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Fire without smoke

Learning from the National Programme

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learning from the National Programme on Improved Chulhas

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Foreword

Traditional cookstoves have been the main device responsible for inefficient combustion of biomass in the rural areas and urban slums of India. To bring about an improvement in this field and to ensure that the cooking requirements of those who depend on traditional cookstoves and biomass fuels are met in an efficient and clean manner, the Ministry of Non-conventional Energy Sources launched the NPIC (National Programme on Improved Chulhas) in the early 1980s. The purpose of this programme was to disseminate efficient and smokeless cookstoves, but the programme had mixed success in different parts of the country. It was, therefore, terminated in 2002. Hence, it becomes critically important that the experience gained and the lessons learnt from the programme are shared by different stakeholders, so that future initiatives can be built on the knowledge and experience gained from the NPIC.

I am very happy to present this volume, which is an analytical presentation of the case studies undertaken by different organizations as part of the World Bank study, to what I hope is a large audience. The book brings together the experience and learning drawn from the implementation of NPIC in six particular states of the country. It not only dwells on programme achievements but also presents specific case studies related to different critical aspects of the programme, such as commercialization, subsidies, technologies, and training

related to cookstove dissemination. This is not a topic of marginal significance to India, as cooking constitutes 80% of rural household energy consumption and the potential for installation of improved cookstoves has been pegged at 320 million.

What I value is that this book has synthesized learnings and insights into variations in programme implementation across different socio-economic and geographical regions of the country. It also brings forth the views and experiences of all stakeholders involved in the process of dissemination of improved cookstoves. The critical issues related to dissemination of improved cookstoves discussed in the book will find wide application not only in India but in other developing countries as well. It is imperative that we take forward the initiatives undertaken in the past to provide energy-efficient options for meeting the cooking needs of rural communities and a growing population of urban dwellings, as yet unserved by modern energy options.

(R K Pachauri)
Director-General, TERI

Preface

A major section of over 720 million rural poor in India continue to depend on biomass sources for meeting their energy requirements. Most of these poor continue to burn biomass in energy-inefficient devices, locally called *chulhas*. In this context, the need for technology as a vehicle for progress is most acute in case of the poor. Different government-sponsored national programmes such as the NPIC (National Programme on Improved Chulhas) and the National Project on Biogas Development have been able to take energy-efficient and clean technologies to different corners of rural India.

Over the last three decades, the Government of India has promoted efficient varieties of improved *chulhas* through the NPIC. The Ministry of Non-conventional Energy Sources managed the programme, which was formally withdrawn in 2002. The case studies carried out in six states of India – Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra, and West Bengal – under the aegis of the World Bank by different agencies including TERI and Winrock International India, revealed that the programme was very useful in reaching out to the rural masses. The main issues that emerged were the target-driven nature of the programme, limited interactions amongst stakeholders, and quality-control-related problems wherein, owing to local pressures or laxity, the size and design of the stoves were altered.

It was revealed that though the levels and extent of dissemination varied across different states, in certain

specific cases, for instance Maharashtra, the NPIC was also moving towards a commercial mode. The case studies indicated that subsidy was not only the single most important factor for wide-scale dissemination of the *chulhas* but also responsible for distortion of the market, hindering the actual process of commercialization of improved cookstoves. The NPIC was an important vehicle for solving the problem related to cooking requirements at the rural level and perhaps what was required was not the withdrawal of the programme but restructuring of the subsidy regime towards facilitating technical assistance and commercialization.

Fire without smoke is a summarized version of the case studies carried out under the aegis of the World Bank. It focuses on deriving learnings from the different initiatives undertaken as part of the NPIC. We hope that this volume will provide insights into critical elements necessary for sustainable dissemination of energy-efficient technologies in general and of improved '*chulhas*' in particular.

We would like to express our sincere gratitude to the World Bank for supporting the documentation and dissemination of the case studies and to Winrock International India for validating the edited version. Our thanks are also due to TERI Press for producing this document and to Mr P K Jayanthan for indexing it.

Editors

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Introduction

Background

The use of traditional biomass fuels is widespread in rural India. According to the 55th National Sample Survey conducted in 1999/2000, 86% of rural households and 24% of urban households rely primarily on biomass for cooking, that is usually over 90% of all stove use in rural areas (World Bank 2003). Most rural households burn biomass fuels (wood, dung, crop residue) in inefficient earthen or metal stoves, or use open pits in poorly ventilated kitchens. This causes very high indoor air pollution, which is detrimental to health, especially for women and children.

Some of the earliest evidences linking IAP (indoor air pollution) from biomass combustion to human respiratory health comes from studies carried out in Nepal and India in the mid-1980s (Ramakrishna, Durgaprasad, and Smith 1989; Pandey 1984; Smith, Aggarwal, and Dave 1983). Since then, a steady stream of studies have linked biomass combustion and health effects, such as chronic bronchitis in women and acute respiratory infections in children (Ezzati and Kammen 2001; Smith 2000; Bruce, Perez-Padilla, and Albalak 2000; Albalak, Keeler, Frisancho, *et al.* 1999; Bruce, Neufeld, Boy, *et al.* 1998; Robin, Lees, Winget, *et al.* 1996; Armstrong and Campbell 1991). Many studies on the health effects of IAP are available in India (Behera, Jindal, and Malhotra 1991; Smith 1993; 1996; Awasthi, Glick, and Fletcher 1996; Mishra and Rutherford 1997; Balakrishnan, Sankar, Parikh, *et al.* 2002). According to

the World Health Organization, IAP caused by biomass fuels is the fourth highest risk factor to human health in developing countries. It is ranked even higher in India, where it is third, just below malnutrition, and lack of safe sanitation and drinking water (WHO 2002).

In India, a majority of rural households will continue to use traditional biomass fuels for their cooking and heating needs for many years to come. Even rural households using liquefied petroleum gas or kerosene typically continue to consume free biomass fuels that they collect from the local environment. Therefore, the improved biomass stove remains an important interim solution for millions of people who have access to cheap, readily available biomass and cannot afford expensive modern fuels. Improved stoves have the potential to reduce smoke in the cooking area—a feature that women find particularly attractive. If used properly, these stoves can also result in fuel conservation and reduction in cooking time, which possibly implies less drudgery and better health for women.

As early as in the 1950s, India instituted programmes on improved cookstoves, biogas, and energy plantations. However, the success of these programmes was limited and thus these stoves were not distributed widely. It was with the introduction and popularity of the Nada *chulha* (stove) in Haryana in 1980, and the ASTRA (Application of Science and Technology to Rural Areas) stove in Karnataka in 1983, that hope for the introduction of a national programme grew. Since 1985, the Government of India's NPIC (National Programme on Improved Chulhas) – second largest in the world after that of China – disseminated around 30 million improved stoves and over 100 different models. However, despite this remarkable effort, the adoption rates of improved stoves have been poor, with their usage accounting for less than seven per cent of the total stock of stoves in rural areas (World Bank 2002). A

1996 World Bank study in six Indian states concluded that the traditional stove is still the most commonly used stove for cooking (Table 1).

The reasons for the limited success of the programme are not entirely clear. One reason of this and other similar government programmes is that they are target-driven, rather than need-driven. A review of the history of stoves programmes around the world also sheds some light in this direction. The early programmes assumed that people would quickly adopt improved stoves and that the intervention would lead to self-sustaining programmes. There are several reasons why this did not happen often. One was the blind belief that energy efficiencies achieved in laboratories could be easily duplicated in the home; this most often was not the case. Also, some programmes failed to identify the proper market for the stoves, and introduced them in regions where people either did not buy the stove or the fuel. Further, programmes generally have not effectively promoted the health benefits of the improved cookstove to the rural people. Finally, the cost of an improved stove can be a significant barrier to adoption, especially in areas where very little expenditure is planned for stoves or fuel.

In India, while performance and achievements of the different implementation approaches of the NPIC have varied substantially across states, a clear understanding is missing on why some states have had high adoption rates, and how the lessons learned from the strong components of these programmes may be implemented. This study report examines the successful practices in the improved stoves programme in India so that future programmes may reach more people.[1] Recently, the

[1] This study report is based on an evaluation of the National Programme of Improved Chulhas conducted as part of a larger World Bank study entitled *India: household energy, indoor air pollution and health* (World Bank 2002).

Table 1 Ownership of cookstoves by states (number per 100 households)

Type of cookstoves	*Andhra Pradesh*	*Himachal Pradesh*	*Maharashtra*	*Punjab*	*Rajasthan*	*West Bengal*
Wood						
Traditional *chulha*	114	84	124	111	125	146
Fixed improved *chulha*	6	19	6.5	10	10	2
Portable improved *chulha*	0.3	4	—	0.2	—	—
Sigri	1	2	3	2	1	—
Improved kerosene stove	18	12	26	4	7	24
Solar cooker	—	2	—	1	—	—
Biogas stove	1	0.4	1	2.3	—	4
Liquefied petroleum gas stove	4	45	2	13	1	1
Pressure cooker	3	105	—	60	4	10

Source World Bank (2002)

Government of India decided to decentralize the stoves programme and transfer full implementation authority, together with responsibility for funding, to the states. In a situation when many states are at a crossroad as to whether and how to continue improved stove promotion, the evaluation reported here focuses on the lessons and factors for success so as to benefit the design of future state-level programmes. It also identifies areas in which the central government bodies are best suited to play a role and where they should retain their involvement.

Study design

The research design of the study involved selecting six states in India and conducting case studies on implementation of the stoves programme in those states. The states selected for the case studies were adjudged by a panel of experts to be among the most successful in the country. Success was measured on the basis of programmes that have achieved a high degree of both sales and sustainability. Sales are an indicator of a high adoption rate by rural households; households purchasing or refurbishing second or more stoves reflect sustainability. Apart from the higher rates of stove penetration, the six states were chosen also to reflect geographical coverage.

The method used in the study involved selecting and conducting case studies on implementation of the stove programme in selected districts of the states. A panel comprising rural energy specialists, rural development experts, NGO and government professionals, and stove scientists was formed. For evaluation the panel chose Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra, and West Bengal (Table 2) as the six states best implementing the NPIC. The evaluation does not represent the entirety of each state's improved stove programme. However, the studies provide an important

Table 2 Overview of the National Programme on Improved Chulhas in six states

States	*Type of fixed mud stoves frequently in use*	*Average stove efficiency (%)*	*Districts surveyed*	*Number of stoves installed in surveyed districts* (1999/2000)	*Number of stoves installed in the state* (1999/2000)	*Cumulative total number of improved stoves installed in the state* (1995–2000)	*Technical back-up unit*
Andhra Pradesh	Two-pot with chimney; pottery liners (*Sukhad*)	20–28	Mehboobnagar	29 112	186 000	1 259 892	Regional Engineering College, Warangal
	Two-pot with chimney; pottery liners (*Gayathri*)						
West Bengal	One-pot with chimney (*Sohini seva*)	18	Medinipur South 24 Parganas Jalpaiguri	159 076	497 589	2 093 735	Kalyani University
	One-pot coal with chimney (*Kalyani*)	22–40					
	Two-pot with chimney (*Sugam seva*)	22					
Haryana	One-pot with chimney (*Mohini*)	23	Panchkula Fatehabad Gurgaon	9 000	55 000	236 970	Punjab University, Chandigarh
	Two-pot with chimney (*Jaitan* and *Akash*)	22					

Maharashtra	One-pot without chimney (*Grihalaxmi*) Two-pot with chimney (*Laxmi*) Two-pot without chimney (*Parvati* and *Bhagyalaxmi*)	24–28	Kolhapur Satara Sangli	10 950	95 103	788 189	Appropriate Rural Technology Institute, Pune
Gujarat	Two-pot with chimney (*Mamta*) One-pot without chimney (*Sneha*)	24	Ahmedabad Surat Dangs	16 522	99 885	397 785	MS University, Baroda
Karnataka	Two-pot with chimney; pottery liners (*Sukhad*) Two-pot with chimney; pottery liners and mould (*Sarale ole*)	20–29	Mysore Hassan	4 500	59 033	438 785	Karnataka State Council for Science and Technology

Table 3 Data collection instrument for a typical state

Stakeholder group	*Data collection instrument*	*Sample size*
Users	Focus group discussions	2–3 groups in each village (each consisting of 8–10 persons)
Non-users	Interviews	7–8 persons per village
Manufacturers	Interviews	2–4 persons
Self-employed workers	Focus group discussions	2–3 per district
Implementing agency	Interviews and discussions	With key staff members in each state
Technical back-up units	Discussions	2 persons per state

understanding and insight into current and prevailing practices in the implementation of the NPIC.[2]

The research for each case study was based on user response surveys and FGDs (focus group discussions) with users, non-users, stove builders, designers, and suppliers. Concise checklists were prepared for FGDs. Questionnaires for interviewing each group were developed on the basis of the issues to be addressed. Finally, a structured questionnaire was developed for assessing the profile of the users of improved stoves (Table 3). All studies utilized similar techniques so that the states' results could be compared.

