

# SIMPLE PLANS TO BUILD THE JUSTA STOVE

The Justa Stove is also known as La Estufa Justa, the Just stove, the Ecostove or El Ecofogon.

**How to build one of the new generation of fuel efficient  
stoves with chimneys.**



The Justa (pronounced *Hu-sta*) stove was developed through the coordinated efforts of the people of Central America, Trees, Water, and People, Rotary International and Aprovecho Research Center

Text: by Peter Scott

Illustrations: by Tony Wiley, Brian Thomas and Ethan Hughes

For more information about the Justa Stove or if you would like assistance in designing a stove for your community please contact us at:



## **Aprovecho Research Center**

80574 Hazelton Road, Cottage Grove, OR 97424-9747, USA

phone: (541) 942-8198 fax: (541) 942-8198

e-mail: [apro@efn.org](mailto:apro@efn.org) webpage: <http://www.efn.org/~apro>

# BUILDING WITH METAL OR CEMENT

The body of the Justa stove can be built with a variety of different materials, such as cement, clay & sand, brick, adobe, or metal. This guide explains how to construct the stove with brick but other plans are available to build the Justa with cement and metal.

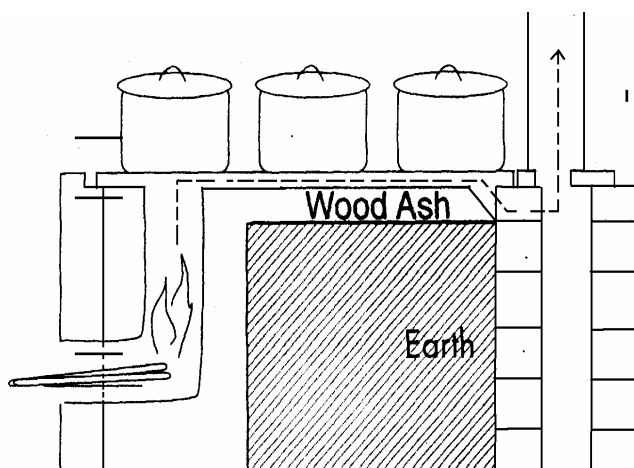


This cement Justa is being built by Helps International in the Guatemalan Highlands. Three individual cement pieces are cast in fiberglass molds and then assembled on site. The molds are easy to transport and prevent design inconsistencies.



This metal Justa with oven is being constructed by Ahdesa in Honduras and by Prolena in Nicaragua. The metal Justa is approx. 30% more expensive but it allows for mass production and ease of transport.

See page 16 for contact information for Helps, Prolena and Ahdesa.



The type of material (cement brick, adobe or metal) that is used for the exterior stove body will not have a great impact on the performance of the stove. Special materials are not needed for the stove *body*. The stove will function effectively as long as the body of the stove can support 5 pots and can withstand temperatures of up to 500 degrees Fahrenheit.

# DIFFERENT STOVES FOR DIFFERENT NEEDS

The Justa type stoves are built using principles that can be adapted to build a stove to suit a particular cooking need. Because one stove design will not work in each community, we offer a number of stove models to choose from:

## THE IMPROVED JUSTA STOVE



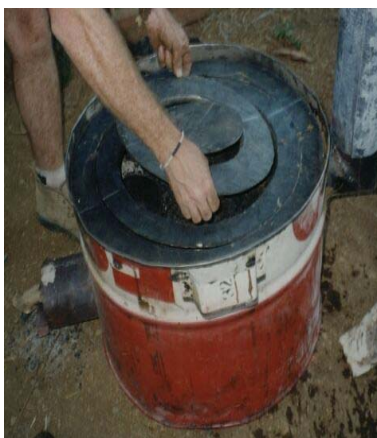
This stove is the same as the original Justa stove yet it features 2 pots that are submerged directly into the fire flow path. When used with 3 pots it is 50% more efficient than the original Justa.

## THE ROCKET STOVE



The single-pot Rocket stove is less expensive and more efficient (25- 30%) than the Justa Stove. It is ideal for cooking outside or in areas where a chimney is not needed or available.

## THE ROCKET RING STOVE



With the rings in place, multiple pots or tortillas can be cooked at the same time. The rings can also be removed for use with individual round bottom pots.

## THE HAYBOX COOKER



The haybox works by retaining heat inside a layer of insulation such as straw, wool or foam. The haybox can reduce fuel consumption by 70% and is simple and inexpensive to build .

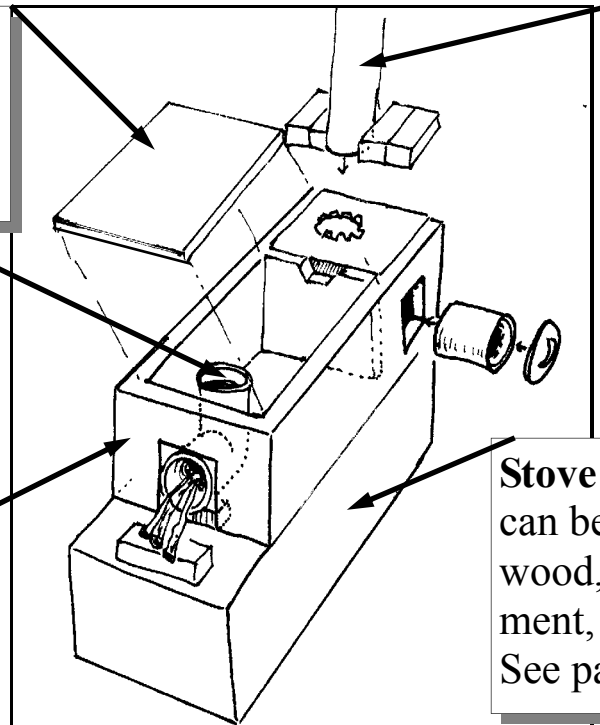
For more information about these stoves or if you would like assistance in designing an appropriate stove for your community please contact Aprovecho Research Center

