



Biochar and SCAD

presented by
David Friese-Greene
The Schumacher Institute, Bristol

Please contact:

David Friese-Greene
The Schumacher Institute
70 Prince Street
Bristol
BS1 4HU
United Kingdom

+44 (0)7778 028790

davidfg@netgates.co.uk



SCAD

Social Change and Development



1. COMMUNITY

- Village committees
- Women's self help groups
- Youth groups

2. IMPROVING HEALTH

- Water and sanitation
 - Rainwater harvesting tanks
 - Renovating traditional drinking ponds
 - Training about safe drinking water
- Mother and Baby programmes
 - Nutrition
 - Vaccination
- Nutrition
 - Development of village gardens
 - Cooking lessons
 - Supply of a nutritional biscuit weekly for all children
- School Health Programme
 - Rainwater harvesting
 - Provision of toilets
 - Distribution of nutritional biscuit
 - Healthy living practice
- Eye Care
 - Including free cataract operations
- Herbal medicine
 - Training
 - Provision of saplings
- Mobile medical camp
- Health Awareness training

3. INCLUSIVE EDUCATION

- Pre- School Balwadi
 - Supports the construction of the buildings
 - Training of teachers
 - Educational materials
- Village Schools
 - Training for teachers in child play education
 - Provision of equipment and resources
 - Repair and maintain buildings
 - Provision of toilets
 - Provision of kitchens and kitchen gardens
- 2 schools for children abandoned by family or denied education because of disablement
 - At 16 support employment training
- School for children with learning and development disorders
 - Learning alongside psychosocial therapy and occupational therapy
- 2 schools for child laborers
 - After 3 years the children are re-introduced to mainstream schools
- School for gypsy community
- School for saltpan community

4. AGRICULTURE

- Irrigation renovation
- Construct check dams
- Dig farm ponds
- Testing soil for salt content
- Tree planting
- Developing organic fertilizers - **Biochar**

5. TREE PLANTING

- For fuel
- Prosopis project
- Fruit trees
- Drought resistant species
- Providing saplings from SCAD nursery

6. ANIMAL HUSBANDRY

- Support livestock
- Provide animal husbandry camps

7. VOCATIONAL TRAINING

- e.g. pottery, tailoring, fast food production, outboard engine mechanics
- marketing and entrepreneur skills
- provision of machinery and networks

8. ALTERNATIVE EMPLOYMENT

- Supporting self employment e.g. tiffin shops, bicycle hire and charcoal production

PADARNTHAPULI

A typical village within the SCAD blocks.

1500 people
300 Families
150 Farmers who own land

For the most part the working villagers are landless laborers.

Average farm size 2 - 3 acres

50% Poor irrigation / Good soil
50% poor irrigation / Poor soil

Families in the village own:
874 goats
32 cows

Prosobis trees and bushes abound and the wood is used for cooking fires and making charcoal.

There are 6 family owned charcoal production units around the village.



Prosobis bushes



(1 acre = 4047 square meters i.e.63.6 meters squared)

Cooking Fuel Used	Rural		Urban		Total	
Fire-wood	7,113,737	86.0%	1,993,931	33.8%	9,107,668	64.3%
Crop residue	234,953	2.8%	107,857	1.8%	342,810	2.4%
Cowdung cake	20,235	0.2%	9,440	0.2%	29,675	0.2%
Coal, lignite, charcoal	1,560	0.0%	2,749	0.0%	4,309	0.0%
Kerosene	296,072	3.6%	1,559,829	26.4%	1,855,901	13.1%
LPG	534,343	6.5%	2,169,627	36.8%	2,703,970	19.1%
Electricity	5,307	0.1%	5,651	0.1%	10,958	0.1%
Biogas	38,427	0.5%	20,986	0.4%	59,413	0.4%
Any other	7,925	0.1%	4,749	0.1%	12,674	0.1%
No Cooking	22,231	0.3%	24,017	0.4%	46,248	0.3%
Total Households	8,274,790	100.0%	5,898,836	100%	14,173,626	100%

Tamil Nadu Statistics	
Rural Homes using firewood to cook 1 or 2 meals per day	7,113,737
Average cooking time per day - hrs	2
Average kg wood used per day/family	2.25
Total wood burnt per day kg	16,005,908
Total wood burnt per day metric tonnes	16,006

SCAD Statistics	
Women's self help groups, set up by SCAD	2,500
Average number of women per group	20
Total women who could use stove	50,000
Average kg wood used per day/family	2.25
Total wood burnt per day kg	112,500

Anila Stove Statistics	
Average kg wood used per day/family	1.25
Bio residue pyrolysed per day in kg	2.50*
Kg of charcoal produced per day	1

SCAD Stats using Anila Stove	
Percentage of self help group members using the stove	50
Number of families cooking per day	25,000
Kg of wood used/day	31,250
Kg of bio residue used /day	62,500
Kg of charcoal produced per day	25,000
Charcoal production in one year - kg	9,125,000
Charcoal production in one year - metric tonnes	9,125

Cost 2000 rupees per stove.
If this was subsidised then 100% would use, according to SCAD

*Based upon a conversion of 35% - 50% of biomass to charcoal



In Tuticorin district 45 to 50,000 tonnes of charcoal is commercially produced each year



All the farmland around the village depends upon rainwater for irrigation.

Most of the 150 farmers within the village community grow:

Pulses - black and green gram

Cereals - millet and maize

These crops are grown because they require less water.

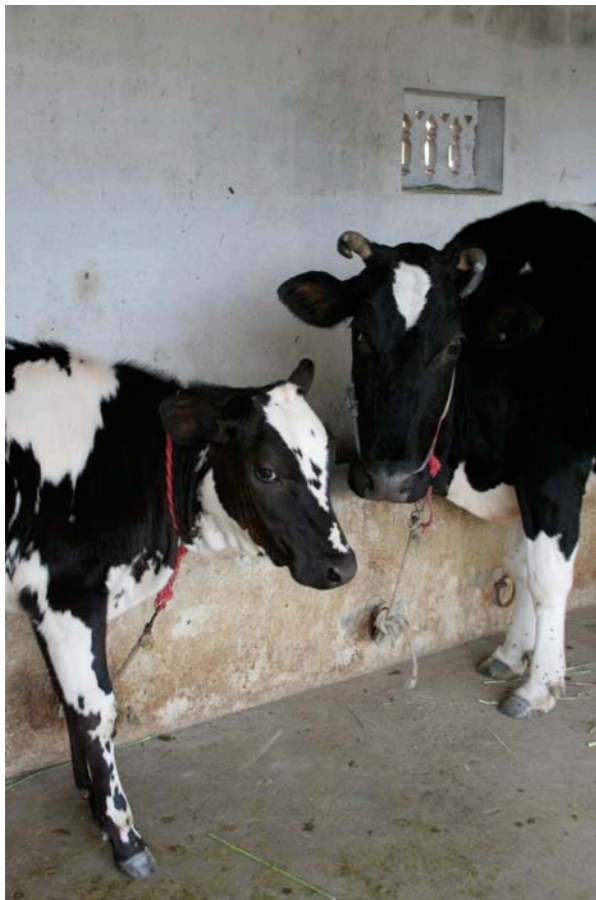
To feed one cow for one day farmers need:

10 kgs of dry fodder

2.5 kgs green fodder and concentrated food

This is all taken from their land.

