

SUBMITTING AGENCY: WHO - DEPT OF HEALTH IN SUSTAINABLE DEVELOPMENT

ITDG PROJECT, KENYA

TITLE

Achieving sustainable reductions in indoor air pollution and improving health through participatory community technology development in rural Kenya

ABSTRACT

Around 80% of people in rural sub-Saharan Africa depend on biomass (wood, dung, crop residues) for domestic energy. There is mounting evidence that the resulting indoor air pollution increases common, serious health problems including childhood pneumonia and chronic lung disease. Previous attempts to reduce this have often failed due to lack of community involvement in developing appropriate, sustainable solutions. Working with 50 households in poor rural Kenyan communities, participatory technology development has been used to alleviate smoke pollution. Evaluation of changes in pollution levels and community views about the process and interventions is being carried out.

KEY ISSUE ADDRESSED

The key issue addressed is *rural energy*, with a focus on reducing the very high levels of indoor air pollution through participatory development of housing and energy use interventions. This has relevance beyond the specific communities described here, to include the many millions of (mainly) women and young children affected by indoor air pollution in other developing countries.

COUNTRY PROFILE

Kenya remains one of the poorer East African countries, with a large rural population dependent on biomass fuels. Key national health and economic data is summarised in the table below, and demonstrate not only the overall level of poverty and poor health, but also the relatively slow pace of development (and no change or deterioration in key child health measures):

Indicator	Year(s)	Value
• Population	1999	27 million
• Infant Mortality rate (per 1000 live births)	1980	75
	1998	76
• Under 5-year mortality rate (per 1000)	1980	115
	1998	124
• Rural population	1999	68%
• Per capita GNP (US\$) and [Rank]	1999	360 [170 th]
• Average annual growth rate	1998-1999	0.1%
• Percent population below poverty line	1992	46.4% (rural); 29.3% (urban)
• Percent population without access to improved water supplies	1990-1996	47%

Source: World Development Report 2000/2001

Project location: The work is being carried out in two rural areas of Kenya:

- Kajiado, some 80km to the south of Nairobi
- West Kenya, in the communities of Kisii (50 km SE of Kisumu) and Ichingo, around 50km west of Kakamega.

Project area profile

Kajiado: A rural area populated by Maasai, who have begun to build more permanent settlements, whilst maintaining their pastoral lifestyle. This is a poor area, with little or no economic activity other than herding. Within the project families, most rely on the sale of milk, livestock and other small enterprises (sale of charcoal, beer, manure). In about a quarter of the households, the husbands and sons work as watchmen, etc. The Maasai rely almost exclusively on biomass (wood, cattle dung, crop residues) for cooking and space heating, with some use of kerosene in simple wick lamps for lighting. Families live in *bomas*, made up of a cluster of mainly traditional wood and mud homes. Families are polygamous, with each wife living in her own home with her children. The homes are squat, flat roofed buildings, with tiny windows, typically no more than 2-4 inches across (Fig 1). Fuel is burned on open fires in the kitchen area, with no flue or other ventilation apart from the small windows. Fires are often kept smouldering between periods of cooking, including at night, leading to very high levels of indoor air pollution to which women and young children in particular are exposed. It is the role of women to collect fuel and cook.

West Kenya: Both communities in West Kenya are poor rural areas, typified by subsistence farming. As in Kajiado, households are almost totally dependent on biomass fuel, although kerosene is used for some cooking tasks, especially for visitors. Recent increases in the kerosene price have tended to reverse any trend towards greater use. Cooking is typically carried out on open fires (Fig 2) which are located either in small, separate kitchen buildings, or in the main house. Windows are larger than in Kajiado, but still small or poorly positioned with regard to smoke removal. Some homes have eaves spaces, although often these are small or closed off for reasons of security and exclusion of animals which might attack poultry. *Upesi* stoves have been developed and marketed extensively in this area of Kenya, and have been adopted by some 30% of homes. As a result of the layout of these homes, larger windows, and the quite widespread use of *Upesi* stoves, indoor air pollution levels are generally lower than among the Maasai community, but still very high by international standards.



