



**Skillshare**  
International

# Fuel Efficient Stoves



**A Manual on How to Create a Fuel  
Efficient Stove**

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# Materials & Equipment Required

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- Bricks x 24\*
- Large Stones x 20\*
- Bucket full of small stones x 1
- Buckets of Clay/Soil x 8\*
- 80cm x 60cm Weld Mesh x 1
- 80 cm long 5/8 Nondo Round Bar/Reinforcing rod x 2
- 8 foot Stove Pipe with 4cm diameter x 1
- Banana Leaves
- Sack x 1
- Pots x 2
- Tape Measure x 1
- Panga x 1

\*Approximate quantities

# Benefits of Creating a Fuel Efficient Stove

The benefits of creating a fuel efficient stove for a household within the developing world consist of environmental, health and social benefits. Due to many 'primitive household cooking fires', usually a 3 stone fire shown below, relying on large quantities of biomass fuels and coal in order to sustain a healthy cooking fire <sup>(1)</sup>, the consequences have negatively affected the environment with increased carbon dioxide release into the Earth's atmosphere and increased deforestation of local areas <sup>(2)</sup>. Whilst the fuel efficient stove outlined in this manual continues to use biomass fuel (wood), its design means that significantly less wood is needed to create a sustained fire for cooking, and as a result continued use of this stove can decrease both the levels of CO<sub>2</sub> release and the deforestation of local areas <sup>(3)</sup>.



3 Stone Fire

Furthermore, the reliance on less wood to fuel the stove effectively can have positive affects socially for women and girls <sup>(3)</sup>. One of the traditional roles for women and girls in the developing world is to collect wood for the cooking fire, and so if less wood is needed to cook then less time will be spent by the women and children collecting wood. Within the community that this manual was initially created for, the introduction of these stoves has meant that the local women now have more time to attend English lessons that are being provided in the local church, and also develop partner projects that will build on the positive environmental benefits that these stoves provide, such as the creation of a tree nursery to reinstate useful trees back into the local area. The social benefits that these stoves can provide should not be underestimated.

The most important benefit that the stove in this manual provides though is improved health. The primitive household cooking fires produce and fill the cooking area with dense smoke that puts the women and girls that use the stove at serious risk of diseases such as chronic obstructive pulmonary disease and childhood pneumonia <sup>(4)</sup>. Smoke from cooking fuels is estimated to account for nearly 2 million deaths, more than 99 per cent of which occur in developing countries <sup>(5)</sup>. The energy efficient stove in this manual eradicates this issue by channelling the smoke generated by the fire behind the stove and into a ‘chimney’ pipe. The smoke is then taken away from the cooking room through the roof and into the Earth’s atmosphere, thus resulting in the women and girls who use the stove not having to breathe in the fumes from the fire.

#### References

1. World Vision (2011) Fuel Efficient Cooking Stoves: a triple win for child health, development and the environment. Australia: World Vision
2. MercyCorps (2010) Basic Guide to Fuel Efficient Stoves and Emission Testing. Edinburgh: MercyCorps
3. Martin II, W.J, Glass, R.I, Balbus, J.M. and Collins, F.S. (2011) A Major Environmental Cause of Death. Science. 334 p180-181
4. The World Bank (2011) Household Cookstoves, Environment, Health, and Climate Change: a new look at an old problem. Washington, DC: The International Bank for Reconstruction and Development/The World Bank
5. World Health Organization (2009) Global Health Risks: mortality and burden of disease attributable to selected major risks. Geneva, Switzerland: WHO Press

## Step 1: Create a Foundation

The area required to create the foundation for the stove should equal 110cm wide by 90cm broad. A layer of clay, approximately 4cm thick, must be placed within the foundation area. This clay needs to be a type of clay that would be suitable for pottery in order for the stove to remain in good condition.

Once the clay has been laid then stones must be placed into the clay. Larger stones should be placed around the outside of the area whilst smaller stones should be placed inside. Figure 1 shows what the foundation area should look like once all the stones have been placed.



Figure 1

Another layer of clay must then be placed on top of the layer of stones. The smaller stones and the stones at the rear of the stove need to be completely covered by the clay, and this layer should be approximately 4cm thick. Once completed, the foundation of the stove should look similar to Figure 2.



