2004 Honduran Market Stove Project Part II

Starting in the spring of 2004 we came to Honduras and started developing a few models of stoves that could be made and sold unsubsidized by local artisans. Almost by definition the people who most need improved cook stoves are not in a financial position to invest in this simple technology. For this reason many of the improved cook stoves being built around the world have to be subsidized in some fashion to make them acceptable by the most in need parts of the population. Working with a grant from the EPA as well as many other generous donors, Trees Water and People, Aprovecho Research Center and AHDESA (The Honduran Association for Development) are collaborating to create a series of stoves that will be affordable to all levels of income and greatly reduce the use of firewood as well as the exposure to debilitating smoke.

On Saturday the 20th of November I got the chance to participate in something I have been dreaming of for a long time. We got to bring our stoves to a local market and shout "Come and get them while they're hot". Well, not exactly, but we did get the chance to show off the stoves to hundreds of potential customers and the interest was incredible. It left us all with the feeling that these stoves are going to be a cinch to sell.

Currently we have developed five different models that can be sold in a market setting and should cover all ranges of incomes and cooking needs.

1) Simple Rocket (Eco Leña)
2) Simple Rocket with comal skirt
3) Super Rocket
4) Barrel Stove (Eco Barril)
5) Eco Fugon

In each of the models we have had various choices to make and are still in the process of refining the production of the stoves. I will try to walk through these five designs and the various options we have in each.

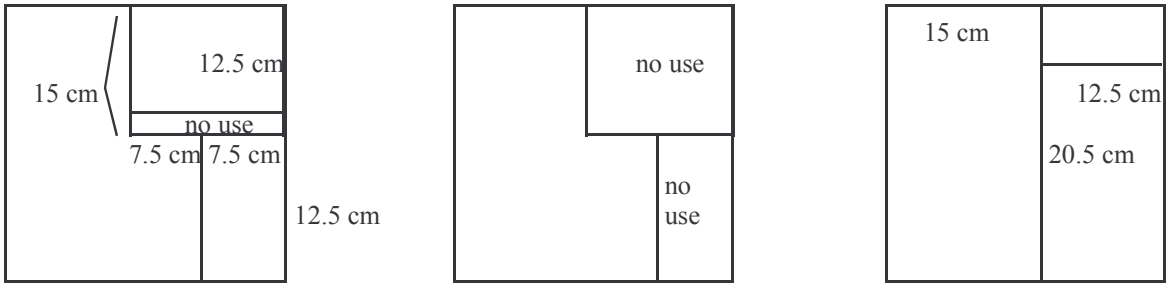
1— The Simple Rocket or Ecoleña

The simplest of stoves we will be offering will be little more then bricks in a bucket surrounded by insulation.

In the simplest of rocket stoves we have five different aspects to decide upon.
A– The combustion chamber
B– The type of insulation
C– The stove container
D— The pot support
E— The shelf or grate

A— In Honduras our choices for material of the combustion chamber will be either the 2.5 cm thick baldosa bricks that we have been using in our Justa stoves or an insulative ceramic brick that will be made with clay and organic matter. We will continue to work towards the insulative ceramic but it is still a work in progress. For now we will be using the baldosa elbow as it our only choice with a proven track record.

We are also deciding on the ideal size for our combustion chamber. For fire power needs a 10 cm x 10 cm combustion chamber would probably be sufficient but as this stove has to meet the approval of the discerning and skeptical public we are going to err on the large side. We will be building our combustion chambers 12.5 cm by 12.5 cm. The baldosas we are buying standardly come in a size 27.5 cm x 27.5 cm. Either by cutting them in the following manner from three standard baldosas or having them custom made in special molds we can make an elbow which costs 15 Limpiras or about $.80.



B— Insulation — In Honduras we are not blessed with pumice or readily available vermiculite/perlite. And as we are not yet there with insulating bricks our only choices for insulation are either to continue with the wood ash that we have been using in the Justa stove or switch to a new insulation that we have been working with that is made from cement and organic matter. Wood ash is not always abundant and has the drawback that if it gets wet it will reduce to a solid paste. I made a series of test batches of different mixes of cement and a lighter material, either sawdust or rice husks. The mixes ranged from 1 part cement: 1 part lighter material up to 1 part cement: 6 parts light material. Given the lower heats that the insulation will have to endure where we are using it I feel pretty certain that it will work, the question is just how much cement we will have to use so that it still holds up once the organic matter burns out and if this will be better then the wood ash we are using. I made about 8 different mixes and put them in stoves being tested in the field this year and only time will tell.

