connected to a

Figure 1 Uganda rocket stove

Figure 2 Pot being put into stove

6 mm round bar wood support. Building the shelf and the wood support together means users are less likely to throw away the shelf or the wood support (the shelf is needed to ensure that air gets into the stove underneath the wood).

Figure 3 shows the stove in operation. Notice the water boiling, no visible smoke and only 2 pieces of wood. In the next few weeks 40 of these will be made, sold and placed in homes around Kampala. Our goal is to produce 10 000 in the next two years

This project is exciting as it is one of only two Household Rocket Stove Projects in Africa funded by the EPA and the PCIA (Partnership for Clean Indoor Air) that will monitor Indoor Air Pollution and fuel consumption before and after the introduction of the Household Rocket Stove.

The stove was designed in conjunction with Kawere Muhammad (Figure 4 – top left) who is the executive director of UCODEA (our main implementer and stove producer in Uganda), and his staff of 14 metal workers and brick layers.

In 2003, I visited Uganda for three weeks and trained GTZ and UCODEA on using Rocket Stove principles. Since then, GTZ has built 30 000 built-in mud Rocket Lorenas (actually that's just in the last three months). UCODEA and others have built approximately 200 Institutional Stoves.

Up until 2 weeks ago almost no work had been done on designing a portable, commercially viable Household Rocket Stove. This project is so exciting as this is the first time I have felt, in Africa, that we have the right materials (appropriate low cost insulative bricks – a pumice combustion chamber costs 2 US$) and the right criteria (people who have to buy wood and charcoal and are willing to buy improved wood stoves).

Figure 5 shows Kawere playing the part of the impatient and hungry husband who wants to eat. The wife, played beautifully by Mrs Muhammad, telling her husband not to worry – with the new Rocket Stove food is coming fast!

So much work has been done with the Rocket Stove in Uganda. For example I kept bumping into people and I would ask THEM what they do for a living and they would say "Oh

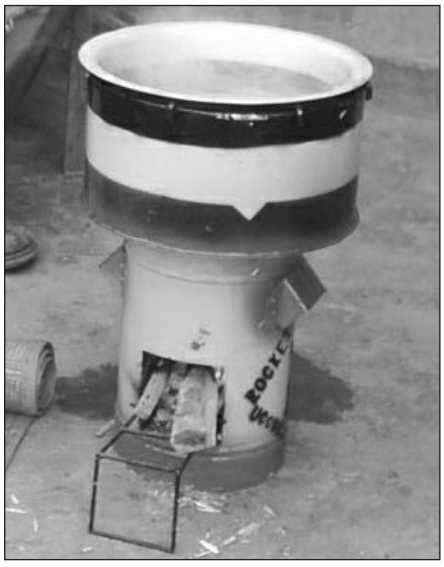


Figure 3 Rocket stove in operation

Figure 4

Figure 5 Playing the role of the hungry husband

I'm a Rocket Stove Designer, What do you do? . . ."

Many thanks to all of the people who helped with the Project: John and Brenda from EPA without their core funding absolutely none of this would have happened; Dana at CEIDH for coordinating; David at CEIDH for setting up the IAP monitoring; Kawere Muhammad and UCODEA for their hard work and flexibility when I changed the design 60 times in two weeks; Margaret Hammskerk for doing the Rocket Stove Logo; Helmut for Quality control; Phillipe Simonis, Lenoard Mugerwa and John Kutesakwe at GTZ-EAP UGANDA for all of their support to UCODEA and the Rocket Stove; and of course for (Uncle) Larry Winiarski for inventing the Rocket Stove in the first place!

Household energies to improve the quality of life for rural communities in the Tibetan Highlands

Dr. Agnes Klingshirn c/o HERA – Household Energy Programme, GTZ Deutsche Gesellschaft für Technische Zusammenarbeit GmbH, Dag-Hammarskjöld-Weg 1–5 65760 Eschborn. Email: aklingshi [aklingshi@compuserve.com]

Purpose of mission

This article describes a mission to the Tibetan Autonomous Region to gather information about solar cookers and improved stoves among nomads and agriculturalists, and to assess the opportunities for their further dissemination. For this purpose interviews with local authorities and villagers were conducted in two Prefectures, Shannan and Naqu. In each prefecture several villages were visited where interviews were held with partners from nomads, semi-nomads and agriculturalist communities.

The work took place within the Sino-German Technical Cooperation Programme 'Renewable Energies in Rural Areas'. The purpose of this programme is to improve the living and working conditions of the rural population by promoting the utilization of renewable energies.

The need for solar cookers and improved stoves

The harsh geographic and climatic conditions in the Tibetan highlands make energy for heating and cooking one of the highest priorities. Traditionally the only fuel available was either fuel wood, in the lower regions supplemented increasingly by roots of bushes, or yak and sheep dung in the upper regions. With a growing population, this has, over time, had negative social and ecological consequences.

With current restrictions on wood collection, the costs in time and/or money, especially for poor semi-nomadic or agricultural families, run high, as they have to travel longer and longer distances to collect and transport the wood. If the costs are too high, this endangers the family's budget for food. Every year the not-so-well off families have so-called 'hunger periods', usually in early summer, before the new crops have been harvested.

Fuel-saving cooking and heating stoves, and solar cookers, are therefore two complementary technologies, which can help to ameliorate this situation.

Main results

Dissemination of solar cookers

Solar cookers have been disseminated through government support programmes or commercially distributed in China over many years. For the most part, these technologies are robust, easy to use and well adapted to the cultural, geographic and climatic conditions of the local environment.

In the Tibet Autonomous Region (TAR), the government has provided solar cookers free of charge, because they can improve the life, especially of poor and middle income households, and bring important economical, social and ecological benefits.

Two versions of solar cookers are imported from mainland China.

- the metal type (Figure 1) with a laminated foil reflecting surface, costing around RMB 450 (100 RMB ~ £7)
- one where the parabolic shaped surface is made of cement, with mirrors glued on to the reflecting surface, costing RMB 100–150, depending on transport cost.

Main benefits of solar cookers

Solar cookers are well suited to Tibetan cooking traditions**.** Approximately 80% of the total cooking energy is needed to boil water for the whole day for their tea. In the morning people eat mostly *tsampa* (Tsampa is roasted barley ground into flour mixed with butter tea to make an instant meal), and in the evening noodle soup, for which they need hot water as well. They prepare hot water during the daytime and put it in vacuum flasks which they can use in the morning and evening to shorten the cooking time.

Economic benefits

- Solar cookers save fuel (wood or dung) and money because if households can save some of it, they can sell it as an extra income. Using the solar cooker reduces the amount of fuel they need to buy. In Shannan Prefecture where heating is not necessary for some months, solar cookers can be used during daytime and save fuel. Even if they use the cooker only 50% of the time, after half a year, the expenses of the solar cooker are repaid.
  Even in Naqu, where the winter is much longer and people have to use their heating/cooking stove anyhow, the possibility to sell the yak dung saved during the short summer makes solar cooking economically interesting, especially for middle and poor households.

Figure 1 Solar cooker plate being covered with cloth to keep it clean

Here it may take up to two years to pay for a cooker, but considering the lifetime of a cooker of up to ten years, this is still a good investment.
- Solar cookers save time spent for collecting the fuel (which can take up to 10 hours daily in the three months when fuel can be collected) which can result in better care for the family and in addition women have more time to look after the animals or get some extra income by weaving blankets or sewing clothes for themselves or for sale.

Social benefits

- The time and money saved usually are spent on household improvements – more time and care for the families, education of children, and even extra cultural activities.
- The burden on women for collecting and carrying the fuel is reduced, improving their health situation.
- CO_2 emissions are reduced and the whole family benefits from a more smoke-free cooking environment and warm water being available for hygienic purposes.
- Potential for conflict within families can be reduced, when the fuel situation is relaxed. Men can go to work and earn extra income, knowing the women have time to look after the family.
- Younger people are not obliged to spend time collecting fuel, but can earn extra income.

Environmental benefits

- In areas where wood is scarce, people tended to cause damage by cutting branches, roots, shrubs and brushes, which lead to increased soil erosion**.** Using solar cookers will reduce the amount of biomass fuel needed.
- Solar cookers save dung**,** which could be used as fertilizer on the pastures of the nomads.

Recommendations

There are a number of changes that could improve the quality of the solar cookers.

Technical improvements

- strengthening cooking pot holders, and solar cooker stands (to prevent distortion of plate)
- improving gauge of aluminium foil membrane on cookers, and making replacement foil more easily available in remote locations
- taking greater care to avoid foil damage in transit
- making solar cooker easier to move so that older people can manage it

Dissemination

For long term sustainability, a more commercial approach will be necessary. In the past solar cookers were disseminated mostly free of charge. This is not only an enormous burden for government, it also brings the danger that:

- people do not care for the solar cooker because they did not pay for it
- others think that solar cookers are a technology for poor people only
- people are not willing to buy a solar cooker because they are waiting for the next distribution by government

Even for the poor, therefore, it is recommended that they pay at least a small sum.

Another approach that has worked elsewhere is that interested people could be loaned a solar cooker – may be for half a year/one year and then asked if they would like to buy it for a reduced sum. This would be a real test, to see if the solar cooker is accepted and useful.

Dissemination of fuel saving cooking/heating stoves

Despite the advantages of solar cookers, people's first priority is an energy-efficient stove, because it can cook and heat the whole day, which is often necessary, especially in winter.

The traditional Tibetan metal stove (Figure 2) is well accepted, but people would prefer one which

- Uses less yak dung or wood
- Produces less smoke
- Functions well, even when the wind is turning

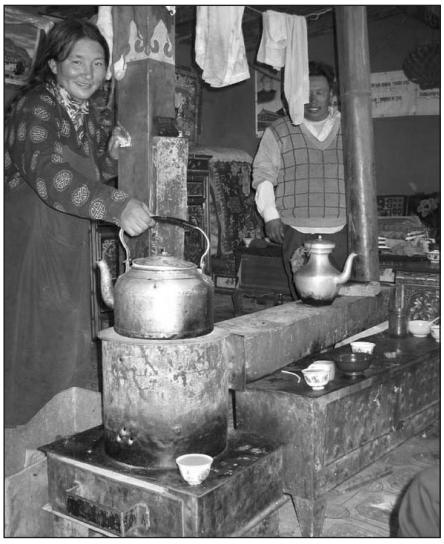


Figure 2 Traditional Tibetan metal stove

The ideal solution would be to improve the existing stove by integrating into the traditional stove a new system of combustion and heat transfer that saves fuel. There are several fuel-efficient metal stoves which have been developed recently and are being tested right now in China and other parts of the world, including` biogasifier stoves, the Vesto stove, the rocket stove.

Challenges and recommendations

1. Adapt existing Tibetan cooking/ heating stoves to improve combustion and heat transfer
2. Training local entrepreneurs and industrial producers to build the improved stoves.
3. Field testing these stoves in a larger pilot project to find out the acceptance and actual fuel savings
4. Planning for a larger, integrated commercial dissemination programme, including publicity campaigns, user information and training, quality assurance, technical training and liability of producers, financing schemes and a systematic monitoring and follow-up system.

Considering the ecological problems of the region, the government should seek ways to save yak dung which could be used as fertilizer instead of burning material. Improving cooking technologies can help protect the environment, and therefore also to improve the life of the inhabitants of the Tibetan Highlands.

Financing watermill upgrades: the business case for scaling up through banking support

B Parthan – Deputy Director – Programme Coordination
Current address: REEEP International Secretariat, VIC D1736, Wagramer Strasse 5, A-1400, Vienna, Austria.
Tel: 43–1–260263209, Fax: 43–1–213–463678, Email: bp@reeep.org

Introduction

This summary report prepared by IT Power presents the business case for supporting the upgrading of traditional watermills *(gharats*) with improved technology. This report aims to encourage rural and agricultural banks to offer appropriate finance for new projects. The report provides an overview of the technical, financial, social and market characteristics of watermill upgrades.