The stems of millet are primarily used for fodder.



+



=



On average each family produces per DAY:

1.3 kgs of cooking fire ash
0.3 kgs of vegetable (food preparation) waste
0.15 kgs of paper and polythene waste

**Average family waste for the whole village
(300 families) per DAY:**

410 kgs of cooking fire ash
90 kgs of vegetable waste
45 kgs of paper and polythene waste

**Average animal waste produced each DAY
within the village and on farms:**

625 kgs of goat dung
266 kgs of cow dung
200 kgs of fodder waste

**Average family waste for the whole village
(300 families) per YEAR:**

150 metric tonnes (150,000 kgs) of cooking fire ash
32 metric tonnes (32,000 kgs) of vegetable waste
16 metric tonnes (16,000 kgs) of paper and polythene waste

**Average animal waste produced each YEAR
within the village and on farms:**

228 metric tonnes (228,000 kgs) of goat dung
97 metric tonnes (97,000 kgs) of cow dung
73 metric tonnes (73,000 kgs) of fodder waste

Within SCAD villages there are estimated to be 5,500 farmers.
60 of those farmers are engaged in vermiculture making vermi-compost

Where possible most animal waste and ash is collected in a shallow pit, mixed with earth and some household waste, then covered with mud and left for 8 months. This material is then dug into soil.

Average agricultural 'waste' per YEAR:

(Not including animal waste) from farming activities in the village.

30 metric tonnes (30,000 kgs) of pulses and cereal 'waste'

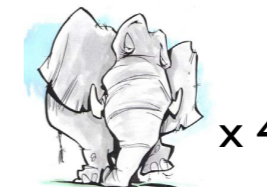
30% is used for animal fodder and composting

70% is left on the threshing floor and most of it burnt

(In some areas a small proportion of this left over waste is collected from the roadside by factories that manufacture greetings cards.)

This means that there is potentially **20 tonnes of agri-waste**

=



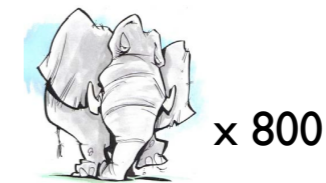
This Indian Elephant weighs 5000 kgs
That's the same as 5000 x 1 litre bottles of water

This could be used for making charcoal, charged with urine, vermi-compost, Terra Cottam and used as a very effective soil improver / fertiliser.

300 villages, like this one, within the SCAD blocks would produce around 6000 metric tonnes of bio waste per year from farming alone.

4000 metric tonnes available to make charcoal.

=



Alternative cooking technologies are the most important tools we have to relieve human suffering on a huge scale.

The most polluted environment in the world is to be found indoors, in poorly ventilated kitchens.

Acute respiratory illness (ARI) caused by smoke inhalation from cooking fires, is the number one killer of children under 5 years old throughout the third world.

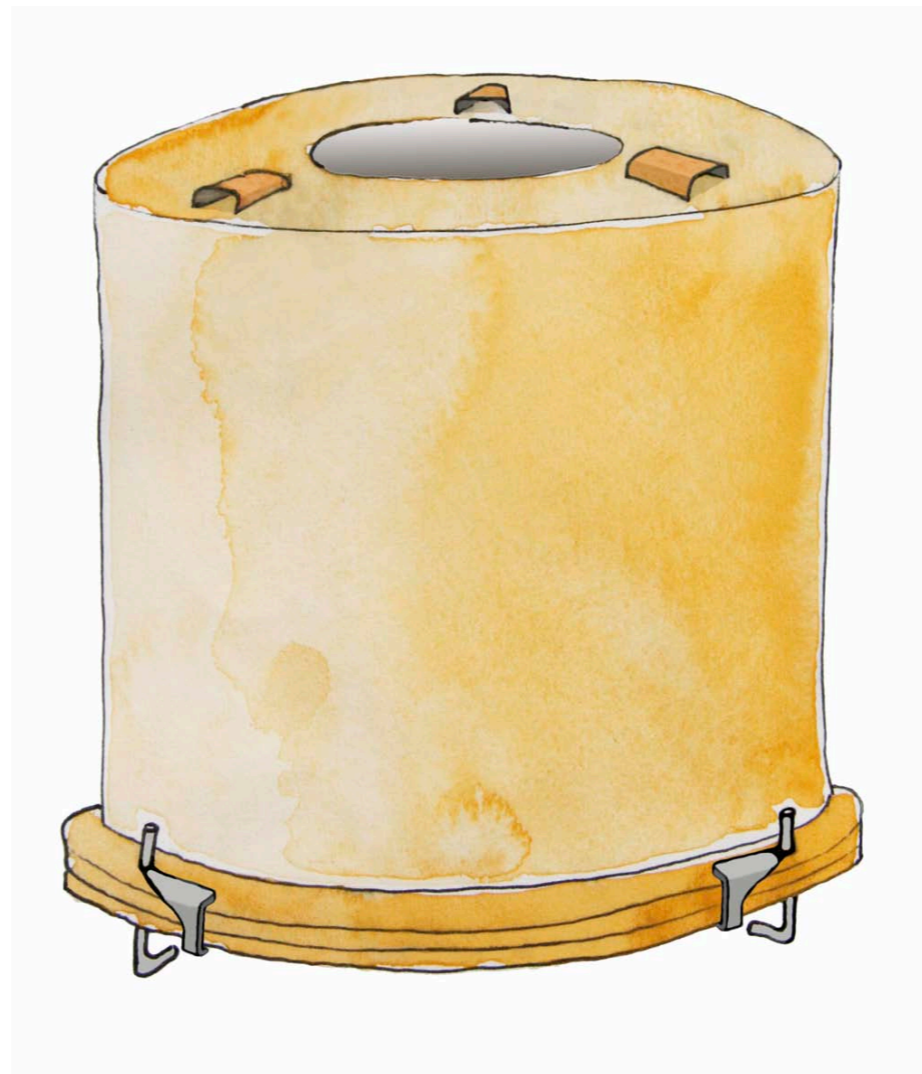
It is estimated that over two million children die each year.

Because of these and other problems, such as the effort involved in gathering fuel, many meals are undercooked.