Figure 2

The next step is to place 12 full size bricks on top of this layer of clay in the positions shown by Figure 3.



**Figure 3**

**Small stones are then placed into the gaps between the 12 bricks. An example of this is shown in Figure 4. Ensure that the gaps are filled as much as possible by the small stones.**





Figure 4

The foundation of the stove is completed by a further 4cm of clay being placed on top of this layer of bricks and smaller stones.

## Step 2: Create the Layout of the Stove

8 full size bricks are placed on top of the layer of clay on their side. They should consume an area of 80cm wide by 60cm broad from the front of the stove and should be placed in the following positions shown by Figure 5.



Figure 5

The gap left at the front of the stove (**green circle** in Figure 5) should be approximately 15 to 20cm wide and will be the entrance to the stove. A half brick/smaller brick should then be placed in the position identified in Figure

6 by the **red circle**, whilst the two gaps highlighted by **green circles** should be left open.

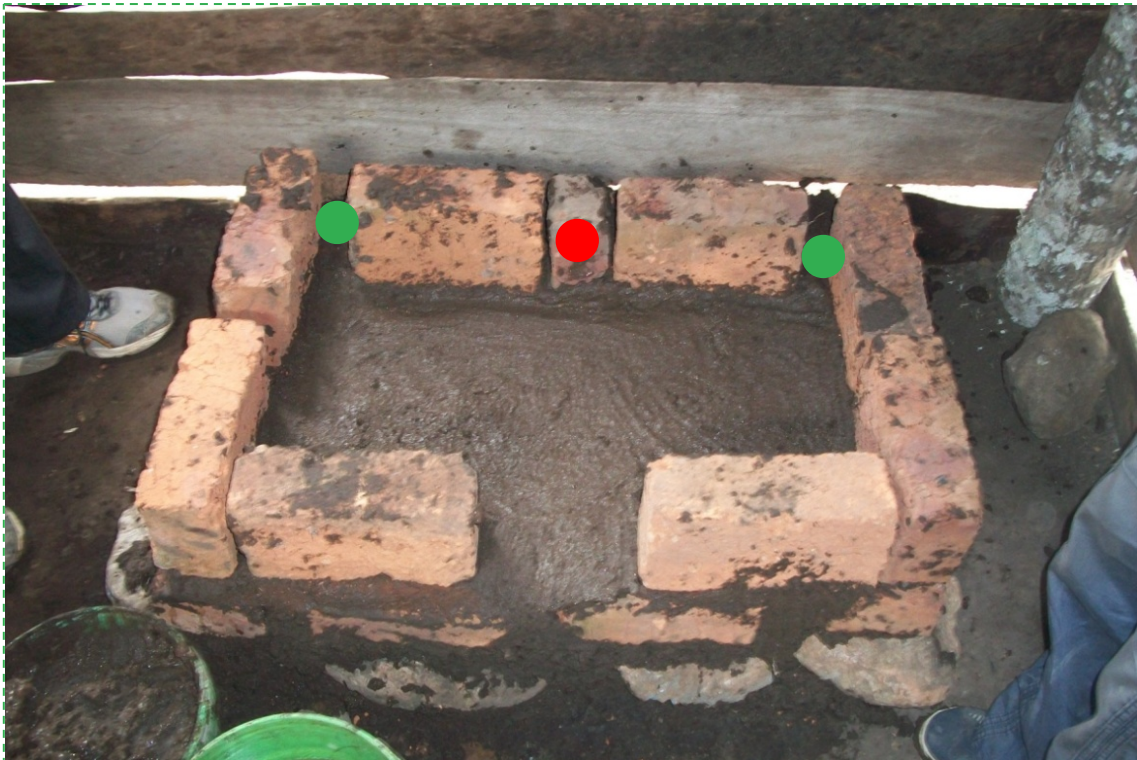


Figure 6

A final full sized brick is added in the position highlighted by the **red circle** in Figure 7. Figure 7 also shows how all the gaps should be filled with clay. Every gap, apart from the two gaps highlighted with **green circles**, should be filled to the tops of the bricks.