C — The stove body — We can make the body of the stove from scratch out of thin sheet metal but the most attractive, cheapest and simplest way will be to purchase galvanized tin buckets already made in the size we want. They come in a size 10.5 inches tall and 11.5 inches wide which will work fine but we are looking into have the buckets custom made a bit taller and a bit skinnier to fit our needs.

D — Pot Support — For a pot support we are using two pieces of 1" by 1/8" flat steel, bent and welded in an X. This will hopefully last the life of the stove but if it does not prove to do so we can make slightly more expensive supports that do not sit in the flames.

E — Grate — On our last trip we were able to convince Ahdesa that it was a worthwhile investment to try and get people using grates. They have since focused heavily on that fact in their stove use component of the project and it seems people are using the shelf. We have been using a grate made out of metal in Honduras for the last year that costs about $2. We had 20 prototype ceramic grates made that will cost about $.50. Our initial test have shown them to stand up to the fire but once again in field test will tell the truth.

The materials for the simplest stove are costing right now about $3.50. Hopefully the stove can be put together in less then an hour and the price at the market will only be a bit more then this.

2 — Simple Rocket with Comal Skirt —

In Honduras much of the use of a stove is to make tortillas. To make the stove more efficient with a comal or griddle placed above it we have a stove with the option of a comal skirt that forced the gasses to pass closely to the bottom of the comal. The comal skirt or comal-mejorada, is a sloping contour that forms a decreasing space as the gasses pass beneath the comal.

We are looking at two different ways of making this skirt. One way is by making a disk and forming it into a slight cone by cutting one radius of a disk and slightly overlapping the outer edge. While this form is relatively easy to make and uses little material it does have the disadvantage of requiring a working spot welder or decent soldering skills. The skirt is also not insulated so it may burn out some time and will be less efficient as well. A final drawback to this option is that the slope does not come out as exact as I would like it to be.

A second way will be to leave the disk flat and place 6 pie shaped pieces of insulating cement bricks on top to act as a skirt. This form requires less soldering and should have a more exact slope. Its drawback is that we have to make insulating bricks which are an extra step in the process, a bit more cost, and as of yet we do not have the best recipe down. As with the insulation in the stove if we go with this choice time will be the verdict as to how light we can make these bricks.

In either of these two designs we will make three pot supports out of either 1/8" angle iron or leftover 1/32" steel doubled over. These pot supports will have lines cut in them so that a pot skirt of varying diameter can be placed in supports.

A final choice for the comal skirt is whether to make it 16" or 18" in diameter. The 18" diameter comal skirt will bring a bit more heat to the outer edges of a comal but we can make only 10 out of a standard 4' by 8' piece of sheet metal, leaving a long section of 1' wide metal left over. This can most likely be used for other things but it is not quite as attractive as the 16" diameter where 18 pieces can be made out of every sheet of metal with no left over. I will be good to make both sizes to begin with and see what is most popular on the market.

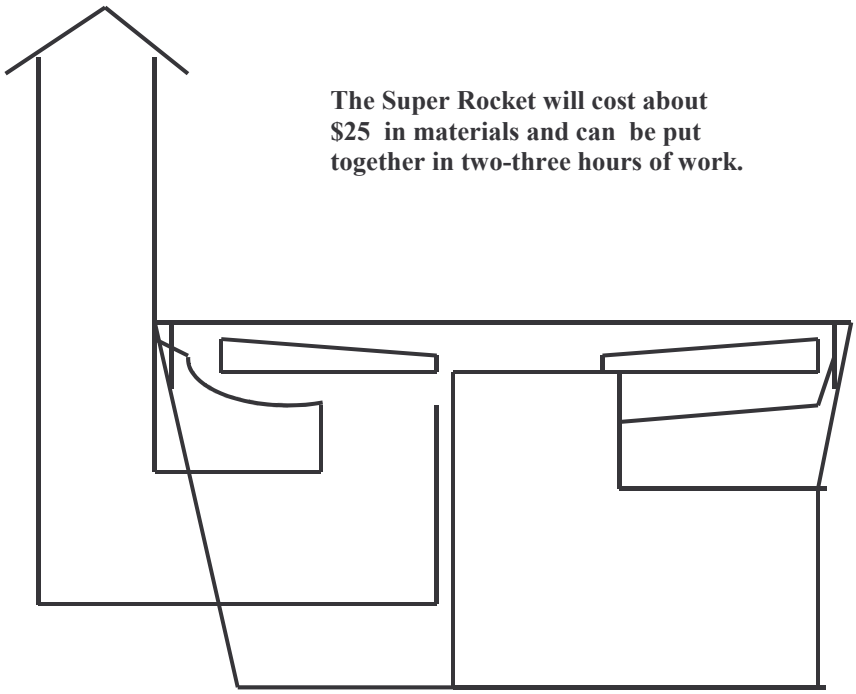
The Comal Skirt will cost as little as $1.50 in materials and should be relatively quick to make so we can hopefully add it to the simpler stove for only a few dollars more.

