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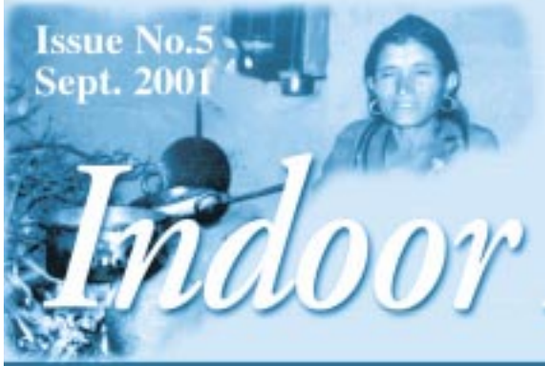

ESMAP
THE WORLD BANK

Indoor Air Pollution

ENERGY AND HEALTH FOR THE POOR

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This issue of the newsletter highlights the emerging results of an ongoing study - Household Energy, Air Pollution and Health - supported by South Asia Region of the World Bank and the joint UNDP/World Bank Energy Sector Management Assistance Program (ESMAP). It presents an evaluation of current practices in Government of India's National Program of Improved Cookstoves (NPIC) based on case studies in selected states of India, where the penetration of improved stoves is relatively high. This evaluation exercise was designed in partnership with the Ministry of Non-Conventional Energy Sources of the Government of India, and undertaken by two leading institutions in the field – Tata Energy Research Institute (TERI) and Winrock International India (WII). The findings of the study provide a basis for developing more cost-effective interventions and strategies to address indoor air pollution.

India's National Program of Improved Cookstoves – A Growing Challenge

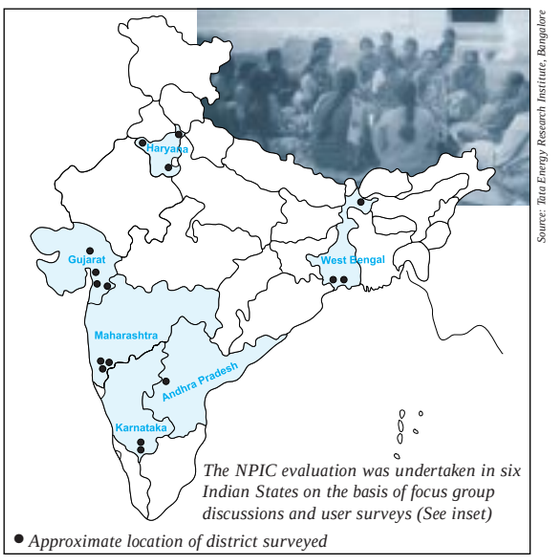
The Program has touched the lives of millions of poor people. However, greater effort is needed to improve its efficacy and make it self-reliant.

The improve biomass stove can be an important device for better household energy for millions of poor people unable to afford expensive commercial fuels. The stove can save fuel, diminish drudgery to collect fuels and reduce indoor air pollution resulting in substantial health benefits.

The Government of India's National Program of Improved Cookstoves has introduced some 33 million biomass-based improved stoves in rural areas during 1984-2000. Next to China, this is the largest program in the world that has reached the lives of a large number of poor people in such a short time. Available studies, however, indicate that problems, such as design failures, lack of public acceptance, and quality control difficulties plague the program. Barring a few such studies, little attention has been given by Indian rural energy and health experts to provide comprehensive inputs into future direction of the program.

The World Bank, in partnership with the Ministry of Non-Conventional Energy Sources (MNES), a central agency under the Government of India, has carried out an evaluation of the Indian stoves program as part of an ongoing study entitled, Household Energy, Air Pollution and Health. The study aims at the development of strategies to reduce indoor air pollution in India, based on an evaluation of NPIC and lessons learnt from successful stove programs in other countries.

The evaluation was carried out in selected districts (see map) of six states - Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra and West Bengal - chosen to reflect geographical coverage and relatively higher rates of stove penetration, which were considered indicators of success. The programs in these



Source: Tata Energy Research Institute, Bangalore

The NPIC evaluation was undertaken in six Indian States on the basis of focus group discussions and user surveys (See inset)

● *Approximate location of district surveyed*

districts were considered worth assessing in order to draw lessons. The evaluation is based on user response surveys and focus group discussions with key stakeholders, such as users, non-users, stove builders, designers and suppliers. While the evaluation is not intended to represent each state's situation, it provides some important snapshots of current practices prevailing in NPIC. An overview of the program in the six states surveyed is given in Table 1 below.