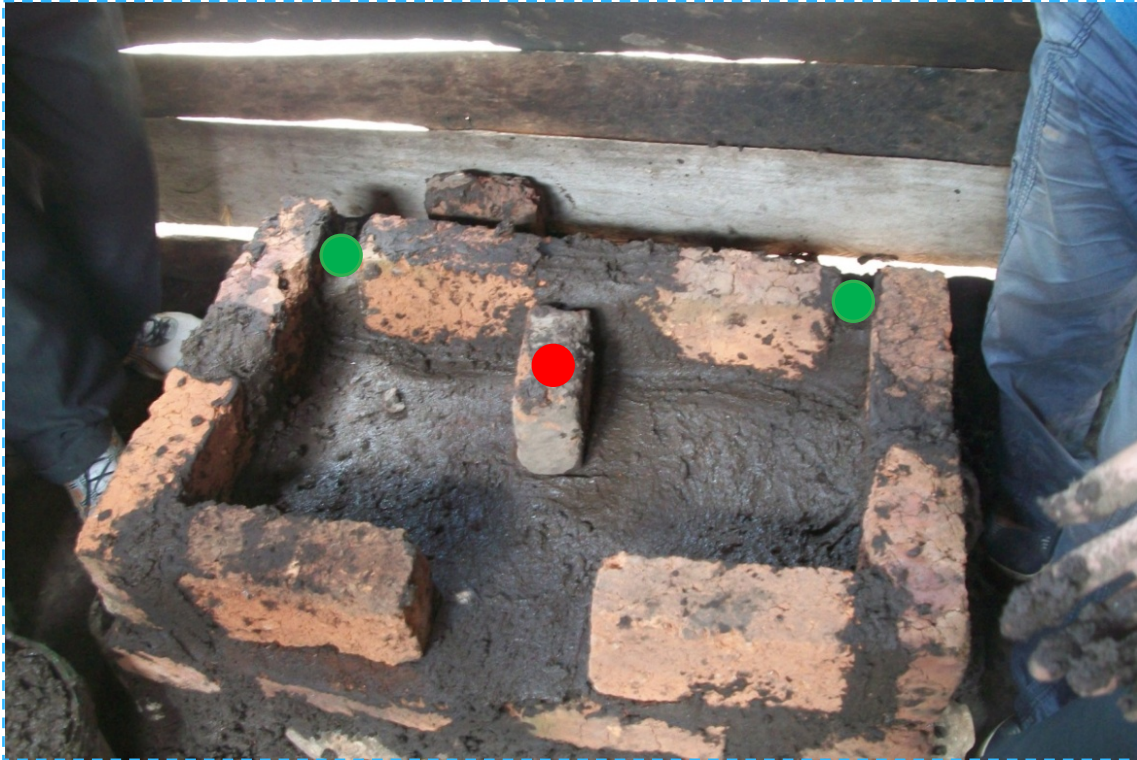


Figure 7

The two gaps identified with **green circles** in Figure 7 are only filled half way to the top of the brick with clay, as shown in closer detail in Figure 8.



Figure 8

The next step is to fill the four corners identified in Figure 9 with **red circles** with clay. The clay in these corners need to be rounded into a 'semi-circles' as shown in Figure 10.

