

INCOME AND HEALTH BENEFITS FOR RURAL HOUSEHOLDS FROM IMPROVED COOKSTOVES IN DEVELOPING COUNTRIES

Homi Katrak

Visiting Professor in Economics,
University of Surrey, U.K.

hkatrak@blueyonder.co.uk

ABSTRACT

This paper surveys the performance of improved cook stoves in nineteen developing countries and examines the likely health benefits for women and children. We find some achievements but also some limitations. All the stoves have helped decrease the use of solid fuel use. This has reduced women's burdensome task of collecting those fuels and also enabled a decrease in fuel expenditure. In addition there could be indirect health benefits: the savings in fuel expenditure may now be used to pay for some other essential health expenditure. However many reports made little mention of any health benefits that would be expected from a decrease in smoke emissions.

INTRODUCTION

In many developing countries low-income rural families use solid fuels for household cooking. Solid fuels include wood, agricultural residues and charcoal. These fuels are cheaper to use (and more easily accessible) than are electricity, gas and paraffin. However use of solid fuels also leads to adverse health effects.

The health effects arise on two counts. Firstly in rural areas solid fuels have to be collected and carried from far off locations. This burdensome task usually has to be performed by women. Consequently women begin to suffer from backaches and other long-term health problems. Secondly burning solid fuels emits smoke and these emissions cause severe respiratory illnesses. Dasgupta *et al* (2006) and Glusker (2006) report that women and children suffer the most from these smoke emissions. WHO (2005) estimates that the emissions cause the death of about one million children each year.

These concerns have led the governments of many developing countries, as well as international agencies and NGOs, to support programmes to reduce the health risks from using solid fuels. Many programmes aim to improve the design and performance of traditional cook

stoves. The improved stoves (IS) would enable a saving in solid fuels use and cooking time. Consequently there would be (i) a saving in fuel expenditures, which would help reduce poverty, (ii) help for women by saving time and effort in collecting fuels and (iii) a decrease in smoke emissions, thereby reducing the health risks faced by households' children and women.

The improved stoves (IS) have both disadvantages and advantages relative to clean fuels (e.g. electricity, kerosene and LPG). These clean fuels have greater environmental and health benefits. If solid fuels were no longer used for household cooking and heating, it would help preserve trees and bushes and prevent smoke emissions. In comparison the IS would only reduce (and not eliminate) the use of solid fuels and smoke emissions. On the other hand clean fuels are not easily affordable by low-income households in developing countries: Obueh (2006) points out that in Delta State, Nigeria, the costs for kerosene and LPG are respectively 4.2 and 12.8 times higher than for solid fuels. The IS would thus have lower environmental and health benefits but greater income benefits.

The United Nations' Millennium Development Goals (MDG) have a target for a decrease in the use of solid fuels: countries should aim to halve by 2015 the number of persons who lack access to clean fuels. However Mehta *et al* (2006) and WHO (2006) have estimated that the

MDG goals are unlikely to be met in many developing countries. In view of these concerns, the United Nations' Millennium Project has called for an additional target, namely, to make improved stoves more widely available.

This paper surveys the performance of 20 recently designed IS in 19 developing countries. The main features of these stoves have been noted by two independent organisations: The Ashden Awards for Sustainable Energy and Practical Action¹. Our interest is in (i) the percentage savings in fuel use, (ii) the gain in household incomes and (iii) the health benefits, particularly for women and children.

The paper goes on to discuss diverse aspects of the income and health benefits of IS and then catalogues the reported benefits of the 20 stoves and also their limitations before summarising the main findings and suggesting questions for further research.

INCOME BENEFITS AND HEALTH BENEFITS

Income benefits may arise if the improved stoves have any of the following features. Firstly, IS may have a longer working life, than traditional stoves; this advantage could more than offset the disadvantage of a higher purchase price. Secondly, IS may have a lower requirement of solid fuel use (and so lower fuel expenditure).

These income benefits may be illustrated with two simple examples. (i) The purchase price of an IS may be twice that of a traditional stove but if the working life of the former were three times greater the overall expenditure on the IS (over its working life) would be only two thirds of that of the traditional stove. (ii) If the fuel expenditure with a traditional stove accounted for, say, 20% of a household's income and if an IS enabled a 40% saving in fuel use, the consequent saving in fuel expenditures would be $(0.2)(0.4) = 0.08$, i.e. 8% of household income.