Broad parameters were established so that each programme could be reviewed objectively and the states could be compared. These parameters were the pricing of stoves, financing of the programme, extent of market

[2] TERI (The Energy and Resources Institute) and WII (Winrock International India), New Delhi, India, undertook the evaluations.

development, and identification and development of the stove types to be promoted under the programme. In addition, there was an assessment of customer service and satisfaction, operational procedures, communication and promotion, and people's general perceptions of the programme. The parameters are based on previous publications on internationally successful improved stove programmes.

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Andhra Pradesh

Introduction

The cookstoves programme in AP (Andhra Pradesh) started, with the initiation of the NPIC (National Programme on Improved Chulhas) in India in 1983/84. The NEDCAP (Non-conventional Energy Development Corporation of Andhra Pradesh) is the nodal agency implementing the NPIC. The other agencies are the KVIC[1] (Khadi and Village Industries Commission) and the APCOST (Andhra Pradesh Council of Science and Technology). The Government of Andhra Pradesh disseminates ICs (improved *chulhas*) under the IREP[2] (Integrated Rural Energy Programme).

The number of portable *chulhas* being disseminated in AP is considerably high compared to Karnataka and West Bengal. These *chulhas* are being disseminated under the various housing schemes of the state such as the Indira Awas Yojana, Rural Permanent Housing Scheme, Urban Housing Scheme, etc., since the government has made it mandatory to install ICs in the houses being constructed under these schemes.

[1] KVIC is a central government-sponsored agency under the Ministry of Rural Development, GoI (Government of India). Its headquarters are at Mumbai. The main function of the KVIC is to promote development of rural and cottage industries, and to generate employment opportunities in the non-farm sectors in rural areas. In addition, KVIC has a division called the Non-conventional Energy Cell that disseminates ICs and biogas plants in the country.
[2] IREP is a central government-sponsored scheme of the Ministry of Non-conventional Energy Sources, GoI.

Institutional structure for stove production and delivery

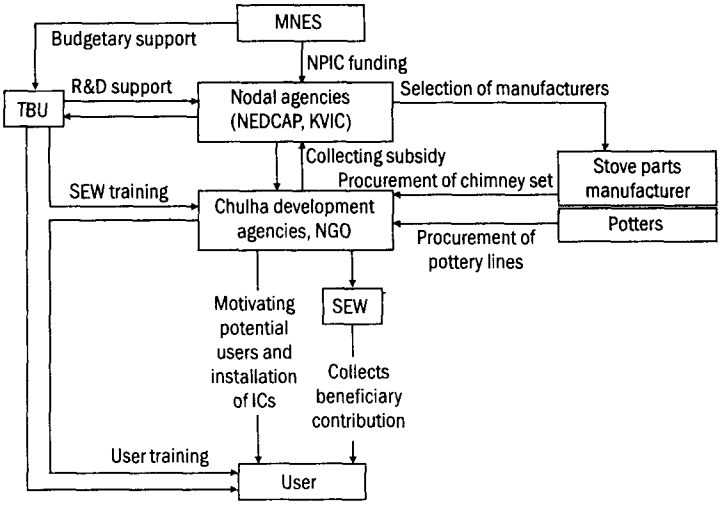
The primary objective of NEDCAP is implementation of non-conventional energy programmes (wind, solar, biogas, improved cookstove). The REC (Regional Engineering College), Warangal, which is the TBSU (technical back-up support unit) for the KVIC, is responsible mainly for providing technical support and conducting training for various stakeholders such as SEWs (self-employed workers), users, etc., who are involved with the NPIC.

NEDCAP identifies and trains SEWs at the district level, and also conducts user training programmes in each district. Some of the SEWs are entrepreneurs who have formed the CDA (Chulha Development Agency). The CDA is an entrepreneur, which invests to purchase material for the construction of ICs, has masons working under it, and also takes the responsibility of identifying the beneficiaries and installing the ICs.

Due to high targets and time constraints, CDAs tend to hire untrained masons and then train them on the job. This leads to faulty construction of ICs, leading to problems such as back smoking.

The CDAs claim subsidy from the implementing agency after installing the ICs. The subsidy amount is released after physical verification by the implementing agency. The method of implementation of NPIC in AP is given in Figure 1.

With the involvement of nodal agencies (NEDCAP, KVIC) and CDAs (entrepreneurs), the NPIC has achieved large-scale dissemination in AP. NEDCAP has its regional offices in all 22 districts of the state and is the main nodal agency implementing the programme throughout AP. It is also involved in training of SEWs and users. The nodal agency conducts a full physical verification to ensure that the IC has been constructed



CDA – Chulha Development Agency; IC – improved *chulha*; KVIC – Khadi and Village Industries Commission; MNES – Ministry of Non-conventional Energy Sources; NPIC – National Programme on Improved Chulhas; NEDCAP – Non-conventional Energy Development Corporation of Andhra Pradesh; NGO – non-governmental organization; R&D – research and development; SEW – self-employed worker; TBSU – technical back-up support unit

Figure 1 Institutional structure of the NPIC in Andhra Pradesh

in the households. The 'whole village' approach being followed stresses on covering more households rather than more villages; this has reduced dilution of the programme.

Approach to *chulha* development and production

The design and development of ICs started with the establishment of a TBSU at the REC, Warangal, in 1990/91. *Sahyog* (before establishment of the TBSU) and *Sukhad* (1989/90) were the two models disseminated under the programme. In 1994/95, the TBSU developed *Gramlakshmi*, a chimneyless, two-pot, fixed IC with pottery linings and grate.

The TBSU has been introducing modifications in IC models to make them more user friendly. A feedback survey was conducted in the villages of Unikichla and Duggondi in the Warangal district in 1991. Inspection of 240 ICs of the *Sukhad* model installed during 1989/90 was carried out in the survey. The users felt that the second pot size was too large and the feed opening was too high. Considering the suggestions made by the users, the second pot size was accordingly reduced. Other modifications were also made in the *Sukhad* model to make it more user friendly (Box 1). Similarly, as per the request of users, the TBSU modified *Aravali* ICs (catering to a larger family size of 10–12 members) by providing a fire door similar to the *Sukhad* model and

Box 1 User-driven design modification in *Sukhad*—a fixed model of ICs (improved *chulhas*)

Sukhad model IC is being propagated through the National Programme on Improved Chulhas in different parts of Andhra Pradesh. This is a chimney-type fixed *chulha*. It requires regular cleaning of the tunnel pipes and the chimney pipe, which get blocked due to formation of soot. Moreover, it is also required to seal the chimney at the roof to prevent leakage of rainwater and to eliminate fire hazards. These problems are more serious in the case of thatched-roof houses. During a feedback survey conducted by the TBSU (technical back-up support unit), it was observed that the tunnel pipes and the chimney pipe were not being cleaned regularly, and that the chimney pipe was not properly sealed. In some places the *chulhas* were demolished completely and in other places the users converted them into traditional *chulhas* because of the above drawbacks. The above feedback prompted the TBSU to develop a chimney-less, two-pot fixed model with a grate and an ash pit. Eliminating the chimney reduced the unit cost of the *chulha*.

Source REC (1995)

Box 2 Development of smaller capacity powdery biomass *chulha*

The Regional Engineering College, Warangal, developed a castable refractory line powdery biomass IC (improved *chulha*), which can work on powdery biomass such as sawdust, rice husk, crushed groundnut shells, and different proportions of these powdery fuels. With one packing with sawdust, the IC worked for about five hours. It was felt that for small size families with 2–4 members, the capacity of the IC was too large. Hence, the development of smaller powdery biomass ICs was taken up by the technical back-up support unit, and tests were conducted for thermal performance. Field evaluation studies were also conducted for the ICs.

Source REC (1998)

adding a suitable grate. It, therefore, did not gain enough popularity for large-scale dissemination.

A notable initiative of the TBSU in *chulha* development in AP was the designing of the smaller capacity powdery biomass *chulha* (Box 2). This is a one-pot portable IC. The powdery biomass *chulha*, however, is not being implemented on a large scale. This is primarily because the use of rice husk, sawdust, or groundnut shell as fuel is limited only to a few regions in the state.

Recently, the TBSU developed two durable models—*Gayathri* and *Gayathri Junior*. They are two-pot, fixed ICs, with chimney and pottery lining. These ICs are constructed using cement, brick, and rock powder. *Gayathri Junior* was developed as a result of field conclusions and feedback that indicated that the *Gayathri* model was too large for families of 5–6 members. *Gayathri Junior* is being disseminated in the state at present.

The development of the *Gayathri* model is indicative of positive interaction between the implementing agency

and the TBSU. The *Gayathri* model also easily developed cracks. This was communicated to the NEDCAP officials by the CDAs, who in turn informed the TBSU. The TBSU addressed the problem by developing the *Gayathri Junior* model.

As part of the process of *chulha* development and production, the TBSU and NEDCAP also organize training programmes for different stakeholders involved in the NPIC. NEDCAP organize training for users and SEWs. Women are encouraged to participate. For example, in 1999/2000, 58% of the participants in the SEW training programmes conducted by the TBSU were women. There is an obvious advantage in training older women as SEWs. Older women are willing to stay in the villages for 15–20 days during the construction of ICs. Younger women, on the other hand, travel to far-off villages to construct ICs only if their husbands or brothers accompany them.

Only trained SEWs, with certificates of training from the TBSU or NEDCAP, are eligible to construct ICs. However it was observed that this is not being followed strictly—CDAs do employ untrained SEWs to construct ICs. Though they help the trained SEWs, at times untrained SEWs construct ICs on their own. This leads to defects in construction and other problems, such as back-smoking. Such occurrences discourage the use of ICs.

In terms of raw material, in Andhra Pradesh, there are no prescribed standards for AC (asbestos cement) pipes. The chimney set can be procured from any AC pipe manufacturer and the only specification is that it has to be 10-feet, 3-inches long. Local potters, who have undergone entrepreneurship training under the TBSU, produce the pottery liners. NEDCAP officers ensure that the liners are produced as per the specified measurements. Cast iron product manufacturers produce the grate made of cast iron. After construction,

the TBSU conducts regular feedback surveys where operationality of the ICs is the main factor observed. Parameters such as efficiency and design are not considered in these surveys.

Financial structure and subsidy flows of programme

The funds released depend on past achievement and the target for the year. The MNES (Ministry of Non-conventional Energy Sources) releases the funds in two instalments—half at the beginning of the financial year, and the balance after the list of achievements is sent by the nodal agencies—NEDCAP and the KVIC.

CDAs and NGOs invest their own funds and implement the programme. Subsidy is claimed only after installation of the ICs and physical verification conducted by the nodal agencies. CDAs pay 20 rupees as SEW charges after construction of ICs, and give 10–20 rupees for their food expenses during the construction period.

CDAs collect SEW charges (20 rupees) and subsidy (80 rupees) from the nodal agencies. Ten rupees is given as maintenance and operation charges. This is not claimed by the CDAs, because the cost incurred for maintenance would be more, considering transportation charges and the number of visits to be made to the village. CDAs earn about 5–10 rupees per IC, which is 3000–4000 rupees per month during peak times. ICs are not installed during the rainy season (June–August).

With the introduction of durable ICs, CDAs are facing the problem of fewer ICs being constructed per day and an additional responsibility of having to transport cement. They were also of the opinion that the overhead has increased. As a result, the CDAs no longer find it profitable to invest in the IC business. Consequently, CDAs seem to be withdrawing from the

programme. For example, in Mahboobnagar district, there were 10 CDAs. However, at present, there are only six CDAs involved in the NPIC programme.

The IC dissemination in AP is solely a government programme. The large number of *chulhas* disseminated is due to the cost subsidy. Subsidy given under the NPIC is more than 50% towards *chulha* cost. The programme has achieved efficacy and has managed to reach the rural households for whom it is intended; however, its sustainability is weak.

NEDCAP claims subsidy under various schemes of the district administration to reduce the beneficiary contribution; the KVIC claims only the central subsidy. As a result, the beneficiary contribution is much less than 50% of the *chulha* cost in case of beneficiaries who receive ICs through NEDCAP. On the other hand, the beneficiary contribution is half the *chulha* cost in case of KVIC-implemented ICs. The KVIC is implementing the concrete *Sukhad* model since October 2000 in order to meet the MNES guidelines for implementing ICs with a life span of five years. The difference in beneficiary contribution creates problems for CDAs implementing the NPIC under the KVIC. The beneficiaries will not pay more (70 rupees) if they know that the stoves are available at 15 rupees. To avoid this problem the KVIC does not implement the programme in the blocks where NEDCAP is implementing. Tables 1 and 2 indicates a lack of uniform *chulha* pricing; a lack of guidelines for pricing, which lead to differences in beneficiary contribution.