Background

The principal use of hydropower in the Himalayas is through traditional watermills for grinding grain. These mills typically develop less than one kilowatt of mechanical power at low efficiency. Many of the traditional watermills are now being abandoned and the remaining mills face increasing competition from diesel and electric mills.

Since 1996, IT Power, in association with the Himalayan Environmental Studies & Conservation Organisation and the Chamoli Watermillers Association, has successfully demonstrated cost-effective solutions for upgrading traditional watermills. These have been developed with the participation of the watermillers and local manufacturing partners; and have been demonstrated under local conditions since 1999.

Technology

Traditional watermills

The concept and main components of a traditional watermill are illustrated in Figure 1, consisting of a grain hopper, millstones, water chute and wooden runner. The grinding capacity of the traditional mills ranges from 5–10 kg of flour per hour, with an efficiency of less than 20%.

Upgraded watermills

An improved watermill has been developed to maximise the grinding capacity of the existing mill-stones at an affordable cost, so that watermills will be able to compete effectively with diesel mills. The upgraded mills have proven capable of grinding at 20–25 kg/hour, typically a three-fold increase. The new runner fits under the existing mill-house and can use the same mill-stones.

Figure 2 depicts the upgraded watermill and identifies the new components.

To improve efficiency and durability, the runner is made of metal, comprising a steel shaft and improved bearings. The runner has been designed to achieve an efficiency of above 50% and to have a geometry that is suitable either for casting, or fabricating at a local welding shop. The upgraded mill is intended to operate at roughly 200rpm (revs per minute) to achieve peak output; the traditional watermills run at less than 100rpm.

The new runner can operate with the existing wooden chute although this is often replaced with a new chute made from GI Sheet. An additional improvement is the provision of a PVC pipe and nozzle, which directs a more powerful jet on to the runner, as indicated in Figure 2(b).

A limited amount of civil work from a mason may be required to make small modifications to the powerhouse, and to ensure that the intake canal is in robust condition. The new system requires some technical assistance to ensure that the equipment is installed for optimum efficiency, and to train the miller in the necessary maintenance tasks. This assistance can be provided by the Chamoli Watermill Association, who have already overseen the installation of more than 100 demonstration units.

Cost estimates

Investment costs

The initial expenses for upgrading a traditional watermill are presented in Table 1.

Operation and maintenance costs

Operation and maintenance costs primarily consist of the replacement of parts that are subject to wear and tear.

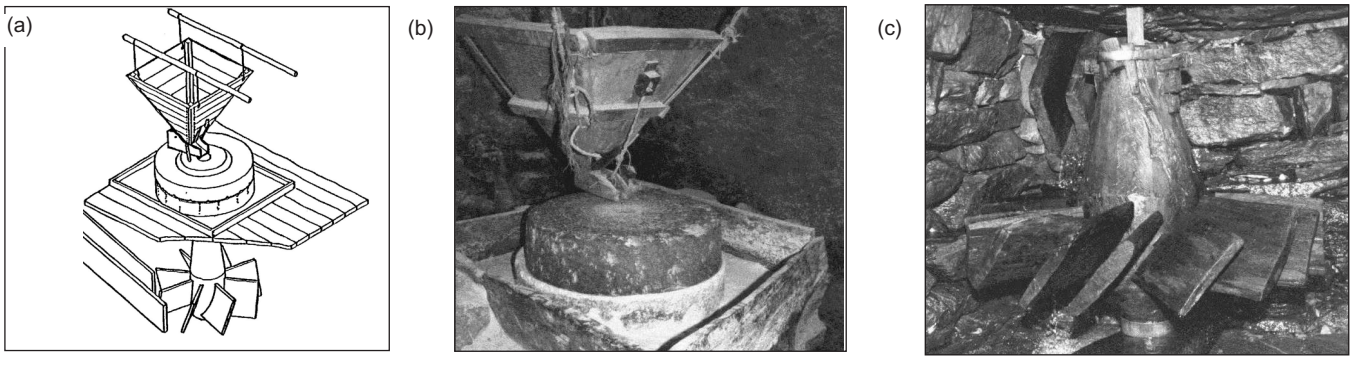
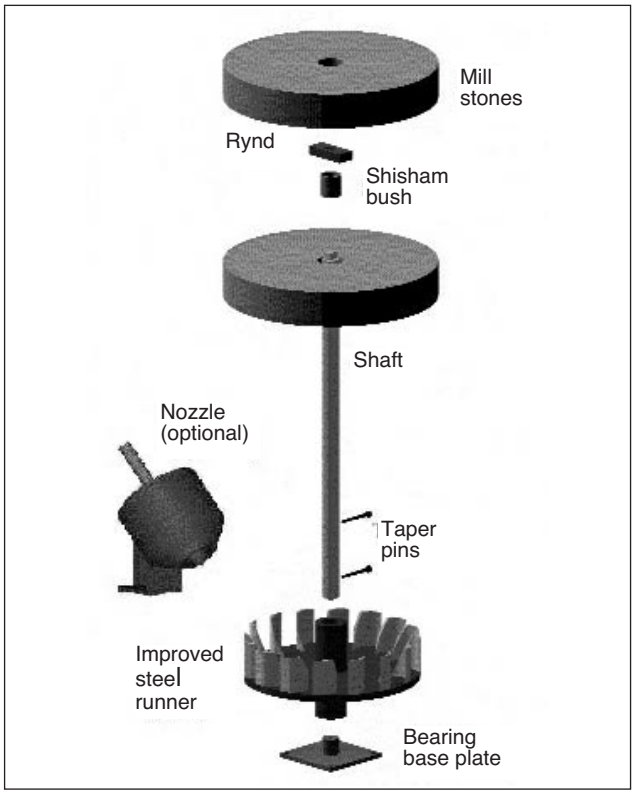
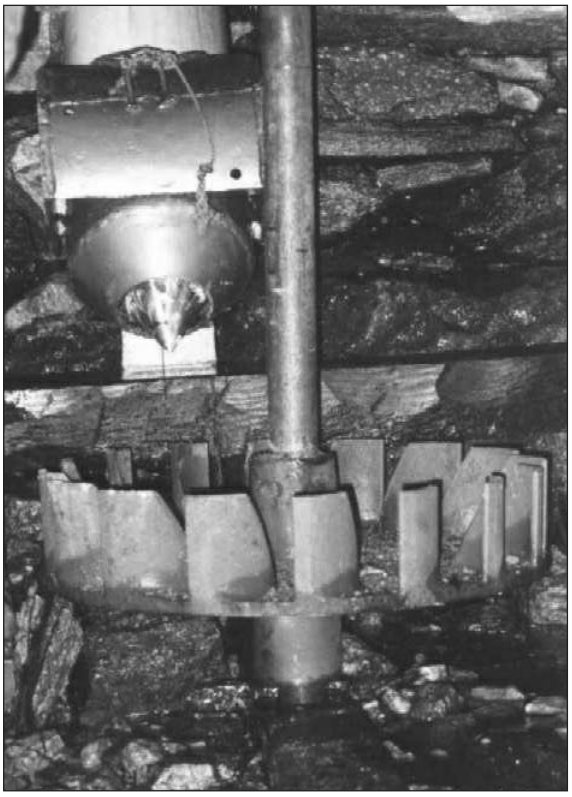


Figure 1 Traditional watermill (*gharat*) (a) Schematic of traditional watermill (b) Traditional watermill – upper section (c) Traditional watermill – lower section



(a)



(b)

Figure 2 Upgraded watermill: (a) Schematic of upgraded watermill; (b) Upgraded watermill

As the life of the components are proportional to the hours of operation of the watermill, the costs given in Table 2 represent an average watermill upgrade. The cost of labour contributed by the watermiller himself is not considered.

It can be seen that in order to benefit from this technology, a watermill owner has to find at least 15 000 Rs to invest in the upgrade of his mill, plus 2000 Rs/year in annual maintenance costs.

Table 1 Watermill Upgrade Costs

Item	Costs (Rs) *	Basis of costs
Hardware costs	6900	Based on manufacturer's quotations
Channel- GI sheet	1000	Based on manufacturer's quotations
Top Grinding Stone	1500	Market survey
Materials for civil works	720	Market survey of prices
Labour for civil works	480	Two man days of effort for a mason
Installation & Commissioning	1000	Market survey
Technical assistance	3740	Market survey
Total	15340	

*1000Rs ~£12.60

Table 2 Average operation & maintenance costs

Item	Annual cost (Rs)*	Basis of costs
Bearing base plates	800	Two base plates @ Rs. 400, based on manufacturers quotation
Ball bearing	40	Based on manufacturers quotation
Shisham bushes	300	Cost of two bushes @ Rs. 150 based on manufacturers quotation
Grinding stones	750	Half the cost of one stone @ 1500 based on manufacturers quotation
Tool repair	50	Past operating costs of upgraded watermills
Sundries	60	Past operating costs of upgraded watermills
Total (Rs)	2000/year	

*1000Rs ~£12.60

Market opportunities

In the hilly regions, large quantities of wheat and millet are grown and consumed locally, all of which has to be processed by grinding. This was the exclusive role of the watermill until diesel and electric mills became available to offer a faster (but more expensive) service.

A market survey of 500 households in Chamoli district, within the service area of two upgraded watermills, revealed that the average household produces between 270 and 350 kg/year of wheat (60%) and millet (40%). Since an upgraded mill should aim to process at least 20 000 kg per year to achieve an attractive income, it is apparent that the market opportunity is for upgrading those mills which can service at least 75 and preferably 100 families. A second essential aspect is that the mill has access to sufficient water to maintain its operations throughout the year, even if processing speed is somewhat reduced in the dry season.

As long as the service is quick and reliable enough, local families have shown a strong preference for 'gharat-atta' (watermill flour) which has the best quality and lowest processing cost: typically 0.75 Rs/kg with payment in kind (known locally as *Bhagwari*), compared with 1.5 Rs/kg cash payment at diesel mills.

There are estimated to have been nearly 200,000 watermills at one time, spread across the Himalayan states of India. Hence the possibilities for replicating the pilot schemes are enormous. A 2003 survey in Chamoli district alone has revealed the existence of 2160 watermill sites, of which 1150 (53%) are still in operation.

It is also worth noting that 3 times as much wheat flour is bought from the market as is grown locally. There is therefore a good opportunity for watermillers to import grains from other wheat growing areas of the country and grind them in their mills for local sale of *gharat-atta*.

Social relevence

A survey to assess the social impacts of watermill upgrades was carried out in Urgam, Gadora and Tangsa villages, Chamoli, in April 2003. This involved village meetings, and interviews with individual millers and their customers.

For the end-users, principally women, upgraded watermills were seen to bring benefits in terms of saving both time and money, as well as better quality flour (compared with a diesel mill). Those who had to travel far to the mills had more to gain from a faster service since it could save them a second round-trip to collect the processed flour.

To the miller, the benefit has been a major increase in business and hence increased earnings, and the ability to operate their mill as their sole source of income.

The only negative aspect has been among millers of traditional mills who feel they have lost customers to the upgraded mills. These millers have been encouraged to invest in upgraded machines themselves.

Table 3 Comparative financial analysis

	Best case upgrade	Average case upgrade	Traditional watermill
Investment costs (Rs)	15 340	15 340	2000
Annual O&M costs (Rs)	2060	1580	740
Annual income (Rs)	22 248	17 064	3348
IRR (10 years, with 3 year loan at 12.5%)	104%	75%	NA
NPV of cash flow (10 years) (Rs)	57256	38472	8636

Business and finance aspects

Financial analysis

A detailed financial analysis has been carried out on the business viability of watermill upgrade schemes, based on the existing experience with watermill upgrades. An analysis of a traditional watermill business without the upgrade was made to quantify the baseline case. The comparative results are given in Table 3.

