

Fuel efficient stoves for baking injera bread

Summary

This project has designed a new stove for the cooking of 'injera', a pancake-like bread that is served with most traditional Eritrean dishes. Injera is made from the fermented batter of Teff flour (an ancient cereal grain) and cooked on a large, flat, black clay cooking plate below a hat-like metal cover. For centuries it has been cooked on simple clay stoves, built over an open fire. These stoves, known as mogogos, are smoky and dangerous and often difficult to start, requiring a lot of blowing, and large amounts of kerosene, to get them going. They are very inefficient and require a lot of woodfuel to complete the cooking process. Given that 50 million people are thought to eat injera every day in Eritrea, Ethiopia and Sudan, this inefficiency represents a significant threat to wood sources in these countries.

The Energy Research and Training Centre (ERTC), part of the Eritrean Government's Department of Energy, has designed a new and improved stove that is safer to use. It has an enclosed fireholder, with enhanced ventilation so that the fire burns more efficiently, and a chimney to take smoke out of the house. The stove also burns a wider range of fuels, working well with twigs and leaves and animal dung. Being raised above the floor and, having an enclosed fireholder, the stove is no longer a danger to children.

The main aim of this project is to disseminate the use of this new stove to rural communities throughout the country. ERTC is teaching women how to build the stoves themselves and also paying them to teach other women, who are, in turn, teaching others. Over 10,000 stoves have been installed to date and the users are delighted with the improved quality of life that the stove has brought them.

The organisation

ERTC is the Energy Research and Training Centre of the Eritrean Ministry of Energy and Mines. The department was set up in 1995, following independence from Ethiopia in 1992, and is involved in many different aspects of renewable energy research and development. It has made dramatic improvements to the mogogo stove, as described above, and has experimented with wind and solar power.

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Context

Preservation of Eritrea's remaining trees is desperately needed. The country lies across the arid and semi-arid regions of the Sahel and has been almost entirely deforested. The land degradation and loss of soil fertility that has resulted from the deforestation is severe. It is estimated that 82% of the country's energy needs are met by biomass sources, principally wood, so the pressure on the remaining forests and trees is enormous. As supplies of wood diminish, people have to spend more and more time gathering dung to be dried for fuel, which might otherwise be used to fertilise soil - and so the cycle continues. This state of affairs is clearly not sustainable.

The ERTC stove project is addressing this situation directly by promoting a stove that reduces household consumption of biomass by more than 50%. Because the stove works as well with small sticks and leaves as it does with large pieces of wood, the users can gather fallen branches and twigs for their stoves and leave living trees standing. Although fuel still needs to be collected and prepared for the stove, the family doesn't have to spend so long doing this as they no longer need to fell whole trees and split logs.

Injera is usually cooked in large batches three times a week. The batter needs to ferment for three days before cooking, so large amounts are made in one go. The new mogogo stays hot for longer than the traditional stove, and does not require constant relighting, so the whole process is much quicker and more efficient. It will clearly reduce the pressure on Eritrea's remaining forests. It will also reduce the emission of greenhouse gases by about 0.6 tons of CO² per household per year and address a critical health issue. The old mogogos filled the kitchen with smoke, causing respiratory problems and eye infections; the new one is virtually smoke-free. The UN estimates that 2.5 million women and children are killed worldwide every year by smoke-related health problems.

Technology and use

The improved stove has been carefully designed by ERTC director, Debesai Gebrehiwet, to ensure complete, and efficient, combustion of the fuel used in it. The new design has improved airflow to the fire to make this possible. An air inlet at the base of the stove leads air into a large, cone shaped 'air accelerator' and then on up towards the cylindrical fireholder. The base of the fireholder is a large, circular ceramic grate punctured by small tapered holes. These holes are wider at the bottom than the top which further accelerates the air flow into the fire. The holes also allow ash to fall to the floor, to be collected later. Once the fire has been lit, the fireholder is isolated by sliding down a metal door.

The sides of the fireholder are built with curved ceramic bricks that give it its cylindrical shape. These bricks are hollow and filled with insulating ash or sand to minimise heat loss to the surroundings.

Two fireholders are usually constructed next to each other, one for the mogogo, the other for the 'moqlo' stove that is used for baking a hard bread called kichta. They both vent to the base of a small stove used for cooking sauce, then go on up to the chimney. The injera bread is cooked on a flat, black, clay plate that forms the top of the fireholder.

With the exception of the curved ceramic bricks, the stove door, the cement chimney and its metal rain flap, all parts of the new stove can be made locally. The ceramic grate and conical 'air accelerator' need to be made to exact design specifications. To ensure uniformity and quality of construction, the project makes moulds for these parts in the capital, Asmara, and distributes them to the installation sites.

The cones have to be made in situ as the stove is being built, but the fire grates can be made separately in advance. Only a few villages have the fine quality clay needed for making these grates, so women artisans in these villages are making them using moulds provided by ERTC, and selling them to the project. This gives the women a much-needed source of income.

Management, finance and partnerships

ERTC is running the project in collaboration with the Ministry of Agriculture, the Ministry of Local Government, and the National Women's Association. All partners are involved in both the training of women artisans in their villages, and the transport of stove parts to them.

To reduce costs, the project has tried to ensure that stove components are made as locally as possible to the villages where stoves are being built. This has reduced the cost of a completed stove to US\$8 - equivalent to the cost of one month's consumption of fuel wood for a household in Asmara.

ERTC is collaborating with the Ministry of Agriculture in adding a tree-planting element to the stove project. The Ministry provides villagers with seedlings from nurseries scattered throughout the country.

This report is based on information provided to the Ashden Awards judges by ERTC, and findings from a visit by one of the judges to see their work.

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