Approach to marketing of *chulhas*

The CDAs take the initiative to promote ICs among potential users. They identify local leaders, local committees such as women's groups, watershed committees, Panchayat members, etc., and take their assistance in creating awareness among potential buyers.

Table 1 Subsidy towards stove cost under Non-conventional Energy Development Corporation of Andhra Pradesh

Model	*Unit cost* (rupees)	*Central subsidy* (rupees)	*Subsidy given by district administration* (rupees)	*Beneficiary contribution* (rupees)	*Material provided by beneficiary*	*Percentage contribution of beneficiary*
Gramlakshmi	52	20	27	5		9
Sukhad	118	40	63	15		12
Gayathri Junior	172	80	50	15	Rs 27 (sand and brick)	24 (cash contribution – 8)

Table 2 Subsidy towards stove cost under Khadi and Village Industries Commission

Model	*Unit cost* (rupees)	*Central subsidy* (rupees)	*Subsidy given by district administration* (rupees)	*Beneficiary contribution* (rupees)	*Percentage contribution of beneficiary*
Sukhad	105	40	0	65	61
Concrete *Sukhad*	160	80	0	70 (sand and brick – 10)	43

Manufacturing of portable ICs is done by private manufacturers located in Hyderabad. These portable ICs have been developed by the CPRI (Central Power Research Institute), Bangalore. Previously, there were three to four manufacturers, but at present there is only one.

The government is the sole purchaser of portable ICs. The manufacturer produces CPRI type 1 medium size *chulhas* and fewer of the Jumbo type. The CPRI type 1 medium size costs 180 rupees and the Jumbo type costs 1100 rupees. The Jumbo type is used in hostels and hospitals for community cooking. Government bodies such as the housing corporation, forest department, etc. purchase ICs from NEDCAP and disseminate ICs to the beneficiaries under their respective schemes. NEDCAP, on the other hand, purchases ICs directly from the manufacturer.

At the grass-roots level, there are various players in the programme such as the SEWs, potters, chimney manufacturers, and entrepreneurs. Efforts can be directed towards tapping the market potential through commercialization of ICs by strengthening these stakeholders. Local entrepreneurs can be given initial support instead of extending consumer subsidy. Women SHGs (self-help groups) are doing well in the state; the programme can also be linked to micro-credit for improving access of the very poor households to ICs.

Operation and maintenance

Of the ICs surveyed,[3] 95% were found to be operational. The SEWs explain to the users aspects such as cleaning the chimney and curing the ICs. The SEWs, however, do not visit the households after IC construction and

[3] A total of 133 wards of ICs were surveyed. Focused group discussions were also organized.

installation. There is a provision for claiming an incentive of 10 rupees for maintenance of ICs by CDAs or SEWs. The CDAs were of the opinion that the amount is not sufficient, considering the cost involved in the number of visits to be made to the households. This amount is, therefore, usually not claimed by the CDAs or SEWs.

Consequently, modifications are done to the improved cookstoves leading to decrease in stove efficiency and problems such as increased smoke levels in the kitchen. The common modifications done to ICs are increase or decrease in the size of potholes. Removal of the grate is another common practice. The pothole is often raised so that the flame is visible while cooking. This is done primarily because the women are used to seeing the flames while cooking on a TC (traditional *chulha*). Such a modification increases the consumption of fuelwood and the kitchens become smoky. Such commonly held perceptions are not dealt with in a conscious manner by the programme. Lack of follow-up after IC installation is also a major lacunae in the IC programme of AP. During the survey, it was observed that women kept a round-bottomed pot on the second pothole, which led to the problem of back smoking.

The other common problem is related to lack of availability of IC parts. For example, *chulha* parts, such as pottery liners, crack after 6–12 months of usage. These spare parts are not locally available. Parts such as chimneys are also unavailable. The benefits of ICs are thus not realized by the households. As a result, when their ICs break, people revert to traditional counterparts.

Users also follow the traditional practice of smearing cowdung or mud over the IC once a week. This causes reduction in stove efficiency. The survey found that 14% of the users did not clean the chimney at all (Table 3). Soot formation in the chimney leads to back smoking.

Table 3 Frequency of chimney cleaning by users

Frequency	*Number of households*	*Percentage of households*
Never	19	14
Weekly	22	17
Fortnightly	31	23
Monthly	48	36
Bimonthly	8	6
Quarterly	2	2
Half-yearly	3	2
Total	133	100

Such problems can be rectified if SEWs visit the villages and provide after-sales service. Though the MNES guidelines direct SEWs to provide free service for a period of one year after installation, this is not being followed.

Some of the problems faced by IC users surveyed have been summed up below (Table 4).

- *Back smoking* This problem was mentioned by 38% of the users. It was observed that women placed deep round-bottomed pots on the second pothole, obstructing the smoke from passing through the chimney, which in turn led to smoke in the kitchen.

Table 4 Problems of using improved *chulhas*

Problems	*Number of households*	*Percentage of households*
None	61	46
Pottery lining cracks	3	2
Back smoking	50	38
Takes longer to cook	3	2
Consumes more fuel	16	12
Total	133	100

They are not aware that flat-bottomed vessels have to be used for the second pothole. Such occurrences are highly undesirable since smoke removal is perceived as the main benefit of IC adoption. Back smoking could also be attributed to faulty construction by untrained SEWs.

- *Higher fuel consumption* Some respondents (12%) stated that an IC consumes more fuel. The reasons for this are faulty construction; modifications by households, which decrease the efficiency of ICs; and more fuelwood fed by women, so that the flame is visible.
- *Crack in pottery lines* Pottery lines crack in about a year's time. Once the pottery lines break, the households revert to traditional *chulhas*.
- *Limited usability* Some households stated that the IC could neither be used for large families, nor for baking *rotis* (traditional bread rounds).

The two key interventions in the IC programme of AP by which ICs can be made accessible and the programme can be made sustainable are (1) increasing the availability of *chulha* parts and (2) extending the service network. This in turn can be achieved by involving the local people, such as women SHGs. Women SHGs can especially be involved in the construction of ICs and in creating awareness.

The other policy guideline (MNES) that affects the sustainability of the IC programme is that a village, once covered, should not be selected again under the NPIC. This is followed strictly by NEDCAP and the KVIC in the state. In the absence of access to stove parts and to SEWs who can construct ICs, the beneficiary has access to an IC only once in a lifetime. On the other hand, the benefits of an IC such as a smoke-free kitchen, less drudgery, etc., last only for one or two years, which is

the life of an IC. Hence, a beneficiary can enjoy the benefits of an IC only for a limited period.

Further, the benefits desired by the beneficiaries are often not delivered. As per the survey, a majority of the beneficiaries got the ICs installed because the SEWs had told that they would also be given vessels and asbestos roofs. They had also preserved the receipts given by the SEWs, in the hope that the IC installation would be followed by such benefits. These benefits were never received by the IC users. Preliminary visits made to other districts like Vizianagaram and Anathpur revealed that SEWs commonly say that IC installation will be followed by other such benefits.

The desire to own an IC and the willingness to pay a high cost was found to exist despite the numerous problems elaborated above. For example, discussions with women indicated that users are willing to pay between 50–100 rupees for an IC, if they are given efficient and durable ICs. In reality, since the chimney lasts for five years, the user will only have to replace parts (such as pottery liners that would cost 12 rupees), and pay for construction (15–20 rupees). Hence, the user can actually have a new IC for just 32 rupees. Thus, if *chulha* parts and SEWs' services are made available to rural women, the latter would refurbish ICs (Table 5).

Table 5 Inclination to refurbish improved *chulhas*

Inclination to refurbish	*Number of households*	*Percentage of households*
Will	94	71
Will not	39	29
Total	133	100

Profile of users and non-users of improved *chulhas*

The average family size of both users and non-users is six.[4] Agriculture is the main occupation of the majority in both groups (Figure 2). It is the main source of income for 84% of the non-user households and 80% of the user households. The majority (63%) of the users are small and usually consist of marginal farmers with less than five acres of landholding (Table 6). Asset ownership, also taken as a surrogate indicator for income in the survey, highlighted that assets such as television sets (21%) and tractors (4%) are more common in non-user households than in user's household[s].

The survey results indicated that 19% of non-user and only 11% of user households had LPG connections (Figure 3). The majority (83%) of non-users had TCs.

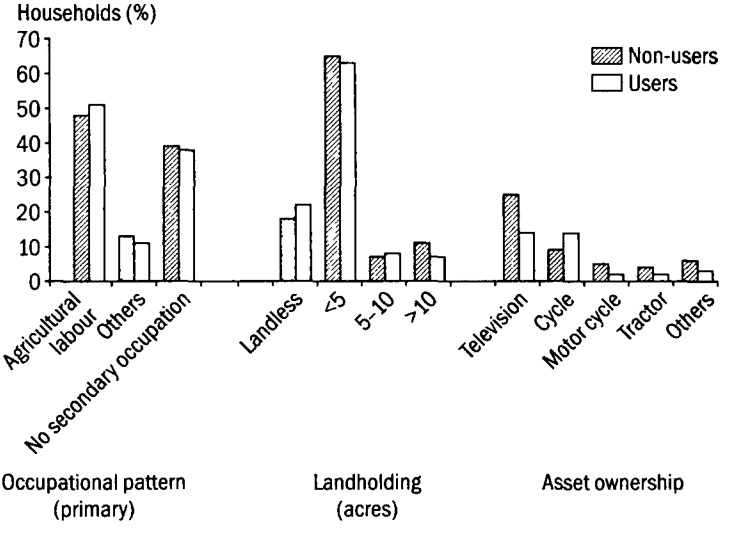


Figure 2 Profiles of users and non-users of improved *chulhas*

[4] Eighty-five non-IC users were surveyed.

Table 6 Stove devices owned by users and non-users of improved *chulhas*, by landholding category

	Liquefied petroleum gas				*Kerosene*				*Biogas*				*Electric*				*Traditional*				*Improved cookstove*			
	Non-user		*User*		*Non-uscr*		*User*		*Non-user*		*User*		*Non-user*		*User*		*Non-user*		*User*		*Non-user*		*User*	
Landholding	HH	%HH	HH	%HH	HH	%HH	HH	%HH	HH	%HH	HH	%HH	HH	%HH	HH	%HH	HH	%HH	HH	%HH	HH	%HH	HH	%HH
Landless	4	5	4	3	1	1	2	2	0	0	0	0	0	0	0	0	15	18	9	7	0	0	29	22
<5	8	9	6	5	4	5	7	5	1	1	1	1	0	0	0	0	53	62	27	20	0	0	84	63
5–10	2	2	2	2	0	0	1	1	0	0	0	0	0	0	1	1	6	7	5	4	0	0	11	8
>10	5	6	3	2	2	2	2	2	2	0	4	3	1	1·	0	0	9	11	2	2	0	0	9	7
Total	19		15		7		12		3		5		1		1		83		43		0	0	133	100

HH – household

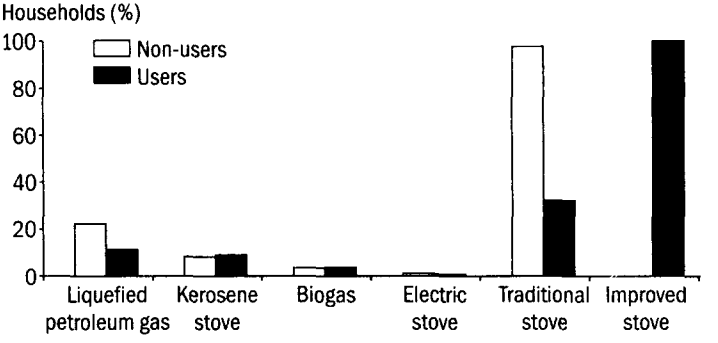


Figure 3 Stove devices used by users and non-users

It was observed that some of the landless user and non-user households had LPG connections (Table 6). They got the connections through the *Deepam* scheme of the AP government. Under this scheme, LPG connections have been given to rural women living below the poverty line where the initial fee for obtaining LPG cylinders has been reduced. However, none of these households were using LPG, and were totally dependent on biomass *chulhas*.

LPG, on the other hand, is used by IC users only for preparation of rice, tea, coffee, or vegetables. While 27% of the IC user households use LPG for less than an hour per day; 53% use it for 1–3 hours per day. In case of non-user households, a majority (84%) use it for 1–3 hours per day. In addition, 58% of user households and 57% of non-user households that have kerosene *chulhas* do not use the ICs. As in the case of LPG, the IC user households that have kerosene *chulhas* as well, use the latter for preparing tea, coffee, rice, or when cooking for guests. The limited usage of LPG and kerosene is primarily due to low availability. Hence, the improved biomass *chulhas* are still the preferred option of households. The hours of usage of ICs in the survey was found to vary along with the type of cooking (e.g. frying, baking, etc.) and the season (summers *versus* winters).