The following key results were drawn from the analysis:

- A six-fold increase in income can be expected for a watermill upgrade compared to a traditional watermill. The income increases from Rs 217/month to Rs1290 /month.
- A watermill upgrade will have a high internal rate of return (over 75%) servicing a loan from a commercial bank. The miller will still have an increased income on a monthly basis after providing for loan repayments;
- The average monthly repayments on a loan of Rs. 10 600 will be Rs 380/month over a three year period. The average repayment represents only 29% of the monthly income generated;

Business framework

A possible business framework for watermill upgrades has been developed based on the rural banking system, the current institutional arrangements for watermill upgrades, and the social and market aspects. A proposed framework is shown in Figure 5, summarised as follows:

- An *intermediary* provides the technical services such as site

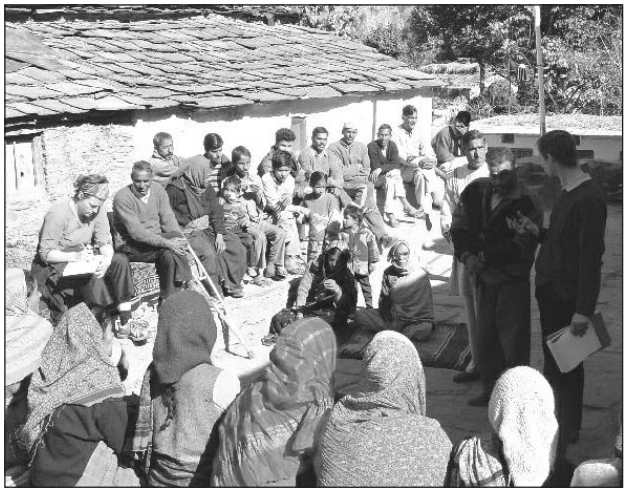


Figure 3 Village meeting with women of Gadora

Figure 4 Interview with a mill-owner at his mill

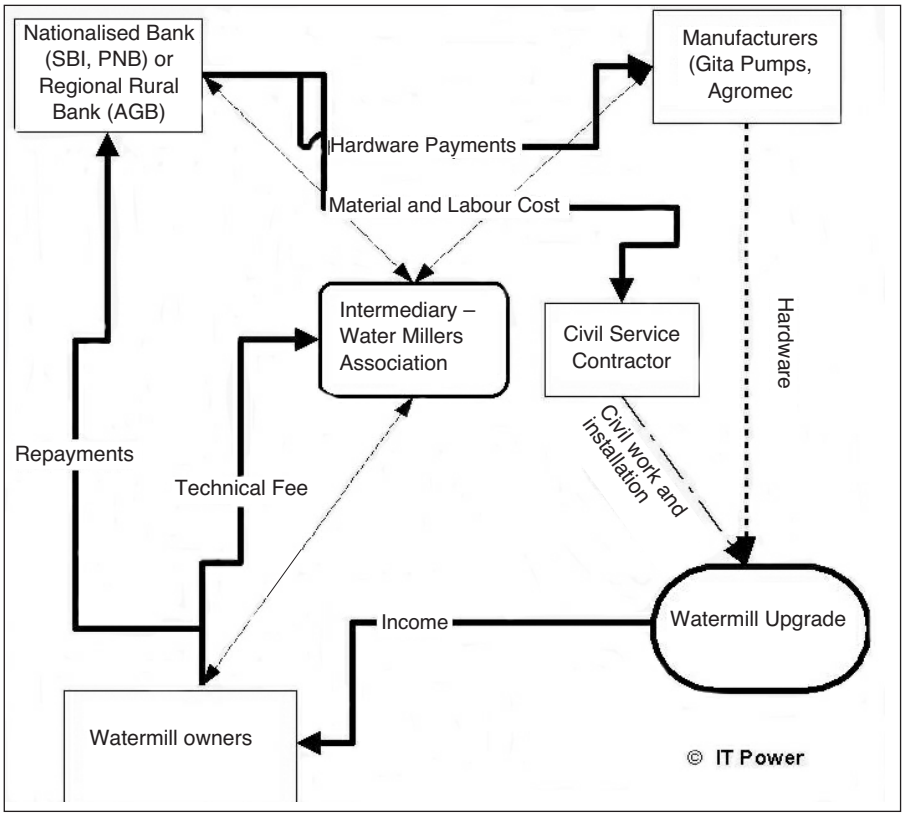


Figure 5 Proposed business framework for watermill upgrades

appraisal, procurement, loan application, and supervision of installation, and co-ordinates with the manufacturer and the local banks on behalf of the miller. The Chamoli Watermill Association has agreed that it can play the role of the intermediary at least during the initial phase of market development.

- The millers get a loan from the local bank to cover the hardware and civil costs of the watermill upgrade. The nationalised banks and the regional rural banks have previously expressed willingness to lend to watermill upgrades as a regular loan. The Regional Rural Banks may seek refinance from NABARD (National Bank for Agricultural and Rural Development).
- The manufacturers who have built watermill upgrades in the past supply the hardware. The intermediary and a civil contractor carry out the installation and commissioning. The costs are financed through a combination of loan and contribution from the miller.
- The upgraded watermill generates increased business and the miller is able to repay the loan on schedule after providing for the miller's own needs.

The relevance of the business framework was demonstrated in November 2003 when two millers obtained loans from a nationalised bank and a regional rural bank and upgraded watermills. A sustained effort is now needed to scale-up the business model so as to bring significant impacts for the many potential beneficiaries.

Conclusions

- Upgrading traditional watermills is an effective and sustainable way of meeting essential agro-processing needs in the Himalayan region using an abundant local energy resource
- The technology for watermill upgrades is now proven, understood and components are being manufactured locally. Capacity has been developed in the hills for those wishing to specify, own and operate these upgraded watermills. Today a critical mass of installations exist as a basis to increase the scale of efforts
- The number of watermills installed and the years of operating experience so far provide a firm basis to estimate the investment and operating costs of the watermill upgrades. The total investment cost for a watermill upgrade is estimated to be around 15 000 Rs, with annual O&M costs around 2000 Rs/year
- A large number of watermills in Uttaranchal and other parts of the Himalayas are not functional or use traditional technology and are candidates for upgrades. There exists a market preference for flour ground by watermills, however it is important to have a critical service level of 75–100 families, and a consistent water supply, in order to ensure viability;
- A social impact assessment concluded that upgraded watermills were perceived as a faster and cheaper means of grinding flour. The quality of the flour was also considered to be the best available. The income generated is sufficient for millers to run their business as their sole source of income.
- The upgraded watermill results in a six fold increase in income and can comfortably service a commercial loan. This presents an opportunity for local banks to lend to watermill upgrades.
- A business framework involving the miller, watermill association, manufacturers and local banks needs to be galvanised to facilitate widespread uptake of this technology.

Mr Parthan has worked as a consultant and expert on over 50 renewable energy and climate change projects in Asia and Africa. Prior to REEEP and IT Power he worked with IREDA, a financial institution specialising in renewable energy.

Who benefits from solar home systems in India?

Kunal Mehta, Global Village Energy Partnership (GVEP), ITDG, Schumacher Centre, Bourton on Dunsmore, Rugby, CV23 9QZ, United Kingdom. Email: Kunalm@gvep.org

Introduction

Solar Home Systems (SHS) are one way of providing electricity to non-electrified and under-electrified rural households to contribute to the overall goal of poverty alleviation. They have been promoted for three reasons;

- quality of life, for example, health benefit, such as clean kitchen lighting (Figure 1), better quality of light for reading and studying
- enhancing income-generating activities for the end-user such as tailoring units, telecommunication booths and other small businesses (Figure 2)
- providing electricity in an environmentally benign manner in a world increasingly alarmed by global climate change.

India has a large market potential with a population of 1.2 billion people (of whom over 50% lack access to electricity), and has the third highest number of installed systems. Despite this, India's SHS programme is still very small in terms of the percentage of the population served by SHSs, with only 0.03% of households with solar home systems. In the last decade, strong emphasis has been placed on their successful dissemination in rural areas, but a number of financial, technical and institutional barriers such as the high capital costs, lack of affordable credit, and unsupportive energy policy still hinder widespread dissemination.

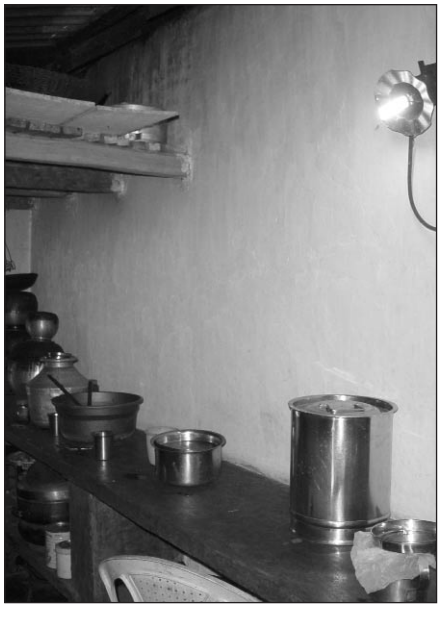


Figure 1 Clean safe kitchen lighting (*photo: Kunal Mehta*)

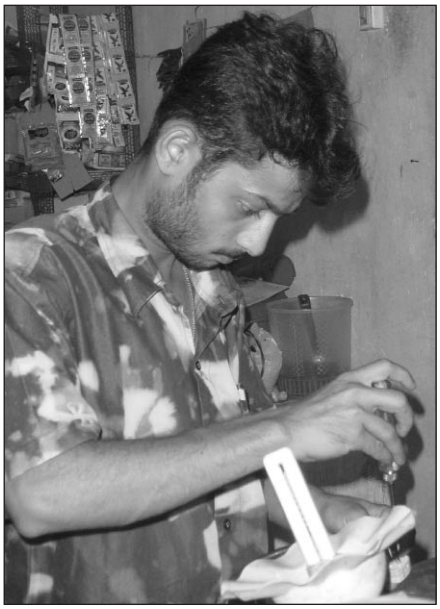


Figure 2 Installing solar lighting in a shop (*photo: Kunal Mehta*)

Financial affordability and lack of affordable credit at the end-user level is one of the fundamental barriers to uptake, making the technology unaffordable for lower-income rural households. This paper explores this barrier by using the example of Solar Electricity Light Company's (SELCO) operations in Dakshina Kannada, a district in Karnataka, India.

Research aims and methodology

The research aimed to analyse the target groups benefiting from solar home systems to explore the success (or otherwise) of SELCO's operations in targeting the lower-income households using a subsidy-assisted market model.

The research for this paper was carried out in June 2004, in the district of Dakshin Kannada, in Karnataka, India. Primary research in the form of structured questionnaires was conducted in Puttur and Belthangady; two among twenty-three rural service areas of SELCO. Questionnaires were conducted in households that had purchased SHSs and in households that had not purchased SHSs. A total of 28 households with a SHS each in area were interviewed and 18 households in Puttur without a SHS were interviewed.

SELCO's market-based model

SELCO is a successful energy services company (ESCO) by industry norms, with the largest sales of SHSs in Karnataka. The business model adopted by SELCO is typical of one that is gaining importance as development moves from donor/government-led operations to a market-based renewable energy services model. SELCO's aims are twofold: firstly – to develop an efficient way to electrify rural areas by increasing affordability of off-grid renewable energy sources, and secondly – to achieve commercial viability in the process of creating a sustainable market.

One of SELCO's primary aims is to provide electricity to the lower-income rural households – the 'underserved' in South India. To achieve this, SELCO's market-based model uses a combination of financial instruments (methods) to break the first barrier for end-users – the capital cost – and provide several financing options including:

- Cash sales – The end-user pays full cash and immediately starts owning the system;
- Short-term credit and long-term financing – The end-user acquires a SHS with credit either financed by SELCO or a financial institution; and
- Fee-for-service – In this model, an ESCO owns the system, and provides an energy service to the end-user who pays a rental to the ESCO.

