

Clean Cookstove Programs: Why the 21st Century is Different from the 20th

The Indian National Programme for Improved Chulhas, like the other major national programme in China, was initiated in the early 1980s and focused mainly on increasing fuel efficiency to assist with rural welfare and, to a lesser extent, protect forests. Secondary emphasis was on reduction of smoke exposures through use of chimneys. Today, however, there are major changes in our understanding and in world conditions that have completely changed the landscape for biomass stove programmes

Rationale

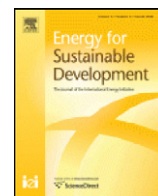
1. We understand much more thoroughly the health impacts of traditional fuel use patterns with hundreds of papers published in the biomedical literature documenting a range of health impacts. Currently, this evidence leads to an estimate of ~4 lakh premature deaths a year in India from household biomass fuel use.
2. We also know that to obtain significant benefits for health it is necessary to reduce exposures by 80% or more – a factor of two, which is all that seems to be obtainable even with the best chimney stoves, is not enough.
3. We now understand that the international price of LPG, being a petroleum product, will likely continue to increase faster than rural incomes, thus making the transition to modern fuels difficult and, if subsidized by government, increasing expensive. This adds to the attraction of deploying advanced biomass stoves that provide high performance using local renewable resources and relieve the government of the cost of fuel subsidies.
4. It is understood now that poor household combustion of solid fuels is responsible for a significant proportion of outdoor pollution in India, perhaps approaching 50%
5. It is now recognized that household fuel combustion is a significant player in climate change with high greenhouse impacts per unit energy compared to other human uses of energy.

Technology

6. Given the combined goals of fuel efficiency, health protection, and low climate impacts, it is now realized that the only best approach is to move toward high-combustion-efficiency low-emissions advanced combustion devices, such as “gasifier” stoves. A chimney adds to the benefits for health, but does not do anything for climate or outdoor air pollution.
7. To achieve reliable high performance, stoves must use either ceramics or good metal alloys, neither of which can be effectively utilized in village manufacture, but must be made in centralized manufacturing facilities with good quality control and other modern mass production techniques.
8. Truly clean stoves tend to have a narrower tolerance to fuel size and moisture and thus generally require more fuel processing at the household or, for highest performance, preprocessing as pellets or briquettes.
9. Blower stoves (with small electric blowers), however, effectively maintain good performance over a wider variety of fuel characteristics. New applications of thermal electric materials, allow blowers to be operated by the heat of the stove, requiring no connection to power grids
10. The microchip and cell phone revolutions are offering cost-effective ways to monitor programs covering millions of households to obtain co-funding from the carbon market

Rural India

11. Widespread access to radio, TV, and cell phones provide entirely new ways to market, disseminate, and otherwise facilitate stove sales and dissemination.
12. Better coverage of social programmes, such as those aimed to improve the birth outcomes for poor pregnant women, offer promise as ways to target the most vulnerable populations, increasing the efficiency of outreach efforts.
13. Based on experiences with other household innovations, there should be a reframing to move away from such terms as “improved,” which mean little, to promoting devices that can be marketed as similar to aspirational products, such as gas stoves. See the editorial appended below.



Editorial

“Cooking with Gas”

Recent work with village women in India has caused us to have a sort of epiphany. They suggested to us that perhaps we have been focusing on the wrong approach in promoting improved biomass stoves. Rather than try to compare their performance with that of traditional stoves, they said, we should try to place them as close as possible to the stove everyone wants, gas. This is the aspirational appliance that every woman knows and would prefer, for convenience, controllability, time savings, and modernity. These services are what we need to provide to make our new improved stoves attractive.

Not only in the industrial world, but also wherever there is advertising, which is essentially everywhere, we are all deluged with solicitations to buy “improved” products. The shelves of drug, appliance, and food shops are filled with them. Often also there is a claim of percentage improvement based on some unstated or vague metric: “32% improved cleaning power.”

Do you believe any of it? Not much, we bet. Then, why would we try to sell stoves to poor people on this basis? They are also deluged with “improved” products and probably rightly even more cynical.¹

Particularly when we have a gold standard against which to compare our product—gas.

The current usual descriptor—“improved”—is thus poorly framed. What is needed is something that looks to the best, not tries to distance from the worst. Certainly true with regard to emissions—needed are stoves nearly as clean as gas because that seems the only way to obtain significant health and climate benefits.

As an illustration, the new generation of blower gasifier biomass stoves in India,² although expensive by some standards, could reasonably be described as

Better than gas

- Much cheaper to use—gathered biomass, not purchased LPG
- Safer—no explosions or leaks of LPG cylinders, a common concern
- More portable—has insulated handles and can even be moved when lit.
- Faster cooking—much faster according to reports from women in the field
- More power for large pots—based on village studies
- Fuel supply much more secure—just small branches and twigs and no worry about LPG deliveries or the cylinder being empty when you need it.

¹ For a bit of humor on this issue, see **Television Commercials and New, Improved Products** by Marjorie Dorfman <http://www.cultureschlockonline.com/Articles/tvcom.html>.