Table 7 Hours of usage of improved *chulha*

Usage per day	*User households*	*Percentage of households*
0	6	5
Only during rainy season	3	2
<1 h	0	0
1–3 h	59	44
3–5 h	62	47
5–7 h	3	2
Total	133	100

With regard to usage of ICs, the survey found that some IC user households use ICs for less than an hour a day for heating water for bathing (Table 7).[5] Other IC user households use the traditional *chulha* to make *jowar* rotis and to heat water for bathing. They felt that the rotis cannot be baked in an IC. Some were of the opinion that the IC was not suitable for large families. The traditional *chulha* is, therefore, used whenever there are guests, or during festival seasons.

Likewise, usage of ICs is also found to vary according to the season. Two per cent of the households said that they use the IC only during the rainy season and winter, and prefer to cook outside the house during summer.

Further, 21% of IC user households use TCs only in summer (Table 8). Women expressed that it was very hot during summers – the temperature rises to above 40 °C in the study area – and hence they prefer cooking outside the house. Many poor households have a TC outside the house since they live in one-room hutments with very little space for a kitchen.

[5] Nearly 47% of IC users use the IC for 3–5 hours in a day (Table 7) while 44% use it for 1–3 hours in a day. The IC is used to cook the main meal—rice, vegetables, and *dal* (pulses).

Table 8 Hours of usage of traditional *chulhas* by improved *chulha* users and non-users

Hours of usage per day	*Non-user households*		*User households*	
	Number	*Percentage*	*Number*	*Percentage*
Used only in summer	0	0	9	21
<1	1	1	13	30
1–3	52	63	12	28
3–5	26	31	8	19
5–7	4	5	1	2
Total	83	100	43	100

Consumer satisfaction

Women stated that with the use of ICs, walls in the kitchen are cleaner because of smoke removal; soot formation on the vessels is also less.[6] The women living in one-room hutments said that the smoke-free kitchen enables their children to study even while they are cooking, and that removal of smoke from the kitchen has reduced the burning sensation in their eyes. They also stated that there is less coughing because of IC usage. While using ICs they do not have to blow in the primary air for burning. Many respondents (71%) stated that cooking on an IC saves time. Convenience of heating water or cooking vegetables on the second pot with residual heat was perceived as one of the benefits of an IC. As many as 60% of the respondents stated that there is fuel saving in using the ICs. The perceived benefits of users is shown in Figure 4.

Reasons given by non-users for not adopting ICs are given below.

- Lack of financial resources and space
- Absence of some potential users: about 26% of non-users said that they were not present in the village

[6] About 100 women participated in the FGDs.

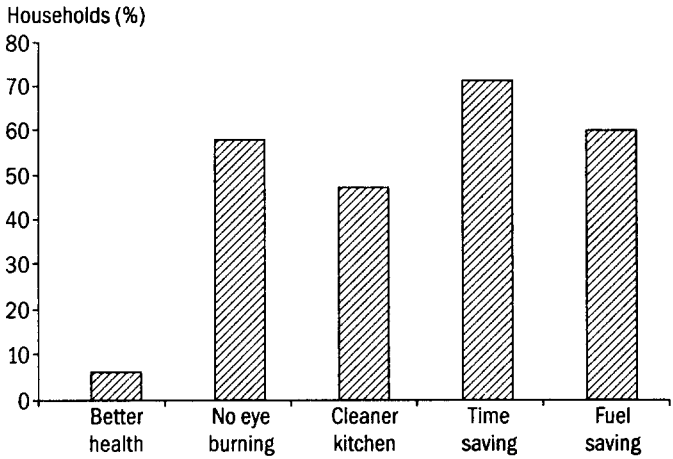


Figure 4 Perceived benefits of the improved *chulhas*

during ICs' installation. They reside in the village only during the harvest season (June–September). For the rest of the year, they migrate to far-off towns and cities where they are engaged as construction labourers.

- A few households stated that although they wanted ICs, because the chimney sets were exhausted, SEWs did not install them. SEWs transport *chulha* parts to the site only if there is a demand of more than 50 ICs.
- A few households did not install an IC because there were pregnant women at home—people's attitudes affected installation.
- Some people install *chulhas* only on auspicious days.

Conclusion

The IC programme in Andhra Pradesh is mainly a subsidy-driven government programme. The subsidy towards *chulha* cost is the main factor for adoption of ICs. It is a one-time programme where the IC is given to the beneficiaries and the benefits are accrued for two

years (the average life of an IC). Due to unavailability of *chulha* parts and services, beneficiaries revert to TCs.

To address these issues, access to IC parts should be improved. Services for IC repair should also be provided. As of now, this is not the case. Though the MNES guidelines state that consumer assistance cells are to be set up at the district level, this is not being practised.

Discussions held with users revealed that there are households that are willing to pay 50–100 rupees towards *chulha* cost. A smoke-free kitchen is the main benefit perceived by the users. In this context, IC's market potential can be tapped through awareness generation.

For sustainability of the stove programme in the state, efforts need to be directed towards commercialization of ICs. This can be achieved by providing incentives to the already existing market players such as entrepreneurs, SEWs, and potters. This is necessary until the market stabilizes, as subsidies have created wrong price signals for ICs. Accessibility of poor households to ICs can be improved by linking the programme to microcredit schemes of SHGs.

The observation in the study indicates that the transition of poor households from fuelwood (biomass) to modern energy sources (LPG, kerosene) will take many years more.[7] Till that happens, ICs can make a useful contribution to cleaner kitchens and an improved quality of life for rural women. Efforts, therefore, need to be geared towards addressing issues of access and affordability in order to strengthen the IC programme in AP.

[7] A woman was supplied LPG under the Deepam scheme of the state government but she could not afford the subsequent LPG cylinder.

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Gujarat

Introduction

The NPIC (National Programme on Improved Chulhas) was initiated in Gujarat in 1983/84 under the aegis of the MNES (Ministry of Non-conventional Energy Sources).[1] It is one of the larger programmes in the country with about 100 000 ICs (improved *chulhas*) being installed every year. All 25 districts of the state are covered by the NPIC, with an average rate of penetration of 4000 ICs per district per year. The programme focuses mainly on people living below the poverty line. A number of IC models have been developed in Gujarat over the years, but the most widely constructed types are the two-pot *Mamta* model and the chimney-less, one-pot *Sneha* model. The other programme under which ICs are disseminated is the IAY (Indira Awas Yojana). Each programme has its own target.

The NPIC is being implemented by GEDA (Gujarat Energy Development Agency), the KVIC (Khadi and Village Industries Commission), the NDDB (National Dairy Development Board), the AIWC (All India Women's Conference), the RDD (Rural Development Department), local Panchayats, and the Rural Housing and Rural Development Department. Each agency implements the NPIC independently. GEDA, which

[1] Then known as the Department of Non-conventional Energy Sources

installs 65% of the state target, has a widespread presence through NGOs that execute their target. Dissemination, however, has not been uniform across the different districts. Ahmedabad, Surat, and Vadodara in the south; Rajkot in the east; and Banaskantha in the north have the highest concentrations of ICs.

Institutional structure for IC dissemination

The RDD is the state's nodal agency for the NPIC and is also one of the two main implementing agencies in the state (the other is GEDA). The AIWC, KVIC, and NDDB handle small targets. The state-level target is divided in the ratio of 2:1 between the GEDA and RDD, with the RDD handling approximately one third of the target and GEDA handling the rest.

As part of the RDD, ICs are installed only for families listed as being BPL (below poverty line).[2] The rationale is that families above the poverty line are more likely to be able to afford other sources of energy such as LPG (liquefied petroleum gas) and kerosene.[3]

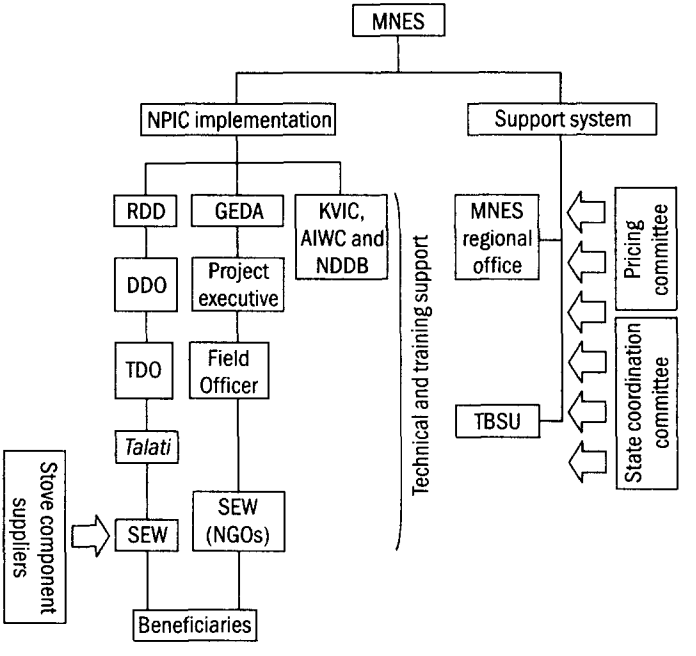
The key institutions involved in the implementation of the NPIC in the state are mentioned in Figure 1.

All the implementing agencies – GEDA, RDD, KVIC, AIWC, and NDDB – receive their targets directly from the MNES and work independently. The KVIC, AIWC, and NDDB fix state-level targets independently. There is no system in place for allotting regions to the RDD and GEDA; it is done in an *ad hoc* manner.

There are two fora that facilitate interaction between the implementing agencies. One is the Pricing

[2] Each district has a BPL (below poverty line) list that is revised every five years. The criterion for a family to be recognized as a BPL family is that its consumption expenditure per head per month should be 254 rupees or less.

[3] The study shows that the use of LPG among IC adopters (who are largely BPL households) is less than 3%. Mainly better-off households use LPG, which is widely available in rural areas of the state, with 17 private companies supplying LPG.



AIWC – All India Women's Conference; DDO – District Development Officer; GEDA – Gujarat Energy Development Agency; KVIC – Khadi and Village Industries Commission; MNES – Ministry of Non-conventional Energy Sources; NDDB – National Dairy Development Board; NPIC – National Programme on Improved Chulhas; RDD – Rural Development Department; SEW – self-employed worker; TBSU – technical back-up support unit; TDO – Taluka Development Officer
Figure 1 Implementation structure of the NPIC in Gujarat

Committee consisting of representatives from RDD, GEDA, KVIC, the regional offices of the MNES, and from the TBSU (technical back-up support unit). The Committee meets as and when necessary to finalize the unit cost that the TBSU works out for different models of ICs. The other forum is the SCC (State Coordination Committee) that comprises representatives from the same agencies and meets once every quarter to monitor and plan the programme.

The MNES has a regional office in Ahmedabad that monitors its renewable energy programmes in the states

of Gujarat, Rajasthan, and in the union territories of Daman and Diu, and of Dadra and Nagar Haveli. Apart from monitoring, the regional office is also expected to facilitate the work of the implementing agencies and represent MNES at state-level meetings.

Implementation models for ICs

The following section briefly discusses the two approaches for the implementation of the NPIC developed by the RDD and GEDA (Table 1).

Table 1 Key features of the implementation models in Gujarat

Feature	*RDD*	*GEDA*
Mode of dissemination	Through local government machinery at district, block, and village levels	Through NGOs operating as SEWs
Average annual installation rate	30 000	59 000
Target allocation	Based on district-level BPL lists as well as demand estimation made by *talati**	Based on demand estimated by each NGO/SEW
Geographical focus	Villages with high BPL populations/tribal areas	More or less equally over the 25 districts of the state
Payment to SEWs	100% of the funds are released to the SEW upon target allocation	50% advance provided for procurement of material and the remaining 50% released after stove is constructed and inspected by field officers

RDD – Rural Development Department; GEDA – Gujarat Energy Development Agency; NGO – non-governmental organization; SEWs – self-employed workers; BPL – below poverty line

* The *talati* or the *patwari* is responsible for maintaining the revenue records of the village. Usually, he or she is also the secretary of the Panchayat.

Implementation model of the Rural Development Department

RDD implements the programme through the three-tier Panchayati Raj system of government at the district, *taluka* (block), and village levels.

District-level administration

The DDO (District Development Officer), in charge of all developmental activity in a district, aggregates the *taluka*-wise requirements he/she receives from each TDO (Taluka Development Officer), and sends it to the RDD. The RDD consolidates district-wise demand to calculate the demand for the state.