The use of a combination of financial instruments is promoted in order to increase affordability at the end-

Table 1 SELCO's sales programme

Financing information	Description
Type of system	2-light 4-light – most common system costs Rs18000 2-light + 1-fan
Mode of payment	Full cash Credit Fee-for-service
Terms of credit	Downpayment: 15%–25% Loan principal: 75%–85% Rate of interest: 12.5%–22%
Loan provision	Commercial bank – e.g. Canara Bank Gramin bank – e.g. Nehravathi Gramin Bank Co-operative society – e.g. farmers co-operative Informal
Instalment period	Ranges from 1–5years
Subsidy structure Both subsidies are available to any household: an example of an unrestricted subsidy is given opposite	Interest subsidy – buys down interest rate from market rate of 10%-15% to 5%. Provided by UNEP
SELCO used the capital subsidy only in Belthangady, Puttur is sercied by the interest subsidy	Capital subsidy reduces capital cost by: Rs3000 for 18Wp Rs5500 for 37 Wp Rs10000 for 74WP Provided by Karnataka Renewable Energy Development Ltd
Fee-for-service	Solar Lanterns rented out at Rs10 for 4–5 hours to petty vendors. Successful in places such as Kundapur and Chennai SELCO is the technology provider for this initiative that is operated by an NGO

user level, as the initial cost of a SHS can be many times a low-income household's monthly average income. Subsidies, which help to reduce the investment cost, also form an integral part of this market-based model. These are provided by the government or/and development agencies. It would then be more appropriate to describe it as a subsidy-assisted market model. The details of SELCO's sales programmes are given in Table 1.

SELCO, along with other major players (Shell and Tata-BP), is using a range of financial instruments to scale up operations and cater to increasing demand. This makes it imperative to explore the ability (or lack) of this model to cater to the lower-income households. Otherwise, the increasing profits could make the commercial success outweigh the concerns of the operators to cater for the underserved, including the lower-income households, and thus fail to achieve the primary aim of increasing access to 'underserved' households.

Affordability analyses

Based on an affordability analyses by SELCO, the estimation of the ability of households to pay in South India is given in Figure 3. This clearly indicates that unless system prices are to fall substantially in the near future, cash sales will be restricted to the higher income rural households in India. As it has been envisaged that SHSs will provide power to the low-income non-electrified and under-electrified rural households, other means of financing the systems are imperative.

Consumer credit is another approach to increasing affordability. While low-income households may not be able to pay full cash, they might be able to purchase a system using credit. Referring again to Figure 1, the affordability analyses by SELCO suggests that around 2.5 million households in Southern India would be able to purchase a SHS. Providing subsidies or a fee-for-service programme increases this to 5 million households (50%). This would lead to the inclusion of low-income and middle-income households to purchase a SHS, one of the primary aims of SHS programmes in general, and the SELCO-led programme specifically.

The market model today is thought to be the answer for three main problems with the use of PV for rural electrification: insufficient financing; the low incomes of the potential customers in the rural areas; and the high initial investment costs of SHSs. SELCO has been cited as a successful example of this market model by reducing the financial barrier for the end-user. Effectively this means that using the market, SELCO has increased access to electricity for rural lower-income households.

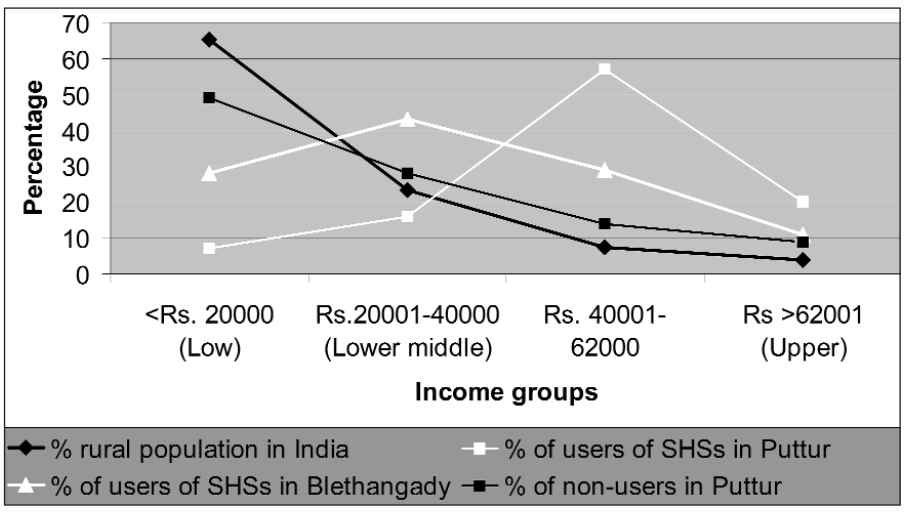


Figure 3 Affordability analyses for Southern India

Results and analysis

Has the model helped to deliver its primary goal: increasing affordability of SHSs by using a range of financial instruments, and has it helped to increase access to electricity to the low-income household? Whilst the interest subsidy, provided by UNEP, buys down the interest rate from market rate of 10%–15% to 5%, the capital subsidy reduces capital cost, as shown in Table 1.

Capital subsidy

Figure 4 puts the findings into perspective, comparing percentage of users and non-users to percentage of India's rural population in different income-groups. It clearly shows that the combination model of SELCO is not targeting the low-income groups in Puttur, with their most significant customer base being the rural middle class. In Belthangady, SELCO does manage to include the lower-middle income group, but only with a substantial capital subsidy of Rs. 5500 on a 37-Wp system.

The capital subsidy has lost favour in the market model as it distorts market pricing and the time-lag between when the company installs the system to receiving the subsidy from the government (6 months) is proving to be too expensive. Because of this, SELCO stopped using the capital subsidy in Belthangady from March 2004. It is important to note that of SELCO's 23 service areas, Belthangady was the sole recipient of the capital subsidy.

Importantly 86% of the respondents in Belthangady stated that they could not afford the system without the capital subsidy. Clearly the capital subsidy for all its market negativities was allowing a wider section of economic groups to purchase a SHS and SELCO's decision has decreased affordability in Belthangady. In the field this was reflected by a sharp decline in sales in the Belthangady service area after March 2004.

Interest subsidy

The interest subsidy is another example of a subsidy failing to reach its target audience. It was intended to benefit the 'poorest of the poor' by helping them switch from traditional fuels to electricity, a cleaner source of energy for the end-user. By benefiting the middle and high-income households (the 'error of inclusion' – UNEP, 2002) the subsidy is failing to increase affordability to the low-income households.

Nevertheless, it would be unfair not to mention briefly SELCO's successes in helping create a market, as there have been many to note, including for example:

- Creating significant awareness of solar electricity in the state, which has helped to boost the confidence of both end-users and financial institutions;
- SHSs have moved from being an 'unknown' technology with high risk investment to becoming 'priority sector lending' in Karnataka. Financing SHSs is a good way to build the loan portfolio of rural bank branches as repayment is positive and risk is small due to the small size of the loan;
- Showing that a combination of financial instruments can be used successfully to sell SHSs; and
- SELCO has demonstrated that rural consumers have the ability and willingness to pay for particular energy services.

At the time of research, SELCO's fee-for-service programme was in its infancy stage, but the early indications seemed to suggest that it was more successful than the other financial instruments. It is important to continue this research to include the fee-for-service customers, as breaking the barriers associated with initial costs would provide the greatest potential for increasing the numbers of adopters. At the moment though, the fee-for-service business constitutes a very small percentage of SELCO's total business operations.

Conclusion

SELCO's successes cannot be underestimated, but unless system prices are lowered substantially, this subsidy-assisted model is still failing to include the rural low-income households. This group constitute over 65% of India's population, whilst SELCO is currently catering to the ± 10% of the middle to high-income segment (with the exception of those benefiting from the capital subsidy). A well-designed microfinance programme is unlikely to positively benefit the poor, especially when commercial viability becomes the parameter for success, as there is a strong tendency for these finances to benefit the top of the clientele group. Lowering capital costs by using a capital subsidy seems to hold positive value for the end-user, even though it poses a hindrance to the process of creating a sustainable market. In the process of scaling-up operations, the fee-for-service model needs greater attention as it is the one method with potential to break the first-cost barrier effectively, and provide electricity to the underserved in rural areas.

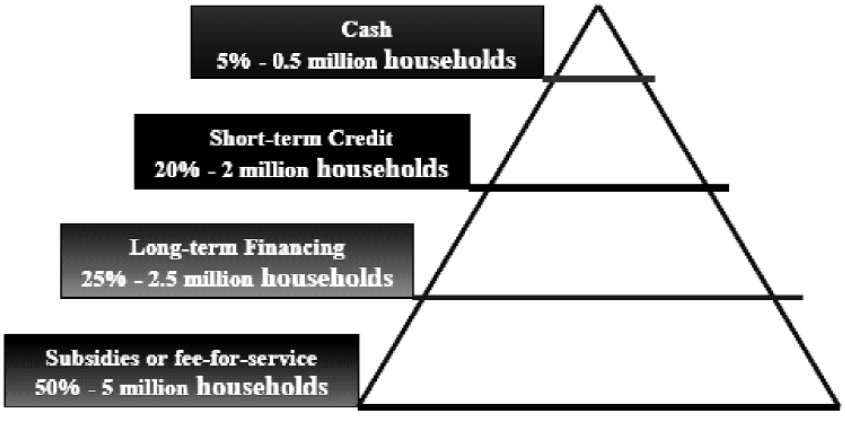


Figure 4 Target group analysis of SELCO

Kunal Mehta works for GVEP, a global partnership promoting the use of energy for poverty reduction. Kunal recently completed a MSc in Environmental Change and Management from Oxford University, specialising in Energy Studies; his first degree was in Environmental Studies from Adelaide University, Australia.

The human and livelihoods cost of fuel-switching in Addis Ababa

Melessaw Shanko[1] and Jonathan Rouse[2]
[1]Megan Power, P.O. Box 180884, Addis Ababa, Ethiopia.
[2]c/o Boiling Point, Schumacher Centre for Technology & Development, Bourton on Dunsmore, Rugby CV23 9QZ, UK.
Or Email: j.r.rouse@gmail.com

This article is an output from a DFID-funded KAR project 'Livelihood substitution: Involving the poor in urban infrastructure and services development'. Project managers: Jonathan Rouse and Mansoor Ali, WEDC, Loughborough University, UK. The views expressed are not necessarily those of DFID.

Background

Household energy crises and fuel switching strategies in Addis Ababa

After the two oil price shocks of the 1970s, there was growing concern within international development circles, as well as the Ethiopian government, about the link between energy and environment and how informed policy decisions could be made. Several studies carried out in the sector in the 1980s concluded that with heavy reliance on biomass fuels, rapidly dwindling forest resources and rising household energy expenditure, Ethiopia was experiencing a serious household energy crisis. In response, a number of policies were implemented to encourage households to switch from using wood fuel to using kerosene and electricity. This article focuses on the implications of these policies on traditional fuel suppliers and their livelihoods.

The traditional fuels sector

The supply of traditional fuels in Addis Ababa provides livelihoods for many thousands of poor urban and rural men and women. Informal sector fuel suppliers include:

- fuel collectors who gather wood either on a small-scale from common land, or a large-scale from plantations (Figure 1);
- transporters who take the wood to Addis Ababa and distribute it; and
- vendors who sell wood from kiosks in markets, or wholesale from warehouses.

Figure 1 Woman collecting fuel, earning around $1US per day (*photo: ESD Ltd.*)

The average income of workers in this sector is about one US$1 a day. The sector is highly informal and decentralized, and relies on what has proven to be an unsustainable resource base. The majority of traditional fuel suppliers obtain fuelwood from state-owned plantations but access is not guaranteed – often bribes are required.