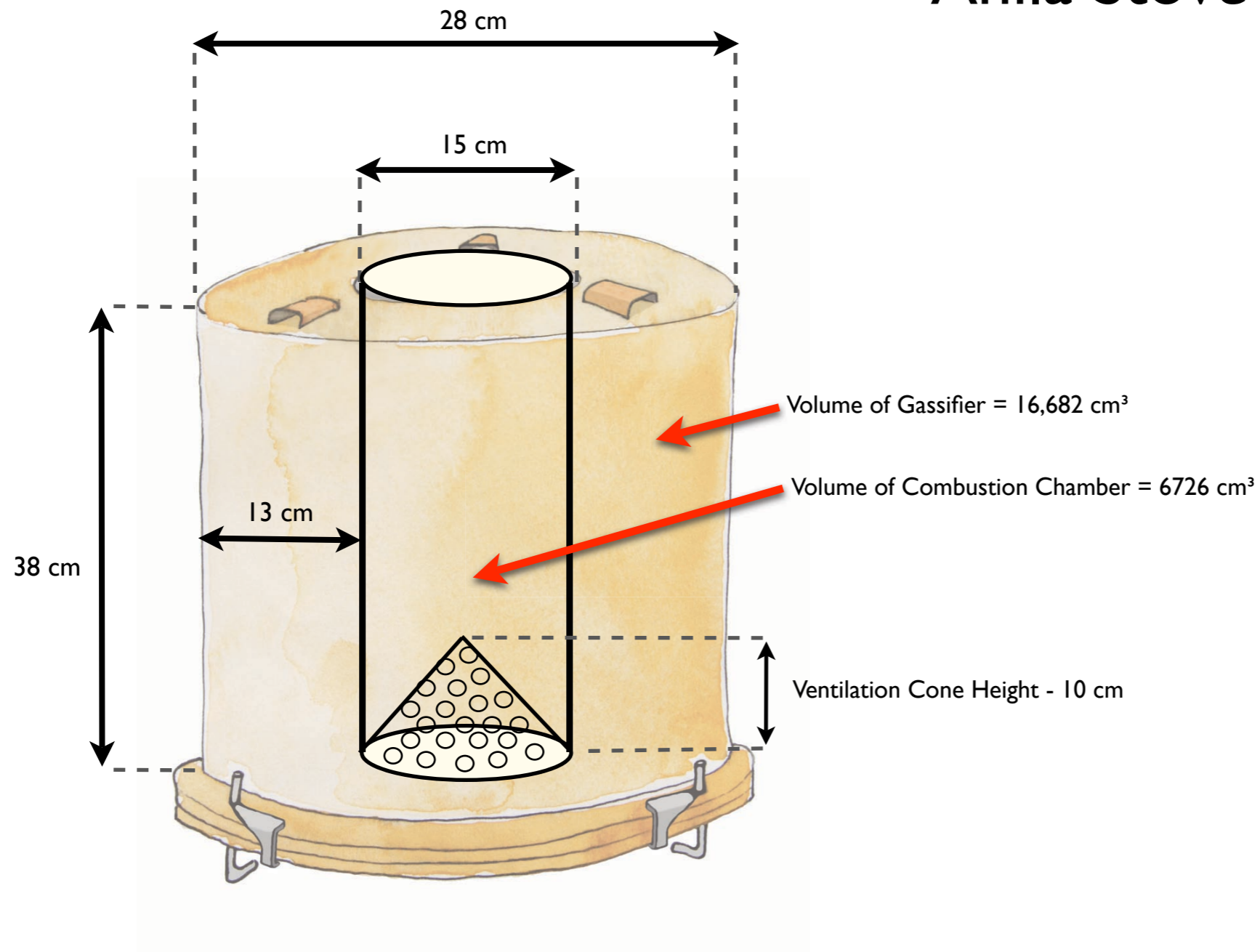


Anila Biomass Gassifier Stove

Designed and built by Professor U.N. Ravikumar (Eng)
Mysore University, India

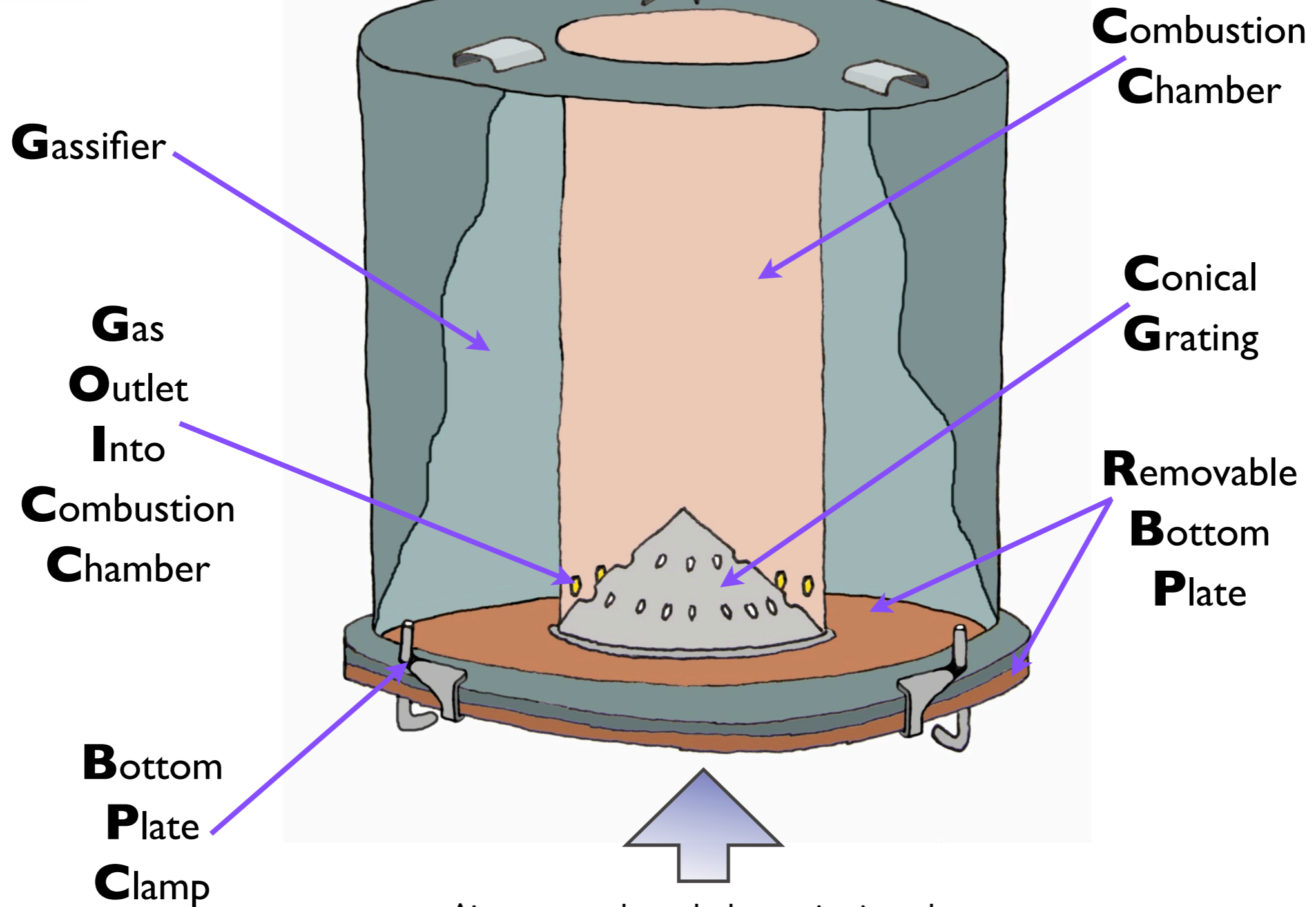


Anila Stove Dimensions



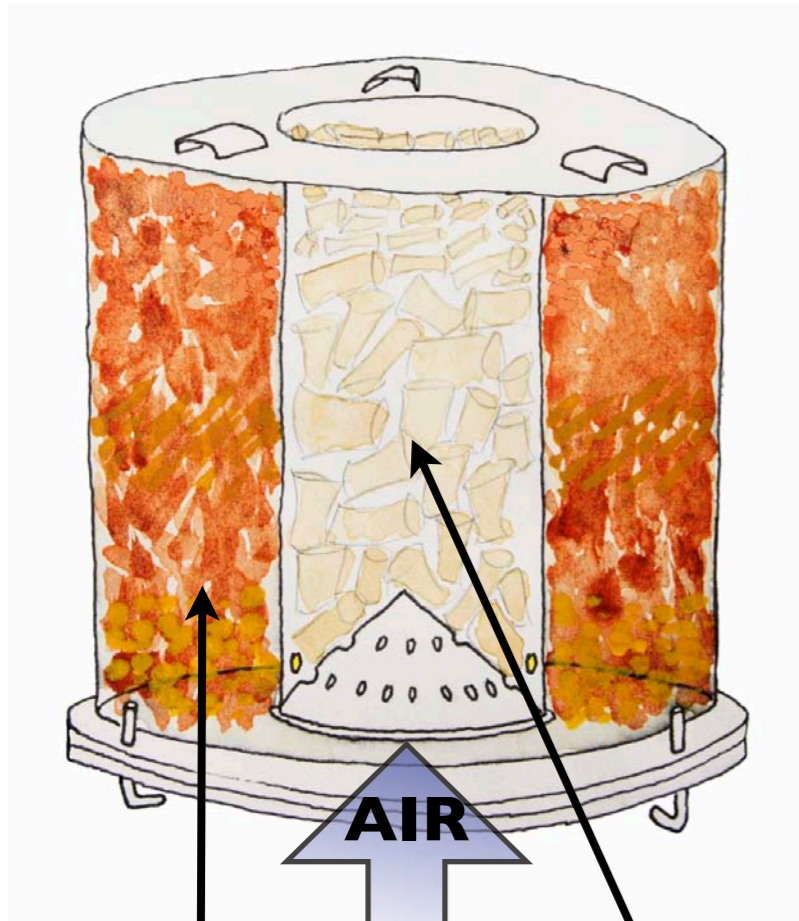


Cutaway Diagram of the Anila Stove



Air can pass through the grating into the combustion chamber but not into the gassifier.

Combustion Cycle



4 kg dry waste biomass

1 kg dry hard wood (Prosobis)



Wood burns from the top down

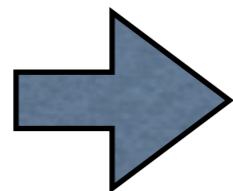
As the waste material reaches 360 deg C it begins release gases and turn into charcoal



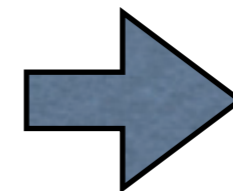
The Pyrolysis gases burn hot and last for more than 1 + 1/2 hrs

At the end of the process all the biomass has changed into charcoal

Raw Material



Pyrolysis



Charcoal



First Burn



Second Burn

Pyrolysis

Above the temperature of 360 deg C in an oxygen free environment, plant material (mostly cellulose and other *carbohydrates* such as sugar) breaks down and various fractions are produced including volatile gases and water.

Methane