NPIC Overview

Launched as a demonstration program in 1983 by MNES, Government of India, NPIC became a national-level dissemination program in 1986. The program's objectives include fuelwood conservation, removal of smoke, checking deforestation and environmental degradation, reduction in drudgery of women and employment generation. Currently, NPIC is implemented in all Indian states with more than 20 models of fixed and portable improved stoves available in the country for family, community and commercial applications. The beneficiaries of the program include low- and middle-income households in rural and peri-urban settlements, especially traditional wood-based stove users. Approximately, 30 per cent reservation for improved stoves is given to economically and socially disadvantaged groups, such as the designated backward classises.

NPIC is a target-oriented program which implies that targets for stove installation are set by MNES and fulfiled by a network of functionaries at the state level. These targets are communicated to the state-level nodal agencies which, in turn, pass their targets to local government agencies or NGOs working with them. The stoves are constructed by rural women or unemployed youth as Self Employed Workers (SEWs) who receive training from the state's Technical Backup Unit (TBU) to build stoves. A total of 14 Technical Backup Units provide research and development and training inputs for the program *(See Figure 1: Institutional Structure of NPIC).*

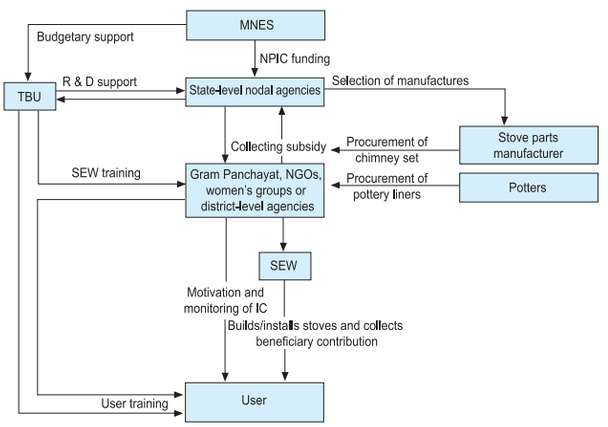


Fig. 1 Institutional Structure of NPIC

TABLE 1: NPIC OVERVIEW IN SIX STATES COVERED IN THE EVALUATION

Name of state	Type of fixed-type mud stoves frequently in use (Name of model)	Average stove efficiency (per cent)	Names of districts surveyed	Numbers of stoves installed in surveyed districts (1999 - 2000)	Numbers of stoves installed in the state (1999 - 2000)	Cumulative total numbers of improved stoves installed (1995 - 2000)*	Technical Backup Unit (TBU)
Andhra Pradesh	2 pot with chimney; pottery liners (Sukhad) 2 pot chimney; pottery liners (Gayathri)	20-28	Mehboobnagar	2,9112	1,86,000	12,59,892	Regional Engineering College, Warangal
Gujarat	2 pot with chimney (Mamta) 1 pot without chimney (Sneha)	24	Ahmedabad, Surat, Dangs	16522	99,885	3,97,785	MS University, Vadodara
Haryana	1 pot with chimney (Mohini) 2 pot with chimney (Jetan and Akash)	23 22	Panchkula, Fatehbad and Gurgaon	9,000	55,000	2,36,970	Punjab University, Chandigarh
Maharashtra	1 pot without chimney (Grihalaxmi) 2 pot with chimney (Laxmi) 2 pot without chimney (Parvati and Bhagyalaxmi)	24 28 24	Kolhapur, Satara and Sangli	10,950	95,103	7,88,189	Appropriate Rural Technology Institute, Pune
Karnataka	2 pot stove with chimney; pottery liners (Sukhad) 2 pot with chimney, pottery liners and mould (Sarale Ole)	20-29	Mysore and Hassan	4,500	59,033	4,38,785	Karnataka State Council of Science and Technology, Bangalore
West Bengal	1 pot with chimney (Sohini Seva) 1 pot coal with chimney (Kalyani) 2 pot with chimney (Sugam Seva)	18 22-40 22	Medinipur, South 24 Parga-nas and Jalpaiguri	1,59,076	4,97,589	20,93,735	Kalyani University, Kalyani

** Includes both fixed and portable improved stoves*

Role of Subsidies

Stove subsidies should not be used to create unsustainable demand but to determine where demand is strongest and the best ways to meet it

In India, all households targeted for improved stoves in NPIC are entitled to obtain a subsidy on the stove. The central government subsidy given by MNES does not go directly to the user, but to the state nodal agencies to cover the stove material and building costs, creation of capacity and awareness and administrative costs. In the six states surveyed, the unit cost of a fixed-type mud improved stove varies from Rs. 110 to 190 (US $2-4), and the central subsidy accounts for 50 per cent of the stove cost in most states.