In summary, suppliers have no secure access to fuel, are marginalized, powerless, vulnerable and are victims of harassment by authorities.

Fuel switching policies

The shift away from wood use

In response to the household energy crisis, various strategies have been adopted since the mid-1980s including:

- promoting and subsidising electricity, kerosene and stoves;
- controlling and restricting the flow of fuelwood into Addis Ababa; and
- improving the fuel efficiency of wood stoves for those still using wood.

These measures resulted in wood accounting for just 13% of the total energy used in Addis Ababa in 2000, compared with 70% in 1980.

Electricity and electric injera mitads

A revised electricity tariff was adopted to encourage households to switch from biomass to electricity. The national electricity utility also embarked upon large-scale production and marketing of electric *mitad* stoves at subsidized prices. The stoves are used for making the local staple 'pancake' called *injera.* The utility provided financing that made the *mitad*s affordable to even the poorest consumers. Ownership of electric *injera mitad*s increased from 13% in 1984 to over 70% in 1997. The deliberate policy decision made by the government to keep both electricity and electric *mitad*s affordable for the majority of the households accelerated the switching from biomass to electricity in Addis Ababa from the mid-1980s.

Kerosene and kerosene stoves

Switching from wood to kerosene as a household cooking fuel was almost unknown in Ethiopia in 1980, until it was proposed as a quick fix for the energy crisis. Since 1983, the government has relaxed import restrictions and embarked upon mass importation of kerosene stoves.

Consumption of kerosene grew from about 3000 cubic metres in 1983 to over

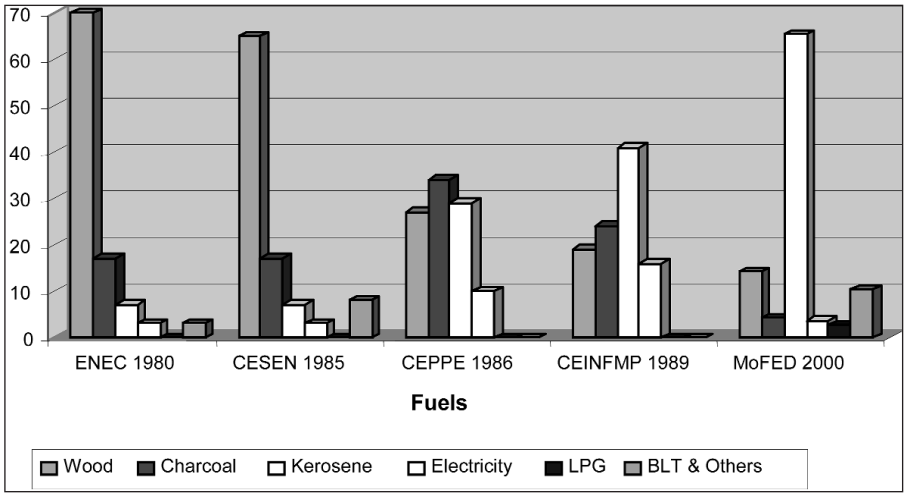


Figure 2 Interfuel switching trends in Addis Ababa 1980–2000

220,000 cubic metres in 2001. Ever since, consumption of kerosene has grown at a rate of about 15% annually. At least half the kerosene is consumed in Addis Ababa, where 90% of households currently own kerosene stoves.

The most notable trends in the Addis Ababa household fuel use include:

- a remarkable decline of wood as a cooking fuel;
- the overwhelming transition to kerosene for domestic cooking; and
- significant penetration of electricity for *injera* baking (Figure 2).

Figures from the national electricity utility indicate a decline in electricity consumption around the year 2000. This is believed to be a short-term response resulting from a reduction in electricity subsidy in 1997. The constant decline in consumption of wood can be seen against steadily increasing consumption of kerosene throughout the period.

Fuel switching: benefits and costs

Environmental benefits

The quantities of modern fuels consumed annually indicate that remarkable environmental gains have been achieved due to fuel switching over the last 20 years. It is estimated that the equivalent of over 400 000 tonnes wood were displaced by modern fuels in the year 2001 alone. Environmentally, the benefit is equivalent to preserving around 50 000 hectares of reasonably stocked forest land.

Social and health benefits

In the mid-eighties, scarcity of traditional fuels increased prices such that poorer households were forced to scavenge for any combustible biomass from nearby waste disposal sites in the city. There are obvious hazards associated with collecting such waste, and the fumes produced from burning them. The perceived benefits of fuel switching for household consumers included reduced energy expenditure, improved health due to the cleaner cooking environment and ease of availability and convenience of modern fuels.

Overlooked costs: impacts on traditional fuel suppliers' livelihoods

National energy and forestry policies promoting fuel switching have increased the vulnerability of traditional fuel suppliers whose numbers have declined as a consequence. In 1984, in a single market day, around 42 000 suppliers were counted transporting traditional fuels into the city. By 1988 there were less than 10 000 falling to 3500 in 2001. This decline exactly coincided with the adoption of fuel switching strategies.

An indicator of the loss of suppliers' livelihoods is the quantity of traditional fuels displaced by modern fuels. Surveys indicated that one supplier supplies approximately 3.4 tonnes, and one retailer sells about 4.5 tonnes of wood equivalent annually. In wood equivalent terms, an average of 205 000 tonnes of traditional fuels have been displaced each year by modern fuels in Addis Ababa since 1983 (Figure 3). This is likely to have resulted in enormous losses of livelihoods.

Ethiopia is committed to achieving the Millennium Development Goals (MDGs), which aim to halve poverty by 2015. This means that new jobs have to be created, but fuel switching has had the opposite effect. Some new jobs have been created by the modern fuels sector, but these are unlikely to replace all of those lost by traditional fuel suppliers. For example, kerosene retailing is usually undertaken through existing petrol stations, so has generated few jobs compared to the number it is likely to have displaced. Other opportunities in the modern fuel sector are not appropriate or accessible to displaced traditional fuel suppliers, as they require formal education and skills, which few

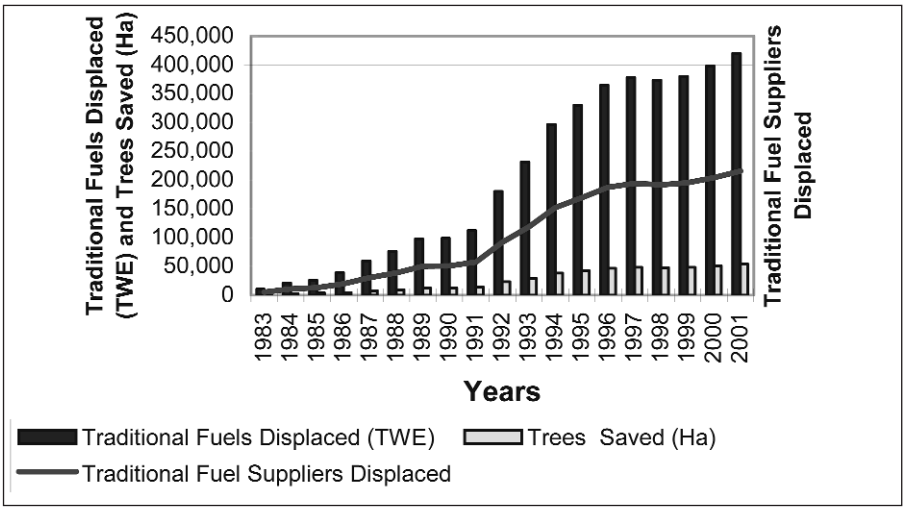


Figure 3 Estimates of traditional fuels displaced, trees saved and suppliers displaced annually in Addis Ababa (1983–2001)

of them have. Around 2000 jobs have been created by small businesses manufacturing electric, kerosene and improved-biomass stoves.

Addressing livelihood losses

Policy makers are either unaware of adverse socio-economic impacts of fuel switching interventions, or they are reluctant to recognise and address the problem. Attributing more value to forest resources, which puts trees before human beings, is still a prevalent attitude among some policy makers.

There have been some sporadic efforts to minimize the hardships encountered by traditional fuel suppliers. These groups included the "Former Women Fuelwood Carriers Association", (FWFCA) and the Finfinne Forestry Development and Marketing Enterprise" (FFDME). Their stories are described in Box 1.

Conclusions and recommendations

Fuel switching interventions adopted in the past have been remarkably successful and have produced considerable environmental and social benefits. Very little was known about the livelihood impacts of fuel switching before this research, which indicates that interventions have had adverse impacts on the livelihoods of many traditional fuel suppliers. These impacts include loss of jobs, declining incomes, increasing vulnerability and insecure access to natural resources. There are insufficient employment opportunities in the distribution and sale of modern fuels to compensate for the high livelihood losses experienced by traditional fuels suppliers (Figure 4).

Figure 4 Selling fuel provides employment for thousands of suppliers (*photo ESD Ltd.*)

Despite its role as a major source of household energy and provider of livelihoods, the official attitude towards traditional fuels is generally unfavourable. There are no policies to inform and guide interventions to address the livelihood-related outcomes. Policy makers are either reluctant or unaware of the unintended consequences of fuel switching.

In the absence of formal mitigation measures, traditional fuel suppliers have borne the brunt of livelihood losses and harassment. Organizing traditional fuel suppliers into groups and providing them with technical and financial support has proved successful in securing some sustainable livelihoods. There is a need to include and consult suppliers in the energy policy formulation process, and to protect both natural resources and the poor, for as long as their livelihoods depend on them.

Box 1 Addressing livelihood losses

Former Women Fuelwood Carriers Association

This ILO-supported project organized women fuel wood carriers into an association that provided alternative employment opportunities. The project brought together over 100 women offering them training and technical support in alternative income generating schemes, and set up an association in the mid 1990s. In spite of serious resource constraints that hampered scaling up of its activities, currently the association's membership has grown to about 200. The association, in collaboration with some partners, has prepared a project concept that would enable its members to participate in, and benefit from, sustainable management of existing fuel wood plantations around Addis Ababa.

Finfinne Forestry Development and Marketing Enterprise

The FFDME owns 27 000 hectares of plantations on which the livelihoods of about 25 000 traditional fuel suppliers depend. The FFDME understands that complete denial of access to the plantation will have far-reaching social, economic and even political ramifications. Therefore, in addition to allowing some access to forest resources, the FFDME is also initiating alternative employment opportunities as forest guards and wage labourers, providing seedlings to communities to develop their own forest resources, and improving access to education and water supply to communities whose livelihoods depend on these state-run plantations.

References

Shanko, M. 2000, *Poverty Alleviation Aspects of Successful Improved Stoves Programmes:* Ethiopia, Country Report, DFID KaR, MGP Ltd: Addis Ababa.

Shanko, M. and Abebe, T. 2002, *Poverty/ Sustainable Livelihood Impacts of Fuel*

Bess, M. and Shanko, M., 1993. *Electric Mitads Producers Survey Results*.

Bess, M. and Shanko, M. 1993. *Implications on Ethiopia's Power and Biomass Consumption*, Ethiopian Energy Authority: Addis Ababa

Rouse, J.R. 2004. Absorbing informal sector operators into improved urban services. *Small Enterprise Development*, Vol 15, No 2 June 2004.

Shanko, M. 2004. Impact of fuel switching policy on traditional fuel suppliers in Addis Ababa. *Field report by Megan Power Ltd.*

Woody Biomass Inventory and Strategic Planning Project (WBISPP). 2003.

The Fuelwood Situation in Ethiopia, WBISPP. Addis Ababa. 2003.

Melessaw Shanko is an independent consultant and managing director of MEGEN Power Ltd, Addis Ababa, Ethiopia, a consultancy firm specializing in renewable energy, energy efficiency, environment and sustainable development. mgp@ethionet.et

Jonathan Rouse is an independent consultant specialising in household energy, urban enterprise and participatory research.

