Weighing up the cost of smoke alleviation

Poor people are willing to invest in improved cooking if they see the benefit, as has been demonstrated by programmes to introduce fuel-efficient stoves. China has successfully introduced nearly 200 million fuel-efficient stoves at minimal cost. In both Sri Lanka and Kenya nearly one million improved stoves have been introduced. For minimal outlay, significant health gains can be achieved. The total cost of reaching those in need will be US$500 million a year for 12 years – less than 1% of the West's aid budget.

Lessons from stoves programmes

Many lessons have been learned from promoting improved stoves (see Appendix 1). While these programmes were not focused on reducing indoor air pollution, experience was gained on how to introduce appropriate technologies within poor communities.

The most successful stoves programme has been in China, where more than 175 million improved stoves have been introduced.[21] It has been reported to be the most cost-effective measure in rural energy conservation undertaken in the country.[57]

The success of the China programme is attributed to stove designs suited to users' needs, targeted national promotion schemes and effective local implementation, including setting up commercial rural energy companies. Direct subsidy from the government per stove was relatively low, and varied between counties, with higher subsidies in counties where need was greatest.

An interim study of this work showed that the Chinese government spent US$200 million (including the cost of administration, research and development, promotion and direct subsidies) over seven years for more than 100 million stoves.[58] Follow-up studies show that over 70% of these stoves were in frequent use. If the direct cost to the householders of installing stoves was $1 billion (100 million stoves costing on average $10 each), then, overall government spending on improved stoves was about 20% of the direct cost of installation. These programmes were not designed for smoke removal, they were aimed at fuel efficiency. However, the Chinese experience shows that this type of programme can target millions of people with limited subsidy.[59]

Other successes with fuel-efficient stoves have included programmes in Sri Lanka, which have reached over 25% of the population – over 800 000 homes – and established a self-sustaining stoves industry (see box, over page). Kenya has led the way in sub-Saharan Africa with over 780 000 stoves distributed, largely in urban areas.[21]

Appropriate stove design and implementation at a local level leading to commercial markets for stoves were key factors in each of these programmes. Experience has shown that a level of subsidy is also required to target the most poor and vulnerable sectors of society.

The improved stoves programme in India, where the government subsidized over half the cost of the stove, has resulted in mixed success. While 30 million stoves have been installed in homes, follow-up surveys have shown that only one-third of these improved stoves are still in use. Reasons for the limited success have related to centralized control of the programme and poor stove design. In some cases, users' perception were of low energy savings, no removal of smoke and high breakdown rates (see Appendix 1).[21]

Appendix 2 gives an outline of the model ITDG is developing from its many years working in household energy to disseminate technologies for reducing indoor air pollution at a community level.

Smoke reduction efforts and health spending

It is useful to compare the spending so far on reducing indoor air pollution with that on other major health concerns.

Currently indoor air pollution receives a few million US dollars each year in direct funds (for example, from the Shell Foundation, DFID and the World Bank), mostly to support individual pilot projects.

Though not sufficient to meet needs, overseas development assistance provided to water and sanitation was US$1.4 billion in 2001, with total spending from all sources (developing countries, aid, private and community investment) totalling $14 billion.[60] The Global Fund to Fight AIDS, Tuberculosis and Malaria had about $1 billion per year in pledges from international donors[61] and US President George Bush recently announced $15 billion from the USA over the next five years in the fight against AIDS.

In comparison the cost of reducing indoor air pollution would be in the region of $2.5 billion annually over the next 12 years based on an average cost of $50 per home. If the Chinese experience is followed, where the government spending was equivalent to 20% of the amount spent by households on the improved technology, then government spending and international development aid would be in the region of $500m a year.

All these pressing issues – clean water and sanitation, AIDS, TB, malaria – have to be tackled at one time. Saving a child's life from smoke only to have him or her die of diarrhoea is not an option.

If ill health and death from hunger, HIV/AIDS, poor water and sanitation, malaria and indoor air pollution can all be fought together in a cost-effective way, then the benefit to health in the developing world will be tremendous.

