



# 6



## CO<sub>2</sub> Neutral Energy

### 42 • Introduction - Energy

There is a lack of firewood and charcoal around many towns in Southern Africa. This means that the price of wood and charcoal go up because they must be transported over long distances. Highly deforested areas are subject to erosion and, at some places, even desertification.

On a global scale, this also affects the amount of carbon dioxide (CO<sub>2</sub>) emitted into the atmosphere. When plants grow and create organic matter, they absorb CO<sub>2</sub>. During combustion, organic matter is transformed into CO<sub>2</sub>. In areas where trees are cut down for energy purposes, more CO<sub>2</sub> is emitted during combustion than the amount absorbed by new trees and plants during their growth. This results in increased amounts of CO<sub>2</sub> in the atmosphere, which leads to the greenhouse effect, increasing the average global temperatures.



*This stove uses 30% less energy than a conventional 3-stone fire*

One way to reduce the problem of deforestation is by cultivating a mixture of plants that also produce firewood. This can be done by improved fallowing, where the production of firewood is combined with the cultivation of one's own fertilizer (see

section 21).

Another way to reduce carbon emissions is to choose alternatives that reduce the use of firewood. Among these are for example:

- constructing firewood-saving stoves
- producing and using briquettes made from available organic matter
- using biogas systems, which produce cooking gas from manure and organic waste
- using solar stoves, in which the food is prepared using solar energy

There are other renewable energy systems that require more technological knowledge. Some of these can, however, also be used to supply energy to rural communities in Africa while simultaneously reducing carbon dioxide emissions.

For example:

- producing jatropha oil and using it as lamp oil, as biofuel in stationary diesel engines or in adapted diesel engines or - after transformation - as biodiesel
- utilising solar panel systems to produce electrical energy
- utilising residues from agricultural industries for producing energy - such as sugar cane bagasse or coconut shells for the production of "charcoal" briquettes
- utilising "biomass" - from trees with high energy values or agricultural residues - in gasification systems, where the gas produced may be used mixed with diesel on a conventional generator. These systems are marketed in India and used, for example, to generate electricity from rice husk. There are also small-scale gasification systems - for example to supply energy to irrigation pumps.



## 43 • Firewood-Saving Stove

### Advantages of this stove

- A well-built stove can use as little as half the firewood used by a traditional 3-stone fire.
- By using a firewood-saving stove, people who usually purchase firewood will save money, while people who usually collect firewood will save time.
- This stove has positive environmental impacts, by protecting trees and saving wood.
- This stove reduces the amount of smoke in the kitchen, and thus improves the health of the people who cook. Inhaling smoke from a stove is as unhealthy as smoking cigarettes.
- This stove reduces the likelihood that children and others will burn themselves.
- This stove improves hygiene in the kitchen. Pots used on the stove are easier to clean than those used on an open fire.
- This stove is easy to build, and it is made from material available anywhere.

### How to make a firewood-saving stove

#### Step 1 - Collect the material

- You need clay, sand, seven large bricks and water.
- The best clay to use is that from small anthills found in wet areas (dambos). Clay from termite hills can also be used.
- Where anthill clay is not available, it may be necessary to dig deeper to find good clay.

- Remove stones, sticks, and other foreign material from the clay and sand.

#### Step 2 - Prepare the material

- Crush the clay into dust.
- Soak it in water overnight.
- Mix the sand and clay together using a ratio of one quantity of sand to two quantities of clay.
- Add water until the mixture is easy to work with. To check if the mixture is good, make a ball and drop it on the ground. If it splashes out, the mixture is too wet, if it falls to pieces, it is too dry.



Use clay from ant-hills

#### Step 3 - Foundation

- Decide where to place the stove. If it is placed in an indoor kitchen, it must face the door in order to get enough air for appropriate combustion. If the stove is placed outside, the opening must face the direction from which the wind usually blows.
- Position 4 large (15 cm x 20 cm) clay bricks so that they form a square.
- Fill the hole in the middle halfway up with clay and plaster the bricks outside and on top with clay/sand mixture.



Mix sand and clay - 1:2

#### Step 4 - Heat insulation

Place ash to a depth of 5 cm into the hole between the bricks and cover it with the clay mixture. The ash acts as a heat insulator so that heat from the fire



4 bricks form the foundation



does not penetrate into the ground.

#### **Step 5 - Construction**

- Use a 5 litre paint or oil tin - or a cooking pot - as a mould. The tin should be 17-20 cm in diameter. Place the tin in the middle of the constructed foundation, on top of the ash insulation layer.