3 — SuperRocket — for lack of a better name yet

Both forms of the simple rocket should fill the varied cooking needs of any family at a price that most any family can afford. With the Super Rocket we will be offering a slightly more expensive option. Realistically this will be a stove that the poorer families of Honduras may not be able to (or choose to) afford, but it will appeal to those who want a chimnied stove but at a slightly less cost then the more expensive versions we are making.

The Super Rocket is little more than a larger version of the simple rocket with the comal skirt, a permanent griddle and a chimney attached. But of course *El Diablo sea en los detalles*. It will help to refer to the diagram below for the following description.

For the body of the stove we are using a larger version of the galvanized tin bucket we are using in the simple rocket. In this we will place a slightly shorter elbow, our insulation of choice, and a comal skirt.



The Super Rocket will cost about $25 in materials and can be put together in two-three hours of work.

The first trick is making an exit for the chimney that does not interfere with the heat transfer to the griddle. As you can see in the diagram we are bringing the chimney in from lower down and then having it come up and draw from next to the back of the elbow. This way the draw from the chimney will come from all directions instead of just the back.

Next we have to make a comal that is easily sealed into the insulation so that smoke does not escape into the room. We are cutting a piece of 1/8" steel as large as the rim of the body and welding on a piece of 2" rolled steel about 1/2" inside of the edge of the griddle. When we put in the insulation we are making it come to about 3" below the top of the body. Then we are making a trough out of denser cement that can be filled with wood ash in which the griddle can be sealed.

Entering into the shady world of the free market is going to be a work in progress. Even though a $30 plus stove should not be an out of reach investment we will have to see if we need to try and make a more affordable chimnied stove. The griddle accounts for almost half of the material costs. To lower costs we may try to make the griddle less expensive and easily replaceable.

4 — El Ecobarril —

Often we are faced with the fact that even if the fuel savings (as well as health benefits) of a stove will pay off in a short while it is not in the economic tendencies for a poorer family to make an investment in a stove. One way to get around this is if we can make the cheaper Ecolena be a stepping stone towards one of the more "deluxe" models, in this case the Ecobarril.

The Ecobarril will consist basically of a used metal barrel, a chimney attached to the back, and a 1/8" mettle griddle. Inside the barrel there is pieces of 1" flat steel welded in place and a partial entrance so that the simple rocket with comal skirt stove can be placed to complete the stove. When we tested the first prototype of this model we found that the sides where heating up too easily so we have now added an inner wall of 1/32" sheet metal about 2" from the outer wall of the barrel that is filled with insulation to cool the sides of the stove.

We should be realistic though about how much being able to buy the insides of the stove will make it more affordable. The barrel, griddle and chimney account for about 75% of the material costs. But this will still help make this stove marketable and may lead more people to purchase the simpler stove.

Material costs for the EcoBarril should be around $30 and take 4-5 hours to put together.

5 — Ecofugon —

The Rolls Royce of stoves we will have going is the Ecofugon; fist cousin to Prolena's market stove. While I prefer the portable Justa stove that is skinnier and longer for heat transfer efficiencies, this is what the people seem to want. Finding a solution for the scarcity of available wood ash will be most important with this stove as it uses the most insulation. This will also be further motivation to work on making insulated bricks.

This stove will also take 4-5 hours to make and material cost for the stove will be something like the following:

Sheet Metal 1/32" -	$ 6
Angle Iron 3/4" -	$ 4
Elbow	$ 1
Grate	$ 1
Griddle (1/8")	$ 9
Chimney	$ 6
Insulation	$ 2
Total	$ 29

6— An adjustable pot skirt —

The final item we will be including at our stove bizarre will be an adjustable pot skirt. For me this item resides in the same category as the haybox or fireless cooker. Like the haybox it can put a serious dent in the fuel use of a household. But also like the haybox it has not had the cultural acceptance that it needs to work. But, we know that a skirt, especially for smaller pots, can greatly decrease the use of fuel, so we will continue to try. Writing this re-inspires me to try to introduce the haybox into our inventory of fuel saving devices. As I look to the future of a growing market in Honduras I do not see why not.

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