The health benefits may be grouped into direct and indirect benefits. The direct benefits would arise from a decrease in women's burdensome task of collecting solid fuels and also a decrease in smoke emissions and in the incidence of respiratory illnesses, which would help women and children. The indirect benefits would be mainly related to income gains. For instance, households could then afford to use fuel to boil drinking water, thereby reducing the incidence of diarrhoea. This could help many low-income households: Katrak (2008) has shown that many households that use solid fuels also lack proper access to clean water². Another possibility is that the income benefit might enable households to purchase essential medicines for diverse illnesses, which they might not otherwise have been able to afford.

ANALYSING THE PERFORMANCE OF IMPROVED STOVES

This section examines the performance of 20 improved stoves in 19 countries. (Two of the IS are being used in different states in India). We focus on four important features: (i) percentage savings in fuel use, (ii) income benefits, (iii) health benefits and (iv) sales.

All 20 reports mention significant savings in fuel use, 7 mention some income benefits, 12 discuss some health benefits and 11 make mention of their sales.

The extent of these savings differs between countries, ranging from 40 – 70%, though most of the estimates are around 50%. These savings will have brought two benefits: the amount of time that women have had to devote to collecting fuels would be reduced by about one-half and/or, alternatively, there would be a decrease in households' fuel expenditure.

Income benefits

These benefits are classified into three groups.

(i) The time saved in collecting fuels has enabled women to take up income-earning activities. Okello (2005) mentions this outcome in Kenya.

(ii) The IS have a longer working life than the traditional stoves and, moreover, this benefit has been high enough to more than offset a relatively higher purchase price. This aspect is reported in Bazile (2002) for Malagassy and in Baskaro (2006) for Cambodia.

(iii) The IS have enabled substantial savings in fuel expenditure and this has more than offset a relatively higher purchase price. Shijao (2007) calculates that in China the price of the DAXU stove can be recouped within a year. This benefit is also observed in Debasai (2003) for Eritrea.

The saving in fuel expenditure has had a significant impact on rural households' incomes. Masera *et al* (2006) estimate that in Mexico the saving is as high as about 8% of incomes. This gain is estimated as follows: the initial share of fuel expenditure in income was 20%, the IS enabled a 40% saving in fuel use and so the saving in expenditures is 8% of income. Basher (2004) and Conway (2005) suggest that in Pakistan and Honduras the savings have been as high as 20% of income.

It may be helpful to put these results in perspective. A gain of, say, 8% of household income would otherwise have required that a country achieve macro-economic growth of about 8%. However such growth is well beyond the macro-economic capabilities of many developing countries. Most of those countries currently manage growth rates of only about 4%. In view of this, an IS that brings an income benefit of even 8% is very impressive.

Health benefits

Direct benefits were reported for 11 of the 20 stoves. Most of these concerned the decrease in women's task of collecting solid fuels. Some also mentioned a decrease in smoke emissions, eye irritation and coughing: for instance Palit (2005) noted that in West Bengal, India, 90% of households experienced much less smoke in the kitchen and 70% reported elimination of eye discomfort.

It is worth mentioning that households were asked about the health benefits only a few months after the switch to the IS. This time period may not be long enough for those benefits to be noticeable. Bruce *et al* (2007) report that a detailed study of the impact of reduced smoke emissions on children's health could last over two years.

Indirect health benefits would arise from the above-mentioned income gains. Some households might now be able to incur essential health expenditures that they would not otherwise have been able to afford. The scope for this benefit arises in at least six of the countries covered in our survey³: this is important for, as UNDP (2003) reports, about 50% of households in those countries cannot currently afford essential medicines.

Mention of sales and stoves installed

This aspect was mentioned in 10 of the 20 reports. Detailed accounts were given in Bazile (2002) and O'Neal (2005) for Malagassy and Guatemala respectively: they report the initial target (of the number of stoves to be sold) and also that the targets had actually been met before the end of the target period. Another 8 reports mention either the target numbers, the numbers actually sold or the need to subsidise sales for low-income households.

Country-level 'needs'

A final question is whether our 19 countries are mainly amongst those where a large percentage of women and children are affected by smoke emissions. Such countries would have a relatively great 'need' for improved stoves. 'Need' for IS is measured here by the percentage of households in a country that currently rely on solid fuels⁴.

The 19 countries were divided into three groups: (i) low need countries, where the percentage of households using solid fuel is 12 – 64%, (ii) moderately needy countries, where solid fuel use ranges between 65 – 84% of households and (iii)

very needy countries, where usage is 85% of households and greater.

The countries with recognised IS are under represented in the highly needy group: the relative number is only (8/43). In comparison those countries are well represented in the moderately needy group, with relative numbers (7/20). The reasons for this under representation in the former group would be worth examining in future research.

