Commercialisation of Rocket Stoves for institutional cooking in Southern Africa

Organisation	Award Category	Technology	Region	Year
Aprovecho Research Centre	Special Africa Award	Fuel Efficient Stoves	Africa	2006

Summary of the Award-winning work

The Aprovecho Research Centre has assisted the Programme for Biomass Energy Conservation in Southern Africa (ProBEC) in designing biomass stoves for institutional cooking in Lesotho, Malawi, Uganda, Mozambique, Tanzania and Zambia. Over 1,500 institutional stoves have been produced and sold by entrepreneurs.


A completed 'rocket stove'.

Malawi is one of the poorest countries in the world. There is a huge problem of de-forestation, partly as a result of the high population density and also because large areas of land are taken up with cash crops such as tobacco and tea, which also use enormous amounts of wood for processing. Fuelwood and charcoal are the main fuels for cooking both in homes and institutions in rural areas.

In each country ProBEC has involved entrepreneurs in training workshops, where a woodstove of suitable efficiency for each country is developed and engineered with the assistance of an Aprovecho Research Consultant. The stoves are targeted at large institutions, such as schools, prisons and tea-estate kitchens, and use the Aprovecho 'Rocket' combustion approach to give high combustion efficiency and efficient heat transfer to the cooking pot. Practical experience suggests that using the stove saves at least 50% of fuelwood, sometimes more, which can give significant financial savings. The reduction in carbon monoxide and particulates provides a much healthier environment for institutional cooks. Stove production businesses are now well established in Malawi, Uganda and Lesotho, and have produced and sold more than 1,500 institutional stoves. Ken Chilewe, the main producer in Malawi, has made 700 of these.

The Ashden Award to Aprovecho and ProBEC recognises the successful collaboration of two key organisations in the commercialisation of institutional stoves in Southern Africa, saving fuelwood and money for users and establishing significant stove businesses.

The organisations

Aprovecho is an NGO established in 1981 in the USA. One of its members, Larry Winiarski, invented the 'Rocket Stove' concept, which its consultants now use to assist organisations throughout the world. It also runs training programmes in sustainable technologies. Aprovecho consultant Peter Scott is currently assisting ProBEC in their programme in Southern Africa. He has worked for several previous Ashden Award winners.

ProBEC is the leading organisation promoting improved cooking stoves in the Southern African region. It provides expertise, training to producers, research support, monitoring and help with marketing. In addition to the work on institutional stoves, it is developing efficient domestic stoves, looking at ways of reducing industrial uses of fuelwood (such as for tobacco drying), and working with central and local governments on biomass conservation.

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Technology

Aprovecho and ProBEC have focused on designing and commercialising large stoves for cooking in institutions, since it is large-scale cooking which puts particular pressure on fuelwood resources. A different stove has been designed in collaboration with local producers and users in each project country (Lesotho, Mozambique, Malawi, Tanzania, Uganda and Zambia) so that the stove is suited to local cooking practices. All of the stoves designed use the Rocket principle of an elbow-shaped combustion chamber.

Most of the stoves developed in Malawi are constructed of metal. In


Finishing a rocket stove for a school in Malawi

these, the wood sits on a shelf in the horizontal part of the elbow and a fold-down metal grid supports the ends of the wood outside the chamber. Combustion occurs under the vertical part of the elbow, where the wood protrudes over the end of the shelf. The vertical height acts like an internal chimney, controlling the quantity of air that is drawn in and ensuring that the flames do not touch the base of the pot, which gives good efficiency. The hot combustion gases are forced through a narrow (~12mm) gap around the sides of the pot. It is very important to manufacture this accurately in order to maximise heat transfer and combustion efficiency, so the top of the stove is designed to fit the size of pot which people want to use. In Malawi, this could be a 200 to 300 litre pot for a large institution, with 20 to 40 litre pots for smaller schools. When constructing Rocket stoves, the height and width of the elbow must be in the correct ratio in order to maximise their performance. The Rocket elbow is made from special insulated bricks fired from clay mixed with sawdust, which makes them light. A layer of very hard cement on the inside protects the bricks from damage when wood is pushed in.