Figure 1 (above): a traditional Maasai house, showing squat construction and tiny windows. The flue was fitted some years previously in a local government initiative, but no longer works (see text)



Figure 2 Open fire, with soot blackened walls, West Kenya.

SUSTAINABLE DEVELOPMENT ISSUE ADDRESSED BY THE CASE STUDY

The challenge addressed by this project was to find effective, appropriate and sustainable means for bringing about a substantial reductions in exposure of women and young children to indoor air pollution, thereby contributing to improved health. This work was to build on earlier initiatives in both areas:

- **Kajiado:** work in this area built on the ITDG Maasai housing project which used participatory community development methods to work with women to improve the quality of housing (roof height and materials), provision for water collection from roof run-off, etc. Some, very small scale work (a few houses) had been carried out by ITDG on smoke level monitoring and the development of hoods/flues to remove smoke¹. There had also been attempts some years earlier by the district health authority to develop enclosed mud stoves with flues, but as has been the experience elsewhere, these quickly became blocked and fell into disuse (Ref: Figure 1).
- **West Kenya:** although less work had been done on housing improvement than with the Maasai, efforts in West Kenya built on the very successful ITDG *Upesi* stove programme which was well established and also used a participatory approach with groups of women producing and distributing ceramic stoves. These stoves had been designed primarily with fuel conservation in mind, although the improved combustion has also been shown to result in some reduction in emissions and pollution levels².

The main barriers to developing more effective interventions are summarised in the table below:

Type of barrier	Kajiado	West Kenya
Economic	Poor pastoral nomadic people now settling. Poor national economy.	Poor rural subsistence farming community. Poor national economy.
Cultural	Maasai traditionally quite resistant to	

¹ A breath of fresh air for smoky houses; Pete Young; *Boiling Point 34* - Smoke removal, ITDG September 1994

² Ezzati M, Mbinda MB, Kammen DM. Comparison of emissions and residential exposure from traditional and improved cookstoves in Kenya. *Env Science and Technol* 2000;34:578-583.

	change, although have responded well to participatory development in e.g. the housing project.	
Social	Women value privacy and security, hence resistant to larger, non-closing windows to improve ventilation.	Security and protection from animals is a concern with respect to larger/more windows, eaves spaces, etc., that could improve ventilation.
Technical	Almost no successful prior experience with improved stoves or smoke extraction (e.g. with flues).	Good prior experience with Upesi, but none with chimney stoves which may be needed for effective smoke removal. Some concern about risk of sparks starting thatch fires.
Environmental (including fuel sources)	Both communities almost wholly dependent on stressed biomass resources for fuel. Recent price rises have limited use of kerosene. For foreseeable future, and without new income generation activities, there appears to be little prospect of a substantial transition to cleaner fuels such as kerosene or LPG.	

OBJECTIVES

The main objectives of the project are as follows:

1. Carry out baseline assessment of pollution and exposure, fuel use and house structure.
2. Identify ways of alleviating indoor air pollution, thereby improving human health
3. Participative development and installation of interventions.
4. Evaluate changes in pollution and exposure, and community views of the process used, and acceptability and affordability of the interventions.
5. Develop strategy in national context for dissemination and sustainability within the market constraints of the communities.
6. Exchange experience internationally to strengthen Kenyan work and to contribute to implementation of best practice in other countries.

IMPLEMENTATION

In summary, project implementation has involved the following steps:

1. Baseline assessment (carried out in two rounds to cover wet and dry seasons) of pollution and exposure, fuel use and household characteristics, socio-economic factors
2. Working with households, identified a range of potential smoke-alleviation interventions that would be acceptable and appropriate to culture and everyday needs.
3. With involvement and financial contribution of households, developed and installed interventions
4. Follow-up measurement of changes in pollution, exposure and related factors, and analysis of effect of interventions, allowing for changes in other factors.
5. Development of strategy for dissemination and market sustainability.
6. Disseminate and exchange experience through networks and other for a (meetings, etc.)