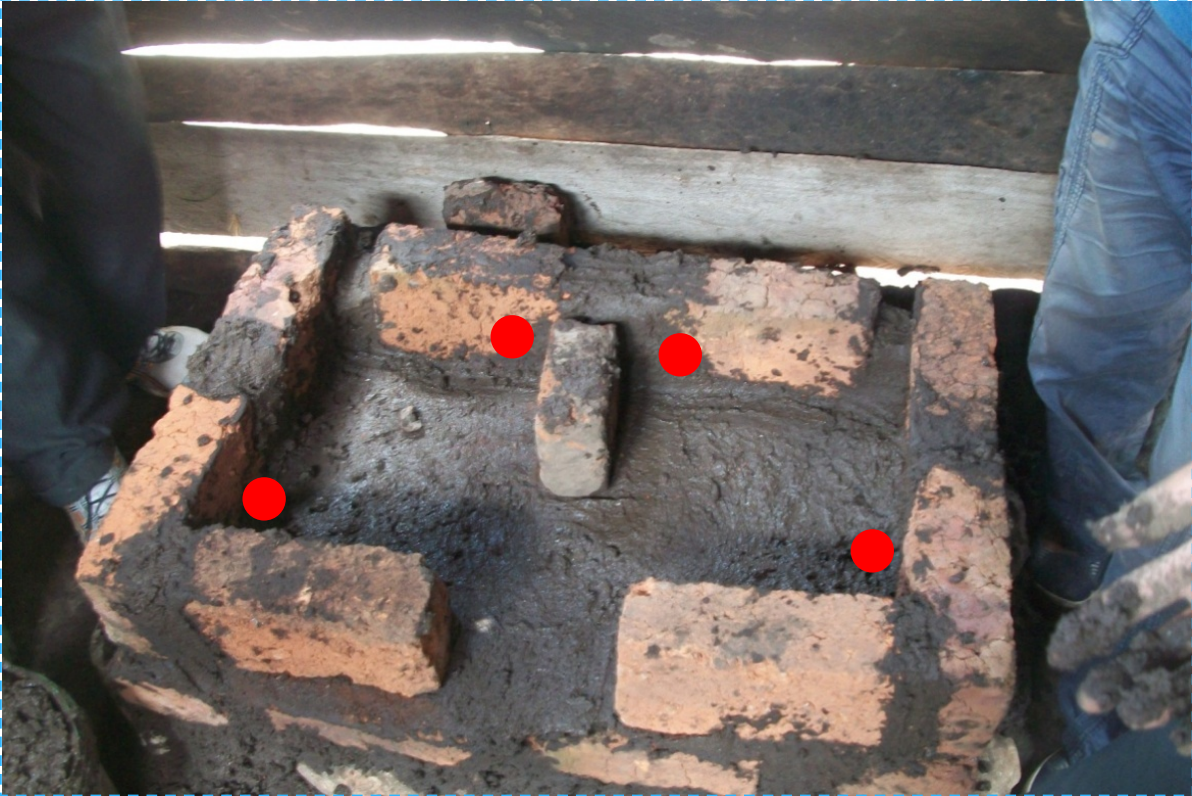


Figure 9



**Figure 10**

**A final layer of clay, approximately 4cm thick, is added to the tops of the bricks before you move onto the next step.**

## Step 3: Sealing the Stove Layout

The 2 pieces of roundbar are then placed across the horizontal dimension of the stove. They are placed approximately 15cm to 20cm apart and should be pushed into the layer of clay on top of the bricks. Figure 11 shows how the roundbar should look.



Figure 11

Banana leaves are then cut into three pieces. These three pieces will be placed over the entrance and back corner gaps, so ensure that the pieces of banana leaf are long enough to cover the gaps comfortably. The weld mesh is then placed on top, squeezed into the clay on top of the bricks and the stove should now look like Figure 12.





**Figure 12**

**A ‘sack’ measuring the dimensions of the stove is then placed on top of the weld mesh, as displayed in Figure 13.**



**Figure 13**

The pots used to cook with are then needed in order to create the correct sized holes in the top surface of the stove. They need to be placed roughly in the positions shown in Figure 14 and be approximately 10 to 15cm apart.



**Figure 14**

**A further layer of clay is now placed on top of the sack and around the pots. This layer of clay should be of a height no less than half the height of the pots. The stove should now like Figure 15.**



**Figure 15**

## Step 4: Creating the Smoke Channels

The space left behind the stove is for the smoke created through cooking to escape. Therefore the back section needs to be sealed. Firstly, four full sized bricks need to be placed in the positions identified by the **red circles** in Figure 16.