Consensus reached by participants at the International Workshop on Rural Energy, Stoves, and Indoor Air Quality in China

For further information contact: Madam Deng, Keyun (China Association of Rural Energy Industry) Email dkk@public3.bta.net.cn; Professor Smith, Kirk R. (University of California Berkeley) Email krksmith@berkeley.edu; Professor Zhang, Xiliang (Tsinghua University) Email xiliang@dns.inet.tsinghua.edu.cn

A workshop, held in Beijing in January 2005, brought together representatives and experts from universities, research institutes, non-government organizations, provincial and national government agencies, rural energy industries, and international organizations from China, South Asia, Europe, North America, and Africa. They came together to discuss the results of an independent study and evaluation of the Chinese National Improved Stove Program (NISP) conducted by the University of California, Tsinghua University, Renmin University, and the Centers for Disease Control of China.

As with other developing countries, most of the Chinese rural population relied on biomass fuels (wood, crop residues, and animal dung) for their household energy about 20 years ago. Such fuels are traditionally used in inefficient stoves that waste resources and produce substantial amounts of indoor air pollution. NISP, which operated from the 1980s through the 1990s, was the largest and most successful improved stove programme ever implemented anywhere in the world. Similar successful programmes were initiated at provincial and local levels in many parts of the country. Nearly one thousand million rural Chinese citizens have benefited from improved efficiency and reduced indoor air pollution from the improved stoves promoted by these programmes.

Biomedical research in recent years in China and elsewhere, however, indicates that indoor pollution caused by incomplete burning of solid fuels – both biomass and coal – is still an important factor threatening the health of rural residents. Thus, although the high pollution levels caused by traditional biomass stoves seem to have decreased, remaining pollution from coal and biomass stoves needs to be brought down further to reach health standards, including the new national indoor air pollution standard.

Having reached consensus on these points, the workshop proposed recommendations to the relevant agencies of China.

- The successful undertaking initiated and implemented by the Ministry of Agriculture and its Rural Energy Offices should be widely acknowledged and highly praised.
- There were many new technologies developed largely by the private sector in China, offering possibilities for using biomass fuels in a much cleaner and more efficient way. Such advanced biomass stove technologies should be encouraged, and new policies should be formulated to deploy such technologies on a larger scale.
- As China has changed since the initial stage of NISP in the early 1980s, there is a need now to find ways to promote sustainable commercialization of the stoves in the private sector, rather than relying on direct intervention by the government, except in the poorest areas. The China Association of Rural Energy Industry (CAREI) can play an important role in this effort.
- As important players, the central and local governments need to continue their efforts in many areas, including the development and enforcement of energy efficiency and environmental standards, protection of intellectual property of advanced technologies, public education regarding health hazards, training of technicians, and support for focused health and environmental studies.
- From the viewpoint of health, it is necessary to speed up the development and dissemination of improved coal stoves with chimneys if coal is to be used as fuel for rural communities for a prolonged period.
- As time goes on, and expectations of rural residents for environmental and health protection continue to rise, there will be a need to provide high-quality fuel to all users that can be efficiently and cleanly burnt in household stoves.
- There is an urgent need to address the serious problems created by use of poisonous coals in the country. This should be addressed through an inter-ministry effort of the Chinese Government: in the short term by immediately providing improved stoves with chimneys, and as soon as possible, by banning the sale and use of coal from the most poisonous coal deposits, and by providing access to alternative clean fuels to the local populations.
- Taking advantage of significant progress made by NISP and other past successes, China should re-emphasize the importance of modern energy supplies, especially gas fuels and electricity, for all households as part of its laudable efforts to bring the benefits of economic development to all of its people.
- The participants of the workshop agreed that China should work collaboratively with other developing countries to assist them in achieving similar successes, including providing an ongoing compendium of new biomass and coal stove technologies and working to share those technologies and lessons for organizing development and dissemination programmes.

Monitoring the charcoal production of an area under a sustainable licensing system in Masindi district, Uganda

by Stijn Cleemput[1], Caroline Moreau[2] , Cornelia Sepp[1]
[1]ECO Consulting Group, D-36280 Oberaula – Germany, Tel.: +49 (0)-6628–8373, Fax.: +49 (0)-6628–8016
Email: stijn@cleemput.com, Cornelia.Sepp@eco-consult.com
[2]Caroline Moreau, consultant, Email: caro_moreau@hotmail.com

This article has been adapted from a final report supplied to the Energy Advisory Project (GTZ) of the Ministry of Energy and Mineral Development, Kampala, Uganda within the frame work of the Knowledge Network on Energy for Low-income Households in Southern and Eastern Africa (www.sparknet.info)

Introduction

Large parts of Kampala's population are using charcoal for heating and cooking. One of the main charcoal supply areas is situated in the Masindi, Luwero, Nakasongola triangle; more specifically in the Masindi district (National Biomass Study (NBS) 2002; NEMA, 2001). This region supplies the main urban centres of Kampala with 250,000 tonnes of charcoal per annum (Energy for Sustainable Development, 1994 data). The region's natural resources are quickly depleting due to increasing population pressures and action is urgently needed in order to protect and restore these remaining woodfuel stocks.

The Ministry of Energy and Mineral Development of Uganda, supported by the GTZ-Energy Advisory Project, introduced a pilot taxation system in Masindi district, commonly known as the Sustainable Charcoal Production and Licensing System (SCPLS). In this system, taxes are collected according to the quantities of charcoal produced and transported. There are no production limits on private land. Tax collection is based on the biomass resources at parish level, so detailed information on biomass stocks and yield is required to determine the levies. Biomass regeneration (distribution of seedlings, tree nurseries . . .) will be financed from these revenues, and it is expected that this will be an effective means to sustain the biomass reserves.

This article describes the findings from the biomass standing stock estimation study. Although the inventory of the available woody biomass in Masindi came from the former National Biomass Study (now part of the National Forest Authority of Uganda) this article is not part of a project evaluation. The objective is to present a recent monitoring study for the forested lands of Masindi district (Uganda) to contribute to its further development.

In this article, the term 'biomass' is limited to the total living woody natural vegetation found above ground. This includes stems, branches and twigs. The term biomass refers to their air-dry mass, measured after drying the wood for up to 15 days, until the mass is constant (NBS, 2002).

Study area

The Masindi district is located in the most Northern part of the Western region of Uganda. It is famous for its forested areas; woodland, bushland, grassland and tropical high forests. Most of the land is privately owned. Subsistence farmers concentrate mainly on growing maize, groundnuts and tobacco, supplementing their income by burning charcoal. The study area where the licensing system has been introduced consists of 20 administrative units, called parishes. There are some areas that are owned and managed by the National Forestry Authority where people are not allowed to practice charcoal burning.

Method

A first estimate of the national biomass stock was undertaken by the Forestry Department in the late 1980s (NBS, 2002), resulting in the classification of the land cover. With the help of this classification, and recent remote sensing data from the FAO Africover Project (Landsat images of 2001), the distribution of land cover was updated. To refine and update the 1980's biomass data, a ground survey was conducted by the former Forestry Department of Uganda in July 2003, and in more detail, in spring 2004. The methodology for determining yield was used in the National Biomass Study (2002), looking at two scenarios; undisturbed and disturbed land (Table 1). As shown in this table, the undisturbed situation is calculated from the theoretical age of the tree (rotation age); this method is preferable for plantation forestry. The disturbed situation is used for natural forests, where forestry growth on private land is influenced by the actions of man, rather than by natural factors. These figures are derived from national level surveys, and do not reflect the specific growth rates of the study area.

By revising the biomass data for specific land cover, it is possible to predict yields for the administrative units that fall under the sustainable charcoal production and licensing system. The main output was to produce updated quantitative biomass stock and yield data at parish level. This biomass standing stock data gives an idea of the status of depletion and biomass shortage in the parishes. In combination with the available yield figures, the biomass standing stock data can be used to determine the tax levied for each parish.

Results and discussion

This study provided highly detailed and up-to-date biomass stock information and yield data at parish level for the area under the licensing

Table 1 Land use, undisturbed situation and disturbed situation

Land use	Undisturbed situation Annual increment (current) *Tonnes per hectare (air dried)*	N	Disturbed situation Annual rate of change *Tonnes per hectare (air dried)*	%
Woodland	5	30	−1.9	−5%
Bush	1	13	−1.0	−4%
Grassland	1	50	0.0	0%
Subsistence farming	1	195	0.1	1%

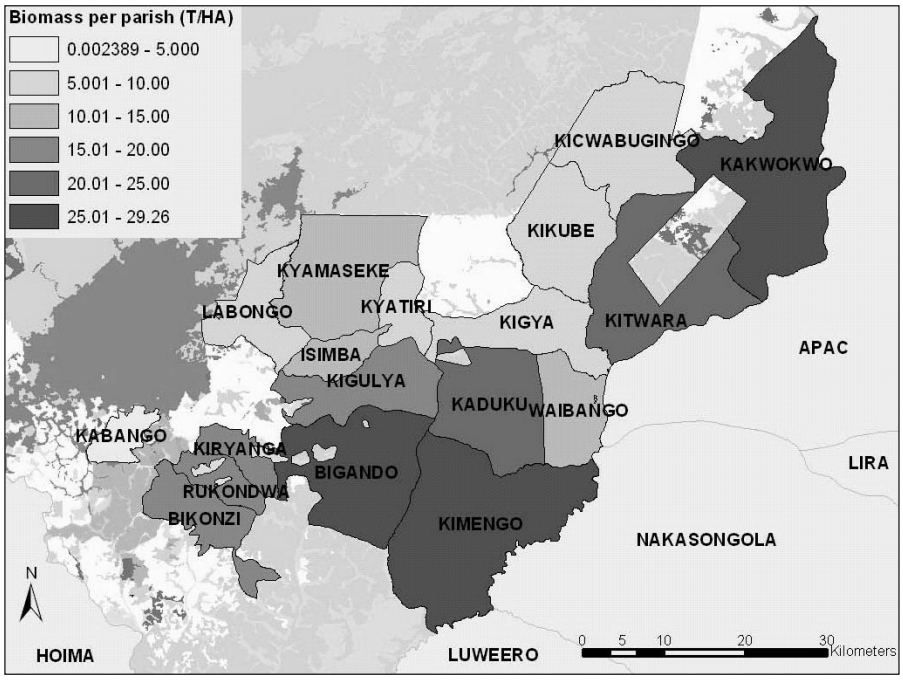


Figure 1 Quantities of biomass per parish under licensing system (Map: Moreau and Cleemput)

system. Figure 1 shows the quantities of biomass per parish that fall under the licensing system.

Parishes inside protected areas are patrolled by forest rangers and are not accessible by road. Thus they cannot be used by charcoal producers, and are currently recorded as having zero biomass available. In future inventories, however, it is recommended that data from these natural reserves be recorded, as it can serve as a reference for comparing the impact of charcoal production on forest land with the natural situation.

Within the parishes surveyed, the average standing stock of biomass ranges from around 5 tonnes/ha to 26 tonnes/ha of biomass. Ranking these values helps to identify the low-ranking parishes that need the most attention. The annual gross yield figures for the disturbed situation reflect the shortfall of natural production capacity of the different land cover areas. For the disturbed situation, the SCPLS region has a deficit of approximately 170 thousand tonnes of biomass per year. Since the protected areas are not included in the survey outputs, the whole loss is on private lands. The undisturbed situation shows the theoretical yield when no encroaching, cutting and grazing activities take place. Based on this figure, the overall yield of the different types of land cover in the SCPLS area is around 600 thousand tonnes of biomass per year.