² A small electric blower stabilizes and greatly improves combustion in these stoves. The current generation utilizes a battery to power the blower, recharged by a cell phone charger.

- Versatile in fuel—even cow dung can be used, at least in some of the new stoves
- No LPG cylinders to refill or pay deposits on—they are heavy, noisy, and inconvenient to handle
- Use renewable biomass instead of fossil fuel—not a consumer concern, but important to the world

And in one important respect, *just as good as gas*

- Modern—the blower stoves are sleek, attractive, and built of sturdy materials

Still being honest, we can say that in other important ways that they are *nearly as good as gas*

- Controllability, by a dial adjusting blower speed—high cooking power is higher, but low end not so low as gas stoves
- Fast to ignite—30 seconds because of the blower, not as fast as gas, but much faster than traditional biomass stoves where one must push, poke, and puff to get them going. True with most “improved” biomass stoves as well.
- Less smoke—not as good as gas, but far better than any non-blower biomass stove, traditional or “improved”
- Little maintenance required—dumping out the ash is usually all that is needed

We have to admit, however, that such stoves still *lag behind gas* in some ways:

- Ability to perform long duration unattended cooking—fuel must be added regularly
- Fuel must be slightly chopped to fit stove—women report, however, that the extra time is more than compensated by shorter cooking time.
- Lifetime—few years versus perhaps 10 years, although warranties are similar for both types
- Requires charging of the battery—this would be fixed with the newly available thermal electric generators that make their own electricity from the stoves' heat
- Perceived insecurity of pot against tipping—this could be fixed with better design
- Capital cost—perhaps 50% more than the cheapest set up for gas, but capable of substantial lowering with economies of scale and much better than having to say “only 10 times more than what you use now.”

We admit that this may seem to fly in the face of those many in the stove field who worry that stove programs have not considered the cultural and local social issues surrounding stoves and blame this for failures of past “improved” stove programs. This implies a wide range of devices are needed to fit the wide range of cultures that exist. Perhaps true, but the fact is that half the world (our half) uses

just two stove types, gas and electricity, and demonstratively cooks every cuisine without problem. Put another way, statistics show clearly that biomass use for cooking is nearly 100% associated with poverty. What can this imply, but that every woman in the world will switch to gas when she can afford it—no matter what her mother used.

Let us call this an ongoing dialectic, but nevertheless there is evidence that when women have access to appliances of any sort with truly superior performance, they switch and do not look back. Think of automatic versus manual washing machines.³ The norm can be shifted if the performance of the new brings sufficient advantages (remember standardized light bulbs, bicycles, and cell phones—all common in villages).

Perhaps, however, cultural and social factors loom larger when stove performance is only slightly enhanced, as with most past and present “improved” stoves, which rely mainly on chimneys and/or better fuel efficiency. Women may understandably be unwilling to make even small shifts in behavior for relatively small benefits. These improvements are insufficient to bring performance to a level that could truthfully be termed to be “like gas,” however. At least to date, they also seem not to reduce human exposures to health-damaging air pollution reliably and significantly and do little for household combustion’s important contributions to outdoor air quality and climate change.⁴

We realize that there may be cuisines, particularly in Africa, where long-duration cooking of porridge or other foods may make dominant the one major disadvantage of current advanced stoves besides cost—unattended cooking. Also, space heating stoves pose difficulties, again because they must work unattended. Furthermore, cooking requiring multiple pots is challenging for many types of “improved” stoves.

In the 1800s, when gas cookstoves were replacing wood and coal stoves in the USA, a clever advertising campaign coined the phrase that “now you are cooking with gas.” The phrase suggests that gas is faster, easier, cleaner, and better than cooking with wood. Over time, this has become an American idiom in which “cooking with gas” means broadly “to be working fast, proceeding rapidly.”⁵ Today, this is what we want to be able to say to village women, i.e., use this stove and you will be (nearly) “cooking with gas.”

Perhaps, then, we need to focus on developing cookstove technologies that allow us to tout how well we *mimic the performance of gas*, but with biomass fuel, whether lightly processed, pelletized, liquid (ethanol), or biogas. Certainly this is what we want with regard to emissions. We also need to work on the remaining ways that current advanced stoves are not as good as gas, particularly unattended use and cost, and to make them even closer to gas in emissions. Not small challenges, but with immense potential human and environmental benefits if overcome. The Indian village women who corrected our approach to the new stoves have shown the way.

Remind us never again to write “improved” stove without the quotation marks.

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³ For a highly entertaining and insightful discussion of this issue, see <http://gizmodo.com/#15788129/why-the-washing-machine-pushed-humanity-forward>.

⁴ If from non-renewable supplies, woodfuel savings alone will reduce CO₂, but better combustion is needed to significantly reduce other climate-active pollutants produced by the incomplete combustion of traditional biomass fuel (wood, crop residues, dung). These include black carbon, carbon monoxide, methane, and volatile organic compounds.

⁵ See a dictionary of American idioms such as <http://www.pride-unlimited.com/probono/idioms1.html#c>.