Further detail is provided below on each of these steps, barriers encountered and how addressed.

1. Baseline assessment: Survey and pollution sampling methods have been based on standard techniques involving interviews (households and socio-economic factors, time-activity patterns), air sampling with pumps and gravimetric analysis for particulates, and diffusion tubes for Carbon Monoxide. The selected households have been fully involved from the start, and have accepted well the two rounds of baseline assessment.

2. Identification of interventions: Discussion was held with individual households and groups of women to identify the types of interventions that they would like to try. Some demonstration (of existing innovations) and exchanges have also been carried out.

3. Development and installation of interventions: Step 2 led on to the development and installation of (a) hoods with flues (b) larger/more and better positioned windows and (c) large eaves spaces. Concern about privacy/security for windows and eaves spaces is being addressed with the use of wooden shutters and metal mesh. Figures 3 and 4 illustrate some of these interventions now installed. Participatory technology development methods have been used. Initial designs for hoods/flues were prepared with the women through discussion and preparing sketches (drawn by women). These were then taken to the local technology institute in Kajiado, and prototypes prepared. Once installed, women then commented on convenience and smoke extraction efficacy, and further modifications made. This has led to designs which are known to be acceptable, meet needs, and through everyday experience, appear very effective (the formal evaluation – see below – will quantify these observations). During this pilot phase, financing has been shared between the project (ITDG and donors) and the community, with the project paying for the more expensive components. However, it is fully recognised that if these initiatives are to be

sustainable, the local community (encompassing residents, artisans, distributors, local government and NGO agencies) will need to be able to pay for, produce and maintain these interventions. This is now being addressed (see below).

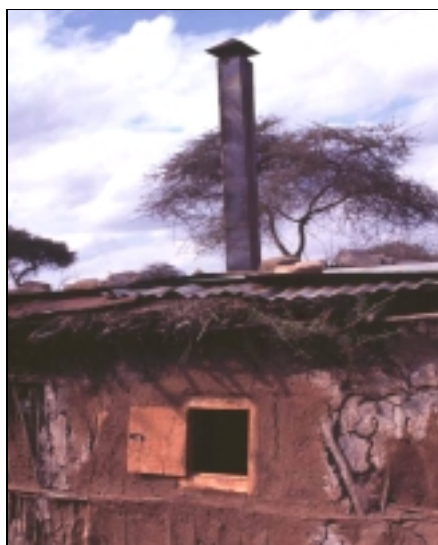


Figure 3: Newly installed hood and flue, Kajiado

Figure 4: The flue and new windows (four per house are being fitted)

4. Evaluation: Evaluation involves repeating the components of the baseline survey, but with additional qualitative (group and individual) discussion and recording of experience with the process of developing and installing interventions, and satisfaction.

5. Development of strategy for dissemination and market sustainability: This began with an assessment of the priority being given to the interventions under development by women in the project homes and in surrounding areas, and the consequent likelihood that they would be able to allocate scarce resources to these changes. Once the more resource-intensive development work has been done, costs of producing and installing the interventions on a more routine basis can be assessed. This work will be linked with the preparation of materials for disseminating the new information on the pollution problem, changes achieved, experience with the interventions, etc., and strategies developed for sustaining uptake and use. This will build on the successful experience of the *Upesi* programme in West Kenya. Arrangements are currently being developed with partners from within Kenya and the UK to use innovative media approaches (video, printed materials, puppetry, etc) to raise awareness, and build the necessary partnerships and commitment at community, district and national levels.