In some states, such as Andhra Pradesh, Haryana, Gujarat and Karnataka, state governments (and district administration) provide a subsidy over and above the central subsidy under various development schemes. This further reduces beneficiary contribution. For example, in Maharashtra, most stove users pay Rs. 110 (US $2) for a mud-improved stove, but beneficiaries belonging to the Scheduled Caste / Tribe and Other Backward Classes pay only Rs.10-20 (US $0.2-0.4) as they receive an additional state-level subsidy. In Haryana, users pay Rs. 20 (US $0.4) for an improved stove. In Andhra Pradesh, one of the nodal agencies provides a state subsidy that reduces the beneficiary contribution to Rs 15 (US $0.3). In Karnataka, stoves are provided free of cost to the economically backward, but the criteria are not very clear. This creates a feeling of dissatisfaction among other users who pay more for the same stove.

The subsidy structure of the Indian stove program in the six states is described in Table 2. NPIC has recently developed a new protocol, which allows only durable cement stoves (with a lifespan of 5 years) to be disseminated in all states. The central subsidy on the cement stoves has significantly increased, while the share of the beneficiary contribution is almost the same *(see Box: Promotion of New Generation… on next page)* .

The Indian stoves program has reached significant numbers of poor people with cheap stoves. Subsidies have also made improved stoves affordable for a class of people who would otherwise not be able to afford these. But the policy of subsidising stoves has some undesirable implications. The TERI and WII surveys show that the usage and maintenance rates continue to be poor among the households getting highly subsidised stoves. In some parts of Maharashtra, improved stoves fell into disuse due to poor maintenance in households that paid negligible amounts for the stoves. In Haryana, users declared that they would continue to use the improved stove as long as it lasts and then revert to the traditional stove. This indicates that stove subsidies have ensured distribution of stoves but not necessarily sustained stove use. Given that the life of these cheap stoves is very short – on an average 2-3 years, there are few benefits from such programs.

Interestingly, in successful stove programs around the world, governments have only subsidised technical support and assistance in determining where demand is the strongest. In China and Sri Lanka, the lower cost of supply in centralised production of components has enabled the out-reach of stoves to local people who do not have significant cash resources and suffer from having to spend considerable time collecting fuel**. Further, attractiveness of improved stoves differs across areas where fuel is collected. The type of areas in which people would value their stoves are those where people experience various degrees of wood scarcity and thus have begun to show interest in improving efficiency of traditional stoves. These are areas where people spend considerable time collecting fuel,

TABLE 2: SUBSIDY STRUCTURE UNDER NPIC

State	Type of Stove	Unit Cost of Stove [1]	Central Subsidy[2]	Subsidy given by State[3]	Beneficiary contribution [4]	% contribution by beneficiary
Andhra Pradesh	2 pot mud 2 pot mud 2 pot cement	148 135 190	70 70 110	63 0 0	15 65 80	10 48 42
Gujarat	2 pot mud 1 pot cement 2 pot cement	110 280 280	70 100 110	25 145 145	25 35 25	23 13 9
Haryana	1 pot cement	130	100	10	20	15
Maharashtra	2 pot mud precast 1 pot cement 2 pot cement	180 220 220	70 100 110	0 0 0	110 [5] 120 110	61 55 50
Karnataka	2 pot mud	140-190	70	23	47-97	33-51
West Bengal	1 pot mud 2 pot mud 1 pot cement	150 180 240	60 70 100	0 0 0	90 110 140	60 61 58

1 This includes charges for material of the stove and stove construction charges of Rs 20-30 paid to the SEW.
2 Central subsidy includes SEW charges.
3 In some states, state subsidy includes subsidy given by the district administration.
4 Beneficiary contribution gets reduced by Rs 10-20 further to the figures in this column whenever the beneficiary arranges for the stove material such as, mud or cement.
5 This amount gets further reduced (in some cases to Rs. 10-20) depending on the amount of state subsidy provided to the user by the Gram Panchayat.
6 Exchange rate US $1 = Rs. 47

have already had to move down the energy ladder to straw and dung, or pay cash for fuelwood supplies. In such areas, the programs have a better chance to work even without – or with minimal – subsidies. For instance, the program has been relatively successful in Maharashtra, where people typically purchase their traditional stoves and it is not uncommon for households to pay for wood fuels.