# TOOLS AND MATERIALS FOR BUILDING THE JUSTA STOVE

**Cooking griddle.**  
1/8th inch steel cooking griddle. See page 8.

**Rocket combustion chamber.**  
See pages 6 & 7.

**Stove body.** 50 (5" by 8") fired clay bricks or 20 adobe blocks. See page 11.



**Chimney.**  
6-20' of 4" diameter chimney pipe. See page 9.

**Stove base.** This can be made from wood, brick, cement, or adobe. See page 10.

## OTHER REQUIRED MATERIALS

- Wood ash, pumice rock, or vermiculite to fill the front half of the stove body (13" by 12" by 14"). Approx. three 5-gallon buckets of insulation
- 2 wheel barrows of clay /sand mortar for constructing the stove body (30% sand/ 70% clay)
- Dry sand or earth to fill rear half of stove body (13" by 12" by 14"). Three 5 gallon buckets
- White clay (for painting outside of stove)
- 4" tin can with plastic or metal lid
- One piece of rolled steel (1/32 by 12" by 16")

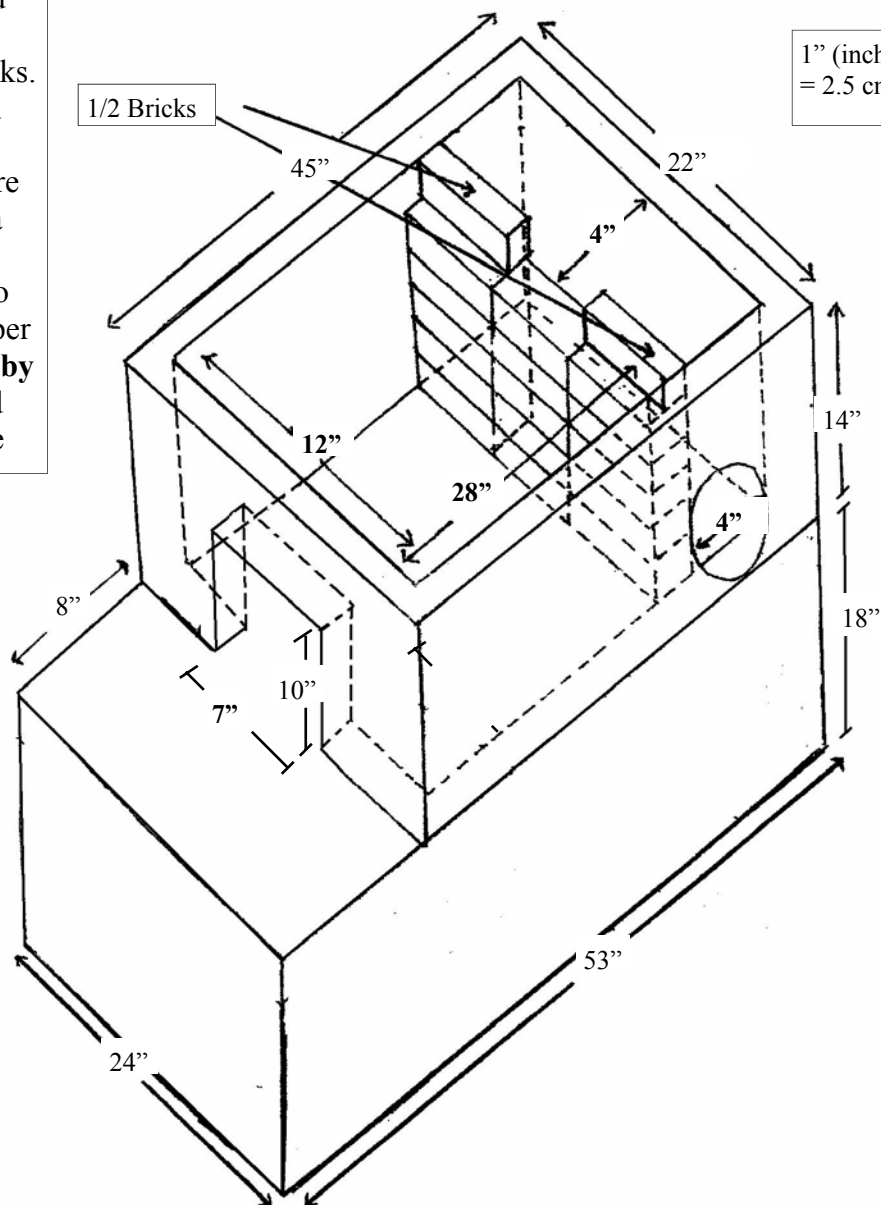
## TOOLS

- Shovel
- Wheelbarrow
- 3' carpenters level
- Aviation snips
- Hacksaw
- Square
- Hammer
- Trowel

# BUILDING THE STOVE BODY

The internal width and length of the stove are the most important. **The internal dimensions will always be 12" wide by 28" long** (assuming you are using the recommended 14" by 30" cooking griddle). These plans are designed for use with 5" bricks. If you are using larger or smaller bricks your external dimensions will change. For example, if you use 6" bricks then the external measurements of the stove will change to 24" by 47".

Use the clay/sand mortar to lay the (pre-soaked) bricks. Use the level and the square when building to be sure that the stove is a uniform shape. Also be careful to maintain the proper dimensions (12" by 28") as you build each brick course



# BUILDING THE STOVE BASE

The base for the stove can be built from brick, adobe, cement, wood, or metal. Even better than constructing a new base is to use one from an old, existing stove. The height and length of the base can be altered to suit individual needs. In Latin America and in these plans the base is built 18" high and 24-26" wide (depending on the width of the bricks). See following page for a note on brick width.

