Rural Empowerment

Improved & Smart Cooking Solution
from
Enphiniti Engineering Solutions Pvt Ltd.
Bangalore, INDIA
info@enphiniti.com
Enphiniti was established in 2008 with its head office in Bangalore, India. Since the inception, Enphiniti has grown into a valued provider of comprehensive product solutions and services. It offers services and solutions in the field of mechanical engineering, electrical and electronics engineering and Information technology.

Enphiniti’s resource pool consists of a dynamic mix of PhD’s, Masters, Engineers and Diploma holders with experiences ranging from decades to months. Enphiniti has built a strong ecosystem of synergy partners for the following and will be glad to offer the same to our clients as a value added service:

- Staffing solutions
- Engineering Services -- CAD, CAE, CFD, MBD, Techpub ....
- Contract Manufacturing – Sheet metal, Plastics and fabrications for Aerospace, Automotive, Heavy engineering and other industries.
- Prototyping and Testing Services

*Enphiniti’s product development efforts focuses on the broader theme of rural empowerment. It is proud of developing solutions and products that will satisfy the long pending needs of the rural areas of the world in the areas of energy, water, refrigeration and transport.*
Dr. Ananda Sundararajan is an experienced mechanical engineering professional, specialised in CAE/CFD and in particular simulation and modelling of engineering systems, managing those projects, project management and people management, budget and resources planning for the projects. His professional experience spans almost twenty years, including various stints at abroad, like Sweden, USA and Switzerland. He has worked for companies like GE, TCS, Infosys and Bloomenergy, on various domains such as steam and gas turbines, Nuclear Accident Safety, Solid oxide fuel cell development and semiconductor manufacturing equipment design. Ananda holds a Master’s and PhD in mechanical engineering with specialisation in CFD from Indian Institute of Science, Bangalore. He is the Director and Head of R&D at Enphiniti.

Anantha Hebbale has Industrial experience over Two decades in the engineering consultancy business with hands on experience in Automotive, Aerospace, Construction equipment/Heavy Engineering, Oil and Gas. He has handled various positions that includes, Country manager for Semcon a Swedish consultancy major, Head- Technology, EASi An Allegis company, Program manager & Technical lead (DaimlerChrysler Research and Technology Centre), System Analyst (Infosys), Scientist (ISAC – ISRO). He has proven track record of establishing and growing dedicated teams and business units for Indian and overseas customers with Manufacturing, Government, Design Houses and OEM’s. He specializes in Design, structural dynamics with hands on experience in FEA/CAE. Anantha has a Bachelors degree in Mechanical engineering and a Master’s in Information Technology from IIIT-B. He holds a PMP certificate from PMI. He is the founder director of Enphiniti.
Scenario: ~67% of households in India (equivalent of ~166 million households) remain wedded to solid fuels as their primary source of cooking fuel.

Problem:
1. Nearly 2 million people a year die prematurely from illness attributable to indoor air pollution (IAP) caused by the emissions due to use of solid fuel. It is estimated that IAP is leading to ~875,000 premature and avoidable deaths.
2. Household air pollution is a serious public health concern in India and is attributable to around 5% of India’s national burden of disease risk (higher for women and children
3. In addition to the health impacts, inefficient cook stoves and practices entails that women spend up to ~5-8 hours per day on cooking activities, with ~20% of that time devoted to the collection of fuel.
The Solution

The Solution is manifold:

1. *Shift them from using solid fuel to liquid fuel or gaseous fuel which can burn more efficiently.*
   
   -- these are fossil fuels again and not easily available locally.
   -- Has to be supplied by govt.
   -- needs a distributor to distribute it and involves cost; hence, will not be cheaper

2. *Shift them from using solid fuel to electric stoves or solar cookers.*
   
   -- Electricity not available all the time everywhere; erratic supply; so not suitable for long hours of cooking;
   -- All foods cannot be cooked; Also needs change in utensils which are costlier.
   -- Restricted hours for cooking.

