Energy efficient *chulha* in rural Arunachal Pradesh

Arunachal Pradesh is a part of the Eastern Himalayan biodiversity hotspot, one among the 25 identified hotspots worldwide. With more than 500 plant species of medicinal and pharmacological significance, this area may be considered as a major ethnobotanical hotspot. The state has 81.25% of its area under forest cover inhabited by 26 major tribes. About 80% of these tribal populations derive their livelihood from slash-and-burn cultivation supplemented by hunting, fishing and food gathering. More than 90% of the population use biomass as primary source of energy. This high dependency on firewood for various household activities such as cooking, water heating, space heating, lighting and livestock rearing, etc. is a major cause of forest destruction.

The average per capita firewood consumption in the northeast is higher than the national level with rural–urban gap ranging from 17 to 52 kg (Table 1). The consumption in rural areas of Arunachal Pradesh is about 61 kg per month which is almost three times higher than the national consumption rate. The consumption of firewood is higher during winter in comparison to summer for warmth and processing of some agricultural products for their value-addition. Among northeastern states, Arunachal stands second after Nagaland in firewood consumption. The fuel consumption pattern in rural Arunachal Pradesh reveals that people spend more (79.23%) on firewood followed by LPG (liquefied petroleum gas, 8.81%), electricity (4.77%), etc. (Figure 1). The indiscriminate use of forest products for livelihood is threatening the biodiversity of the area and also triggering climate change. It may not be possible to prevent rural people from using firewood for the sake of biodiversity unless we provide them with good alternatives. We can perhaps reduce the amount of firewood collection at family level by making their fuel consumption more energy efficient.

Due to decrease in firewood source and increase in local market price, rural people are compelled to resort to indigenous energy-efficient technologies. In this respect, rural people of Arunachal Pradesh, especially of West Kameng and Tawang districts, have developed a new energy-efficient *chulha* to reduce firewood consumption. Initially, this technology was brought in from Bhutan and the local people have gradually learnt to manufacture it at a cheaper rate.

The *chulha* is made of iron of various thicknesses and costs between Rs 1500 and 3000 in local markets and Bhutan. It is user friendly and has multiple features. The iron body of the *chulha* emits sufficient heat to keep the indoors warm (Figure 2). It has a safety lead to minimize fire risk. The knob and safety lead help retain fire for longer periods. The ash tray at the bottom of the fire chamber prevents ash from falling on the floor and keeps the room clean and safe. The enclosed structure keeps the fire chamber warm which helps fuel to reach its combustion point rapidly and burn efficiently. As a result, it produces sufficient heat with few scraps of firewood. During our study, we could estimate that it consumes 50–60% less firewood per family per year compared to the traditional *chulha*. Thus, the improved *chulha*, with higher thermal efficiency of 60% compared to 6–8% in traditional ones, has potential to conserve firewood, thereby saving forests. It has longer life and can serve for 20–25 years if used judiciously.

Fire accidents often occur in Arunachal Pradesh combating human settlements during dry season. The open and unsafe traditional *chulha* is the cause of fire outbreaks in majority of the cases. This new technology (*chulha*) with safety lead may minimize the fire risk in rural areas. It is also smoke-free and

### Table 1. Per capita firewood consumption in north-eastern states and India

<table>
<thead>
<tr>
<th>States</th>
<th>Rural (kg)</th>
<th>Urban (kg)</th>
<th>Comparison† (rural)</th>
<th>Rural–urban gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arunachal Pradesh</td>
<td>61.297</td>
<td>17.304</td>
<td>286</td>
<td>43.99</td>
</tr>
<tr>
<td>Assam</td>
<td>30.643</td>
<td>9.526</td>
<td>143</td>
<td>21.12</td>
</tr>
<tr>
<td>Manipur</td>
<td>25.364</td>
<td>8.718</td>
<td>118</td>
<td>16.65</td>
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<tr>
<td>Mizoram</td>
<td>46.096</td>
<td>11.565</td>
<td>215</td>
<td>34.53</td>
</tr>
<tr>
<td>Meghalaya</td>
<td>47.079</td>
<td>7.565</td>
<td>220</td>
<td>39.51</td>
</tr>
<tr>
<td>Nagaland</td>
<td>80.412</td>
<td>28.292</td>
<td>375</td>
<td>52.12</td>
</tr>
<tr>
<td>Sikkim</td>
<td>26.822</td>
<td>0.315</td>
<td>125</td>
<td>26.51</td>
</tr>
<tr>
<td>Tripura</td>
<td>32.463</td>
<td>13.914</td>
<td>151</td>
<td>18.55</td>
</tr>
</tbody>
</table>

| India           | 21.439     | 6.291      | 100                 | 15.15           |

*Comparison of firewood consumption in north-eastern states considering national per capita consumption as 100.

Source: NSS Report no. 509: Household consumption of various goods and services in India, 2004–05.

![Figure 1. Per capita monthly expenditure (%) on fuel and light in rural Arunachal Pradesh.](image-url)
reduces the drudgery of women and children from cooking in smoky kitchens and collection of more fuel. The improved chulha proved to be a boon to rural women, as it saves about 300 kg of fuel wood equivalent per year, besides reducing health hazards. This model is however, more suitable for the colder regions where room heating is needed during most part of the year and hot water is necessary round the clock.

As commercial fuel is beyond the reach of the rural communities due to poor socio-economic conditions and inaccessibility, this new and energy-efficient chulha can be popularized in the rural parts of the country. The National Programme on Improved Chulha (NPIC) operating in several parts of the country has mitigated improved chulha better than the traditional ones. However, the proposed model seems to have more advantages than the NPIC model because of its multiple features, chamber space, portability, etc. Furthermore, there are reports that NPIC model consumes more firewood than the traditional ones. The government can therefore, adopt this improved model for propagation in rural areas at subsidized rates.

**Figure 2.** Energy-efficient chulha used by rural people of West Kameng district. a, Side view; b, Front view.


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