Carbon monoxide
Hydrogen

These gases are very combustible and this is the second burn.

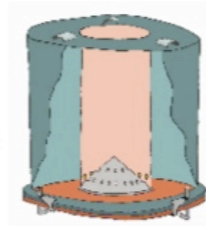
Oils which form as a tar include:

Phenol
Levoglucosan
Aldehyde

To aid the 'cracking' of these products, 5 small stones can be placed in the combustion chamber with the wood.



THE ANILA STOVE



FLIP THE STOVE UPSIDE DOWN AND TAKE OFF THE BOTTOM PLATE



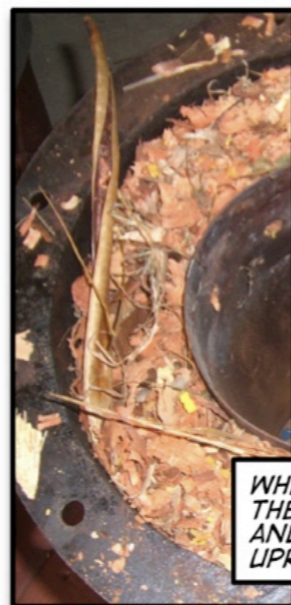
PACK THE BIO WASTE INTO THE GASSIFIER SPACE



DON'T PACK IT TOO TIGHTLY - ABOUT 4KG OF MATERIAL IS ABOUT RIGHT



YOU CAN ADD VIRTUALLY ANYTHING YOU WANT AS LONG AS IT'S BROWN AND DRY!!



WHEN PACKED REFIT THE BOTTOM PLATE AND FLIP THE STOVE UPRIGHT



IN THE CENTRAL COMBUSTION CHAMBER PLACE DRY HARD WOOD WITH KINDLING ON TOP



THIS FIRE IS GOING TO BURN FROM THE TOP DOWN!



SOAK A RAG WITH KEROSENE AND PLACE IT IN THE VERY DRY KINDLING



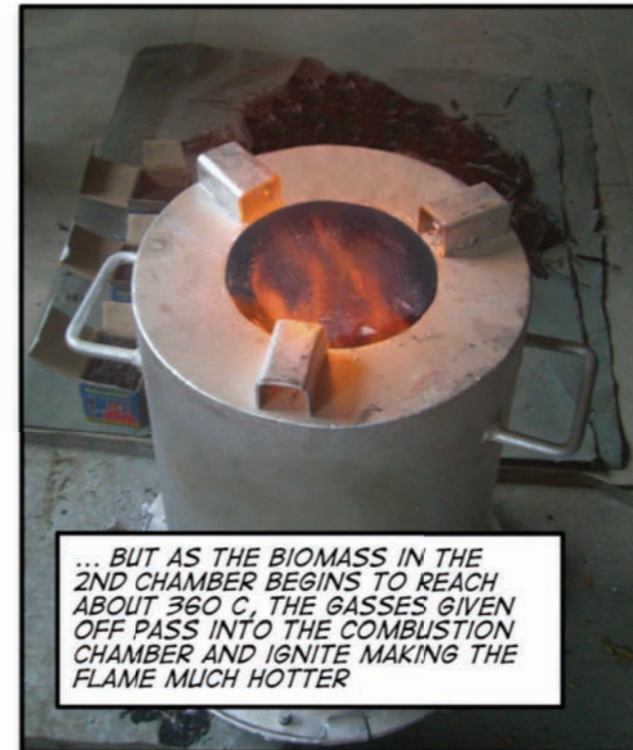
... AND IGNITE



AFTER AWHILE THE KINDLING WILL CATCH LIGHT AND THE PROCESS BEGINS



FOR ABOUT 10 TO 15 MINUTES, WHILST THE LARGER PIECES OF WOOD BEGIN TO BURN HOTTER THE FLAME WILL BE LIKE THIS....