3. *Provide improved cook stoves (ICS) which can overcome the existing drawbacks with use of solid biomass fuel, such as smoke and particulate emissions and has improved efficiency so that less fuel is consumed.*
   
   -- No change in cooking style or change of vessels required.
   -- All foods can be cooked as now.
   -- This is the best solution
## Major Players in ICS

<table>
<thead>
<tr>
<th></th>
<th>Envirofit</th>
<th>Prakti</th>
<th>BioLite</th>
<th>Vikram</th>
<th>Eco-chula</th>
<th>Philips</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of models</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Units sold</td>
<td>600,000</td>
<td>7,000</td>
<td>Piloting</td>
<td>10,00,000</td>
<td>12,000</td>
<td>NA</td>
</tr>
<tr>
<td>Technology</td>
<td>Natural draft stoves</td>
<td>Natural draft stoves</td>
<td>Forced draft TE stoves</td>
<td>Natural draft stoves</td>
<td>Forced draft stoves</td>
<td>Natural &amp; forced draft stoves</td>
</tr>
<tr>
<td>Sales geographies</td>
<td>India, Africa</td>
<td>India, Africa</td>
<td>India, Africa</td>
<td>India</td>
<td>India</td>
<td>Maybe restarting sales in Africa</td>
</tr>
<tr>
<td>Other products/businesses</td>
<td>Charcoal stoves, solar lights</td>
<td>None</td>
<td>TE camp stove for North America</td>
<td>None</td>
<td>Contract manufacturing</td>
<td>Brown &amp; white goods MNC</td>
</tr>
<tr>
<td>Price (₹ MRP)</td>
<td>2400</td>
<td>1999</td>
<td>4900</td>
<td>1400</td>
<td>3000</td>
<td>6500</td>
</tr>
</tbody>
</table>
Governing Parameters for people acceptance

Relative advantage: Is the new technology perceived better than the one it aims to replace?

Compatibility: Is the new technology perceived as being in accordance with the existing values, past experiences and needs of potential adopters?

Simplicity: Is the new technology perceived as simpler to understand and use than the one it aims to replace?

Trialability: Is there an opportunity to experiment with the innovation on a limited basis?

Observability: Are the results of innovation visible to end users?
Performance of existing stove models

Relative advantage: Is the new technology perceived better than the one it aims to replace? **YES**

--- in terms of saving fuel and time.

Compatibility: Is the new technology perceived as being in accordance with the existing values, past experiences and needs of potential adopters? **NO**

--- Some of the daily food like Tandoori Roti (in North India) cannot be cooked
--- In some of them fuel has to be cut in smaller pieces and not all solid biomass fuels can be used.
--- Converting to two burners which many of the households need is not possible.

Simplicity: Is the new technology perceived as simpler to understand and use than the one it aims to replace?

--- In Forced draft ones, the fan speed needs adjustment and if not adjusted then it is difficult to use and will not produce desired results.
--- Due to thick ceramic insulation the stoves are somewhat heavier.

Trialability: Is there an opportunity to experiment with the innovation on a limited basis?

--- No; the design cannot be changed for local cooking needs.

Observability: Are the results of innovation visible to end users? **YES**
Ojaskara – The Enphiniti Improved Cook Stove

• Novel & Unique Deign
  -- Trapezoidal in shape thus conserving metal and hence reduces overall weight without compromising stability.
  -- Due to the draft angle the flame can easily draw the secondary air from the vents provided.
  -- The secondary air also serves the purpose towards insulating the outer skin from the heat. This results in reduced use of physical insulation and hence reduced weight.
  -- A tower like design provides maximum stability at minimum weight.
  -- Unique Solid Fuel Grate/Ash tray design so that no ash spills out and it is easy to remove for cleaning purposes.
  -- THIS UNIQUE DESIGN can be easily modified to accommodate the tandoori ROTI making (flame radiation baking of Indian bread).
  -- THIS UNIQUE DESIGN enables both single burner and double burner stoves to be made without any change in efficiency and effectiveness.
Ojaskara (ICS) versus Traditional Stove (TCS)