Finally, wood supplies were compared with wood consumption and charcoal production in Masindi district. Kisakye estimated (2004) that approximately 9162 tonnes of charcoal were transported from Masindi to Kampala. In addition, the population of the SCPLS region consumes about 66 639 tonnes of firewood annually; and 93 151 tonnes of charcoal (converted to wood weight). Aggregating the local consumption and the production for Kampala results in a total 251 411 tonnes per year of wood for domestic purposes within the SCPLS region.

Conclusions

These methods for assessment of biomass resources and yield can be efficient for setting up further forest management planning and licensing systems in the region. A direct link with the planning of sustainable forest management allows the taxation system to influence the charcoal production quota of the SCPLS area.

To monitor the development of the biomass resources, and to test effectiveness of the licensing system, the yield data should be assessed regularly, e.g. every 1–2 years.

The balance between the production of charcoal and the vegetation yield should be interpreted carefully. These scenario analyses allow the effects of different governmental policy actions in the district to be interpreted.

The authors wish to acknowledge the project coordinator Philippe Simonis, and the teams who were involved in this study. The teams comprised: John Kuteesakwe, Mr. Paul Drichi, Mr John Ayongera, Mr John Diisi, Christopher Mukwaya, Alfred Macapili, Edward Damulira, John Ongodia. Special thanks is extended to Mr Solomon Kaahwa, Vice Chairman of Masindi district.

References

National Biomass Study 2003, Technical Report, Forestry Department, Ministry of Water Lands and Environment, Kampala Uganda

National Biomass Study 2002, Technical Report, Forest Department, Ministry of Water Lands and Environment

Kisakye Richard 2004, Final Report: Study on the establishment of Quantity of Charcoal Produced per Parish and Recommended Reserve Prices for Masindi District. Ministry of Energy & Mineral Development supported by the GTZ, Kampala, Uganda

NEMA 2001, State of Environment report for Uganda 2000/2001, Kampala, Uganda

High altitude smokeless metal stove research and development

Kanchan Rai, A. Zahnd and J.K.Cannell, Kathmandu University, Dhulikhel, Nepal

Introduction

A Jumla-designed 'smokeless' metal stove, manufactured and distributed from 1995, is used by some 2783 families in the villages in Jumla, Mugu and Jumla, in the Karnali zone. Now a stove project, researching secondary combustion, has been introduced at Kathmandu University (KU), based on experience gained from the Jumla-design stove.

Data on firewood *(daura)* use

Firewood accounts for 80% of energy consumption in Nepal, with 90%–100% dependence on firewood in rural mountain areas. According to a survey carried out in 1999 in the remote Jumla VDC of Patrasi and Gothichauer, mountain communities use up to 3000 kg per person (18000 kg per family) of firewood per year, comprising 32% for cooking and 56% for heating, compared with 40% for cooking and 36% for heating in lower hill areas. The remainder is used for lighting, boiling water and agro-processing activities. In Jumla, every home in the remote and high altitude villages uses firewood in open fireplaces for cooking, heating and lighting. In winter, families consume 30 kg–50 kg of firewood per day, using most of the firewood for space heating and cooking.

Rural development data

Kathmandu University's Research Development and Consultancy (KURDC) Unit, sponsored by the ISIS Foundation of Bermuda, has developed a rural energy service development programme for Jumla people. During 2003–2004 a detailed survey of household wealth in the two villages of Chauganphaya (63 houses) and Kholsi (56 houses) measured:

- 95% of the houses are build with stone/mud, 5% with stone/dry masonry
- 94% of households use an open fire and an *odhan* (one-pot tripod) for cooking, 3% use an open fire with stone supports, and 3% use a non-Jumla designed enclosed stove.
- For heating, 97% use open fire, 1 household uses a non-Jumla designed enclosed stove.
- For lighting: 97% use *jharro* (a resin soaked pine wood stick from the local available pine tree called *salla*. One household uses a small Chinese solar PV home system.

Health and environment

> Women and children are most likely to suffer from the enormous indoor smoke pollution problem, causing respiratory diseases and other serious ailments. Nepal is one of the very few countries in the world with a lower female life expectancy rate than men. The constant deforestation means that people, mainly women and children, spend up to seven hours every second day gathering fuel wood.

High altitude smokeless metal stoves

Jumla Design Stove (original design)

Mr. Alex Zahnd worked for 5 years with the United Mission to Nepal as the Jumla Rural Development Project Director where he developed the *Jumla Design* stove. Properly used, the stove consumes forty percent less firewood than a traditional open fireplace cooking fire, and also produces nine litres of hot water in a side water vessel. Currently, the stove is installed with a fifty percent (NRp 2500) subsidy to farmers in Jumla; the remainder is raised through project donors. The stoves are manufactured in Nepalgunj, and up to June 2005 a total of 2783 Jumla Design Smokeless Stoves have been installed in the Karnali zone.

Figure 1 Jumla family with no light and with no cooking stove (*photo: Kanchan Rai*)

This stove is especially designed for use in high altitude areas. It has a flue and three pot holes, enabling an entire traditional meal Dal Bhat (rice, lentil and a vegetable dish) to be cooked at the same time. The attached water vessel provides continuously hot water. A Roti Grilling Device included, allowing roti to be baked in the traditional way directly on the embers. The stove has a mud-filled double bottom for insulation. Air draughts are regulated through an adjustable valve in the main door, and a damper in the flue pipe. Walls are 1.5mm steel, and the upper cooking surface is 4 mm, with 4 mm reinforcing rings. These stoves are portable, and have 'worn' well in daily use.

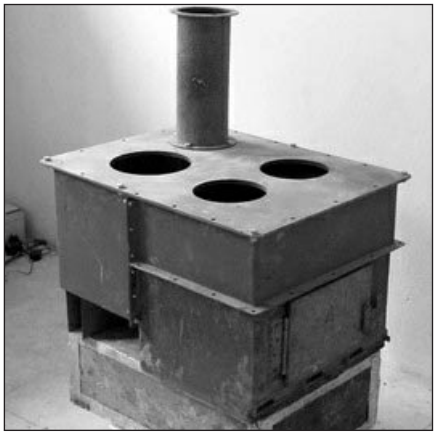
KU-2 (new design)

In 2001–2002, two students of KU Mechanical Engineering Department engaged in a Smokeless Metal Stove project to develop a stove, with secondary combustion, that is at least twice as efficient than the 'Jumla design' stove. With the sponsorship of SINTEF, Norway, a new prototype KU-2 has been designed and tested.

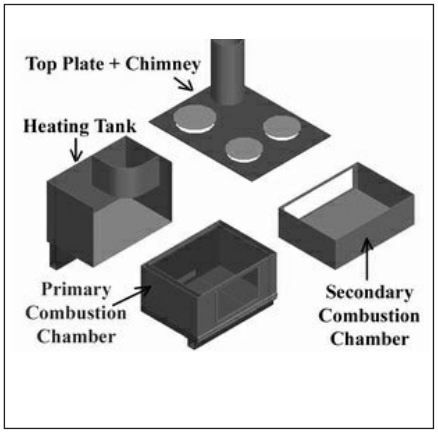
In the KU-2 stove, firewood is loaded through the main door into the primary combustion chamber. The

Figure 2 Jumla family with a 'Jumla Design' stove (*photo: Kanchan Rai*)

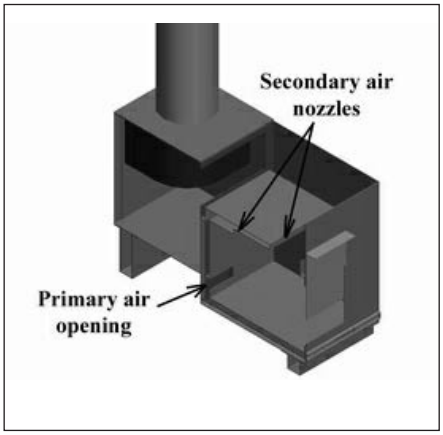
R&D



(a)



(b)



(c)

Figure 3 (a) Improved stove; (b) improved stove schematic; (c) secondary combustion chamber detail

floor has a grate for air passage into the primary combustion zone. The tray for ash serves as an air passage for both primary and secondary chambers. Separate vents for each air passage control the airflows. There is a water tank made of stainless steel, holding eight litres of drinkable water and a 'Roti Grill'. In the secondary combustion chamber, hot air from the secondary air passage is mixed with unburned flue gases from the primary combustion chamber to promote further combustion of flue gases, reduce energy losses and increase the efficiency of the stove. After combustion, the cleaner exhaust gases escape through the chimney, which has an adjustable damper to control the draught.

The primary air flowing below the floor is preheated, and the secondary air supply beneath the primary zone floor and up the back of the primary chamber enters the secondary combustion chamber through two layers of nozzles, well preheated. Both secondary and primary chambers are insulated using mud. A baffle plate below the chimney induces better circulation of hot flue gases, making maximum use of convective heat transfer. Air flows are controlled by a primary air sliding vent, two secondary sliding air vents and a damper in the exhaust pipe.

Results

See Table 1.

Table 1 Results

Fuel consumption	With the KU-2 stove the firewood consumption is slower and thus the same amount of wood burns for much longer than in the 'Jumla Design' stove
Heat transfer	The KU-2 stove transfers the combustion energy (by radiation and convection) to the cooking utensils better, and over a longer period, than the 'Jumla Design' stove.
Chimney temperatures	A chimney temperature of around 400°C occurs in the 'Jumla Design' stove, and this is higher than that occurring in the KU-2 stove. The very hot flue gases escaping in the original stove result in a lower stove efficiency.
Velocity	The velocity in the 'Jumla Design' stove chimney is about 1.4 m/s for the first 10 minutes and then drops slowly. Since the KU-2 stove burns firewood more slowly, its velocity is also lower.
Combustion chamber temperatures	The primary chamber temperature is around 600°C in the Jumla design stove, with maximum values of up to 700°C for a short time. The second chamber temperature is lower for the first half of the test period and then reaches about the same level during the remainder. In the KU-2, the primary combustion chamber is the hottest zone, measuring 600 to 750°C. Ideally the secondary zone should have higher temperatures than the primary, but with the present KU-2 design the secondary air usually is not quite hot enough to ignite and a redesign is needed.

Conclusions

The secondary combustion stove is still in the design, research and testing phase, though already it has been shown that increased available energy for cooking and heating can be achieved with the same energy input.

Further changes are planned to: the chimney position; secondary air passages; airtight seals; improved energy loss measures; and a glass door (because users insist on keeping the door open so as to see the flames).

Already this stove demonstrates the potential of improved domestic metal stoves for use at high altitudes. Continued design, research and development will allow us to build on our understanding of the processes involved, step by step, until we have developed a truly effective product.

References

Alex Zahnd: Murdoch University (Western Australia) thesis for MSc in Renewable Energy, 2004

Kanchan Rai completed his Mechanical Engineering degree from Kathmandu University in 2002. He has worked as a Research Assistant at the Research, Development and Consultancy Unit in Kathmandu University. His project was entitled "Development of an Improved Cooking Stove for Mountain Areas of Nepal". Kanchan is now doing an MSc on Energy and Environmental Technology in Telemark University in Norway.

What's happening in household energy?

HEDON

www.hedon.info

HEDON announces support from GTZ

HEDON is delighted to announce that GTZ-HERA has agreed to co-fund part of its activities in further developing the knowledge data base on various household energy issues and to initiate an a special interest group on scaling-up household energy interventions. GTZ is the first major organisation to recognise the role of HEDON as the 'first-stop shop' for household energy information.

As discussed in the article *'HEDON – the household energy network'*, HEDON is planning to develop special interest groups on topics such as clean indoor air, cooking and carbon (CDM), alcohol fuels, gaseous fuels, and scaling up. If organisations would like to collaborate with, and/or finance one of these areas of interest, please contact Grant Ballard Tremeer at *grant@ecoharmony.com.*

Ashden Awards for sustainable energy

the **Ashden Awards** for sustainable energy

The Ashden Awards for sustainable energy are now looking for entries from inspirational and innovative local sustainable energy projects from across the globe and which use renewable energy to address one or more of the following areas: Food, Education, Light, Health and Enterprise. There will also be a Special Africa Award designed to highlight the role which sustainable energy can play in meeting the particular challenges facing that continent.