## **For a cement base**

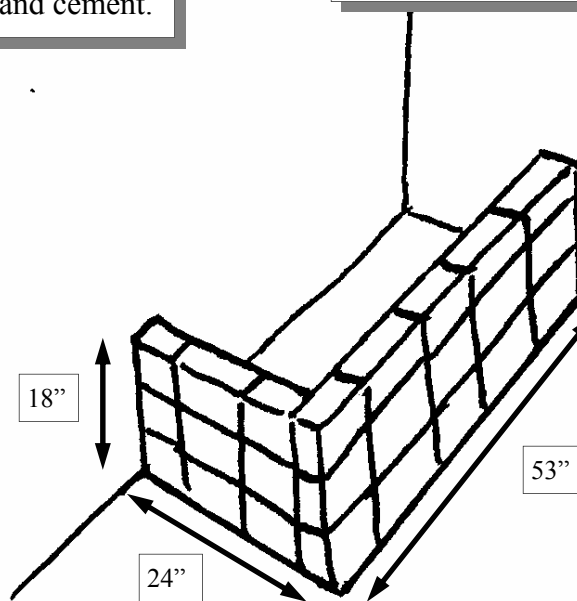
**2 walls:** 10 cement blocks and 1/2 bag of Portland cement.

**4 walls:** 20 blocks and 1 bag of Portland cement.

## **For a brick base**

**2 walls:** 35 bricks and 2 wheel barrows of clay/sand mortar.

To minimize the use of materials the stove can be built in a corner of the kitchen so that only 2 walls are needed instead of 4. If you prefer to build it away from the wall just double the amount of materials given for 2 walls. Once constructed the base can be filled with earth or rocks.



## **For a wood base.**

Construct a wood table that can support 400 lbs.

## **For an adobe base**

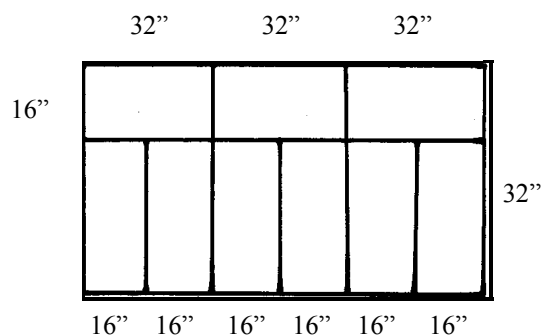
**2 walls:** 20 adobe blocks  
And 1 1/2 wheel barrows of clay/sand mortar.

**NOTE:** Adobe blocks are the most environmentally friendly option for building the base and the body of the stove because adobe blocks are not fired like clay bricks. The plans use bricks only because, in the USA, and in many parts of Latin America, fired bricks are easier to obtain than adobe blocks.

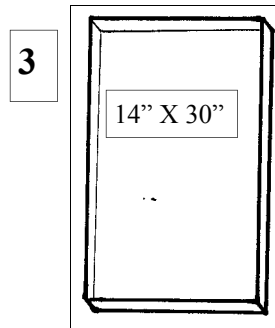
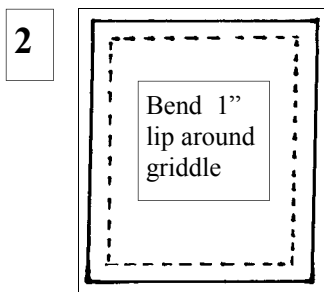
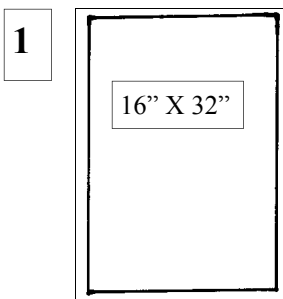
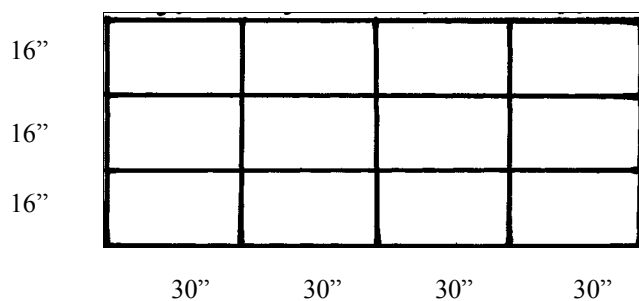
# THE COOKING GRIDDLE

The griddle can be made from rolled steel or cast iron. For rolled steel use no less than 1/8th of an inch thick. This is ideal if you are producing multiple griddles from a 4' by 8' sheet of steel cut the griddles 16" by 32". If you are cutting from a 4' by 10' sheet, cut the griddles 16" by 30". The smaller griddle must be compensated with a smaller stove body (from 12" by 28" to 12" by 26"). The dimensions of the griddle can be elongated (32"- 40") and widened to no more than 20".

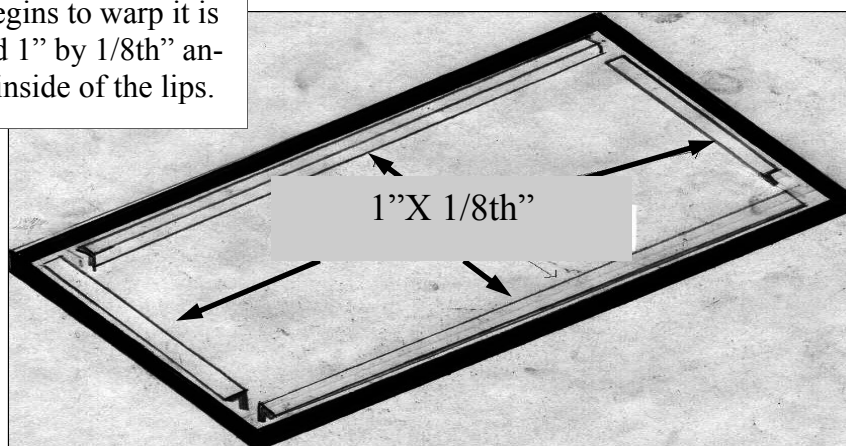
One 4' X 8' sheet of rolled steel will produce nine 16" X 32" griddles



One 4' X 10' sheet of rolled steel will produce twelve 16" X 30" griddles



If the griddle begins to warp it is possible to weld 1" by 1/8th" angle iron on the inside of the lips.