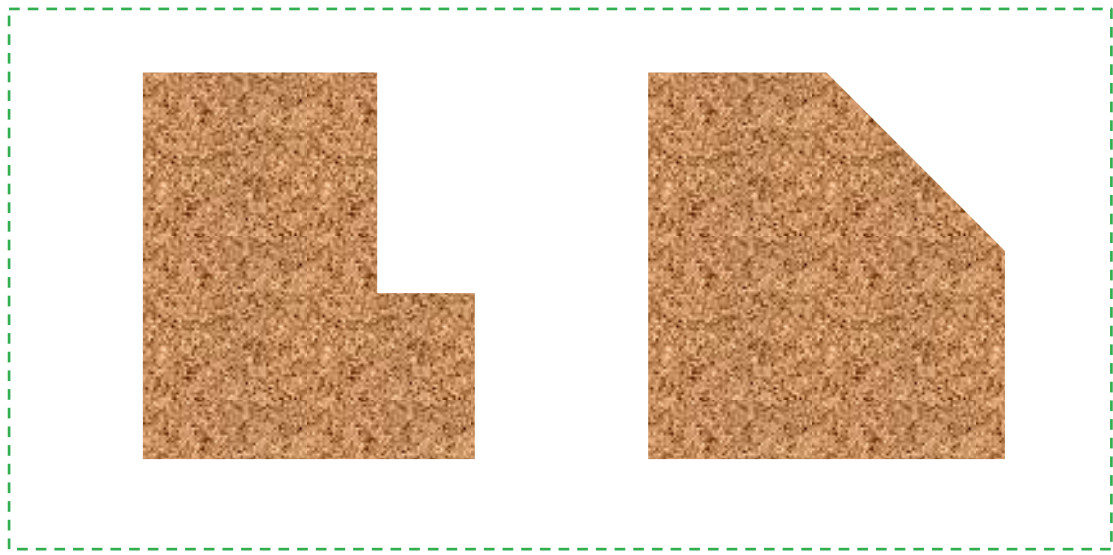
Figure 16

A half/smaller brick should then be placed in the gap identified in Figure 16 by a **green circle**, and the result should look like Figure 17.



**Figure 17**

The central brick needs to be shaped roughly to match the shapes in Figure 18 below, as the stove pipe needs to rest on a surface but it cannot rest on the clay 'floor' as otherwise no smoke will be able to be escape through the stove pipe.



**Figure 18**

The next step is to install the stove pipe. An opening needs to be created in the roof of the ‘stove room’ the size of the stove pipe’s diameter. The stove pipe must then be fed through this hole, as shown in Figure 19 , and must rest on the central brick’s gap/slanted edge. Figure 20 gives an example of how the stove pipe should look once in a correct position.



**Figure 19**



**Figure 20**



Two pieces of banana leaf measuring the distance between the stove pipe and the edge of the stove must then be cut and rounded around the stove pipe like Figure 21 demonstrates.



Figure 21

The back section of the stove then needs to be covered with clay. The height of this layer of clay should match the cooking area of the stove so that the entire stove is level. Once this has been completed, the stove should now look like Figure 22.



**Figure 22**

## Step 5: Applying the Finishing Touches

All that is remaining to do before the stove is complete is to cover the outside of the stove with clay, ensuring that there are no stones/bricks visible. Then the top layer of clay needs to be 'smoothed'. To do this, a piece of banana leaf dipped in water is a great way of creating a smooth finish. Once the clay has been 'smoothed', the finished stove should look like the following images:



Front of stove



**Entrance of Stove**



**Bird's Eye View of Stove**

Before the stove can be used it needs to be left to 'set' for 7 days. After the 7 days, a fire should be lit in the stove but **NO** cooking should be done. This is because the first fire will burn the banana leaves and sack that have provided the base for the clay to harden. The stove can then be used for cooking the following day.

The Fuel Efficient Stove (FES) within this manual is inspired by Bente Luther-Medoch, who has been building these stoves for the community of Kibosho in Kilimanjaro and kindly ran a workshop for us on how to construct one for the community of Ngyeku.

The FES within this manual is an adaptation of her design.

If you have any questions regarding the manual and the stoves email [KevSanders8@gmail.com](mailto:KevSanders8@gmail.com) and I will do my best to answer your questions as quickly and thoroughly as I possibly can!

Originally created in March 2012 by Kevin Sanders for the AMANI community group of Ngyeku Village, Near Arusha, Tanzania