The Ashden Awards reward outstanding projects which can demonstrate how local sustainable energy can be used not only to slow down the factors contributing to climate change, but also to radically transform the lives of communities lacking essential energy. The Awards are designed to encourage a wider take-up of local energy solutions worldwide, proving to both the public and policy-makers that such schemes offer viable, practical ways of tackling both lack of access to vital resources and climate change.

In 2006 the Ashden Awards for Sustainable Energy will be offering:

Five first prizes of £30,000 each and four second prizes of £10,000 each for projects in the developing world (the 'Overseas' Awards) including a Special Africa Award designed to highlight the role which sustainable energy can play in meeting the particular challenges facing that continent. Prizes will also be given for projects in the UK.

The Ashden Awards are inviting applications from projects in developing countries

For more information on the Ashden Awards, please visit www.ashdenawards.org or contact: Danielle Jones on + 44 207 410 0330; email: info@ashdenawards.org
Closing dates for entries 21 November 2005

'Myth' that forests improve water flows – Reuters

A recent report from Reuters (July 28 2005) discusses findings from research done by John Palmer, manager of the Tropical Forestry Research Programme run by the British Department for International Development. He is quoted as saying 'Trees on the whole are not a good thing in dry areas if you want to manage water resources'. The report described as a myth, the belief that forests acted as sponges that soak up rain, releasing it throughout the year and ensuring more regular flows in rivers. Instead, trees' deep roots often aggravate water shortages in dry seasons. Although recognising that forests have many other benefits, including building materials and firewood, the report suggested that countries are wasting millions of dollars in planting trees specifically to improve water flows. These findings could have a major impact on policies around forest resources.

Funding opportunities

GVEP gap fund

GVEP has announced the establishment of its Action Programs Fund – the GAPfund. Dr Abeeku Brew-Hammond, Manager of the GVEP Technical Secretariat, said the GAPfund would make US $1.5 million available for innovative projects which would provide energy services to poor communities around the world, including India. He added that the fund would support projects that deliver benefits in education, health and agro-enterprise, and so help reach the Millennium Development Goals (MDGs). GVEP will work with a partner-base which includes the UK Department for International Development, the United States Agency for International Development, the World Bank and partners from the NGO community as well as the private sector. For further information contact GVEP at: *Global Village Energy Partnership (GVEP), Abeeku Brew Hammond, Practical Action, Schumacher Centre, Bourton on Dunsmore, Rugby, CV23 9QZ, UK. Email: info@gvep.org*

EU Co-opener

The call has been announced for this EU funding. Over 100 grants will be disbursed totalling €5m. A minimum of two independent organisations per application is required. Funding is up to a maximum of 50% of the cost of the project. This year, funding is available for activities under the following headings: 'Energy policies, legislation and market conditions for enabling poverty alleviation in developing countries' and 'Strengthening local energy expertise in developing countries'. These are

explained in more detail in the Call text itself and in the Annual Work Programme 2005 (both available on *(http://europa.eu.int/comm/energy/intelligent/call_for_proposals/call_library_en.htm):*
Deadline for submissions is February 2006.

New books

Power to the people by Vijay V Vaitheeswaran

This is a highly readable and well-researched book. It opens by describing the situation in which the world finds itself, dominated by the major players in energy dictating access and using energy to wield power. The alternatives for local power generation, including the exciting potential of fuel cells and other forms of micropower are discussed. The author shows that this is no longer the domain of cranks and boffins, but that major players are already looking seriously at these forms of energy. There is a large section on the effects of these changes on developing countries, including a rarely-seen reference to the major effects of indoor air pollution on population health and how these new technologies could benefit health as well as providing access to energy services. This book is a lesson in how clear, well-argued and deeply-researched information can be presented in such an engaging and enlightening way. *ISBN: 1-84407-176-6 Earthscan, UK*

Household Fuels and Ill-Health in Developing Countries – What improvements can be brought by LP Gas by Kirk Smith, Jamesine Roger, and Shannon C Cowlin

This short book describes all the issues surrounding LPG (Liquified Petroleum Gas) and why it has such an important role in reducing the burden of ill-health in those communities which are able to access this fuel. However, the book does much more than this in that it describes the whole indoor air pollution issue in a clear, understandable way. The book discusses why LPG produces less greenhouse gases than woodfuel burnt in a traditional stove. The importance of harvesting fuel renewably is highlighted in this discussion. Social aspects, such as fuel collection and women's earning potential are discussed. Comparisons with other fuels are drawn, and the sustainability of LPG as a fuel is examined. Finally, the book is amply supplied with up-to-date references and a helpful glossary, for those new to this topic.
World LP Gas Association, Paris, France WWW.WORLDLPGAS.COM/PUBLICATIONS

Useful websites

Although Boiling Point reaches many people without computers, it also serves many who do have access. As this issue is about communication, I hope those with no access to computers will forgive this brief section. I'd also welcome any other suggestions for useful and informative websites to include in future editions

HEDON *www.hedon.info*
A good place to start for finding out about all the other websites . . . and lots more

World Health Organization indoor air pollution site *http://www.who.int/indoorair*
This site is really useful for statistics, information material, databases

REPPS stoves site *www.repp.org*
The Renewable Energy Policy Project has a stoves pages within the 'discussion groups' page. This describes the latest developments in stoves for cooking with biomass fuels in developing regions – lots of good pictures.

Partnership for Clean Indoor Air *www.pciaonline.org*
The mission of the Partnership for Clean Indoor Air is to improve health, livelihood and quality of life by reducing exposure to air pollution, primarily among women and children, from household energy use.

SciDev.Net *www.scidev.net*
News, views and information about science, technology and the developing world. Includes articles from other news sources worldwide.

REEEP *www.reeep.org*
The Renewable Energy and Energy Efficiency Partnership (REEEP) is a coalition of progressive governments, businesses and organisations committed to accelerating the development of renewable and energy efficiency systems.

EarthTrends – environmental information portal *http://earthtrends.wri.org/*
A really useful website for tables and statistics on key environmental indicators

GVEP global village energy partnership *www.gvep.org*
GVEP's aims are to reduce poverty and enhance sustainable development through the accelerated provision of modern energy services to those unserved or underserved. See 'News from Practical Action'

ProBEC The **Pro**gramme for **B**iomass **E**nergy **C**onservation in Southern Africa *www.probec.org*
The aim of ProBec is to enable lower income population groups satisfy their energy requirements in a socially and environmentally sustainable manner.

Sparknet *www.sparknet.info*
SPARKNET is an interdisciplinary interactive Knowledge Network focusing on energy for low-income households in Southern and East Africa. It provides up-to-date information on several countries and a very useful comparative data bar chart facility on energy sources and use.

Energia *www.energia.org and* Energia Africa*: energia-africa.org*
ENERGIA is an international network on gender and sustainable energy which links individuals and groups concerned with energy, sustainable development, and gender. ENERGIA's goal is to contribute to the empowerment of rural and urban poor women through a specific focus on energy issues.

Energy news from Practical Action

Focus on GVEP

GVEP
Harnessing Energy for Poverty Reduction
www.gvep.org

The Global Village Energy Partnership (GVEP) was launched at the World Summit on Sustainable Development in Johannesburg, in August 2002, to increase access to energy services, for those not served and underserved. GVEP is a 10-year implementation-based partnership bringing together developing and industrialized country governments, multilateral institutions, public and private organisations, NGOs and consumers, to achieve the Millennium Development Goals (MDGs). The Technical Secretariat of GVEP is responsible for day to day management of GVEP and is hosted by Practical Action (the new name for ITDG).

Mission

GVEP promotes development of the linkages between energy and poverty reduction strategies at national level, and the Millennium Development Goals (MDGs) at global level, through dynamic partnerships at national, regional and global levels.

Objectives

GVEP objectives are fourfold:

- To *catalyse* country commitments to energy for poverty reduction projects and programmes, and to guide policies and investment in this area.
- To *bridge* the gap between investors, entrepreneurs, and customers in the design, installation, and operation of replicable rural and peri-urban energy projects.
- To *serve* as a one-stop-shop for information, best practices, and lessons learned on the effective development and implementation of energy for poverty reduction projects and programmes.
- To *create and maintain* an effective Global Village Energy Partnership organisational structure.

GVEP approach and expected outcomes

GVEP builds on existing experience and adds value to the work of individual partners. The GVEP approach is multi-sectoral (energy for health, education, agriculture, water, transport, telecommunications and productive uses/ enterprise sectors), multi-application (i.e. not just electric power), multi-stakeholder, technology neutral, and market based.

Expected outcomes for GVEP for the ten-year implementation period from 2002 to 2012, as agreed at the WSSD launch, are as follows:

- Over 30 countries with national energy-poverty programmes.
- Over 400 million extra people with access to energy services as a result of GVEP.
- Over 50,000 communities with energy services.
- A nucleus of trained professional entrepreneurs specialising in the delivery of energy services.
- Financing leveraged from multilateral, bilateral, and host country sources in support of energy access.
- Increases in productivity, income, environment, equity and quality of life via urban, rural, or peri-urban energy services, with measurable improvements in quality of life by those served.

GVEP partners and governance

GVEP has over 700 partners from around the world including representatives from developing and developed country governments, multilateral organizations, non-government organizations, the private sector, the financial community, and academia. Only half of the GVEP partners are from the energy sector, with the rest representing agriculture, education, environment, health, rural development, water, and other sectors.

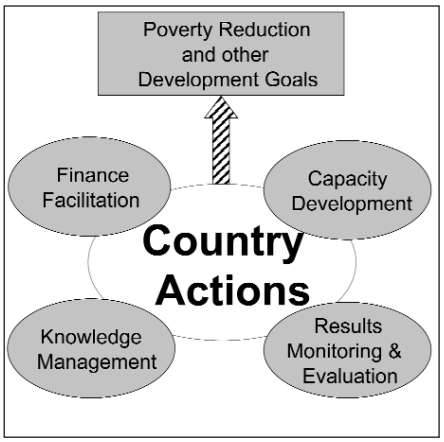


Figure 1 GVEP support services

GVEP products and Services

GVEP's primary products relate to the development of country programmes which involve scaling up of investments in energy services targeted at the poor and unserved or underserved, and/or reorientation of existing programmes in ways that shift the emphasis from "energy for energy's sake" to deliberate targeting of strategic development sectors like education, health and agro-enterprise.

GVEP currently provides support services in four areas: Finance Facilitation, Capacity Development, Knowledge Management, and Results Monitoring and Evaluation (Figure 1).

A GVEP Action Programmes Fund (GAPfund) has been instituted to support small-scale projects aimed largely at demonstrating innovative approaches to scale-up.

Contact details

Further information on GVEP may be obtained from
GVEP Technical Secretariat
ITDG Practical Action
Bourton Hall, Bourton on Dunsmore
Rugby, Warwickshire CV23 9QZ
United Kingdom
Tel: +44-1926-634478
Fax: +44-1926-634401
E-Mail: info@gvep.org
Web: www.gvep.org

Boiling Point is a technical journal for those working with stoves and household energy. It deals with technical, social, financial and environmental issues and aims to improve the quality of life for poor communities living in the developing world.

Contents

Theme

GTZ

Non-theme

R&D

PRACTICAL ACTION
Technology challenging poverty

Our mission is to build the technical skills of poor people in developing countries, enabling them to improve the quality of their lives and that of future generations

Intermediate Technology Development Group Ltd., Patron: HRH The Prince of Wales, KG, KT, GCB
Company Reg No. 871954, England. Reg. Charity No. 247257