The pots are supported underneath and at the sides by metal rests, so that they sit very accurately in the centre of the stove, with the stove body coming about 5 cm below the top of the pot. The outer body of the stove does not get very hot (because of the insulating bricks), so it is fabricated from mild steel. The best material for the pots is stainless steel, but this is expensive: for an institutional stove, the pot would cost twice as much as the stove. Some stoves have been designed around pots made from half oil-drums which are very cheap, although not very durable.

Rocket stoves have also been built more cheaply using brick in the kitchens of the tea estates and prisons by the workshop staff. In these, the brick surround extends to the top of the pot, and the pot rim rests on metal supports at intervals, to keep the right distance for air flow. The tea estates have developed minor improvements - for instance the brick surround slopes slightly, so that any spills run away from the pot and not into the combustion chamber.

These stoves do not have external chimneys, but rely on maximising the combustion efficiency in order to minimise the production of smoke, and transferring as much heat as possible to the pot. Adding a chimney to a stove which is designed around a symmetrically placed pot will make the air flow path non-symmetrical, and decrease both the combustion efficiency and the heat transfer efficiency. This also avoids problems with chimneys not being used properly and resulting in greater pollution.

How users pay

At the time of writing (July 2006) 250 Malawi Kwacha = UK£1 = US$1.8

In Malawi, purchasers of metal Rocket stoves pay the entire cost of the stoves. There is no formal credit scheme, although Ken Chilewe offers payment in instalments. Quite a number of stoves are purchased by donor and charitable organisations for schools.

A 120 litre stove currently costs 85,000 Kwacha (£370) including a stainless steel pot, although the stove alone costs only 25,000 Kwacha (£110). A stove for a small school, which can take one 20 litre and one 40 litre pot, sells for 37,000 Kwacha (£160); and a single-pot domestic stove for about 6,000 Kwacha (£25). A small domestic stove was launched on the market in May 2006 and sells for 2,500 Kwacha (£10).

Training, support and quality control

Ken Chilewe and some of his workforce outside his thriving 'rocket stove' business.

In each country, ProBEC recruited entrepreneurs who were interested in learning about stove production, and brought Peter Scott - an Aprovecho consultant - to work with the group to develop an appropriate stove design. It was very important to select trainees who had already shown both business and technical skills, as well as enthusiasm for stove manufacture. There are currently 15 producers in Malawi, Zambia and Tanzania.

ProBEC allows a producer to use the Rocket brand only when they have checked their quality of production, returning and re-checking at intervals. The licensed producers add a name plate with a serial number to each stove, and keep a record of sales. They offer a three-month guarantee against defective manufacture.

The producer usually delivers each stove himself and explains to the customer how to use and maintain it, with a leaflet provided by ProBEC for each user. The stoves are simple to operate and require very little maintenance. Every day, ash should be removed from the combustion chamber, and after six months the inside should be cleaned to remove soot.

ProBEC believes that, with careful use, the stoves should last for at least ten years. Many stoves produced at the beginning of the programme (two years ago) are still in good condition. Some of the early stoves were returned because of problems with the insulating bricks, but this problem has been reduced by the hard plaster finish on the inside. Most problems which have occurred are from cheap pots starting to leak: ProBEC is therefore encouraging producers in Malawi to sell stoves with a stainless steel pot as standard. There are still some problems in prisons, where the prisoners who cook unsupervised sometimes hammer wood into the stoves and crack the lining.

Benefits and replicability

A Rocket stove uses less fuel than an open fire thus reducing pressure to cut down trees. Anecdotal evidence from users suggests that it reduces fuelwood use by 50% or more compared with an open fire: one trial carried out in a tea-estate kitchen found a reduction of over 90%, with food for 250 people cooked in a 200 litre Rocket stove using only 10-13kg of dry wood.

Many institutions buy fuelwood; spending less on wood releases money for other purposes, such as educational