** Kirk Smith et al, 1993, One Hundred Million Improved Cookstoves in China: How was it done?, World Development, Vol. 21, No. 66, pp 941-961

Global Environmental Facility, 2000, Improved Stove Program in Sri Lanka, Paper prepared for a study on Cleaner Rural Household Fuels

Stove building to empower women

Women's participation in the stove program through stove building activities is notable in some states. This has led to financial independence amongst rural women, productive utilisation of time and opportunities for travel and interaction with people. In Gujarat, women belonging to Self Help Groups (SHGs) are trained as SEWs to build stoves. Of the total SEW charges that the SHG members receive, 10 per cent is contributed towards the SHG's collective account. In Haryana, a network of 7,000 women's groups (Mahila Mandals) supported by the Government of India's Department of Women and Child Development implement the program at the village level. The groups identify beneficiaries, motivate households and supervise stove building. Trained women SEWs build stoves. In West Bengal, a women's organisation (Asnan Ma Saradamoyee Mahila Samiti) is actively pursuing dissemination of improved stoves. Three of the 55 villages covered by the organisation have been declared "smoke free" with hundred per cent households using improved stoves. Thirty women have been trained as SEWs to carry out stove operations.

Commercialisation of Stoves

On the whole, India has not had much success with commercialisation of improved stoves. In the mid 1990s, the Ram Krishna Mission, an established NGO in West Bengal, made an attempt to promote stove dissemination without subsidy. While the Mission was successful in motivating users in its areas of operation, severe pressure from the village panchayats (village bodies comprising elected members that are authorised to make decisions affecting the entire village) made it revert to the subsidy-based program. The panchayat members feared that commercialisation of stove dissemination would dilute their influence on the community, because such rural development programs are used for furthering public relations activities.

Some success with commercialisation, however, can be seen in Maharashtra. One of the most striking aspects of the program in the state is its promotion of rural entrepreneurs who sell their products in the open market and through NPIC. With annual turnovers each of Rs. 1,00,000, the entrepreneurs are professional potters who have been trained by Appropriate Rural Technology Institute (ARTI), the state's Technical Backup Unit. Some 25 entrepreneurs operate in Maharashtra, some of whom have obtained loans from local cooperatives. Commercialisation has helped a large class of households in the state to be served who would otherwise be out of reach of NPIC. It has resulted in stove manufacturers adhering to better quality control norms and innovative designs. With modest investments, stove entrepreneurs have earned reasonable profits and are keen to expand their businesses. However, with a shift towards cement stoves *(see Box: Promotion of New Generation…)* that are costly to produce, some entrepreneurs are grappling with problems related to profit margin and working capital issues.

Source: Winrock International India, New Delhi

A two-pot improved stove in use in Maharashtra which also heats water using chimney smoke. Such innovative models are sold by entrepreneurs in the open market.

Promotion of new generation improved stoves

The Technical Backup Units of NPIC have been developing and field-testing cement stoves having a minimum lifespan of five years since January 2000. In addition to durability, these stoves offer advantages, such as ease of transportation, better quality control of materials and adhering to design specifications. Under NPIC, MNES shifted its policy in October 2000 towards promoting durable improved stoves with chimneys. The fireboxes of these models are made of cement mortar, pottery liner or mild steel sheet. Considering the high costs of these new models, estimated to be Rs.140 to Rs.250 (US $3-5) per stove, the Government of India has enhanced the central subsidy to Rs. 80 (US $2) per stove. Besides, some State Governments provide additional subsidy in the range of Rs. 10 to Rs. 50 (US $0.2-1) under State Government Budget and beneficiaries meet the balance cost. Self employed trained workers (SEWs), mostly women, who are involved in building the new generation stoves and providing free maintenance in the first year, will be given higher incentives. The Government has announced an increase in the amount of SEW charges by Rs.10 (US $0.2). The TBUs will organise short duration courses for SEWs in the building and maintenance of new models. Trainees will be given moulds, each costing Rs. 500 (US $ 11) for building cement stoves, as a part of the training.