... BUT AS THE BIOMASS IN THE 2ND CHAMBER BEGINS TO REACH ABOUT 360 C, THE GASSES GIVEN OFF PASS INTO THE COMBUSTION CHAMBER AND IGNITE MAKING THE FLAME MUCH HOTTER

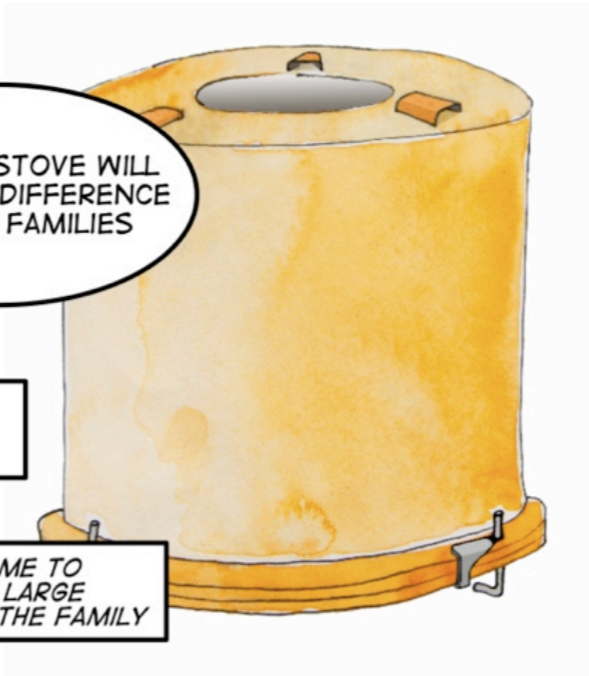


THE ANILA STOVE WILL MAKE A BIG DIFFERENCE TO MANY FAMILIES

THIS PROCESS WILL LAST BETWEEN 1 TO 1.5 HOURS

ENOUGH TIME TO PREPARE A LARGE MEAL FOR THE FAMILY

WHEN EVERY THING IS BURNT THE FIRE WILL DIE AND THE STOVE WILL TAKE ABOUT ONE HOUR TO COOL



TAKE OF THE BOTTOM PLATE AND THERE IS THE CHARCOAL

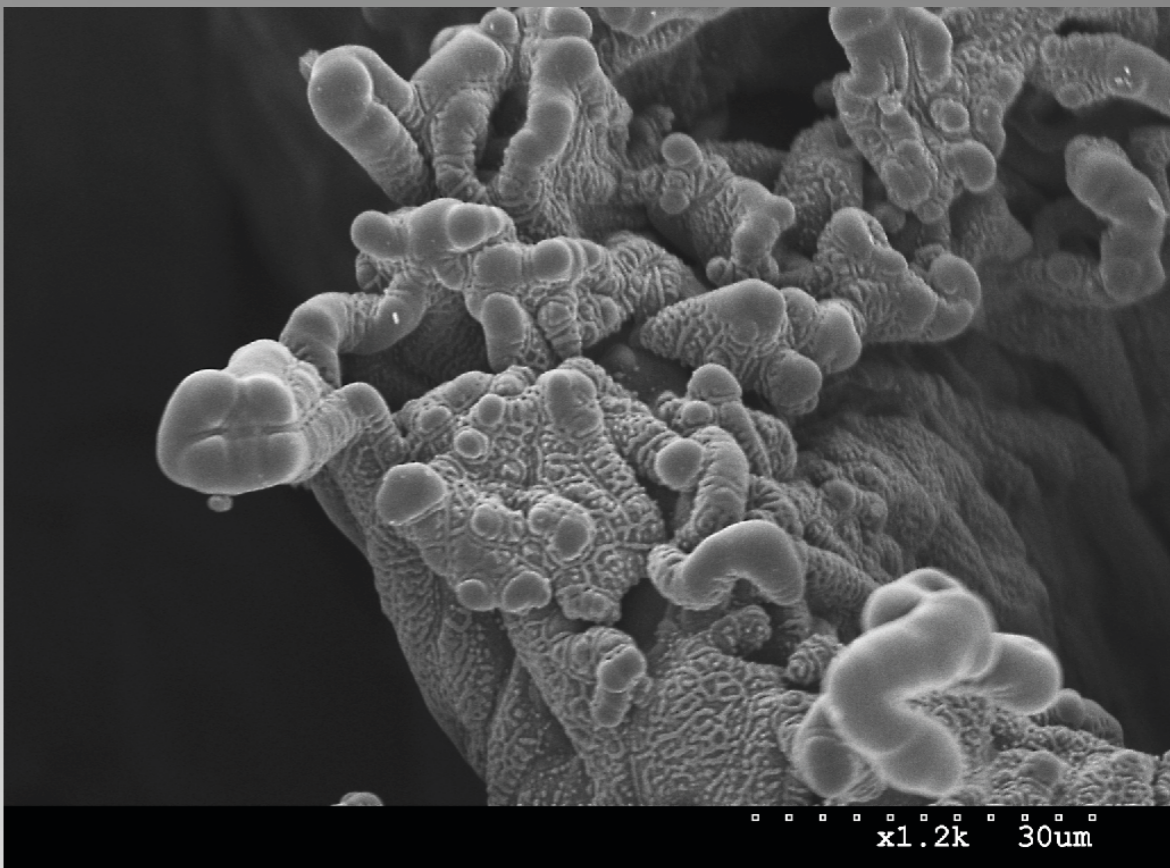
