



ARTI's Energy Technologies

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About ARTI...



ARTI

NGO Est: 1996
No. of Members: 35

R&D on Sustainable
Rural Technologies
Focus:
Agriculture
Energy
Bamboo Technology

Standardisation of
Technology as a Tool for
Income Generation

Information
Dissemination
Orientation Workshops,
Training Programmes,
Website,
Publications

ARTI's involvement with Rural Cooking Energy Technologies



1996-2002	Technical Back up Support Unit for National Programme on Improved Cookstoves, in Maharashtra and Goa
2003-2005	Commercialisation of Improved Biomass Fuels and Cooking Devices in India : Pilot Project
2006-2010	Commercialisation of Improved Biomass Fuels and Cooking Devices in India : Scale Up Project

1996 to date — Various R&D and Field Testing Projects on a variety of biomass fueled cooking devices for rural households and commercial establishments

The Problem being addressed



- **60%** households in India still rely on wood and biomass as cooking fuels using primitive, smoky and inefficient chulhas (Census, 2001)
- Every year **500,000** women and children in India die prematurely due to long term exposure to smoke in the kitchen (WHO, 2002)
- Subsidy on LPG and kerosene is **not sustainable** in the long term (Planning Commission Committee, 2005)

ARTI is Proud of...



- Ashden Awards - 2002 and 2006
- World Technology Award 2005 in Environment Category
- Several Prestigious Awards in India

'First Generation' Improved Stoves



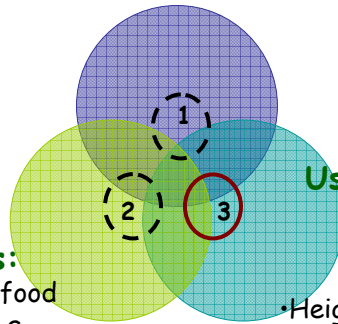
- Primary focus on fuel saving.
- Smoke removal from kitchen rather than smoke elimination.
- Designed for wood as the primary fuel.

Three Pronged Approach



Fuel Use Efficiency:

Fuel use < 850 g wood for cooking 5 lit food



Low Emissions:

For cooking 5 lit of food
CO emission < 20 g
PM emission < 1500 mg

User friendliness:

- Fast lighting
- Flame control
- Fast cooking
- Height suited to squatting
- Flexibility in fuels
- Low smoke and soot
- Fuel saving
- Low price

Improved Laxmi Stove



- Fixed Cement stove for wood or woody biomass fuel
- Two pot stove with chimney
- Manufactured by local rural artisans using molds
- Low emissions in the house confirmed through measurements

Vivek Sawdust Stove



- Portable metallic stove
- Fuel - sawdust, or any powdery biomass
- Smokeless Clean flame
- Operates continuously for 2-3 hours

Features of Vivek stove



If heating on steady flame is required for a long period, this stove is most useful. For example, heating water, cooking on low heat, boiling, reducing, etc.

It is possible to use sawdust or other light powdery waste biomass in a very efficient manner.

A Clean Cooking Device

Emission Results
(for cooking 5 lit of food)



CO = 17.6 gm
Particulate Matter = 1381 mg

Sarai Cooking System



Medium size model of Sarai Cooking System



ASHDEN AWARD FOR RENEWABLE ENERGY, 2002

Features of Sarai



Available in four sizes / capacities

Small Size: Cooks food for 2-3 persons using 100 g charcoal/char briquettes.

Medium Size: Cooks food for 5 persons using 100 g charcoal/char briquettes.

Large Size: Cooks food for 10 persons using 200 g charcoal/char briquettes.

Jumbo Size: Cooks food for 25-30 persons with 500 g charcoal/char briquettes.

A clean charcoal burning device

Emission Results
(for cooking 5 lit of food)



CO = 27 gm
Particulate Matter = 96 mg

Some of the Food Items cooked in Sarai System

- | | | | | |
|--------|----------|--------------|---------|--------|
| ● Rice | ● Pulses | ● Vegetables | ● Meat | ● Eggs |
| ● Idli | ● Dhokla | ● Cake | ● Modak | ● Corn |

Already about 30,000 units sold, growing demand from all over the world.

Sampada Stove



- ARTI's Gasifier stove
- Developed in 2006
- Stainless steel outer body
- Fuel: Wood chips, pellets, biomass briquettes, small twigs, wood chunks, etc.
- Charcoal produced as a by product

Features of Sampada Stove



Source of Additional income

After cooking, charcoal is left behind in fuel holder. Burning 1 kg of wood, leaves 250-300 gm of charcoal.

Cost of fuel wood (1 kg) = Rs. 2

Value of charcoal by-product (300 gm) = Rs. 2.5 to 3

Hence, profit earned / kg used fuel = Rs. 0.5 to 1

A clean cooking device

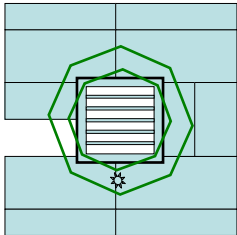
Emission Results
(for cooking 2.5 lit of food)



CO = 8.1 gm
Particulate Matter = 69 mg

Already about 500 stoves sold, growing demand from all over the state.