For more information please contact Dr. K.C. Khandelwal, Advisor, MNES, Government of India, New Delhi -110 003, India at advkck@ren02.nic.in

Stove User Issues

The users are not particularly concerned about the stoves having to conform with technical specifications; rather their primary interest is a smoke-free kitchen and adequate heat generation in the firebox. Common modifications made by users include altering the pothole size and removing the grate.

In some Karnataka households, the users fixed an extra broken pipe to enhance the length of the prescribed 10-foot chimney. Some households with thatched roofs removed their chimneys during rainy season to avoid leakages inside the house through the roof hole made for the chimney.

In Haryana, people complained that improved stoves consumed more wood compared to traditional stoves. The Gujjar community in Haryana preferred to increase the size of firebox to accommodate large rotis (Indian bread) which are baked inside the box. In some households, the chimney outlet was inside the house as people were unwilling to make a hole in their roofs to allow the chimney to pass through.

In Gujarat, the size of the firebox was enlarged to fit bigger pieces of wood for burning. People also complained that the roof got damaged when the chimney was cleaned or that the chimney mouth needs to be bigger. Some households had completely broken down the improved stoves and recast it.

In Maharashtra, changing the pothole size and removal of the grate are common modifications made by users. However, unlike other states, the practice is to make the potholes smaller. Women removed the grate because of difficulty in removing hot ash from under the grate and lack of space to accommodate large pieces of wood. A majority of the households belonging to one district had cast aside their stoves as the gap between the end of the chimney and tin roof had not been sealed properly resulting in leakages during the rainy season.

In West Bengal, the diameter of the tunnel was increased to facilitate the flow of heat to the second pothole. Also, the diameter of the chimney was increased from 3 to 4 inches to facilitate cleaning and smoke elimination.

In Andhra Pradesh, people changed the pothole size, removed grates and raised the height of pothole to be able to see the flame while cooking. This leads to more fuel being used and smoke that does not pass through the chimney. Some households felt that their improved stoves used more fuel and pottery liners got cracked. In such cases, they reverted to traditional stoves. All of the problems cited above could be the focus of research and development by the Technical Backup Units, most of which are developing stoves that take into consideration user concerns.

Some reasons-why people don't adopt stoves?

- In houses with thatched roofs, installation of stove chimney leads to leakages during the rainy season.
- People cannot afford a one-time payment for the stove.
- Lack of space in the house.
- Unavailability of stove parts.

Common modifications made by stove users include altering the pothole size and removing the grate and chimney

In four of the six states surveyed, users perceive smoke elimination from the kitchen as the primary benefit of an improved stove. Following this, people value their improved stove for fuel savings, convenience due to faster cooking and cleaner kitchen. None of the respondents reported better health benefits other than reduced eye burning/cough.

RANKING OF BENEFITS OF IMPROVED STOVES PERCEIVED BY USERS

State	Smoke Removal	Fuel Savings	Faster Cooking	Cleaner kitchen due to less soot	Better Health (less eye burning/ cough)
Andhra Pradesh	4	3	1	4	2
Gujarat	1	2	3	4	5
Haryana	1	3	4	2	5
Karnataka	1	2	3	4	5
Maharashtra	2	1	3	4	5
West Bengal	1	4	3	5	2

*Ranking is based of the proportion of users that acknowledged the benefit. A rank of 1 denotes highest benefit while a rank of 5 denotes least benefit

Metallic Cookstoves

Metallic cookstoves are popular in states, such as Andhra Pradesh, Gujarat, Kerala, Madhya Pradesh, Maharashtra, Punjab and North-Eastern Region States. More than 20 small industries are manufacturing portable metallic stoves in conformity with Indian Standards IS:13152 (Part I) 1991. The thermal efficiency of a portable metallic stove is 30 to 35 per cent. In hilly areas, metallic stoves are used for both cooking and space heating purposes. A recent survey in Gujarat found that 93 per cent of the families who had received stoves a year ago, were regularly using them and reported the advantages of convenience, less smoke, saving of firewood and easy to move. Metallic stoves have also been found useful in relief camps. MNES supported distribution of 5000 community stoves in cyclone affected area in Orissa in 1999-2000 and recently directly procured and placed 4000 small size and 2000 big size metallic stoves with the authorities in district Bhuj, Gujarat, for using in community kitchens and distributing among earthquake affected families. A metallic stove suitable for a family costs about Rs. 160 to Rs. 250 (US $3-5) and MNES provides a subsidy of Rs. 50 (US $1) to Scheduled Castes and Scheduled Tribes; Rs. 75 (US $2) in notified and hilly desert areas and island states and Rs.135 (US $3) in North-Eastern Region States. A high altitude stove costs about Rs. 500 (US $11) and subsidy of Rs. 450 (US $10) is given in North-Eastern Region States and Rs 250 (US $5) is given in other States. Community stoves cost Rs 1,100 (US $23) and are not subsidised