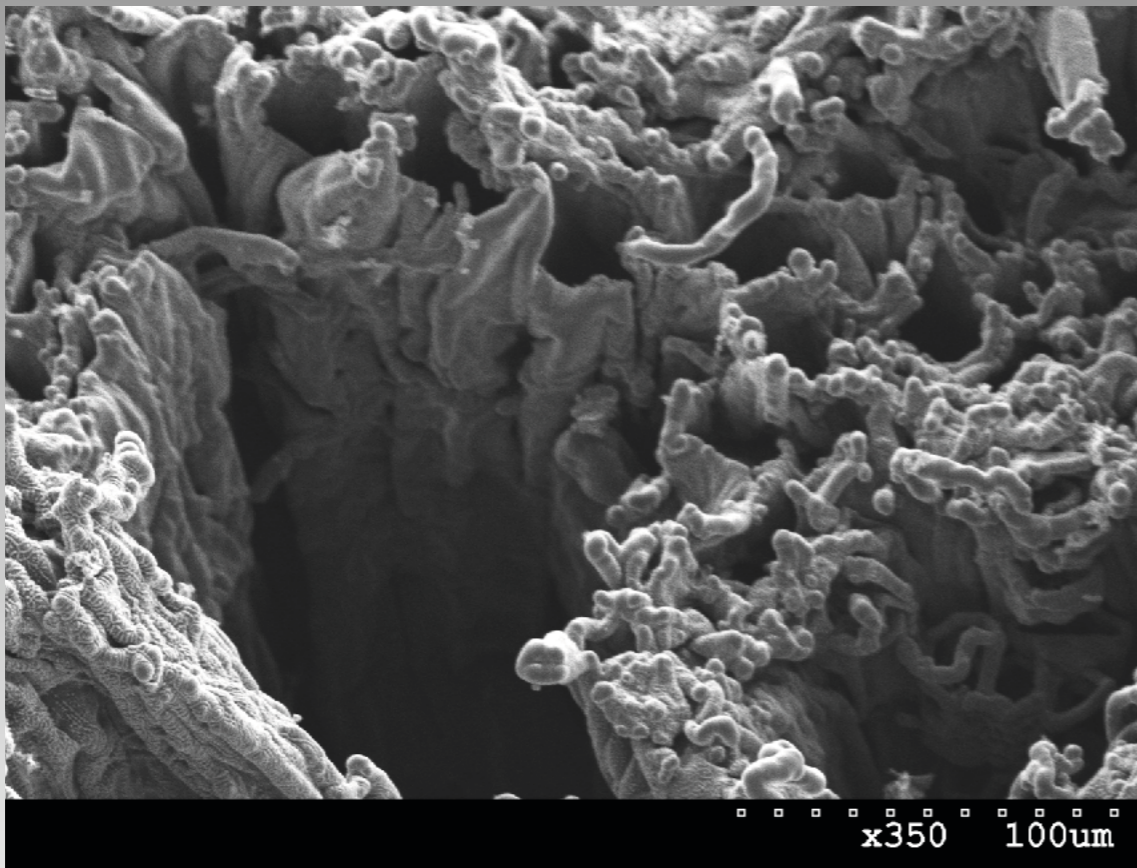
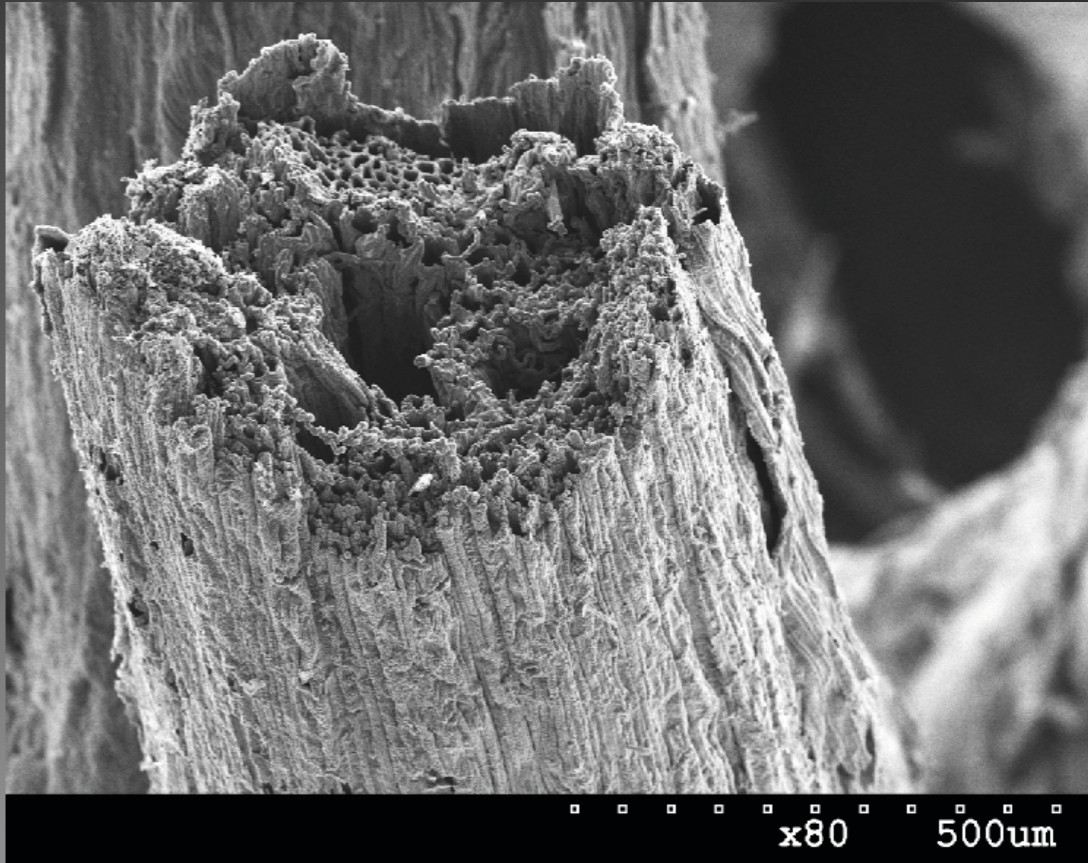
JUST SHAKE IT OUT AND THERE YOU HAVE IT!



FOR EVERY 4KG OF BIO MASS YOU PUT INTO THE STOVE - YOU GAT 1.6KG OF CHARCOAL



SCAD Stats using Anila Stove	
Percentage of self help group members using the stove	50
Number of families cooking per day	25,000
Kg of wood used/day	31,250
Kg of bio residue used /day	62,500
Kg of charcoal produced per day	25,000
Charcoal production in one year - kg	9,125,000
Charcoal production in one year - metric tonnes	9,125