Block-level administration

The TDO is in charge of the programme (at the block level) and of the supervision of *talatis*. Each block has 2–3 *Gram Sevikas* involved in the programme. The TDO informs the district-level administration of the demand for ICs in a block. The TDO also identifies SEWs (with the help of *Gram Sevikas* and *talatis*), allots them targets, and disburses funds. SEWs are generally masons trained in *chulha* construction by the TBSU and sometimes by NGOs who have been identified by the TDOs. SEWs are responsible for procuring material for ICs. The *talati* is expected to inspect all the *chulhas* constructed every year, and the TDO is expected to inspect 10% of them.

Village-level administration

The *talati* is responsible for motivating people in his/her village, identifying beneficiaries, estimating demand, and inspecting *chulhas* after construction.

As mentioned above, although the *talati* and TDO are responsible for inspecting constructed ICs, the government plays no role in procurement of the material; SEWs do that directly. The RDD has, therefore, little control over the quality of stoves constructed.

Implementation model of GEDA

GEDA, on the other hand, works with NGOs to disseminate ICs. It allocates a small target to each of the NGOs already working in different areas of the state, and monitors the NGO's performance closely. Based on feedback in inspection reports regarding the NGO's performance received from GEDA's field officers the NGO is either dropped or allocated a higher target the following year.

The selection of villages is done by the NGOs themselves—they prefer to work in villages where they already have a good rapport and are reasonably confident of achieving their target. The NGOs have to ensure that at least 10% of the beneficiaries under the NPIC belong to the Scheduled Castes, and at least 20% to the Scheduled Tribes. Some NGOs (such as the Gujarat Rajya Shramik Vikas Parishad) systematically collect information on the firewood situation, population, type of house, fuel used, etc. to identify beneficiaries. Other NGOs (such as the Mahila Khadi Gramodyog Trust) rely on more informal methods, such as personal contact with the *Sarpanch*.[4]

Chulha masons are generally associated with the NGO and also work on other programmes of the NGO. They could also be selected at the village level and trained further by the TBSU. These masons can be either full-time employees with the NGO, in which case they work on several of their programmes or part-time employees, whose services are called upon *ad hoc*. Some NGOs maintain a pool of skilled *chulha* masons in different districts who are again called on an *ad hoc* basis and are paid on a piecemeal basis.

The NGOs procure material directly from dealers; the implementing agency does not play any role in this

[4] *Sarpanch* is the village headman.

Box 1 Variations in *chulha* prices

The cement *chulha* (*Unnat* model) disseminated by the NGO Gramya Kamdar Seva Kendra, Junagadh, costs 210 rupees, while the subsidized price paid by the beneficiary is 20 rupees. The NGO Parabat Bhai Ma Kavaira, Porbandar, installs the same model for 220 rupees, while the beneficiary has to pay a subsidized price of 80 rupees.

process. In fact, there are no government-approved dealers in Gujarat for procuring material. The chimney, tunnel, and cowl are procured from sanitaryware manufacturers, both within the state and outside. Consequently, the rate at which material is procured varies considerably from one NGO to another, and so do their construction costs and overall earnings (Box 1).

The main success factor of GEDA's implementation model has been the spread of its programme to all the districts of the state without an increase in its staff.[5] It also allows the NGOs flexibility in adopting implementation mechanisms.

Stove development, technical support, and training

The TBSU[6] (Gujarat University, Vadodara) is the key technical support and training provider to agencies/NGOs/SEWs implementing NPIC in the state. The TBSU provides training to SEWs in the construction of ICs. The TBSU also prices the ICs and develops appropriate models on the basis of feedback from users and SEWs.

[5] Currently, GEDA has a workforce of about 70 people of which only 8%–10% work on the NPIC.
[6] The TBSU's staff includes a senior scientific officer, a senior research assistant, a senior technical assistant, two master craftsmen, and an assistant.

In training programmes for SEWs, potential SEWs are instructed on how ICs work, how they are superior to traditional *chulhas*, and what their benefits are. This is done in addition to training in IC construction so that the SEWs can provide correct information to the beneficiary and also motivate them. The TOT (training of trainers) programme is similar to the SEW training programme, but aims to develop a human resource base capable of transferring the technology to other masons and potential SEWs. Entrepreneurship training programmes seek to encourage SEWs to take up IC construction and other such programmes as a business and thereby venture into the open market.[7] User education programmes are similar to user camps organized by implementing agencies in which users are informed about the NPIC, benefits of the ICs and their maintenance. Management training programmes are organized to orient the implementing agency staff, including NGOs and government officers, in the implementation process of the NPIC.

Technology development and interaction between designers, stove makers, and stove users

In order to promote and test IC models developed by the TBSU in the field, 5–6 demonstration villages are chosen every year where the TBSU motivates people to construct ICs and implements the programme on their own. This exercise aims to work as a demonstration model for the surrounding villages and to provide feedback for use in management training programmes.

[7] The main constraint in promoting entrepreneurship development based on ICs is the lack of capital. The TBSU is now considering the possibility of establishing collaboration between an established entrepreneur or businessman and a skilled *chulha* mason to promote entrepreneurship.

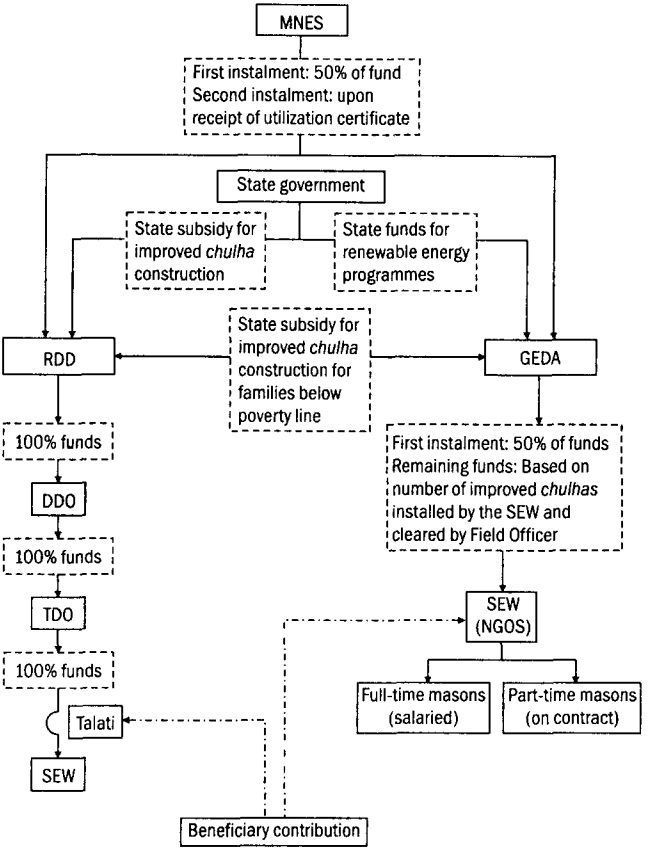
Financial structure and subsidy flows of the NPIC in Gujarat

In Gujarat, ICs are financed by the MNES (central government), by the state government (through the RDD), and by the beneficiaries (Figure 2). Both the MNES and the state government provide subsidies. The state government provides a subsidy exclusively for BPL families (families below the poverty line). The IC programme is given considerable importance by the state government as it is one of the main agendas of the 20-point programme. The subsidy structure for ICs is given in Table 2.

The fund release pattern to the RDD and GEDA varies (Figure 2). The RDD gets funds from the MNES and from the state government. The MNES subsidizes the ICs in two instalments—half the fund is disbursed around June, and the other half is disbursed once a utilization certificate is submitted. As mentioned above, the state fund is used to construct ICs in BPL households only. GEDA receives state subsidy through the RDD and uses it solely for BPL households. GEDA also receives a fund directly from the state government to implement other renewable energy programmes. Sometimes, it diverts part of this fund to the NPIC.

Table 2 Subsidy structure for improved *chulhas* in Gujarat

Subsidy structure	Mamta *model* (mud)	Mamta *model* (cement)
Central subsidy (rupees)		
Material	40	80
Self-employed worker charges	20	30
State subsidy	25	145
Beneficiary contribution	25	25
Total cost	110	280



DDO – District Development Officer; GEDA – Gujarat Energy Development Agency; MNES – Ministry of Non-conventional Energy Sources; NGOs – non-governmental organizations; RDD – Rural Development Department; SEW – self-employed worker; TDO – Taluka Development Officer

Figure 2 Financial structure and subsidy flow of the National Programme on Improved Chulhas in Gujarat

Organizations such as the AIWC, NDDB, etc. which get country-level targets from the MNES, do not have access to state government funds. This means that there is no fixed beneficiary contribution for ICs in Gujarat. The beneficiary's contribution depends on the

implementing agency operating in his or her village and if he or she is in the BPL list of the state government.

For ICs installed under GEDA through different NGOs, the beneficiary's contribution depends on the NGO's approach. Some NGOs do not take any contribution from BPL families. In many cases, the RDD takes beneficiary contributions in the form of labour and not cash. GEDA disburses the second half of the subsidy amount in small instalments after the NGOs submit completion reports and GEDA's field officers, who inspect all the *chulhas*, submit inspection reports. Its main constraint is that it has very few (three) field officers.

Quality and after-sales service

Working condition of ICs[8]

Most ICs (96%) covered by the study were found to be in working condition. More than 30% of users had modified their stoves: most (17.7%) had increased the pothole diameter. Users had either changed the size of the pothole or had inserted three nails inside its rim to fit small vessels. Mud plastering seemed to be the only maintenance done. Almost 36% of the respondents admitted to cleaning the chimneys of their ICs only once in three months or even less frequently, and 32% had never cleaned the chimneys, although 73% of these users had attended users' training programmes.

Consumer satisfaction

The most commonly stated benefit was the reduction or elimination of smoke—86% of users interviewed said

[8] Seventy-five users were interviewed using a pre-designed questionnaire to develop a likely profile of users and assess consumer satisfaction. As many as 66% of households covered by the survey had two-pot *chulhas* constructed in 2001. All cement *chulhas* inspected (20%) were constructed in 2001.

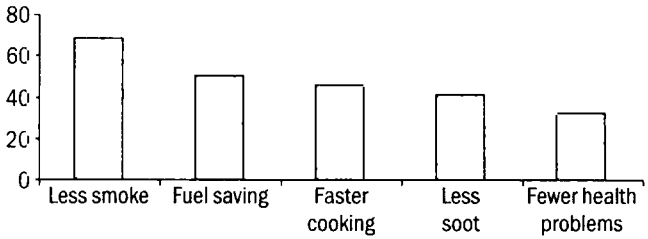


Figure 3 Perceived benefits of improved *chulhas*

that their cooking environment was cleaner. The facility of cooking on two pots simultaneously was also highlighted as a benefit (Figure 3).

The problems reported in using ICs were not significant; over 62% of respondents had no problems.

Plans to repurchase

Repurchase of ICs is not a common practice in Gujarat. When users were asked what they would do when their ICs broke, the most common response was that they would revert to their traditional *chulhas*. Despite the TBSU's efforts, IC construction has not yet taken off as an entrepreneurial activity. Some users are able to reconstruct mud ICs (with some deviation from specified dimensions), but this depends on the condition of the chimney pipe—if it is broken, they construct a traditional *chulha*. ICs are sometimes repurchased if the SEW lives in a neighbouring village and is easily accessible.

With the introduction of cement ICs, the repurchase scenario is likely to change. At present, there are not enough cement *chulhas* in the state for people to have formed an opinion about them. However, on the whole, the change from mud *chulhas* to cement *chulhas* has been received positively. The problems foreseen in the repurchase of cement *chulhas* are the inability of users to reconstruct cement ICs and the low probability of a

BPL family paying 280 rupees (*chulha* cost and SEW charges) for a *Mamta* model cement *chulha*.

Constraints in the IC programme

Some bottlenecks in the implementation of the NPIC in Gujarat are listed below.

Mislaid emphasis The emphasis of the NPIC in Gujarat seems to be only on IC installation, rather than also on following up with beneficiaries to ensure that ICs are used and maintained properly. Ensuring that the stoves work, controlling quality and generating awareness are extremely important. These are lacking to a large extent in NPIC implementation.

Lack of coordination There is also a lack of coordination among implementing agencies. At the field level, the *talati* plays a key role in avoiding cases of overlap between the district administration's and GEDA's implementation of the programme, as he/she is always consulted before a village is selected. However, there are no efforts to explore synergies in the functioning of the two implementing agencies. As a result, the RDD ends up disseminating ICs even in areas that have a good NGO network and vice versa.

Full subsidy has proven to be a hindrance Providing the ICs practically free of cost to the beneficiary tends to work against the programme in the long run. Past experience in the implementation of developmental activities has demonstrated that for a programme to be successful, involvement of the beneficiary, especially in monetary terms, is very important as it nurtures a sense of ownership and thereby the proper upkeep and maintenance of the 'product'.