Note: cast iron can be used but should be no more than 1/4" to maintain effective heat transfer.



# THE ROCKET COMBUSTION CHAMBER



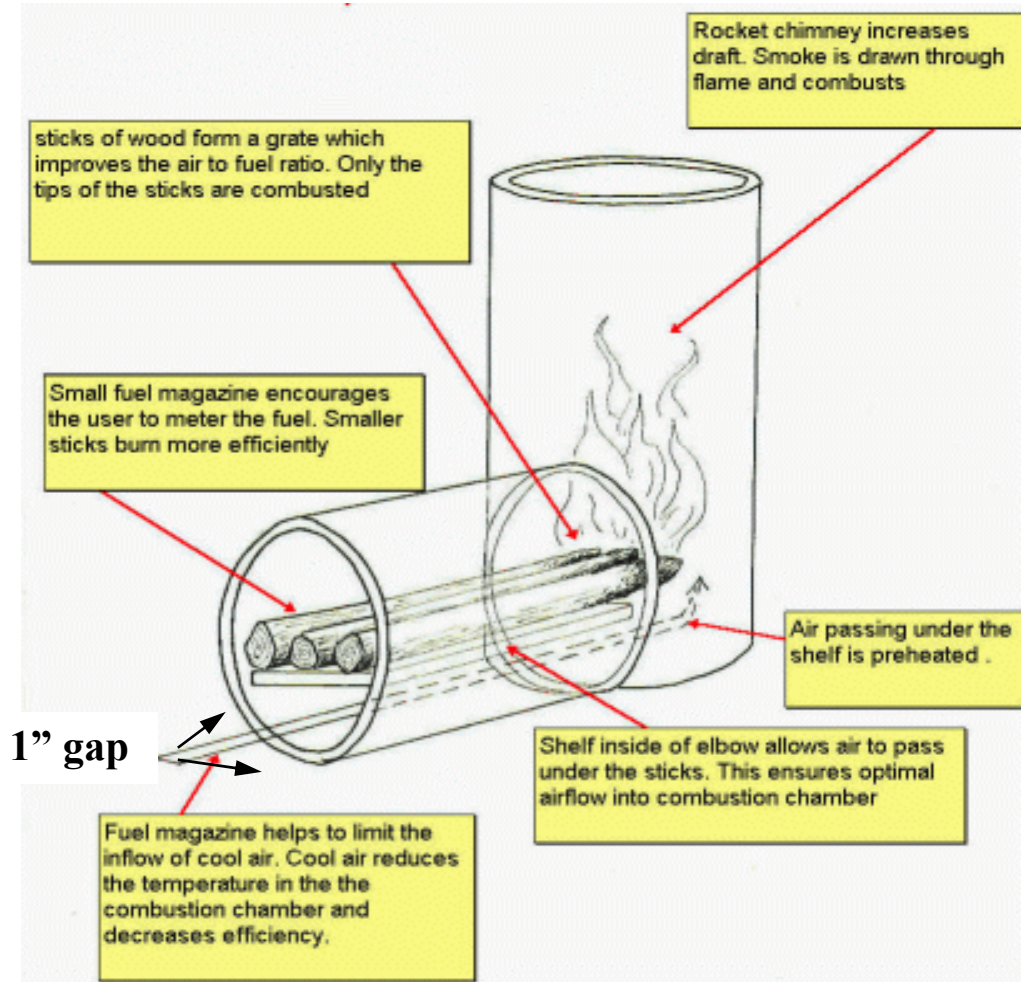
The combustion chamber can be made from refractory cement, refractory ceramic, 1/8th" steel, or cast iron. We are also experimenting with a ceramic tile (see page 7) from Guatemala and our own refractory mix.

In Honduras, a women's cooperative makes a highly durable ceramic combustion chamber that can last up to 10 years. See page 16 for contact information.

Clay pottery often isn't effective but experimentation with local materials can often lead to positive results.

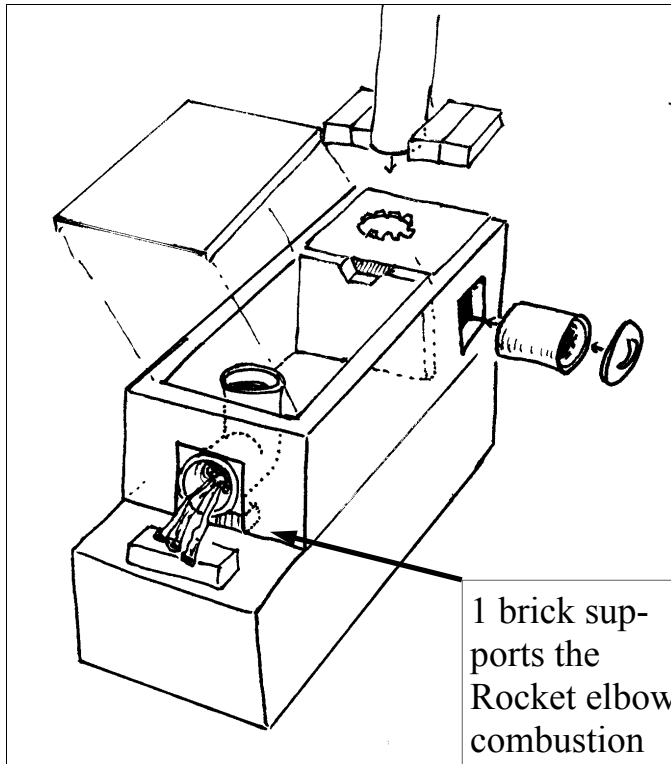
These plans call for an elbow that is 5" in diameter (internal) by 10" tall by 11" long (see photo).