- Place the clay-sand mixture around the tin until it is 4 cm from the top of the tin. This should make the firebox 19 - 20 cm high. It is important not to make the walls too thick. Otherwise, they absorb too much heat.

#### **Step 6 - Make the firewood rest**

- Lay three bricks as a foundation, as shown in the photo.
- Plaster the bricks with the clay-sand mixture.
- Leave the stove to rest overnight.



#### **Step 7 - Shape the stove**

- Remove the tin.
- Shape the outside of the stove using a knife or construction trowel.
- Make the stove smooth using water.

#### **Step 8 - Carve out the firewood opening**

- Carve out an opening for the firewood using a knife or building trowel. The size



should be about 12 x 17 cm. Do not make it too small, otherwise you will need to chop the firewood too much.



- Make sure the stove wall above the hole is not too narrow. It should be 5 cm high or more in order not to break easily.

#### **Step 9 - Carve the edge**

- Carve the edge of the top opening to an angle of 45° with a knife. This will make it possible to place pot-rests and use pots of different sizes (see the photo showing pot rests).

#### **Step 10 - The pot rest**

- Use some clay to make a pot-rest. It should be about three fingers wide and one finger thick (5 cm x 1 cm). It is important not to place a pot-rest on top of the firewood opening.
- Make small cuts on the pot-rest and on the part of the stove where it is to be placed (so that they fit together firmly).
- Add some water to both surfaces
- Press the pot rest firmly against the stove and shape it nicely. See next photo showing pot rests.

#### **Step 11 - Place the pot rests**

- Place three pot-rests on the stove, as shown in the photo. (It is important to have three of them - not any other number).
- The pot-rests allow smoke to come out, and enable the use of pots of different diameter.



Note: If the pot rests later fall off, you must replace them. Without them the stove will not function well.

### Step 12 - Let the stove dry

- Let the stove dry completely before using it. Drying can take 2 to 3 weeks depending on the weather.
- Some cracks will appear while the stove dries. Repair these with some of the surplus clay-sand mixture. It is recommended that you keep a bit of the original mixture for this purpose.
- Cracks might keep on appearing. These must be repaired in the same way.

### How the stove works

A fire can burn at different temperatures. The more oxygen a fire receives, the hotter it gets. A hot fire uses the firewood completely, which means it is very efficient. A cool fire releases more smoke due to gasses which are not fully burned. If you look at a 3-stone fire, you might notice that the fire at the edges releases more smoke - because it is cooler at the edges and hotter towards the centre. This stove promotes a small, hot fire - which releases less smoke, and which uses the firewood more efficiently.

### Most common mistakes

#### 1. Making the stove very big or too small.

It is very important for the stove to be the right size. If the distance from the firewood to the pot is too great, some heat will be lost before it reaches the pot. If the stove is too small, the firewood must be chopped into very small pieces, which makes the stove less user-friendly.

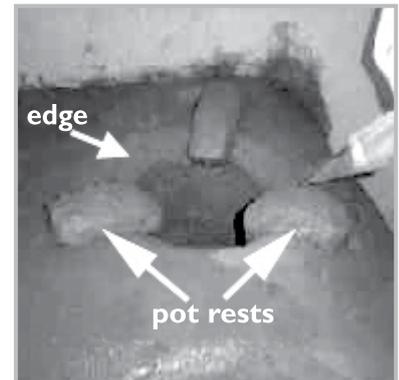
#### 2. Making the pot rests too thin or too thick.

If they are too thin, they will not effectively let the smoke escape from the stove. If they are too thick, they will allow too much heat to escape and the stove will be less efficient.



#### 3. Correct clay-sand mixture.

Make sure the mixture is not too wet or too dry. Using the right amount of water in the initial mixture will make a stronger stove and there will be fewer cracks during drying.



### Other types of firewood saving stoves

There are many types of firewood saving stoves. Some have two pot holes and a chimney. The chimney ensures that there is no smoke in the kitchen, but it uses more firewood and is more difficult to make. The one-pot stove can be placed in the middle of the kitchen, so that the family can sit around it in the evenings, or it can be placed in a corner in the kitchen. Which stove will be appropriate depends on the family's needs and wishes.

*It is important to have 3 pot rests in the right position*

*Photos and text by: Development Aid from People to People, Child Aid and Environment, Monze, Zambia*