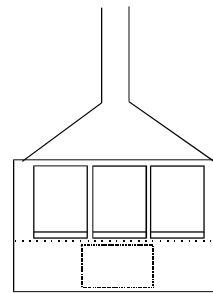
Bharatlaxmi Stove



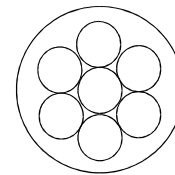
Community cookstove



Char Briquettes - large scale production



Vertical cross-section



Horizontal cross-section

Sectional Views of Charring Kiln

ASHDEN AWARD FOR RENEWABLE ENERGY, 2002

Char Briquettes - household level production



- Single barrel kiln suitable for charring leaf litter around a bungalow or in the garden of a housing society.
- Hand or diesel engine operated small briquetting machine is sufficient.
- A unit consisting of a pair of kilns and a briquetting machine costs just Rs.10,000 and can produce 70 kg of charcoal daily.



Potential Users for Char Briquettes



- Users of Sarai Cooking Systems
- Hotels, restaurants, hostel kitchens, etc.
- Goldsmiths, metal smiths, etc.
- Industries where currently charcoal or mineral coal is being used for producing thermal energy.

- Char powder can be directly used
 - In Foundries as a sacrificial layer
 - In steel manufacturing
 - In incense sticks, fire crackers, etc.
 - As a fertilizer cum potting medium

ARTI Compact Biogas Plants



ASHDEN AWARD FOR RENEWABLE ENERGY, 2006

ARTI Compact Biogas Plants



• ARTI Compact Biogas - Terrace Model:

- Size: 1 m³ digester
- Capacity: upto 2 kg kitchen waste
- Quantity of gas produced: upto 1 kg biogas, capable of replacing 250 gm of LPG.
- Depending on type of cooking done, either breakfast or one meal can be cooked entirely on biogas.
- Requires space on open terrace with good load bearing capacity or open to sunlight area of land - about 2-3 m².

• ARTI Compact Biogas - Balcony Model:

- Size: 0.5 m³ digester
- Capacity: upto 1 kg kitchen waste
- Quantity of gas produced: upto 0.5 kg biogas, capable of replacing about 100 gm of LPG.
- Depending on type of cooking done, about 15-20 min of cooking (tea, snacks, etc.) can be done.
- Can fit into a balcony.

ARTI large scale biogas plant



Electricity from Biogas



ARTI Biogas... some numbers



1 kg dry weight of starch/sugar/protein

→ 1 kg biogas = 250 gm methane + 750 gm carbon dioxide

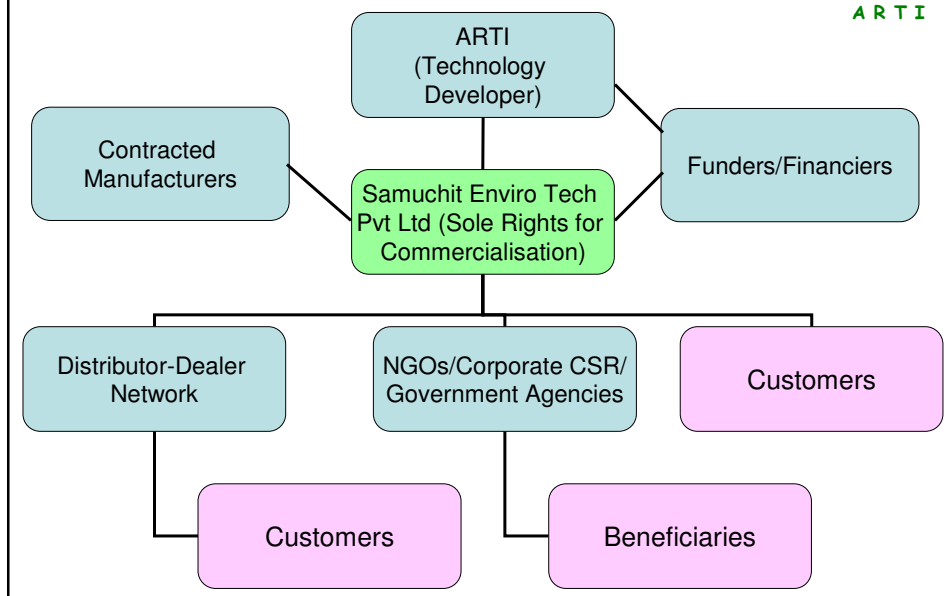
→ 250 gm methane = 250 gm LPG

1 kg biogas → 250 gm LPG

1 kg biogas → approx 1-2 unit of electricity

IMP: The 'wet garbage' contains 50-70% moisture!

Commercialisation Strategy



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Our Solutions (Products)



Improved Laxmi Stove



Bharatlaxmi Stove



Vivek Sawdust Stove



Sarai Cooking System

- Products not fuel specific (e.g., specifically sized pellets).
- Other source of energy not required (e.g., electricity).

Ashden Award
2006

Ashden Award
2002



Biogas from Organic Waste



For ARTI's energy devices,
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