For optimum efficiency, the Rocket stove requires an internal shelf. The shelf should be made from refractory ceramic or 1/4" steel. When in place, the shelf should create a **1" unobstructed gap** between the wood and the bottom of the combustion chamber



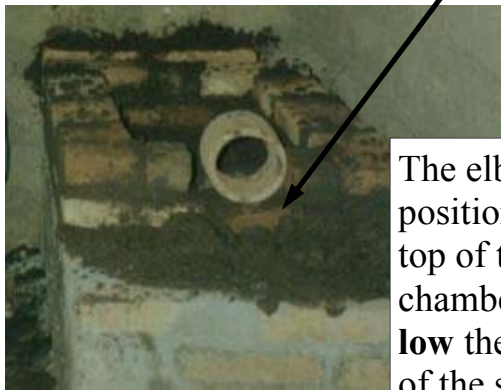


# ASSEMBLING THE JUSTA



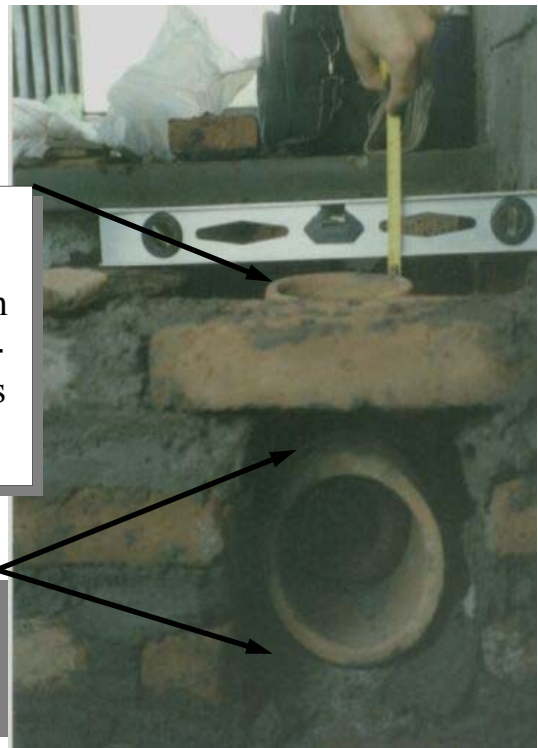
1 brick supports the Rocket elbow combustion chamber.

If possible build the stove body with the Rocket elbow combustion chamber in place. This will allow you to build a strong front wall that fits snugly around the combustion chamber. Otherwise insert the elbow after the stove-body is complete. The mouth of the elbow should be supported by one brick (see photo below). This will raise the elbow 2 inches from the floor of the stove body. This space beneath the elbow should be filled with insulation. The elbow should not be touching the floor of the stove body.



The elbow should be positioned so that the top of the combustion chamber sits **1/2"** below the exterior walls of the stove body.

Use the clay/sand mixture to fill the gap between the combustion chamber and the exterior wall.

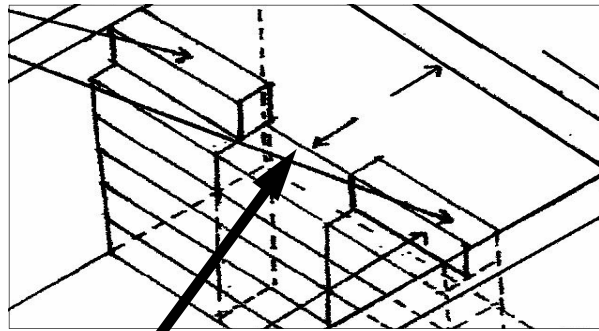


# ASSEMBLING THE JUSTA

Once the elbow is positioned — 2” above the floor of the stove body, 1/2” below the exterior walls, and 3” from the front wall (see photo right) — join the 2 pieces of the elbow together with the same clay/sand mix that was used for mortar.

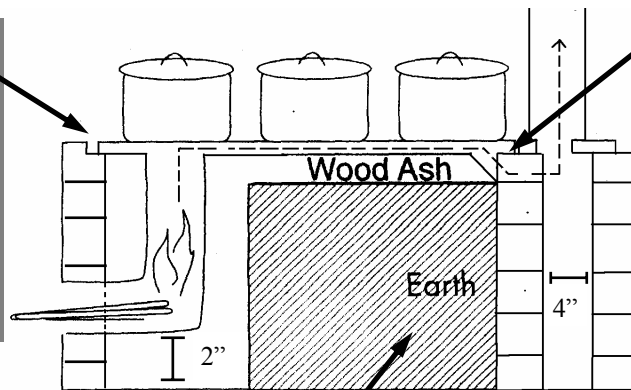


Fill the stove body with insulation (dry wood ash, vermiculite, or pumice) so that it is **level** with the exterior wall.



KEEP THIS SPACE UNOBSTRUCTED. DO NOT FILL IN THE GAP OF THE INTERIOR WALL'S LAST BRICK LEVEL

The 1” lip of the griddle creates a 1” passage that allows the hot flue gases to travel above the insulation and below the griddle.



The insulation should begin to slope down 3 inches before it reaches the interior wall. This creates a passage that allows the hot flue gases to exit to the chimney.

If possible, fill the entire stove with insulation. However, if there is a shortage of insulation, the back corner can be filled with dry earth or a mixture of tin cans/dry earth or glass bottles/dry earth.

The Justa stove is for people who make tortillas, have multiple pots, and cook indoors. The Justa:

- Has generated an average fuel savings of 40% in Central America. Savings depend on the efficiency of the previous stove
- Removes 100% of wood smoke from the house and produces 35-85% less green house gases than an open fire.
- Is easy to construct. 2 people can build a Justa in 4-8 hours.
- Is long lasting. In Honduras we are building Justas with a life expectancy of 10 years (not including chimney) for approx \$50.
- Has a high level of acceptance in many Central American communities.