Comparing costs of health gains

In order to compare the impact of different health programmes the term disability-adjusted life year (DALY) has become widely used. The World Bank Environment Strategy has compiled the known studies on the cost per DALY saved as due to interventions, as follows:[62]

- Hygiene and behavioural change: $20 per DALY
- Water connections in rural areas: $5 per DALY
- Malaria control: $35-75 per DALY
- Improved biomass stoves: $50-100 per DALY
- Use of kerosene and LPG stoves in rural areas: $150-200 per DALY
- Improved quality of urban air: large variations, from negative costs to $70 000 per DALY, and more for some pollution control measures. Most measures cost over $1000 per DALY.

Successful uptake of stoves in Sri Lanka: lessons to be learned

Despite persistent political instability, and the difficulties of introducing a new product to both users and producers, stove programmes in Sri Lanka have managed to reach over 25% of the households in the country. This success was due to combined initiatives of NGOs and the government. A new self-sustaining stove industry has been established within 20 years, benefiting around 250 producers and 800 000 cooks and their households. While not much more than US$1.5 million has been spent on stoves by development agencies and households since 1977, the financial benefits (mainly fuel wood savings) are valued at over $37.5 million. That does not take account of the unquantifiable but impressive quality of life, health and environmental benefits.[54]

ITDG/Jean Long

A Sri Lankan stove designed to suit local conditions.

Economic gains from reducing indoor air pollution – evidence from India

In one of the largest studies ever undertaken of the costs incurred by poor families, the Indira Ghandi Institute of Development Research looked at the rural energy and health impacts on poor rural communities in three of India's northern provinces of Rajasthan, Himachal Pradesh and Utter Pradesh.

The research looked at the health of adults, but not children. Forty five per cent of families had an income of less than 10 000 rupees a year, which is less than US 60 cents a day. The costs to poor families due to days lost collecting fuel wood, lost earnings and cost of medical treatment of adults came to 85 billion rupees ($1.84bn) per year. Days lost due to collecting fuel and illness came to 1 billion days. These figures are for a population of 226 million.[39]

In another India study, Green India 2047 by Tata Energy and Resources Institute, it was estimated that a change to cleaner fuel would increase slum dwellers' income by between 2000 and 7400 rupees ($43–161) per annum.

'Several studies to value the economic benefits of controlling air pollution have demonstrated not only its significant health benefits but also its economic feasibility: the cost of implementing policy decisions no longer appears prohibitive once it is weighed against the economic benefits of a healthy citizenry. Benefits of controlling air pollution indoors – pollution mainly due to burning firewood, dung-cakes, etc. for cooking – are even higher, and the groups that would benefit most are women and children, especially those living in slums, and those in rural areas in general.'[64]

The World Bank has proposed that health sector interventions of up to $150 per DALY saved should be considered cost-effective.[63]

The data would suggest that interventions to reduce exposure to indoor air pollution are cost-effective in reducing the burden of disease – especially when compared with the expense of measures to control urban air pollution.[37]

Estimated costs and benefits for the householder

Much of the cost for implementing solutions to indoor air pollution will be borne by the households themselves. Therefore, it is important to assess the cost to the user, (see Table 4). Some of the interventions are relatively low cost; others are a significant outlay for a poor household.

The use of subsidies and government support would have to be considered to increase access to these solutions for many very poor people. However, given the social, gender, economic (see box above) and environmental benefits of some of the solutions, in addition to the health gains, many of the solutions become an extremely attractive options for governments aiming to achieve the Millennium Development Goals.

Solution	Approximate cost	Possible reduction in indoor air pollution
Chimney stove	$10–150	0–80% depending on type, cost, condition, etc
LPG stove	Burner $30–120 Cylinder deposit $50–60 Weekly cost for fuel $1–2	Up to 90%
Smoke hood	$10–60	Up to 80%
Biogas	$300	Very clean (no data currently available)
Solar cooker	$5–50	No emissions, but may not replace all biomass cooking
Behavioural changes, e.g. use of pot lids, drying fuel, keeping children way from smoke	Less than $5	Variable (no data available)

Table 4: Typical costs for solutions to indoor air pollution[5] (derived from specific studies and therefore illustrative, not necessarily accurate for all cases).