6. International dissemination: The collaborative group has good contacts with key networks involved in household energy, health and development, and these will be used to disseminate reports, arrange presentations, etc. These contacts include the Household Energy Development Organisation Network (www.ecoharmony.net/hedon), Boiling Point, and links through WHO, USAID and the World Bank and other relevant agencies developed through a recent WHO/USAID organised International Consultation³.

OUTCOME AND IMPACTS

- **Levels of pollution:** Preliminary analysis of the baseline surveys have found median 24 hour values for respirable particles of $4605 \mu\text{g}/\text{m}^3$ in Kajiado and $812 \mu\text{g}/\text{m}^3$ in West Kenya. As expected, these are very high in comparison with the current annual EPA PM_{10} standard of $50 \mu\text{g}/\text{m}^3$ (24 hour mean levels in these rural communities are a good guide to annual means due to consistency of daily routines). Levels of carbon monoxide are also very high, especially in Kajiado.
- **Progress with interventions:** Interventions have been completed in Kajiado (all homes having new windows, 50% hoods with flues for comparison purposes). Interventions have been started in West Kenya and are due to

³ WHO/USAID Global technical Consultation on the Health Impacts of Indoor Air Pollution and Household Energy in Developing Countries; May 3-4th 2000, Washington.

be completed in November/December 2000 (all homes to have Upesi stove, larger and better position windows and eaves spaces, and up to one-third hood with flues subject to successful participatory technology development).

- **Evaluation of outcomes:** The post-interventions survey work (quantitative and qualitative assessment) will begin in November 2000, so results of this are not yet available. Qualitative assessment will include diary keeping by field teams, observations (photography, video), interviews and discussions with women. Initial discussion during the installation phase has found very positive responses, with women reporting improvements in smoke levels, comfort (headaches, eyes), more light, and greater convenience around the home.
- **Capacity building:** Development of capacity has included skills in survey work (include air quality assessment) and project management, data handling, technology development. This has involved new and existing IT field staff, partners and core team members, and will be consolidated through plans to expand the work within Kenya and in an international collaborative effort applying similar methods.
- **Partnerships:** An effective and broad-based partnership has been established between the UK contributors (ITDG-UK and University of Liverpool), IT-Kenya, the University of Nairobi (air quality assessment, statistical analysis) and district-based resources including local government and technology institutes. Community participation has been a crucial and effective component of this. Joint-working with ETN (a UK and Nairobi based media and health development organisation) and AMREF is under discussion in respect of achieving wider dissemination and sustainability.

PROJECT/PROGRAM STATUS

Stage	Status
Baseline survey	Completed
Identification of interventions	Completed
Installation of interventions	Underway, completion by December 2000
Follow-up evaluation	To be carried out November 2000 to May 2001
Strategy for dissemination and sustainability	Under development

REPLICABILITY

This participatory approach has wide application. Although the quantitative evaluation has yet to be completed, preliminary findings indicate that the methods adopted are both effective and have the potential to be sustainable. The women have been empowered to making their homes cleaner and safer. Specific knowledge about these interventions may also be quite widely applicable in Kenya, though since participatory approach is recommended the details would be expected to emerge in response to needs and circumstances of community involved.

LESSONS LEARNED

Since the project is not yet completed, the following points are preliminary:

- Levels of smoke within the project communities are at a dangerously and unacceptably high level.
- The problems faced by women within the project are based in poverty - they have neither the time nor resources to make changes, even if they are aware of the problems of smoke. The project's role is to empower those women to make improvements to their (and their children's) quality of life.
- Women within the communities themselves, are in the best position to determine what will work for them, and strategies for smoke-alleviation must be worked out participatively for them to be sustainable. The abilities (assets) of these poor communities should not be under-valued.
- Women are very receptive to change, if they themselves instigate it from a position of knowledge and understanding.
- Much greater effort needs to be put into identifying low-cost, acceptable and financially sustainable mechanisms for alleviating smoke and improving the home environment.

FURTHER INFORMATION

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