The Justa's chimney, combined with its high combustion efficiency, make it an ideal stove for people who are aware of the health hazards of inhaling wood smoke. However, the Justa stove is not the ideal stove for every cooking situation.

**Here are some things to consider before introducing the Justa stove in your community:**

**Are people cooking outside?**

**If yes**, then consider building an unvented stove outside the house. Unvented stoves can often be more efficient, easier to build and longer lasting. If the chimney is not replaced when it eventually degrades it will expose the family to more smoke than if they had continued to cook outside.

**Is Liquid Petroleum Gas (LPG) readily available?**

**If yes**, then consider encouraging a switch to LPG. In many southern countries wood is not sustainably harvested so even an improved wood stove can lead to long term forest degradation. There is some evidence that LPG stoves produce less green house gases than wood stoves.

**Are they building conservative open fires?**

**If yes**, consider introducing a hay-box or an unvented stove outside the house. A small, carefully tended open fire can be very efficient. Unfortunately, this type of fire is uncommon in most parts of Central America.

**Are they using round bottom pots?**

**If yes**, consider introducing the rocket ring stove or a regular Rocket outside. Round bottom pots will not work with the Justa due to poor contact with the cooking surface. If they have only one pot, consider introducing a Rocket

**If you answer YES to any of these questions, you should RECONSIDER introducing the Justa stove into your community.** See the next page for other designs that might be more appropriate or contact Aprovecho for more information.

# THE JUSTA CHIMNEY

Diameter: 3 1/2 - 4 1/2"

Height: at least 10" above the roof .

Ideally the chimney should be above the peak of the roof but usually this is not an option due to cost considerations

**There are at least 3 materials options for the chimney**

## Galvanized Steel

### Pros

- Inexpensive
- readily available
- Light
- Easy to handle, transport and clean

### Cons

- Questionable durability (1-4 years)
- Toxicity in manufacturing process
- Susceptible to acid rain degradation

## Cement water pipe

### Pros

- Very durable (10 years+)
- Can be cheaper than Zinc

### Cons

- Less efficient (higher mass)
- Difficult to transport, handle and clean.
- Earth quake hazard
- Need to build sturdy base for support

## Clay pipe or blocks

### Pros

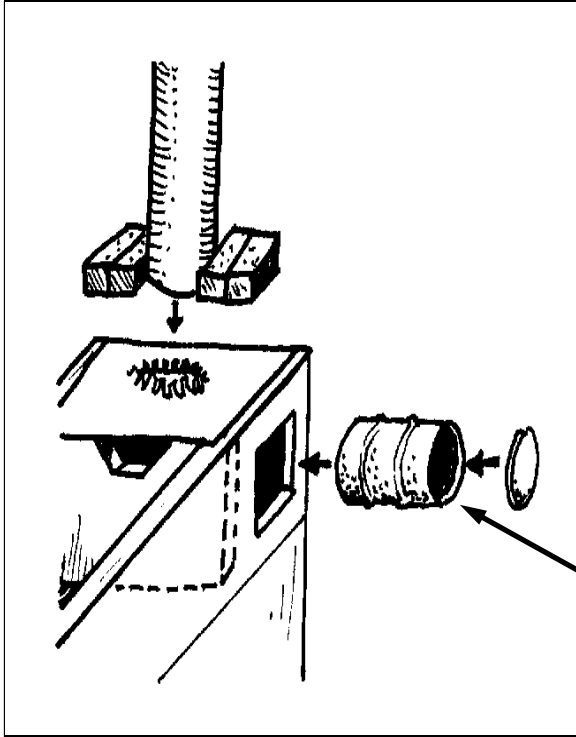
- Very inexpensive
- easy to transport and handle
- Very durable (10 years+)

### Cons

- Earthquake hazard
- Not readily available.
- Difficult to clean

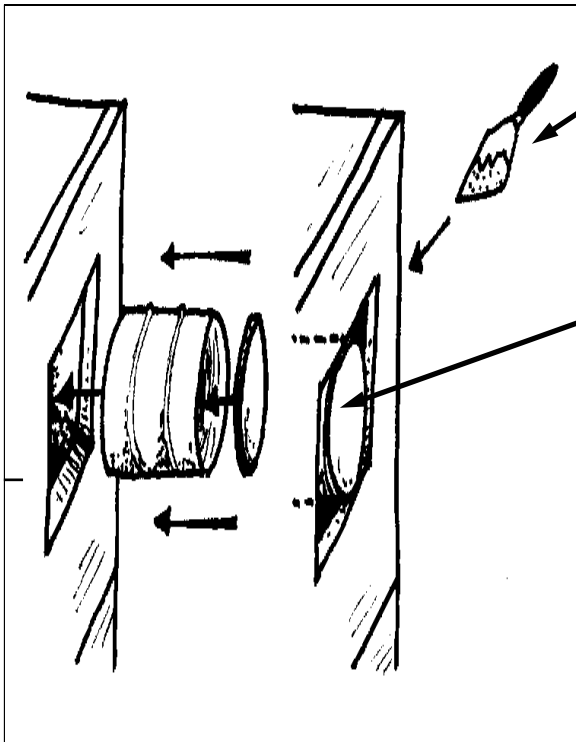
Better material options exist, especially in the USA. Any commonly accepted chimney material such as black chimney pipe , stainless steel or masonry blocks can be used with the Justa.