Poor quality control system The existing system of quality control is poor. Unlike the states of Haryana and Maharashtra, where stove component suppliers for the NPIC are identified and certified by the state

government, there is no such identification done in Gujarat. The SEWs can procure the raw material from whomsoever they choose which results in a compromise in stove quality. There are also quality problems relating to the work of NGOs, evident from the high turnover rate in GEDA's programme. According to GEDA, almost 20% of the NGOs have to be dropped every year due to poor performance and quality of the ICs constructed. The staff number responsible for inspection and quality control in GEDA (three field officers for the entire state) is grossly inadequate to perform its monitoring function.

The R&D process is not user-driven Finally, there is a need to strengthen the R&D (research and development) function and the feedback process to match the IC to the user needs. For example, the *Sneha chulha*, being constructed in the Dang area does not fulfil the needs of the people. Therefore, the traditional *Dangi chulhas* are constructed right next to the IC, making its improved features redundant.

Successful practices in the implementation of the NPIC in Gujarat

Certain practices in the implementation of the NPIC in Gujarat that may be replicated in other areas or states are discussed below.

State-level policy commitment

The NPIC is part of the 20-point programme: a yardstick for measuring the performance of the state administration. Therefore, even though the funds allocated to the IC programme are small, the state government machinery pays considerable attention to it. Two important functions of the state government's financial contribution in the dissemination of ICs are that it makes ICs available to the BPL households (who

need it most and who would not be able to afford them otherwise), and it ensures that people who prefer chimney-less *chulhas* (in Dang, for example) can also benefit, as the central government does not subsidize chimney-less *chulhas* any more.

Integration of NPIC with other rural development programmes

The effort to integrate the NPIC with other programmes in the state is worth noting (Box 2). ICs are installed in houses built for the BPL households under various housing schemes for the poor. The rationale is that the family that is allotted the house also gets an IC. It also makes the implementation process easier for the RDD.

Box 2 Integrating the NPIC (National Programme on Improved Chulhas) with other rural development programmes

In Surat district in south Gujarat, the NPIC is linked to SAY (Sardar Awas Yojana): a rural housing scheme supported by the state government. Integrating the NPIC with SAY saves the local administration time and resources in promoting the *chulha* programme separately, and also helps to get a pre-identified set of beneficiaries. The state government adopts a cluster approach to implement the SAY. In each cluster, a local institution is assigned the responsibility of implementing the entire programme—right from hiring an engineer to ensuring that the work is successfully completed. Each cluster has an SO (Section Officer) who oversees the construction and is the technical hand of the TDO. The SO, who is trained by the technical back-up support unit, trains selected people in villages, creating a pool of skilled self-employed workers. The fund for the SAY is released in three instalments; the final one is released upon completion and inspection of the structure. This mandatory inspection report serves as a mechanism for ascertaining that improved *chulhas* have actually been constructed in the new SAY houses.

Decentralization of the IC programme

The devolution of the IC programme to the *Panchayats* and its implementation through the three-tier *Panchayat* system is a positive step as it ensures implementation by people closest to the beneficiaries. This system of implementation ensures that the actual demand for ICs is conveyed to the state nodal agency effectively (through the *talati* in every village) and is reflected in the targets that are sent to the MNES for approval.

A focused approach

The RDD has adopted a focused approach in implementing its development projects. Instead of spreading its efforts thinly over a large population, it concentrates on a small population, and tries to improve their well-being with its resources.

Involvement of NGOs

Involving NGOs to implement the NPIC is effective, because of the following.

- NGOs implement the programme in or around villages where they work, and where they understand field conditions well.
- NGOs feel motivated to implement the programme since they need to maintain their credibility; they are to continue working in the same area, and so often promote the programme with their own resources.
- NGOs spread awareness about ICs to a large population in a variety of ways: one way is through village-level institutions such as women SHGs (Box 3).
- The procedures and processes of NGOs are more flexible than those of large administrative or bureaucratic bodies. They, therefore, can easily adapt their strategy to suit specific requirements; for example, an NGO (Gujarat Rajya Shramik Vikas Parishad) has successfully innovated a way to persuade women to work as SEWs—otherwise always a difficult proposition (Box 4).

Box 3 Disseminating ICs (improved *chulhas*) through village-level institutions

BAIF (Bhartiya Agro Industries Foundation) implements many programmes in 11 villages of Surat district. It operates as a self-employed worker that implements the National Programme on Improved Chulhas through SHGs (self-help groups). It obtains targets, funds, and material from the ATRC (Agricultural Tools Research Centre). Over the last four years, BAIF has installed 2300 ICs. BAIF selects a few of the executive committee members of each SHG and trains them in constructing ICs at camps that are usually held at the ATRC campus so that the women do not have to travel far from home. After training, they return to their village and train other members of the executive committee. This skilled workforce motivates potential beneficiaries in their village and also constructs ICs. SHG members work in teams of two. These teams are accompanied by field guides, who are women trained in IC construction. SHG members contribute 10% of the fee that they receive to the SHG's collective account.

Box 4 Adapting an implementation strategy to ensure the participation of women SEWs (self-employed workers)

The Gujarat Rajya Shramik Vikas Parishad is an NGO (non-governmental organization) that implements the NPIC (National Programme on Improved Chulhas) for the Gujarat Energy Development Agency. To motivate women to participate in the *chulha* construction process, the NGO has restructured the same into three distinct phases.

1 Construction and installation of unit
2 Fitting of chimney
3 Maintenance of unit during the warranty period

Women often do not work as SEWs as they find it difficult to climb onto the roof and fit the chimney. This new process enables women to participate in the construction of the *chulha* unit and in its maintenance. The NGO feels that such a phased construction of the ICs also generates more employment under the NPIC.

Conclusion

The implementation of the NPIC in Gujarat follows different approaches and models. While it cannot be called an unqualified success, many facets of the programme's dissemination processes are worth examining, and may be summarized as follows.

- Focus on BPL families
- Integration of the NPIC with rural housing schemes
- Involvement of a network of NGOs to disseminate ICs in villages in all parts of the state
- Autonomy given to NGOs in their IC implementation strategy.

Haryana

Introduction

The NPIC (National Programme on Improved Chulhas) started in Haryana in 1983/84 . According to the DWCD (Department of Women and Child Development), the state's nodal agency, approximately 48% of rural households have been covered till now. The annual achievement of the programme in recent years has been 55 000 to 60 000 *chulhas* (stoves) (Figure 1).

Work on improved stoves in Haryana started in 1980 when the *Nada* model was developed under a Ford Foundation programme. The *Nada chulha* is a simple modification of the traditional two-pot *chulha* to which a chimney is attached. In order to address some of the problems faced in the use of *Nada chulha*[1], the Energy

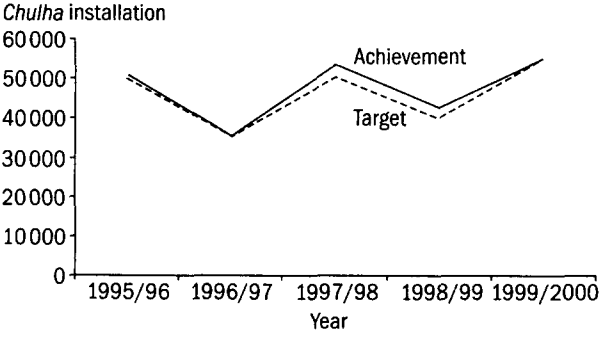


Figure 1 Improved stoves installed under the National Programme on Improved Chulhas in Haryana

[1] Dampers were perceived as an unnecessary inconvenience and were often removed by the users, which affected stove efficiency.

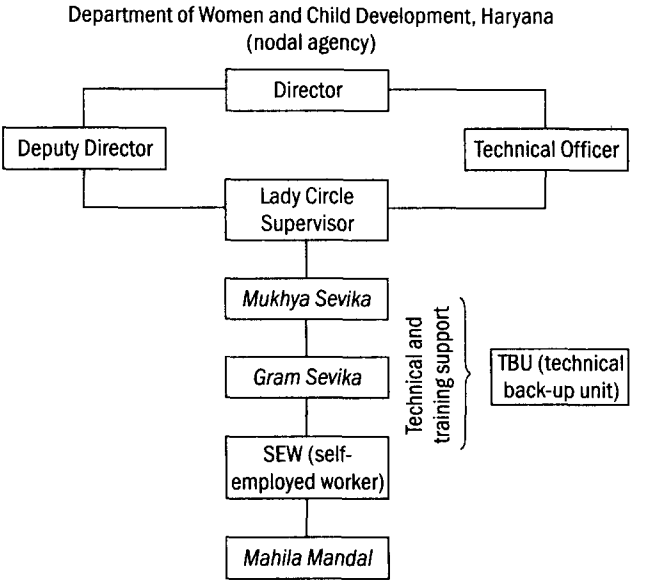


Figure 2 National Programme on Improved Chulhas structure in Haryana

Approach to stove development and production

Stove development

As mentioned in the previous sections, the *Nada chulhas* installed during the initial years of the programme had dampers, which were found to be inconvenient by users. Damper-less *chulhas* were, therefore introduced in the mid 1980s. Since then, several modifications have been made in the IC design to suit users' varied needs. For example, the baffle, which was introduced in 1988, enabled the second pothole to retain heat. Presently, several models (both one-pot and two-pot) of ICs are being promoted in the state. The main models include *Jaitan*, *Akash*, and *Mohini*. While the *Jaitan* model can cook food for up to 8 persons, *Akash* can cook food for 8–15 persons. A further improvement was the

incorporation of a grate at the bottom of the firebox that increases the combustion efficiency. The *Mohini* model caters to smaller and poorer families and occupies less space. Besides ICs for cooking, an improved design of the traditional *Hara* model has also been developed. In Haryana – a milk-surplus state – milk is simmered throughout the day to keep it from souring. Cowdung cakes are used as fuel. The traditional *Hara* is thermally inefficient and extremely polluting. The TBU accordingly developed a model called *Sohini* that allows large quantities of milk to simmer more efficiently all day long. The subsequent modification was a combination of *Mohini* and *Sohini–Hara* models (called the *Mohini–Hara* model) in response to demand for a small *chulha* that could simmer milk. The TBU has also modified the *tandoor*, used traditionally in the region to bake *rotis* (Indian bread).

After extensive R&D, new models of cement ICs have also been developed and field-tested. One of the pottery stoves, the *Sudha* model, is said to have an efficiency of 42%. However, these cannot be constructed in the traditional kiln because they cannot maintain a temperature of 900 °C throughout the baking process, which this model requires.

Interaction between designers, stove makers, and users

Surveys that provide continuous user feedback form an important component of the stove development process of the TBU in Haryana. These surveys also help the TBU to assess the quality of the SEWs' work and understand the problems they face in building stoves. Another regular forum for interaction between users and designers are the users' camps. Unfortunately, the TBU is too understaffed to attend all such users' camps.

Stove delivery

With reference to the process of stove delivery, the method of target allocation is fairly straightforward. The total target for the state is distributed among the districts, and the district target is divided equally between the blocks. The typical target for a block is 500–600 *chulhas*.

The ICs are constructed by SEWs who are village women trained in *chulha* construction. All SEWs in Haryana are village women identified by the *Gram Sevika*s.

Once the raw material reaches the village, *chulha* construction work is undertaken by the SEWs under the supervision of the *Gram Sevika* (Figure 2). According to the SEWs, *chulha* construction is not a remunerative occupation. On an average a SEW can construct 4–5 *chulhas* in a day. After deducting the bus fare (to and from the construction site) from the SEW's fee, the income from every two-pot *chulha* constructed is 25–30 rupees. During the *chulha* construction season (usually January to March), a SEW can earn up to 100 rupees per day. However, *chulha* construction provides a livelihood for only 3–4 months a year. Though the work is not very remunerative, the motivation to have a so-called 'government job' seems to be the driving force for the SEWs.

SEWs have to ensure that the ICs they construct function for at least a year. They make at least two visits to the village where they have installed ICs. Typically, they make their first visit three months after installation and their second visit 6–10 months after installation. Their payment schedule is linked to these visits. In case of complaints, the SEW repairs the faulty *chulha*.

Quality control

The DWCD has instituted several mechanisms to ensure the quality of *chulhas* constructed by the SEWs. The

SEW fee is directly linked to the functional status of the *chulhas* constructed. In case a *chulha* is found faulty, the SEW is required to construct it again at no extra charge. The DWCD has also designed a three-level monitoring system for the NPIC. At the village level, the *Mahila Mandal* exercises some control over the quality of stoves constructed. In case of problems, the *Mahila Mandal Pradhan* informs the DWCD staff, and the SEW is recalled to repair the faulty *chulha*(s). At the second level, the *Gram Sevika*s keep in regular touch with the villages (both for the NPIC as well as for other DWCD programmes). Each *Gram Sevika* visits 20–25 villages every month to check the *chulhas* constructed and then reports, in a standardized format, to the LCS (Lady Circle Supervisor) the number and status of *chulhas* examined. The LCS monitors the status of the *chulhas* at the district level. Similarly, the supplier of stove parts has to pass the quality control test as well, which involves a physical inspection of the pipes by the DWCD staff, usually the LCS. Samples are then tested in the Public Works Department Laboratory (at Rohtak) for physical characteristics. The supplier is allowed to supply material only after the laboratory clears the sample for quality.