Agapanthus charcoal from the Anila Stove



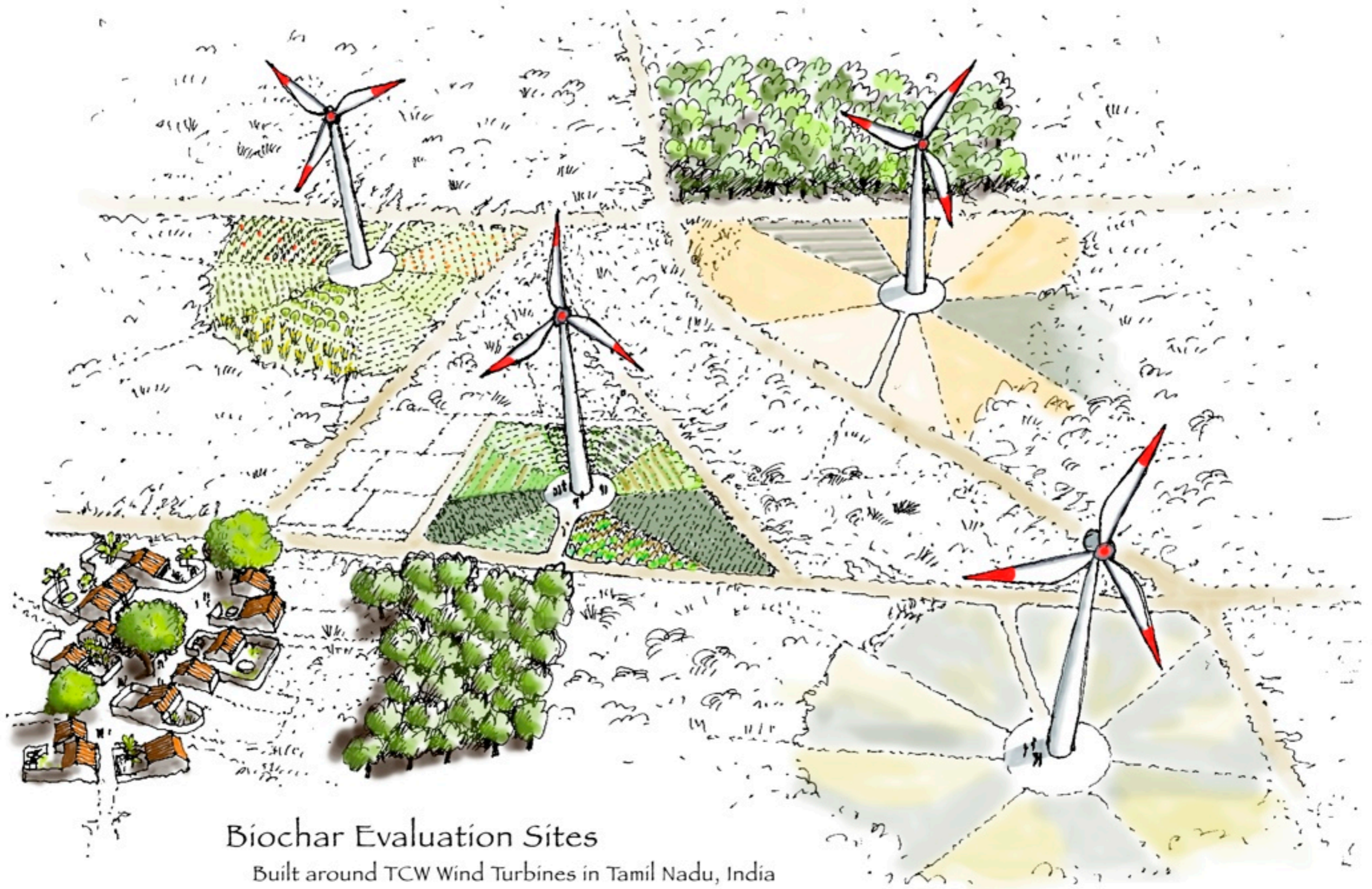


In January of this year I initiated a biochar research project in Tamil Nadu with an NGO called SCAD (Social Change and Development - www.scadindia.org)

With the collaboration of Universities and other research organisations we have funded a rural development programme that will eventually involve over 400,000 people.



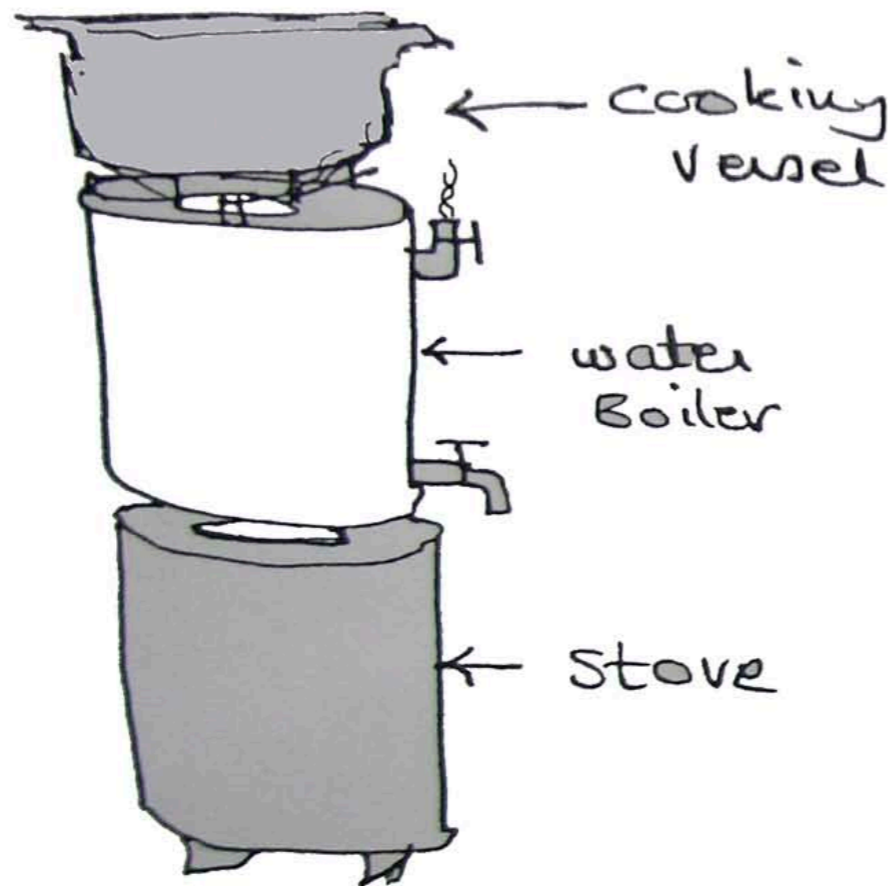
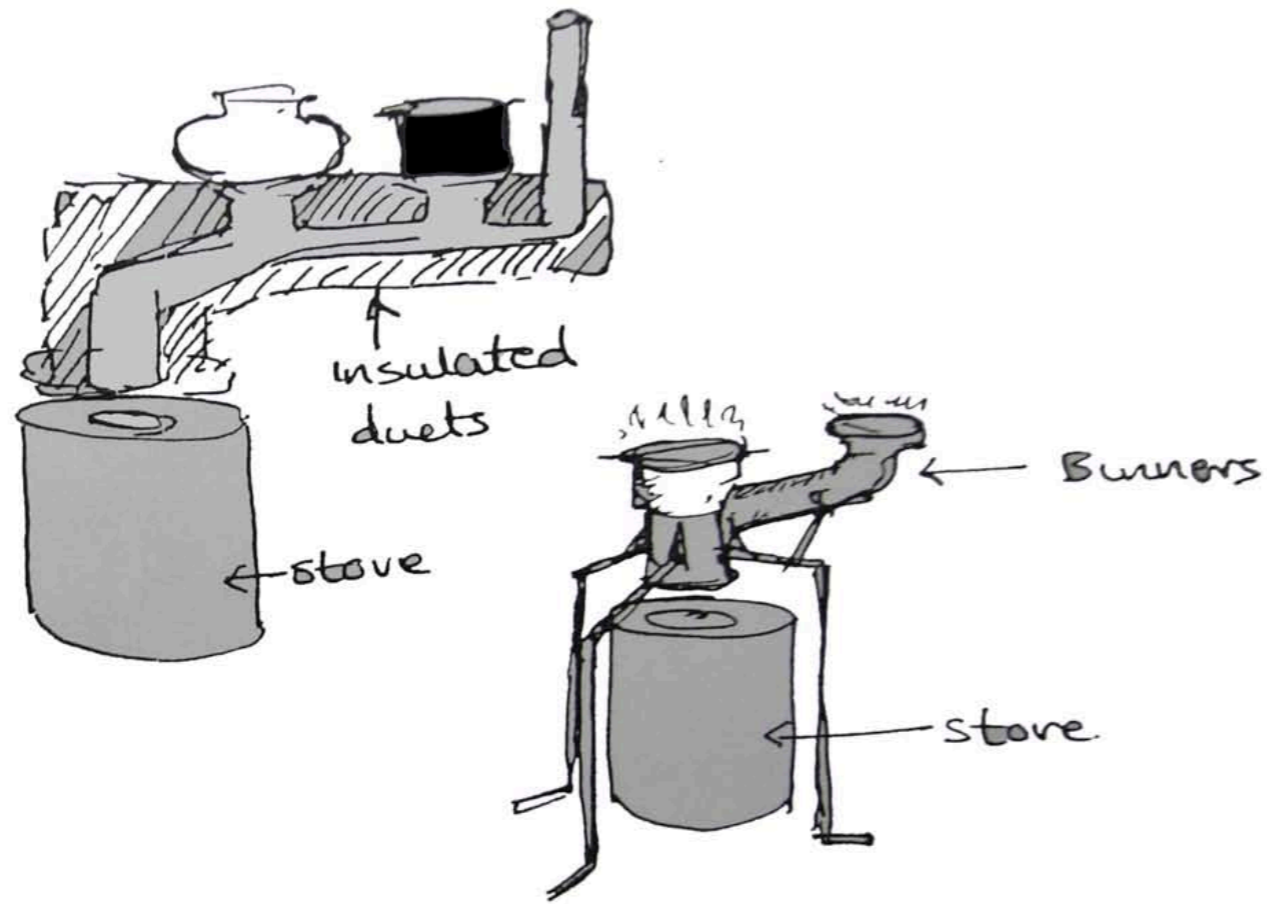
One of The Converging World Turbines