# ASSEMBLING THE JUSTA



## Constructing the soot removal chamber

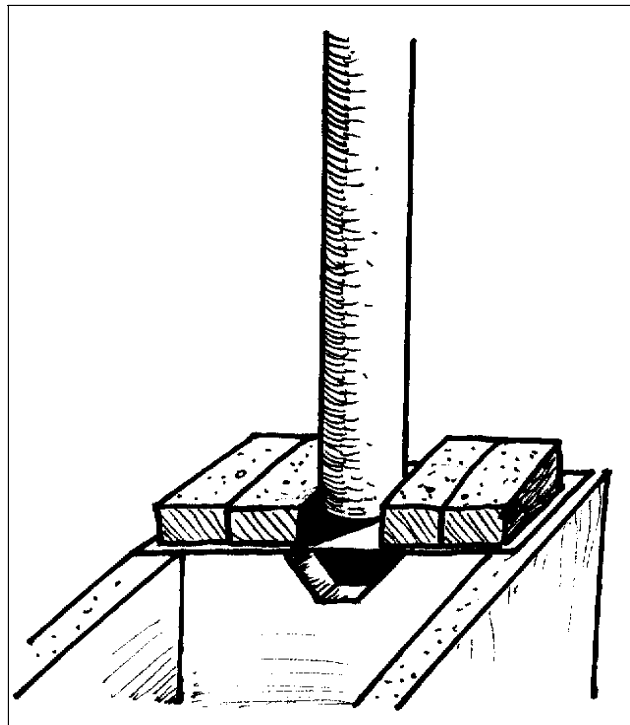
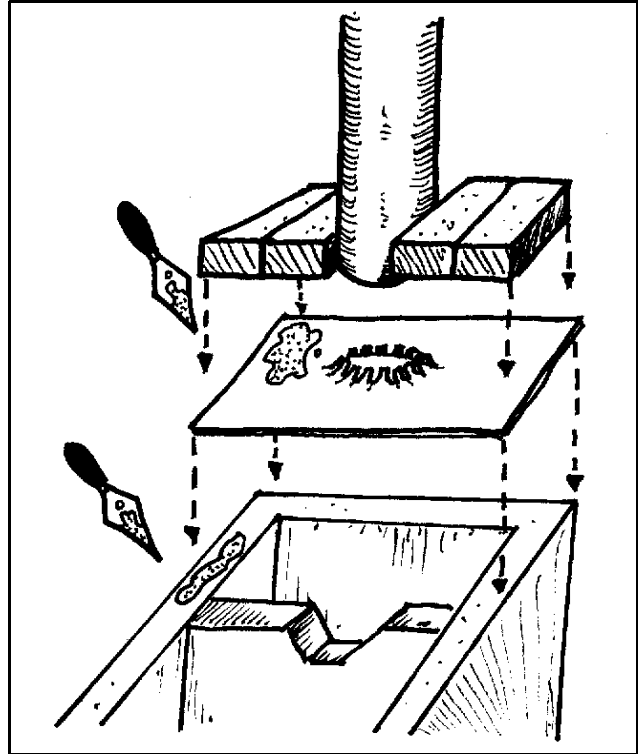
- Take the 4" tin can and cut the bottom out of it.
- Insert it in the opening in the back corner of the stove.
- Use clay/sand mortar to fill the space between the can and the bricks.
- Seal the can with the plastic or metal lid.
- Remove the lid every few months and sweep out any soot that has accumulated beneath the chimney.



# ASSEMBLING THE JUSTA

## CONNECTING THE CHIMNEY

- Take a piece of 1/32 steel (10" by 32") and cut a 3" diameter hole in the middle of the sheet.
- Then cut twelve 1" tabs in the circle. Bend these tabs upwards.
- You now have a 4" hole with 1" vertical tabs. Lay this across the antechamber and seal with sand/clay mortar.
- Place the chimney on top of the hole (with the flanges **inside** the chimney pipe).
- Hold the chimney pipe steady as you lay the 4 bricks snugly against it.
- Place mortar between and under the bricks and between the bricks and the chimney.

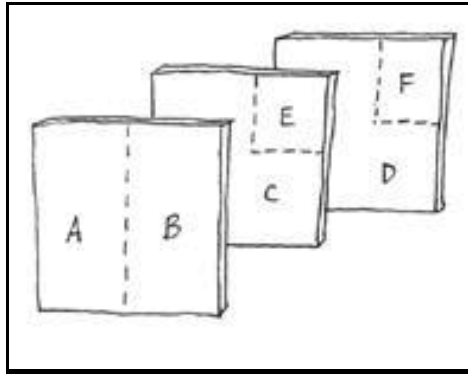




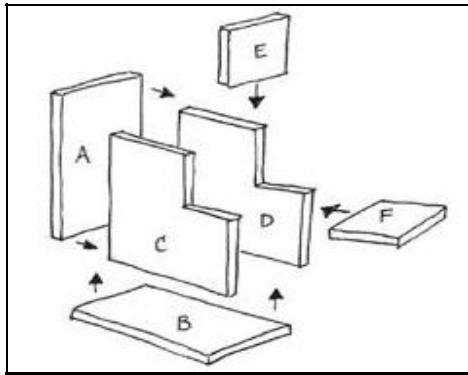
# THE ROCKET COMBUSTION CHAMBER

Using a ceramic floor tile to build the combustion chamber.

The baldosa is a ceramic floor tile that offers an inexpensive option to other refractory combustion chambers. The baldosa in Guatemala costs US\$.25 per tile or US\$.75 for an entire elbow. This compares very favorably to the US\$6-7 for the refractory ceramic or refractory cement elbow that is currently being produced in Honduras. However, the refractory ceramic and refractory cement elbow are reported to last for 10 years+, whereas the baldosa has only been in use in Guatemala since February 2001 (approximately 6 months as of this printing). Please contact us far an update on the availability and durability of the baldosa.

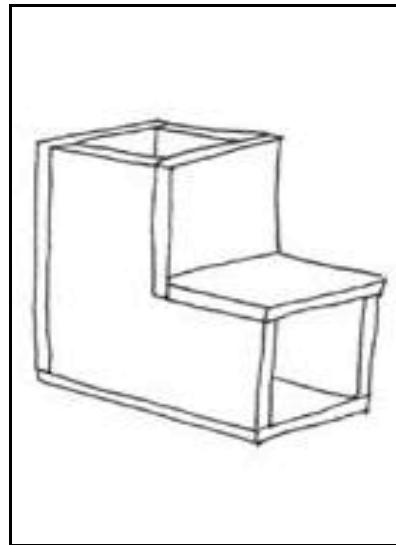


Take three baldosas (1" by 12" by 12"). Cut all 3 tiles to 1" X 10" X 10". Cut the AB tile in half. This will leave you with two 5" by 10" pieces. Then take the second tile (CE) and remove a 5" by 5" square (E) and then take the third tile (DF) and remove a 5" by 5" square (F).