At the start of the financial year, the *Gram Sevikas* and *Mukhya Sevikas* start identifying villages, relying on their well-established rapport with the local community. Normally, only villages where the *Gram Sevikas* are confident of motivating at least 50% of the households to install ICs are selected. Awareness camps are then organized in these villages by the DWCD staff (through interactive collaboration with the *Mahila Mandals*), which are attended by village women. An improved and traditional *chulha* is also constructed (generally in the *Pradhan's* home) for demonstration purposes. This is followed by a pre-installation survey. At this stage, the beneficiary's contribution is collected by the *Gram*

Sevikas. The village-wise demand is worked out and consolidated at the block level, which is then forwarded by the LCS in the form of material requirements—such as pipes, clamps, etc. to the DWCD (for an entire district). The DWCD forwards the requirement to a certified supplier.

In Haryana, all raw material for government programmes is sourced centrally by the Directorate of Supplies. The supplying agency is selected by the DWCD by inviting bids. The agency is signed up for a term of two years. Once cleared, the contractor transports the raw material to the concerned block office. The *Mukhya Sevikas*, who are ultimately responsible for the cartage, pay the transporter some percentage of 5 rupees (which is allocated for transportation per *chulha*) to deliver the material directly to the village. This saves a round of unloading and then reloading from the block headquarters, and reduces the chances of breakage.[3] The suppliers find it financially viable to supply IC pipes to the government at a price lower than that of the market (market price is 120 rupees per pipe, while one supplier charges 44 rupees per pipe), because of the large volume and assured demand. A particular company supplying chimney pipes under NPIC in the state had an annual turnover of 2 million rupees (1999/2000).

Training

Training is an important component of the implementation process. Different training courses are held for the five broad types of stakeholders in the NPIC. They are

- courses and camps for users,

[3] Extra pipes are generally sent to account for any damages during transportation.

- management courses for officials of nodal departments at state, district, and block levels, and representatives of NGOs, Panchayats and local bodies, etc.,
- training courses for newly-recruited SEWs,
- courses for entrepreneurs, and
- training courses for trainers.

The TBU teaches the technical aspects, and *Gram Sevikas* and *Mukhya Sevikas* deal with the more general aspects of the programme. The TBU is quite stringent with the training of SEWs; it certifies them only after they have passed the required test. Refresher courses are also organized and serve as a forum for the TBU to collect feedback from the SEWs and the DWCD staff. On an average, 5–7 *chulha* construction training programmes, 15–20 refresher courses, and around 100 user awareness camps are held every year. The Haryana TBU has been conducting training courses for other states as well. They also develop training capsules for officials of the department and representatives of the *Panchayat* and NGOs.

Financial structure and subsidy flows of the programme

The IC programme in Haryana is funded by the MNES through the NPIC. The MNES gives a grant of 750 000 rupees, which is released in three instalments. Salaries have to be covered entirely from the state's budget. In 1998/99, the central outlay for the NPIC formed just 0.1% of the total central outlay for the DWCD. Similarly, the expenditure on NPIC formed 1.3% of the total state expenditure on the department's programme. On the other hand, *Gram Sevikas* and *Mukhya Sevikas* spend 90% of their time in NPIC related work.

The DWCD staff keenly feel that the effort they invest in the programme is disproportionately high to its

share in the department's total outlay. In addition, there are no financial incentives for the DWCD staff under the NPIC. However, *Mahila Mandals* receive cash awards of 1000–2000 rupees, based on their performance.

As of now, much of the actual cost of the stove is subsidized. Users contribute 20 rupees towards the actual cost of the stove; this is less than 20% of the cost. It is clear that subsidies have played an important role in propagating the use of ICs in Haryana. However, at the same time, the perspective of the user towards ICs also indicates that subsidies have devalued the stove programme in the state. Users are unwilling to pay anything more than what they are already paying for mud ICs. Despite wanting to own an IC, women who could not be covered under the NPIC did not get an IC installed at a non-subsidized price. The common opinion is that the government should subsidize at least half the cost of the IC.

The perception of *Gram Sevikas* and *Mukhya Sevikas* further corroborates the notion that subsidies are crucial to the success of the programme. According to them, it is difficult to persuade families to buy ICs even at a price of 20–22 rupees. According to the SEWs, women prefer to wait until their village is covered by the NPIC rather than pay the unsubsidized amount and get ICs constructed by SEWs on their own. Often women say they want the IC but cannot spare the money. At times the *Gram Sevikas* have to lend them money for an IC.

Approach to marketing of stoves

While the original intent of training village women as SEWs was to encourage them to be independent entrepreneurs, this has not actually happened. In the present set-up, SEWs are identified by the *Gram Sevika*s, trained in construction of ICs, and given targets depending on the total target and on the number of

SEWs in the area. There are very few SEWs who venture out of their block to construct ICs. Also, the SEWs only construct the *chulhas*; they have no role in motivating potential stove users or in developing a market for ICs. All the users are identified by DWCD staff.

Functionality and maintenance

Around 58% of the IC owners surveyed had one-pot *chulhas*, especially in the poorer villages.[4] Women in the Mewat region of Gurgaon did not know that they could choose between one-pot and two-pot *chulhas*. The SEWs had assumed that the women would find it difficult to pay 20 rupees for the two-pot *chulha*, and hence, had not informed the women about it.

In 1999/2000, information collected from a random sample of 879 beneficiaries in 51 villages showed that 86.1% were using their ICs, 7.2% were not, and 6.6% had broken *chulhas* (Figure 3). The improved cookstoves (mud ICs) last between six months and two years.

Among the ICs surveyed, some dysfunctionality was reported in older *chulhas*, but all ICs constructed in 1999 and 2000 were in working condition.

Common user-made modifications to ICs in Haryana were alterations of the pothole and of the opening of the firebox (30%) (Box 2). Most women regularly plaster their ICs with mud as they do for traditional *chulhas*. Other than this, there is no maintenance at all. Many women did not even know that the chimney of the IC had to be cleaned regularly. Almost half the IC users had never cleaned the chimneys or undertaken any other kind of maintenance.

[4] Ninety-four stove users were interviewed using a pre-designed questionnaire. Further, 16 FGDs with users were conducted in eight villages. For each FGD, women belonging to the same social group participated.

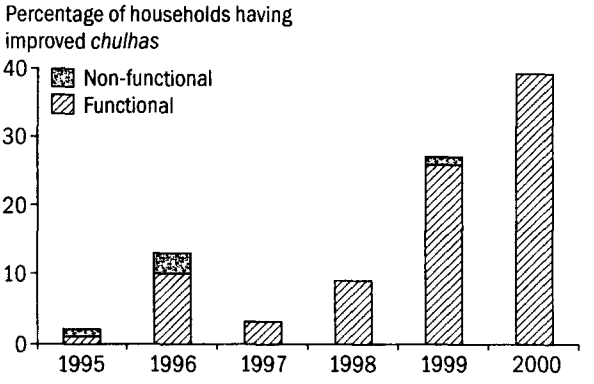


Figure 3 Functionality status of improved *chulhas*

Box 2 Sociocultural practices and changes in stove dimensions

Salamba is an economically backward, largely Muslim, village in Gurgaon district of Haryana. Families in the village are mostly large. Most users find the standard-size IC too small. As many as 8 out of 11 interviewees had enlarged the pothole size. In Panchkula district, *Gujjar* households enlarge the firebox to bake large *rotis*. There are other common cultural practices (for example, plastering the cookstoves regularly with fresh clay) that result in a change in stove dimensions.

Users' response towards ICs was quite positive on the whole, since 80% of the users did not experience any problem in using or maintaining ICs. A few respondents, however, complained that the IC was actually consuming more wood than the traditional *chulha* (Figure 4). A remarkably high percentage of respondents felt that every feature of the IC was desirable.

Many families that had functional ICs also had traditional *chulhas* that were in working condition. This is mainly because a single *chulha* is inadequate for daily requirements. One is kept inside the house or in a

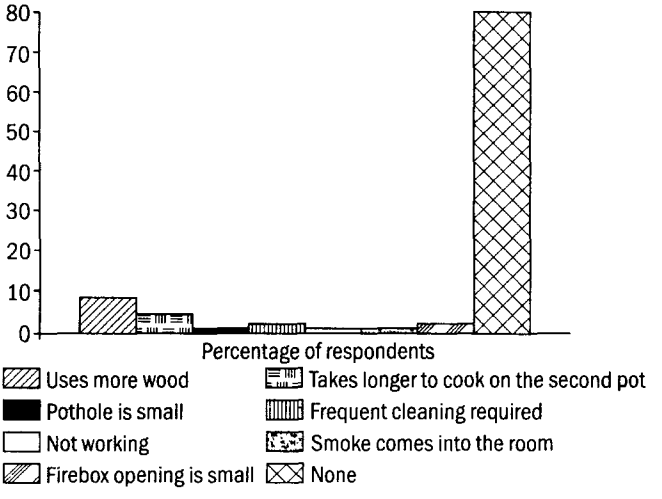


Figure 4 Problems faced in improved *chulha* usage

separate kitchen and the other is kept in the courtyard. Quite often the IC is constructed in the courtyard.

Typically, the IC is used for cooking main meals (3–4 hours per day), while the traditional *chulha* is used for heating water, preparing feed for cattle, etc. (2.5–3 hours per day). Further, during summers, the women prefer to cook outside, as it gets very hot indoors. Over 60% of IC-owning households were also using traditional *chulhas*.

Profile of stove users

The average size of stove users' families was found to be 5.18. It was slightly higher in the district of Gurgaon. Among the stove users surveyed, there were more (>50%) landless labourers than relatively well-off households (Figure 5). One reason for this is that most well-off, landowning families have LPG (liquefied petroleum gas) connections and more than one traditional *chulha*, and so do not feel the need to use ICs. Similarly, a survey of asset ownership indicated that

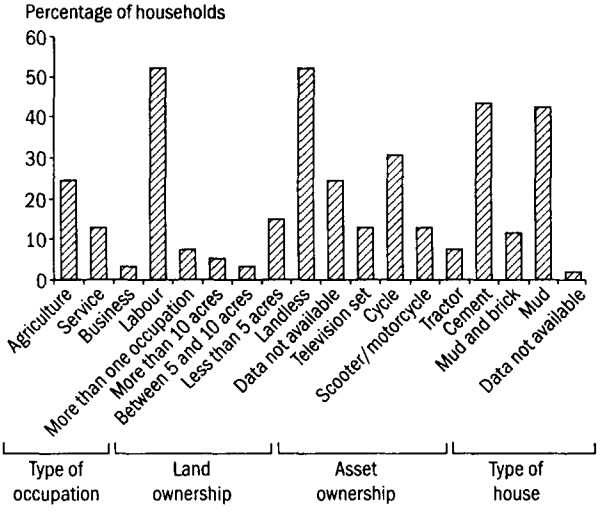


Figure 5 Profile of improved *chulha* users

ICs are adopted more by lower income families. Also, 85% of the stove adopters had either cement or mud houses. The type of house does not seem to influence the IC adoption decision significantly. A majority of the households get ICs constructed outside in the courtyards as they do not want to make a hole in their kitchen roofs for the chimneys.

Perceived benefits

The major benefits as perceived by IC users are reduced smoke; less soot, therefore cleaner utensils and kitchens; and faster cooking, because of two burners.

With respect to fuel saving, which is the popularized benefit of NPIC, not many IC users in Haryana perceived this particular benefit. This is primarily because rural Haryana does not experience any shortage of biomass fuels. Hence, access to fuel (firewood, dung cakes, agricultural residue) and stove efficiency are not issues for them. Fuel shortage was, therefore, never

mentioned as a problem during all the interactions that took place as part of the study. Neither fuelwood nor agricultural residue is difficult to gather, so there is no incentive to conserve fuel. Even in areas where fuel is relatively scarce (such as the Mewat region in Gurgaon district), people do not accord much importance to stove issues, as there are more pressing priorities (such as cash for obtaining food).

