Grupo Interdisciplinario de Tecnología Rural Apropiada (GIRA), Mexico 2006

the Ashden Awards for sustainable energy

Clean, efficient stoves bringing health benefits in rural Mexico

Summary

The Grupo Interdisciplinario de Tecnología Rural Apropiada (GIRA) has developed the 'Patsari' stove for making tortillas and general household cooking, and has measured significant improvements in the health of women who use the stoves as well as reductions in air pollution and wood use.

About 95% of rural Mexican households cook with wood on open fires. Although this is bad for their health and uses unsustainable wood resources, the majority cannot afford to change to cleaner liquefied petroleum gas (LPG), even though the government encourages this. This situation is especially acute among poor indigenous people in the Central Mexican Highlands, where thousands of micro-enterprises run by women sell hand-made tortillas cooked over open fires for long hours each day.

GIRA started a stove programme to improve the health and security of households, bring new opportunities for small businesses, and improve the supply of wood. The Patsari stove, developed through a participatory approach involving stove-users, is an improvement on the 'Lorena' design with a more efficient combustion chamber and made of more durable materials, including a prefabricated metal chimney and hotplates. GIRA has shown that respiratory disease decreases by 30% and eye infections by 50% in women who use the Patsari stove rather than an open fire, thanks to 70% reduction in indoor air pollution. Fuelwood use is halved. Users greatly appreciate having cleaner, smoke-free kitchens.

The Ashden judges commended the holistic approach of GIRA. This has combined technical skill with community involvement to develop appropriate and affordable stoves. It has also implemented a rigorous assessment of health and environmental benefits under real-life operating conditions

The organisation

GIRA was formed in 1985 and is a non-governmental, not-for-profit organisation. It works with local communities on the development of appropriate technology and micro-enterprises. Its staff includes engineers, ecologists, doctors, educators, promoters and representatives of local villages. It has three main programmes: agro-ecology, community forestry and rural energy.

Contact name: Dr Omar Masera Cerutti
Address: GIRA Centro comercial El Parian Int.
17 Col Morelos Patzcuaro, Michoacan,
C. P. 61609 Mexico
Tel: +52- 434-3423216; +52-443-3222709
Email: omasera@oikos.unam.mx
Website: www.gira.org.mx

Technology and use

GIRA has developed a new stove called 'Patsari' (meaning 'takes care') which is an improved version of the Lorena stove dating from the 1970s. The stove is built permanently into the kitchen, on a raised base to provide a convenient height for cooking. It has a large, circular 'comal' (hotplate) for making tortillas and one or two smaller comals for boiling pots or keeping food warm. A galvanised steel chimney (of a type used in LPG boilers) is used to take smoke out of the kitchen and to provide a good flow of air for combustion. GIRA has a contract with a company to make high quality comals out of pressed steel with a rust-resistant finish.

Household Patsari stoves can be made either from bricks or from a mixture of pottery clay, sand and cement. This stove-mix is poured into a metal mould, which has separate moulds for the combustion and heat-transfer chambers inside it. A metal structure that forms the base of the chimney is set in the stove mixture. Each comal is sealed to the stove to prevent smoke from leaking into the kitchen. The stove takes about two hours to build and the stove-mix sets within two hours, giving a strong, resistant finish.

A major technical improvement of the Patsari, compared to the Lorena, stove is the optimised design of the combustion chamber. There is a great emphasis on using exact, standardised dimensions, and custom-made parts such as the metal chimney support and ceramic stove entrance.

These technical developments have been achieved with the regular involvement of local users; and an ongoing sequence of modifications is backed up by thorough testing both in the laboratory and the field. Over 3,500 Patsari stoves have been bought by households and around 70 by tortilla-making enterprises.

How users pay

At the time of writing (July 2006), 20 Pesos = UK£1 = US$1.8.

The domestic Patsari costs about 850 pesos (£42) for materials and installation. Various incentives are available. Some municipal authorities and NGOs provide users with the raw materials (sand, bricks and chimneys) so the user then just pays a stove builder for assembly. Some customers contact the stove builders directly and pay the full price, often in two or three instalments. Tortilla-making enterprises are able to buy the stoves at a 30% discount.

Training and support

GIRA has trained about 100 local builders to supply Patsari stoves. They must work to careful quality criteria. Each stove has a ceramic label with a serial number, so that GIRA can keep a detailed database of stoves, including measurements of performance.

New users are carefully trained in the operation and maintenance of their stove. The stove builder visits the customer at least three times after they have purchased a stove to correct any problems arising from the construction, to ensure that it is being properly used and explain how to maintain it. Stove maintenance is straightforward, and users are taught how to clean the tunnels and chimney. GIRA gives customers a promotional calendar which explains the basic items of maintenance and how to solve the most common problems. Metal chimneys and other spare parts are available in towns within the region.