Biochar Evaluation Sites

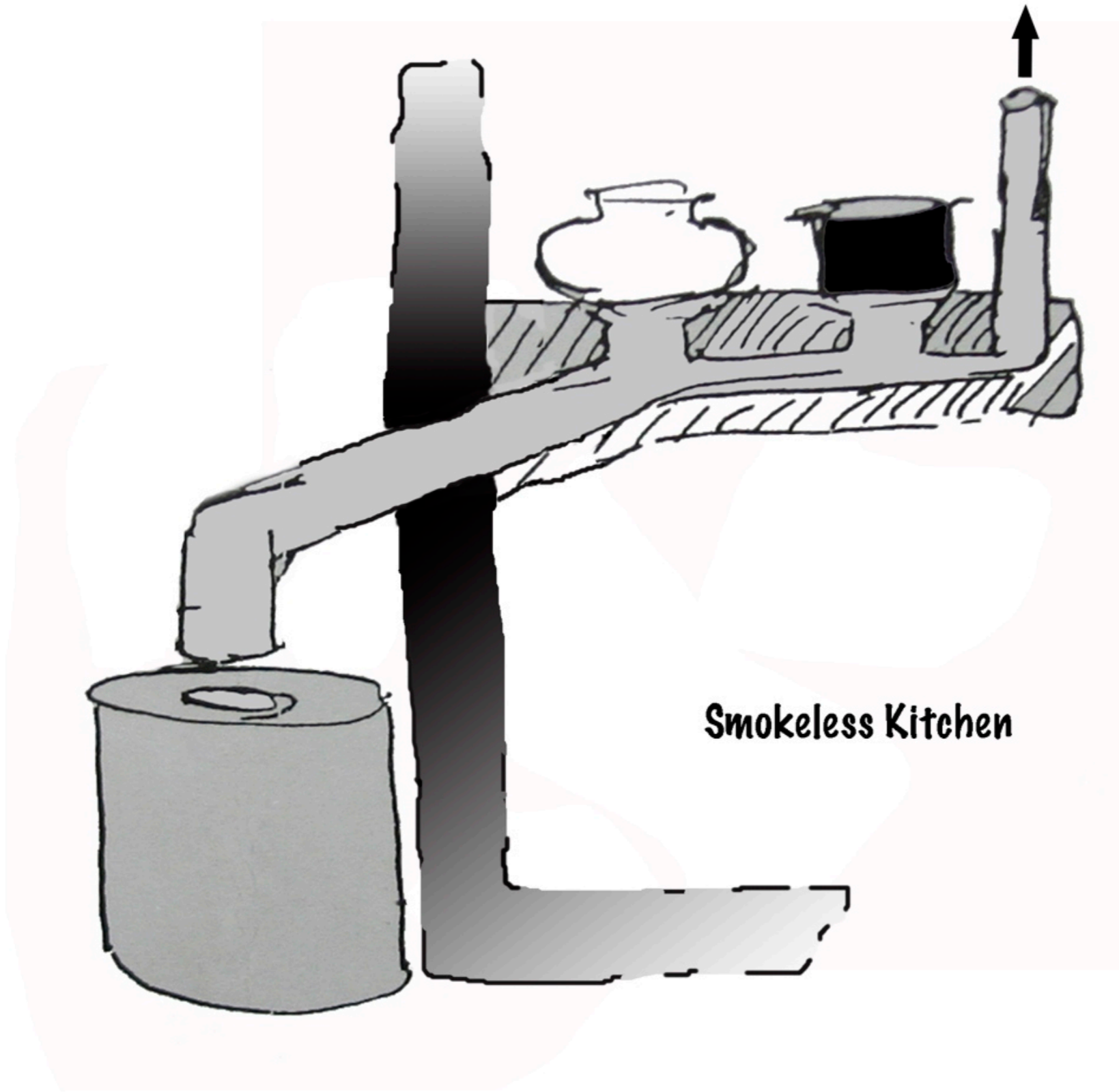
Built around TCW Wind Turbines in Tamil Nadu, India





Examples of stove appliances

es for the
.ove



Smokeless Kitchen