For more information please contact Dr. K.C. Khandelwal, Advisor, MNES, Government of India, New Delhi -110 003, India, at advkck@ren02.nic.in

Interaction among Stove Users, Builders and Designers

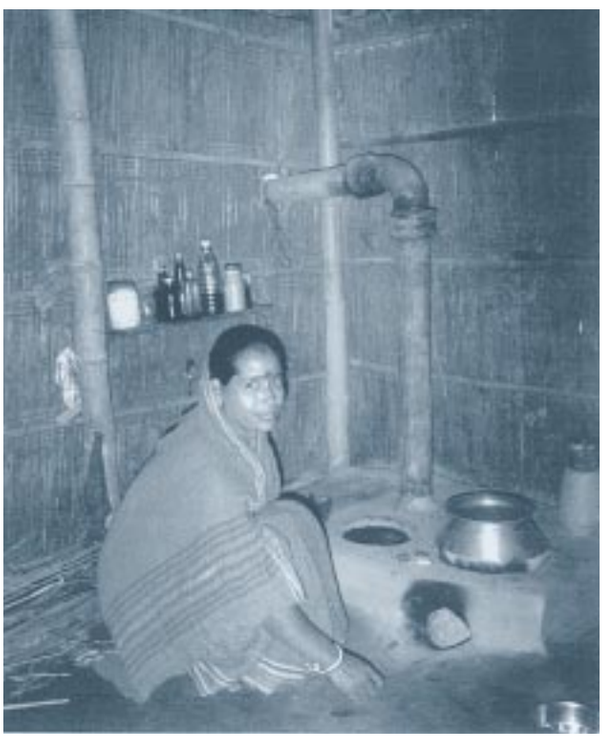
The role of stove designers to meet the needs of the users has to be strengthened.

In almost all the states covered by the survey, the close coordination and understanding among users, SEWs and NGOs is markedly absent in their interactions with the TBU. The expectations of users from TBUs in affecting changes in stove design and development have remained unfulfiled to a large extent. The users are largely unaware of the TBUs involvement in formalities of stove development and look upon the SEWs as informal stove designers.

The Karnataka survey revealed that only six per cent of the users had participated in a users training program organised by the TBU. While the TBUs conduct surveys to assess the working status of stoves, the surveys do not take into account issues relating to stove design and efficiency.

Further, the interaction between stove builders and TBUs is limited to sporadic state-level meetings, capacity building programs and feedback surveys. In most of the states surveyed, NGOs and SEWs used their ingenuity to make modifications due to the lack of technical support from the TBU *(see photo below)*.

However, even after many years of stove development, in most states, users either still have some complaints about the improved stoves and make modifications to the stove design to improve its usability. This generally points to a weakness in the feedback mechanism among stove designers (TBUs), users and producers.



Source: Tata Energy Research Institute, Gauhati

In West Bengal, NGOs have responded to user needs by replacing the roof chimney with the shorter bent chimney that goes through the wall This change has helped avoid leakages inside the house during the rainy season

Quality Control

- NPIC permits only SEWs trained and certified by the TBU to construct stoves. However, uncertified SEWs build and install stoves leading to defective construction.
- Stove parts must be bought from suppliers approved by the TBU. However, SEWs often purchase stove parts from unapproved suppliers.
- While the SEWs are responsible for providing one year's service to users after stove construction, however, they are not inclined to do this.
- No standards exist for Asbestos Cement Pipes used for chimneys. These can be procured from any suppliers

There is no uniform TBU policy to approve the modifications suggested by the NGOs. Also, users are not trained adequately by the TBUs to understand the impact of stove modifications on quality and efficiency. While the TBU's inability to address the stove design problems at the field level has resulted in lowering of quality control during construction, it has had no impact on the numbers of improved stoves installed, with higher penetration being a function mainly of efforts made by SEWs and NGOs, rather than improvement in stove design per se *(see Box: Quality Control)*.