Three-Stone Fire

- Produces a lot of smoke and emission of poisonous and global warming gases
- Less efficient due to loss of heat and hence more fuel consumption
- Danger to health due to long exposure to heat and smoke.
- No protection from wind and not portable.
- Can cook variety of foods including Roti with fire radiation

Ojaskara

- Smoke restricted to only during ignition.
- High efficiency; heat is captured inside.
- Owing to the above, less emissions as all the gases get burnt inside.
- Surface temperature less than ~ 100 C; hence much reduced exposure to heat.
- Protection from wind and also portable.
- Has a provision to cook tandoori Roti too using fire radiation.
Performance testing comparison

**Efficiency:**

\[ \sim 12\% \quad \text{Vs.} \quad \sim 22\% - 25\% \]

(this results in saving of 40% of wood and 50% of time)

(as per BIS 13152 part 1: 1991 Solid Biomass Chulha the emission should be \( \sim 25\% \))

**Emission (CO/CO₂):**

\[ \sim 0.12 \quad \text{Vs.} \quad \sim 0.02 \]

(as per BIS 13152 part 1: 1991 Solid Biomass Chulha the emission should be within 0.04)

**Particulate emission (TPM):**

\[ \sim 6-7 \text{ mg/m}^3 \quad \text{Vs.} \quad 1.4 \text{ mg/m}^3 \]

(as per BIS 13152 part 1: 1991 Solid Biomass Chulha the emission should be within 2 mg/m³)
Solid Fuel Agnostic

- Areca Nut Husk (Betel Husk)
- Wood
- Coconut Petiole
- Agri Residues
- Pellets from Residues
- Twigs
- Ripe Coconut Shell
- Tender Coconut Shell
Variants for local needs

Tandoori style cooking for ROTI

One Variant of OJASKARA™ to Meet Local Needs in Jaipur
Data on India shows that about 44% of the rural households have no access to electricity. These households, again, depend on Kerosene for the lighting purposes. Moreover, they cannot even charge their simple mobile phones.

Either with the waste heat from the stove or directly from the fire, this electricity module based on thermo electric principle (Seebeck effect) can produce electricity to the tune of 0.5 A /0.6 A and about 5 V. This is enough for charging a feature mobile phone or for lighting a 2 W LED Lantern.

![Lantern charging from waste heat](image-url)
People Acceptance IN KERALA
People Acceptance

IN BIHAR – Cooking with Twigs
People Acceptance

TIPTUR (KARNATAKA) using locally available coconut tree fallings (Petiole)
People Acceptance

IN SIRSI (KARNATAKA) using local fuel – Areca Nut husk
Double Pot Stoves

Double pot is NOT is not a double burner; because the second pot will not have the same heat input and efficiency as the primary pot in the double pot stove; And it needs an exhaust installation as shown above left. Double burner has two equally effective and efficient stoves!!

26-Jul-19
This is the list chart for the Single Burner (SB) and Double burner (DB). The prices are inclusive of GST of 12% and individual stove packaging plus six in one bigger box for single burner SB and three in one in the same sized box for double burner DB, for shipping purposes, when the order is beyond six for SB and/or three DB. These prices are ex-works Enphiniti (factory) and does not include yet any shipping charges which will depend on the mode of transport and destination within India.

Less than 100 : Rs. 1422 (SB) and Rs. 2421 (DB)

Above 100 : Rs. 1350 & Rs. 2322

Above 500: Rs. 1260 & Rs. 2196

Above 1000: Rs. 1188 & Rs. 1980

Above 5000: Rs. 1125 & Rs. 1854

Above 25000: Rs. 1017 & Rs. 1737

Above 50000 : Rs. 873 & Rs. 1512
Here is what you should know about fuel agnostic cooking subsidy

- Niti Aayog said LPG subsidy is a hurdle to adoption of clean and cheap fuels such as biofuels in rural areas and piped natural gas (PNG) in urban areas.
- The government think-tank also said eligible beneficiaries receiving subsidy on LPG should rather be given a ‘cooking subsidy’ through direct benefit transfer (DBT).
Thank you !!!