SUMMARY AND QUESTIONS FOR FUTURE RESEARCH

This paper has surveyed the reports of 20 improved cook stoves in 19 countries. All these stoves have received the attention of two independent organisations. We considered three benefits of the stoves: (i) the savings in solid fuels use, (ii) the income benefits, which might help in poverty alleviation and (iii) the health benefits.

The main findings were as follows. All 20 reports mentioned significant savings in fuel use: the average saving was about 50%. The consequent savings in fuel expenditures have brought significant gains to households' incomes. Additional income benefits were mentioned in 7 reports. The direct health benefits were noted in 11 reports and in addition there could be some income-related indirect health benefits. However only a small proportion of the improved stoves were designed in countries that have a high need for such stoves.

Future research could examine whether the above findings will show up in a larger study of improved stoves, particularly those designed in the 'high need' countries. It would also be interesting to see if the importance that households attach to the diverse benefits depends on their incomes, family size and age profile.

NOTES

1. These reports can be accessed on www.ashdenawards.org and in the journal *Boiling Point* on www.practicalaction.org.

The reports on the IS of the Ashden awards are written by the awards' selectors, though the names cited in the references are those of the award winners.

2. In this respect the benefits of the improved stoves are like those of farmer training programmes to help decrease use of toxic pesticides. The latter are evaluated in Katrak (2006).

3. The six countries are Cambodia, Honduras, India, Kenya, Nepal and Nigeria.

4. Country-level data of solid fuel use is available in Rehfuess et al. (2006 March).

REFERENCES

- Basher, M. (2004). "Fuel-efficient stoves for rural women in Pakistan." www.ashdenawards.org
- Baskaro, I.S.Y. (2006). "Commercialisation of efficient charcoal stoves in Cambodia." www.ashdenawards.org
- Bazile, D. (2002). "Improved stoves as a means of poverty alleviation." *Boiling Point*, No. 48, pp. 20 – 22.
- Bruce, N. et al. (2007). "Pneumonia case-finding in the RESPIRE Guatemala indoor air pollution trial: standardised methods of resource-pooling." *Bulletin of the World Health Organisation*, Vol. 85 (7), pp.
- Conway, S. (2005). "Fuel efficient stoves for rural and urban households." www.ashdenawards.org
- Dasgupta et al. (2006). "Who suffers from indoor air pollution? Evidence from Bangladesh." *Health Policy and Planning*, Vol. 21(6), pp. 444 – 458.
- Debesai, G. (2003). "Fuel efficient stoves for baking Injera bread". www.ashdenawards.org
- Glusker, A. (2006). "Women and children suffer most from exposure to coal smoke." *British Medical Journal*, Vol. 333, No.1192.
- Katrak, H. (2006). "Better health, more wealth: the impacts of farmer training in developing countries." *Pesticides News*, No.73, pp. 18 – 21.
- Katrak, H. (2008). "Measuring the shortage of medical practitioners in rural and urban areas in developing countries: a simple framework and simulation exercises with data from India." *The International Journal of Health Planning and Management*, Vol. 23, pp.93 - 105.
- Masera, O.R. et al. (2006). "Clean and efficient cook-stoves in rural Mexico." www.ashdenawards.org
- Mehta, S. et al. (2006). "Modelling household solid fuels use towards reporting of the

Millennium Development Goals indicator.” Energy for Sustainable Development, Vol. 10, Issue 3, pp. 36 – 45.

Obueh, J. (2006). “Methanol stoves for indoor air pollution reduction in Delta State, Nigeria: addressing the needs of people for clean energy.” Boiling Point, No.52, pp.17 – 18.

Okello, V. (2005). “The Upesi rural stoves project.” Boiling Point, No. 51, pp. 2-5.

O’Neal, D. (2005). “Designing stoves for mass production.” Boiling Point, No.50, pp.8 – 11.

Palit, D. (2005). “Institutional partnership in improved cooking stoves: experience from West Bengal, India.” Boiling Point, No. 50, pp. 29 – 30.

Rehfuess, E. et al. (2006). “Assessing household solid fuel use: multiple implications for the Millennium Development Goals”. Environmental Health Perspectives, Vol. 114, (3) pp. 373 – 378.

Shijiao, P. (2007). “New stoves designed to burn crop waste transform the lives of rural areas”. www.ashdenawards.org

UNDP. (2003). Human Development Report, “Millennium Development Goals: A Compact among nations to end human poverty.” Oxford University Press

WHO. (2005). “The environment and health for children and their mothers.” www.who.int Fact sheet no. 284, February

WHO. (2006). “Fuel for life: household energy and health.” www.who.int/indoorair/publications/fuelforlife/en/index.html