Repurchase or Revert?

A global review of successful programs has revealed that repurchase of the improved stove is the most practical definition of sustainability*. The repurchase is unlikely to be greatly influenced by factors other than the household's judgment of relative costs and benefits.

In India, the fixed mud stove by virtue of design and construction is repaired and reused depending on the nature of the damage. Repurchase of improved stoves is not common. Most users reported that they would revert to the traditional stoves if their improved stove is broken. In Karnataka and Andhra Pradesh, people are not willing to purchase the same type of stove again. The problems faced by them are non-availability of stove parts locally and lack of skilled masons to build the stove. The NPIC policy is that villages where improved stoves are installed once are not visited again for installation. Hence, benefits of improved stove last only up to 2-3 years, which is a stove's typical lifetime.

* Douglas F. Barnes et al, What Makes People Cook with Improved Biomass Stoves?: A Comparative International Review of Stove Programs, World Bank Technical Paper, ISSN 0253-7494; No.242, Energy Series, 1994.

CHARACTERISTICS OF NPIC VIS À VIS INTERNATIONAL BEST PRACTICES*

INTERNATIONAL BEST PRACTICES IN STOVE DISSEMINATION	NPIC PRACTICES
Focus on need-based users	Target approach, stress on covering certain number of villages with saturation approach to benefit all households of the selected village at one time. Demand for stoves is not taken into consideration.
Minimal subsidy from government	Subsidy on stove accounts for the largest share (50%) of government support. Users in peri-urban areas are willing to pay greater amounts subject to guarantee on stove quality
Close interaction among the designer, producer and user	Adequate interaction between producer and user, but negligible between designer, and producer and user
Dependence on centralised production of stove and stove parts to enable out-reach to larger number of people due to lower cost of production	For fixed stoves, there is no scope of centralised production as these are built at user's homes. Mass production of stove parts (chimney, cowl, etc) undertaken by private manufacturer
Onus on producers and designers to meet needs of consumers	Consumer needs met by SEWs / NGOs through changes in stove design with low inputs from designers
Maximum support for R&D, production and distribution of stoves, credit, capacity building and publicity awareness	Inadequate support given for R&D. Support for capacity and awareness generation not adequate.
Long-term funding	Target-based funding by government, routed through nodal agencies and disbursed through NGOs for implementation

* Douglas F. Barnes et al, What Makes People Cook with Improved Biomass Stoves?: A Comparative International Review of Stove Programs, World Bank Technical Paper, ISSN 0253-7494; No.242, Energy Series, 1994.

Looking to the Future...

The future of NPIC in India is at crossroads with the latest directive to disseminate only durable models. Although many users are willing to pay for durable stoves, the economically backward users may not be able to raise the increased user contribution. Some NGOs feel that the current mud stoves should be continued, with a gradual phase-out, until acceptance of the durable model is established. At the same time, incentives may need to be provided to people to help them make the transition to a more expensive stove. Whatever steps are taken, however, the goal of any successful stove program must be to become self-sustainable over a reasonable timeframe. There is a need to distinguish geographical areas in which sustainability may be decades off from those where it is just round the corner. In all cases, the Indian stove program is obliged to plot a course that responds to demand, promotes commercialisation and entrepreneurship and leads to eventual self-reliance.

Measuring Health Outcome of Improved Stoves

While growing evidence of significant health damages from traditional biomass household cooking in India is difficult to confront, an understanding of health benefits of improved biomass stoves — vis à vis other possible interventions to change household behaviour, fuel and cooking technologies — needs to be improved. Few studies have been conducted in India to quantify the actual reduction in exposures to respirable particulate matter and resulting health benefits from the use of improved stoves in field conditions. If indeed showing a considerable impact on exposure levels and health out come, availability of this data can serve to bolster NPIC and help meet its objectives. More simply, stove users can be motivated to adopt and sustain improved stoves on the basis of its health benefits. Recently, the Ministry of Non-Conventional Energy Sources (MNES), Government of India, launched a study to examine the effects of improved stoves on indoor air quality, exposure reduction and health outcome. The study design will allow measurements of human exposure to respirable particulate matter and carbon monoxide before and after the introduction of improved stoves in households. In addition, lung function tests will be carried out to ascertain the effect of exposures. The field work is expected to begin in November 2001. Meanwhile, scientists at the Technical Backup Units have been trained for exposure assessment and medical teams are being formed and trained for the survey work in five states.