All parts are manufactured with an emphasis on durability, and the Patsari stove has an expected life of about five years with careful use. Comals and chimney will eventually rust, but can easily be replaced.

Benefits of the project

GIRA has emphasised the importance of monitoring the environmental and health benefits of cooking stoves under conditions of real-life use. Their monitoring includes health indices and studies of indoor air pollution, wood use, greenhouse gas emissions, and user attitudes.

The main health study was undertaken with the National Institute of Public Health, and involved 300 new users of Patasri stoves with a control group of 300 women who cooked on open fires. The study asked about coughing, chest pains and eye irritation, and also measured lung capacity and analysed pollutants in sputum and blood, over a six month period. Preliminary results suggest that using the Patsari stove leads to a 30% decrease in respiratory symptoms and a 50% decrease in eye infections. These benefits occur quickly after the change to the stove: users noticed health improvements within two weeks. This study is valuable confirmation that the measured reduction in indoor air pollution in the kitchen (70% decrease in particulates and carbon monoxide) really brings health benefits to cooks. The financial benefit from reduced health care costs is estimated to be seven times greater than the cost of a Patsari stove, and these research findings are underpinning the development of new legislation on indoor air pollution in Mexico.

GIRA has measured the wood fuel savings in some detail using a combination of controlled laboratory tests, and field tests where the fuel to cook tortillas in a customer's kitchen is measured. Their kitchen measurements showed that the Patsari stove saves 50(+/-10)% wood compared with an open fire, which equates to about 2.3 tonnes of wood per year for each stove, or over 8,000 tonnes per year for the 3,500 stoves installed to date. Assuming that about 65% of this wood is harvested unsustainably, GIRA estimates that the programme currently prevents the annual emission of about 10,000 tonnes of CO_2 equivalent, taking into account both actual CO_2 and other greenhouse gases. GIRA has used Geographical Information Systems (GIS) to identify 'hotspots' of unsustainable fuelwood use, and future stove dissemination may be targeted at these areas.

A major benefit of the Patsari stove for many owners is the improved cleanliness of their kitchen. Decorative plates can be displayed on open shelves without having to be washed every week. More family members are willing to share in cooking when the kitchen is less smoky, and many people have tiled their stoves and redecorated their kitchens, making them into a pleasant eating area as well as a cooking area. However, LPG stoves are still regarded as desirable consumer items (often given as wedding presents), and GIRA is looking at ways to make the Patsari stove more attractive.

Stove manufacture has provided local employment. Most of the 100 stove builders trained by GIRA have taken on and trained an assistant, and each enterprise can install three stoves in a day. About 10 additional jobs have been created for people making ceramic and metal stove parts.

Patsari stoves have been supplied to 70 businesses which are run by women who spend over five hours per day making tortillas for local fast food outlets and shops. The Patsari stove is better for their health, reduces their fuel costs and saves time. These enterprises often use local varieties of maize and this promotes biodiversity. Some restaurants now cook with Patsari stoves, providing a better environment to both staff and customers while reducing fuel costs.

The interest in improved cooking stoves is growing rapidly with at least 3,000 more Patsari stoves requested in villages that already have them. GIRA has trained other NGOs in three regions of Mexico in response to requests to launch more stove programmes. The national government has proposed a country-wide programme, which they would fund, although GIRA has some concerns about moving to a scale where people are no longer actively engaged in solving their own problems.

Management, finance and partnerships

The GIRA approach involves people of different backgrounds and disciplines working together - including villagers, stove makers, health promoters and agriculturalists. Omar Masera and Victor Berrueta work with the local university, Universidad Nacional Autonoma de Mexico (UNAM), and

the health studies were realised with local and national government groups and the University of Liverpool. The monitoring of stove efficiency and emissions was done with the help of PhD students from the University of California.

The Shell Foundation funded the stove development programmes, which enabled this comprehensive approach. When data analysis is completed, UNAM will ensure that the results are both published in international journals and made available to local people.

Use of the Ashden Award

The Ashden Award to GIRA has been funded by Climate Care, an organisation which helps companies and individuals to counter their impact on climate change by funding new projects to reduce the emission of greenhouse gases.

Climate Care sponsored a first-prize Ashden Award to GIRA, because of the significant potential for greenhouse gas savings from using the Patsari stove The Award will be used to build up the GIRA cook-stove research and analysis centre, where people can be trained and improvements can be tested. GIRA also intends to expand the programme to eight more villages and 30 tortilla enterprises, and to improve their promotional materials to better explain the health, environmental and cultural aspects of stove use.

This report is based on information from the application submitted to the Ashden Awards by GIRA, findings from a visit by one of the judges to see their work in Mexico, discussions between Omar Masera and the Ashden judges at interview, and a presentation by Omar Masera at an Ashden Awards seminar.

Dr Anne Wheldon, Technical Director of the Ashden Awards Jeremy Rawlings, Technical Assistant July 2006.