Improved stoves for preventing deforestation: myth or reality?

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Introduction

Fuelwood (charcoal and firewood) is the main source of household energy in Madagascar. This situation is particularly alarming because the country's forest areas are decreasing by 2.5% per year. Urban population growth is the main cause of deforestation; urban growth rate is often greater than 4% per year.

It is important to highlight that although fuel gathering is not the only cause, it is responsible for 40% of the deforestation. Given the absolute necessity for the population to use fuelwood, it is important to have an energy policy which aims to limit depletion of the country's natural resources. The two main objectives of the Woodfuel Energy Saving National Program (PNEBE) are:

- To reduce consumption of woodfuel
- To alleviate the cost of household energy.

A first step seemed to be the dissemination of a large number of fuel-efficient improved stoves. To evaluate the usefulness of this approach, the questions that needed to be addressed were:

- How will household behaviour be affected by the introduction of improved stoves?
- Will the dissemination of improved stoves affect wood energy savings significantly from an environmental perspective?

Study Framework and Methodology

PNEBE is part of the Energy II project of the Ministry of Energy and Mines of Madagascar, financed by the Malagasy Government and the World Bank.

The present impact study of household behaviour change, following dissemination of improved stoves (Figure 1), has been carried out in Antananarivo and its suburbs (about 1.5 millions habitants). The distribution of households was based on income as shown in Table 1.

Table 1: Household sampling in Antananarivo

Income level	*Low-income*	*Middle-income*	*High-income*
Percentage of total population	70	26	4
Number in sample	335	103	42

Table 2: Percentage of households using any given fuel in Antananarivo

	Wood	*Charcoal*	*Sawdust*	*Oil*	*Gas*	*Electricity*
Percentage of households using each fuel	6.3%	93%	2.6%	4.2%	6.3%	1.6%
Main fuel used by household	2.6%	91%	1.6%	2.6%	4.2%	0.5%

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Figure 1: Artisan making an improved stove

Results

The survey of Antananarivo inhabitants confirms that biomass (firewood, charcoal, and sawdust) is still the main source of household energy in Antananarivo (Table 2). In fact, 95% of the households in the capital city use biomass as their main fuel, usually as charcoal (91%)

Since the only improved stoves available in Madagascar use charcoal, the study has been based on the behaviour analysis of those 93% of households using charcoal as their main or secondary fuel. Table 3 shows the income distribution of those who use stoves

Middle-income use of improved stoves (54%) reflects that this group are able to pay the difference between the cost of a traditional stove (*fatampera*) and an improved stove (*fatana mitsitsy*). The average cost of a traditional stove is 7400FMG (franc Malgache), compared with 12500FMG for a fuel-efficient stove (1 US $ = 6 700 FMG; November, 2000). Overall, 41% of households have improved stoves. Low-income households are interested in improved stoves as they reduce fuel costs.

Every household using the *fatana mitsitsy* is convinced that the stove is fuel-efficient. The project therefore investigated how the extra money saved through using the improved stove was

Table 3: Distribution of improved stoves equipped household by income categories

Income category	*Use of Improved stove (%)*
High income	36
Middle income	54
Low income	33
Mean	41

Non-Theme

Table 4: Use of money saved from the use of the improved stoves

Households	*Low-income*	*Middle-income*	*High-income*
Energy	4.55%	23.53%	66.67%
Other uses	95.45%	76.47%	33.33%

Table 5: Distribution of savings spent on non-energy uses

Households	*Low-income*	*Middle-income*	*High-income*
Foods %	54.5	26.06	
Hygiene – Health %		2.78	
Telephone			2.78%
Others	5.5%	7.16%	1.22%
Total	60%	36%	4%

Table 6: Population involved in energy saving from improved stoves use

Income level	*Low-income*	*Middle-income*	*High-income*
% of total population	70%	26%	4%
Households owning improved stove	33.71%	54.05%	32.82%
Uses of savings to non energy uses	95.45%	76.47%	33.33%
Population involved in energy saving	23.86%	10.75%	0.44%

spent. Two main points came from the data:

- Part of the saving is immediately allocated to other energy uses (Table 4). This fraction is larger for high-income households. For these households, two-thirds of the 'savings' are fictitious because they are spent buying energy for new purposes; water heating, ironing, etc. The improved stove contributes to an improvement in their quality of life by providing access to other energy services, without increasing their reliance on forest supplies.
- Secondly, 80% of the beneficiaries say they buy extra food with their savings.

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Figure 2: Artisan making the Lafatra stove

Results analysis and perspectives

Use of improved stoves by the least well-off contributes most to environmental benefits, and at the same time it reduces their expenditure on biomass energy. Only 35% of charcoal users contribute to wood saving.

The different models of improved stove give charcoal savings of between 20% and 45% (Bazile et Rabearivelo, 2000), which contributes to an overall saving near 30% in Antananarivo. So with only 35% of the population engaged in energy-saving through using improved stoves, among the 91% of charcoal users, we find that, in reality, this produces only 9.56% of charcoal saving.

This analysis shows that, in Madagascar, it is necessary to develop and diffuse an improved wood stove in parallel with charcoal stove dissemination. Since June 2000, the PNEBE has disseminated a fuel-efficient Lafatra wood stove that, under laboratory conditions, provides 50% fuel savings and an energy efficiency of 25%. However, using an improved wood stove is a new cooking concept in the country, and will thus take a longer time to diffuse, so an analysis of potential benefits has assumed a diffusion rate of only half that for charcoal stoves. In addition, by increasing peoples' awareness of good fire management, it is possible to double the saving made by the use of improved stoves (Bazile 1998).

Conclusion

These figures only refer to household energy consumption. They do not measure other uses such as cheap restaurants, bakeries, brickworks and other industries. Nevertheless, by extrapolating results from Antananarivo to the whole country, and by modifying the above observations for local differences, such as income groups, types of fuel used etc. we estimate that a programme like PNEBE might lead to 11 000 tonnes wood saving, if improved stoves for both charcoal and wood were distributed. This figure is still low because it is the equivalent of only 38 000 cubic metres of forest. Although modest, its impact is worth considering because, in a country like Madagascar, where the urban population growth is as high as 4%, the savings achieved are 3.5 times the energy needs created by demographic growth. Thus, a project like PNEBE is one way to slow down degradation, to allow time for other complementary actions such as forestry management or energy substitutes for wood to be developed.

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