Parallel to the Indian initiative, the Chinese authorities are geared up to focus on indoor air pollution to further improve maternal and child health in two northern provinces of China. A team comprising the Chinese Ministry of Health, in collaboration with the Chinese Academy of Preventive Medicine, and some local universities will undertake an intervention-based study of improved stoves. The ultimate objective is to reduce respiratory disease and other related illness among women and children and prevent the development of dental fluorosis in children caused by exposure to coal smoke. The proposed study will assess alternative cost-effective and affordable household energy interventions (improved stoves, better ventilation, cleaner fuels) that meet community needs and induce behaviour changes for reducing exposure to indoor air pollution.

For information on the Chinese Study, please contact Dr. Jin Yinlong, Director of Institute of Environmental Health and Engineering, Chinese Academy of Preventive Medicine, at jinieche@public.bta.net.cn

For more information on the MNES Study, please contact Dr. K.C. Khandelwal, Advisor, MNES, Government of India, New Delhi -110 003, India, at advkck@ren02.nic.in

Interview

The health aspects of improved stoves have not been highlighted adequately…

NK Ganguly
Director - General
Indian Council of Medical Research
Government of India

What, in your opinion, are the knowledge gaps in the area of indoor air pollution and health?

Most of the published reports on indoor air pollutants from domestic fuel have focused on common air pollutants like suspended particulate matter (SPM), CO_2, SO_2 and NO_X. There is a particular lack of information as regards the quantitative analysis of poly aromatic hydrocarbons (PAH), aldehydes, benzene, 1, 3 butadiene and volatile organic compounds, many of which are known carcinogens. Sporadic studies carried out in India and other developing countries show that exposure to indoor air pollution results in acute respiratory infection in children, chronic lung diseases, such as tuberculosis, cataract and adverse outcome of pregnancy. However, well-planned epidemiological studies in the area are still lacking. There is also a need for experimental studies to understand the biological mechanism of health effects of indoor air pollutants. Finally, there is a need to understand the socio-behavioural aspects relating to the acceptability of improved stoves and use of clean fuels for cooking.

What are your views on the main reasons for lack of health research in the area of indoor air quality in India?

The adverse health effects of biomass fuels have been perceived only recently. Most people tend to argue that biomass has been used for centuries in India without any noticeable adverse effect. This complacency is seen even among the scientific community.

What is being done by the Government of India (particularly Indian Council of Medical Research) to address the problem?

The Ministry of Health and Family Welfare, Government of India, has sponsored a research project entitled "Health risk assessment of rural and urban population due to indoor / ambient air pollution" at a cost of Rs. 1.36 crore. The objectives of the research project are as follows:

- Develop a database on the levels of benzene, 1,3 butadiene, formaldehyde and PAHs in ambient / indoor air
- Assess the levels of relevant metabolites in the biological fluids as markers of exposures in exposed populations.
- Study the effects of pollutants using different biological end points
- Determine patterns of morbidity due to air pollution
- Suggest intervention strategies / remedial measures for policy decision making

Why does ICMR emphasise the need to address indoor air pollution and health in the Tenth Five Year Plan?

It has been estimated that about half a million women and children die of indoor air pollution in India each year. Twentyeight per cent of all deaths due to indoor air pollution in developing countries occur in India. Further, a 1997 report of the World Health Organisation states that a pollutant released indoor is one thousand times more likely to reach people's lung than a pollutant released outdoors. Given the magnitude of the health problem, ICMR will try to fill the knowledge gaps on various aspects of indoor air pollution with the main objective of identifying mitigation strategies.

Where do you feel are the avenues for strengthening the multidisciplinary efforts needed to address these problems?

In the last two decades, the Ministry of Non-Conventional Energy Sources (MNES) has strived to popularise the non-polluting energy efficient stoves. However, the health aspects of improved stoves have not been highlighted adequately. MNES can continue to act as a nodal agency emphasising on health aspects and involving other relevant ministries / departments.

Feedback

We welcome your contributions, comments and suggestions. The last date for receiving articles for the next issue is Sept. 30, 2001.

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