Then connect the pieces as shown. Use a 50% sand/ 50% clay mortar to connect the pieces. Once in use, the weight of the insulation will keep the elbow in place but it should be checked periodically to assure that it is still properly connected.

The final dimensions of the elbow will be the same as the ones listed on the previous page but with one exception. The elbow will be 10" long instead of 11"  
**Baldosa elbow dimensions: 10" tall by 10" long by 5" in diameter.**



# CONTACT INFORMATION FOR OUR STOVE PARTNERS

## In the USA:

### **TREES WATER AND PEOPLE (TWP)**

is coordinating stove projects throughout CA. Contact Stuart Conway. 633 South College Avenue. Fort Collins, CO 80524. Tel: 970 484 367. Fax: 970 224 1726  
E-mail [twp@treeswaterpeople.org](mailto:twp@treeswaterpeople.org) Website [www.treeswaterpeople.org](http://www.treeswaterpeople.org)

## In Honduras:

### **ASOCIACION HONDURENA PARA EL DESARROLLO**

AHDESA in partnership with TWP, is building stoves in Tegucigalpa and Marcala.

Contact Ignacio Osorto. Tel: 235 5343 /231 0741 Fax: 504 239 0883

E-mail: [ahdesa@optinet.hn](mailto:ahdesa@optinet.hn)

### **RICARDO CRUZ**

is constructing the portable metal version of the Justa Stove with oven

E-mail: [ricardohonduras@yahoo.com.mx](mailto:ricardohonduras@yahoo.com.mx)

### **NUEVA ESPERANZA**

produces durable ceramic combustion chambers for approx. US\$ 6

Aldea Jocomico Pan american Highway in the direction of san lorenzo 10 kms

## In Guatemala

### **HELPS INTERNATIONAL**

is building cement Justa stoves with molds and is experimenting with the ceramic tile baldosa. Contact: Richard Grinnell 502-318-5756. email [rgrinnell@amigo](mailto:rgrinnell@amigo). Web page: [www.helpsintl.org](http://www.helpsintl.org)

## In Nicaragua

### **PROLENA NICARAGUA**

is building portable metal Justa Stoves (Ecostove)

Contact Rogerio Miranda 365 9278 088 34144 E:mail [rmiranda@sdnnc.org.ni](mailto:rmiranda@sdnnc.org.ni)

### **COOPERATIVE LEAGUE OF THE USA (CLUSA)**

is also building portable metal Justa stoves in Managua

Contact Julie Varron or Stanley Kuehn at [rayo@ibw.com.ni](mailto:rayo@ibw.com.ni)

## In El Salvador

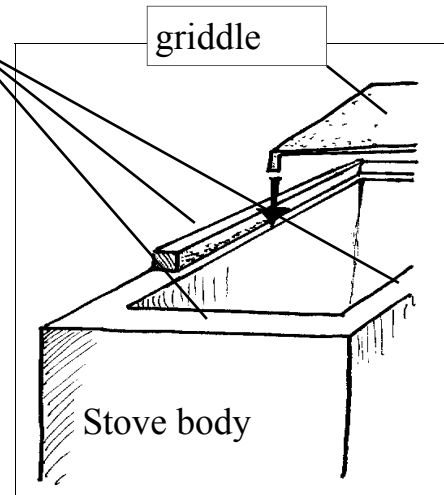
**FUDEMCO (FUNDACION PARA EL DESARROLLO EMPRESARIAL COMUNITARIO)** is building modified Justa stoves in EL Coco

Contact Armando Hernandez Tel/fax 260-7063 e-mail [fudemco@ejje.com](mailto:fudemco@ejje.com)

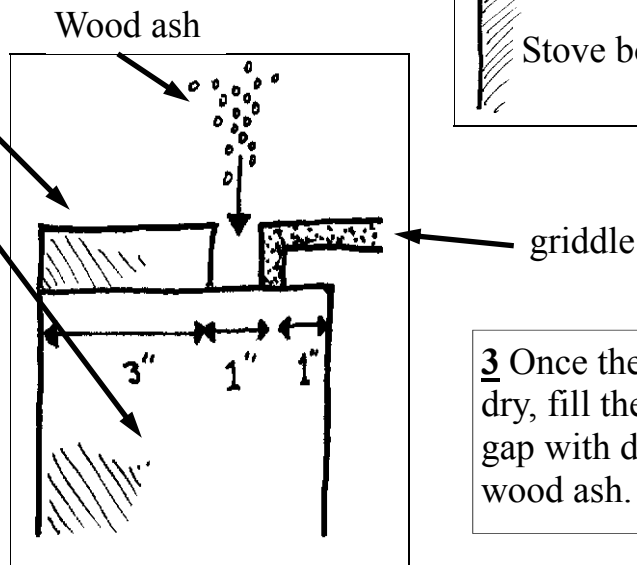
# ASSEMBLING THE JUSTA

## Placing the griddle on the stove body

**1** Build a lip (1" high by 3" wide) along the edge of the front wall and the two side walls of the exterior stove body



**2** Place the griddle on the stove body, leaving a one inch gap between the lip and the griddle.



**3** Once the lip is dry, fill the 1" gap with dry wood ash.

## YOUR JUSTA STOVE IS NOW COMPLETE!

Note: the placement of the milk or coffee can with removable lid. Be sure that the clay/sand mixture is placed tightly around the can and that there are no cracks for air to pass through.



Place 2 bricks in front of the stove to support long pieces of wood.