Another reason why stoves are not accorded much importance is because the use of LPG is common in rural Haryana. Most houses that have LPG maintain *chulhas* as well. In general, *chulhas* are used to heat water during winters, for boiling milk, for cooking leafy vegetables (mustard leaves, spinach) or in some areas just to bake *rotis*. LPG is used mostly when there are guests or when food has to be cooked or heated quickly. Generally, small farmers and the landless (low-income group) are totally dependent on *chulhas*. For households in the high-income bracket, installation of an IC is more out of fancy than out of a real, felt need. This shows clearly that the efficiency of an IC is not an issue, and therefore, not a real perceived benefit of an IC in Haryana.

The benefit that most interviewees (77%) said they experienced is a cleaner cooking environment (Figure 6). However, this appears somewhat anomalous, as most people revert to their traditional *chulha* as soon as their IC has a problem. Also, ICs have been installed mostly in the courtyards, because men do not like to drill a passage in a *pucca*, asbestos, or RCC roof for the chimney pipe to pass through (Box 3). In addition, during winters women prefer to cook only on their traditional *chulhas* in their kitchens as they feel that these retain heat and provide more warmth than ICs. Reduced smoke is perceived as a convenience, rather than as a health benefit.

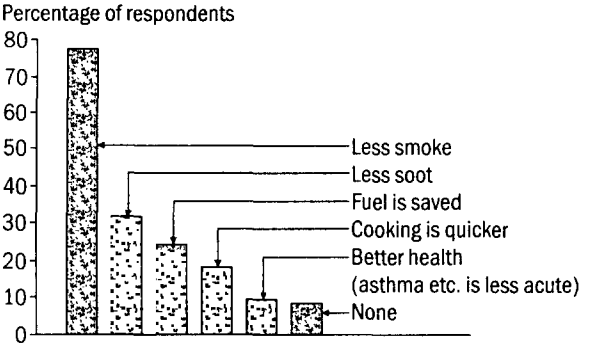


Figure 6 Perceived benefits of improved *chulhas*

Box 3 IC (improved *chulha*) chimney outlet in the kitchen

In some Muslim households of Khangesara village, the chimney outlet is inside the kitchen because the women did not want a hole drilled in the asbestos ceiling in the absence of the menfolk. Even now, though they recognize that the very purpose of the IC is defeated, the men are unwilling to make a hole in the asbestos sheet for passing the chimney pipe through. The SEW who lives in the nearby village of Nangal and visits them regularly, has not reported this to the higher authorities.

The *Mahila Mandal*, and the *Mahila Mandal Pradhan* in particular, greatly influence the adoption of ICs in villages. In fact, most women said that they had bought ICs because the *Pradhan* had asked them to do so. In all villages studied, people were under the impression that the IC programme will be followed by some other government programme on *pucca* kitchens or sanitary latrines that would benefit them. The women, in fact, are disappointed that some other, 'better' programme has not followed the IC programme. A few women, especially among the *Harijan* community, were under the impression that they are required by law to get ICs

constructed. There is also a section of women, albeit small, who had previously seen ICs in operation, were aware of their benefits, and had them built purely on the expectation of these benefits.

Common reasons for not adopting ICs are lack of space to install an IC, reluctance to drill a passage in the *pucca* kitchen roof for chimneys, and lack of clarity and incomplete information regarding the benefits of ICs. One factor common to non-users in almost all villages is that they are not members of the *Mahila Mandal*. This suggests that the *Mahila Mandal* chooses its members as beneficiaries at the expense of non-members.

Conclusions

The average life of a mud IC is 1–2 years. For the programme to be really successful, the IC must be reinstalled at regular intervals. If there is no follow-up, or if the IC is not available off-the-shelf, women revert to their traditional *chulhas*. At the current rate of operation, it would take the government an impractical 40 years to cover the remaining households. The actual time scale of penetration should not be more than 2–3 years, and it is only after 3–4 such cycles that the IC would have truly penetrated the rural areas. Unless a household is reached every 2–3 years, the effort will go waste.

The TBU in Haryana has been actively and continuously catering to the design requirements of the users by developing new and better models. The reports of the TBU indicate that models exist for many specific requirements. However, there is still scope for improvement. For instance, women in many communities prefer baking *rotis* under the *chulha*, in the firebox where wood is burnt. Since the fire box opening is not high enough, they modify the IC structure. Clearly, the continued efforts of the TBU in the sphere of R&D are required.

While the improved stove programme in Haryana cannot be called an unqualified success, many facets of its dissemination process are worth examining. Through a network made up entirely of women, the programme has managed to motivate women in a large number of villages to adopt ICs and use them over a period of time. It has also involved village-level women's institutions quite effectively in the programme and set in place an effective monitoring mechanism. Perhaps the most important lesson the programme offers is that it should not be assumed that stove users appreciate more efficient stoves, or that fuel saving is necessarily the feature users value in an IC. ICs can be appreciated and adopted for other benefits that they offer, such as reduction or elimination of smoke from kitchens, cleanliness, and time saving. It also establishes clearly the role that subsidies should play in a stove programme. Currently, the programme is in a phase of transition from improved mud stoves to longer lasting cement stoves. In its present form, the programme has several bottlenecks and problems. These must be addressed effectively for it to enjoy a better adoption rate in the future.

Karnataka

Introduction

The dissemination of ICs (improved *chulhas*) in Karnataka has been primarily through the NPIC (National Programme on Improved Chulhas) which was initiated in 1983/84. The nodal agency for dissemination of ICs in the state is the RDPR (Rural Development and Panchayat Raj) department. This programme has also been implemented by the NDDB (National Dairy Development Board) through its milk unions in 2 out of 27 districts, since 1989.

Although both fixed and portable *chulhas* (stoves) are being disseminated in the state, fixed *chulhas*[1] are accepted more widely. Of all the models, *Sarale ole* has been disseminated the most. Portable *chulhas*[2] have been accepted only in the hilly areas of the state.[3]

[1] The various models of fixed ICs disseminated in the state are *Sarale ole, Sukhad ole, Mamta,* and *Abhinava. Sarale ole* is a two-pot fixed stove without a firebox lid or ash lid. It may be opened from the front or from the side. The efficiency of the stove is 27%–29%. It is built using a mould and is being disseminated in the Mysore district. *Sukhad ole* is a two-pot *chulha* with a pottery lining, being disseminated in the Hassan district. *Mamta* and *Abhinava* are two-pot stoves, catering to families of 6–10, and are being disseminated in Mysore district through the milk unions of the NDDB (National Dairy Development Board).

[2] The portable *chulhas* being disseminated in the state are *Priagni* (pottery), *Swasthee* (metallic), and *Chara ole* (metallic).

[3] During the field study, researchers did not come across households living in the plains with portable *chulhas*. Officials of implementing agencies corroborated this finding.

About 11.4 million ICs have been installed in Karnataka since the inception of the programme. The numbers installed have progressively increased over the years. Despite this achievement, total installations between 1984 and 2000 have covered only two per cent of households in the state.

Institutional structure for *chulha* production and delivery

The rural energy wing of the RDPR department administers the NPIC in Karnataka. The RDPR department allocates the state target to districts on the basis of their performance in achieving past targets, and conveys the target for each district to its CEO (chief executive officer). CEOs are free to decide whether to involve NGOs (non-governmental organizations), turnkey workers, or to make use of the institutional mechanisms provided by government agencies. The CEO allocates the target to the different *talukas* of the district, and the executive officers at the *taluka* decide the targets for each *Gram Panchayat.*

The JEs (junior engineers) advise the *Zilla Parishads* of various districts on technical issues of the NPIC. The JEs also advise the CEO on the type of *chulhas* to be disseminated, based on their understanding and experience of the region. They also motivate and train SEWs (self-employed workers).[4] SEWs are entrepreneurs who invest in purchasing stove components and getting the stoves built in the field and

[4] The technical back-up unit for the NPIC in Karnataka has been set up at the KSCST (Karnataka State Council for Science and Technology) at Bangalore. Junior engineers, who are project assistants with the KSCST, implement other programmes such as the National Project on Biogas Development and the dissemination of solar devices.

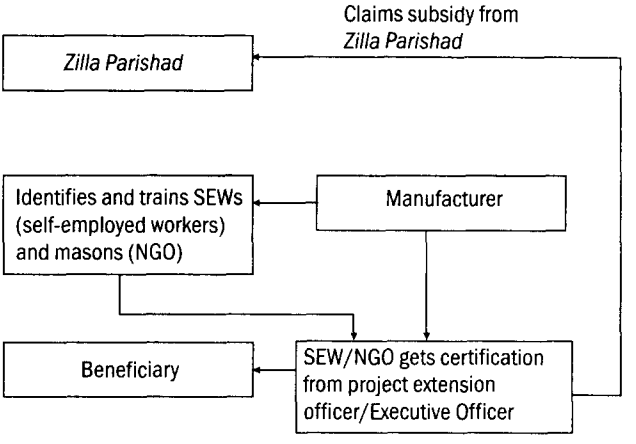


Figure 1 Method of implementation of the National Programme on Improved Chulhas in Mysore and Hassan districts of Karnataka

then claim subsidy. SEWs have masons[5] working under them (Figure 1).

This mechanism for disseminating stoves was initiated in 1981 by the JEs of the IREP (Integrated Rural Energy Programme) blocks in the Hassan and Mysore districts of the state. Prior to this, the improved stoves were procured by the *Zilla Parishad* and disseminated through the *Gram Panchayat* and/or the masons. Beneficiary contribution was collected in the same way. Similarly, prior to the initiative of the JEs to involve the SEWs and NGOs in the state's IC programme, the stove model to be disseminated was also decided at the state level.

Financial structure and subsidy flows

Till 1993/94, the NPIC was funded entirely by the MNES (Ministry of Non-conventional Energy Sources)

[5] A mason can construct 7–8 *chulhas* a day on an average. At 25 rupees per *chulha*, he earns 175–200 rupees a day.

in Karnataka.[6] Since then, the state government has been contributing towards the subsidy component of the IC programme. The pattern of funding from the centre is common to all states, including Karnataka. The nodal agency receives funds from the MNES in two instalments—half the subsidy at the beginning of the financial year, and the other half after targets have been achieved and relevant documents submitted. The funds released every year depend on the target set for that financial year. As mentioned earlier, the targets for a particular year are set based on the performance of the preceding year.

Since October 2000, the SEWs and NGOs that implement the programme in the Hassan district have been claiming – from the nodal agency – subsidy (both state and central) of 103 rupees per IC. The agency gives 30 rupees per IC to the SEW or NGO for maintenance and installation. SEWs do not receive any advance for implementing the programme. They invest their own money in buying stove parts such as AC pipes, cowl, and pottery lining (for *Sukhad ole* model). SEWs earn 13–30 rupees per IC after paying for IC parts, masonry charges (25–30 rupees) to construct the stove, and the administrative costs (supervision of installation, paperwork, etc.). Implementing agencies, however, have made special efforts to reduce such costs (Box 1).

The NDDB directly claims from the MNES its subsidy of 40 rupees per IC, and a further 30 rupees per IC towards SEW subsidy. The unit cost of the stove varies from 110 rupees to 160 rupees. For example, the cost of the *Sarale ole* model (built using a mould) is 130 rupees, and the cost of the *Sukhad ole* model IC is 155 rupees. The beneficiary contribution ranges from

[6] The MNES provides funds for subsidy towards stove cost, for the SEW fee for maintenance and installation, and for capacity building and awareness generation.

Box 1 Effort by an NGO (non-governmental organization) in Hassan district to reduce costs

Suma Khadi Gram Udyog, the NGO implementing the IC (improved *chulha*) programme in Hassan district, was incurring an extra burden of 22 rupees per IC towards transportation cost and breakage loss during their first year of installation, because the pottery lining was being transported from the neighbouring state of Andhra Pradesh. Loss due to breakage during transportation was more than 50%. Later, the NGO persuaded the families of potters to come to Hassan district from Andhra Pradesh, and make pottery linings there.

35 to 75 rupees in different districts (Table 1). Apart from this, the user also pays 5–20 rupees to the mason as a token of appreciation. The beneficiary contribution towards stove cost ranges from 25%–37%, depending on the unit cost of the IC. Hence, more than half the stove cost is subsidized under the NPIC. For economically backward households, stoves have been installed for free.

Some SEWs feel that full subsidy will lead to a lack of sense of ownership of the ICs and that ICs will, therefore, fall into a state of disrepair and disuse.

Table 1 Contribution of beneficiaries towards stove cost

Amount paid towards stove cost (rupees)	*Households* (number)	*Households* (percentage)
0	4	3.10
35	41	31.78
40	18	13.95
45	1	0.78
50	19	14.73
60	46	35.66
Total	129	100.00

Marketing of stoves

For marketing ICs, SEWs and NGOs identify motivators such as *Anganwadi* workers and members of other local NGOs (such as those working with the community development wing of companies) to help generate awareness among potential users. In certain cases, SHGs (self-help groups) have also been involved (Box 2). In case such linkages are not possible, SEWs involve the village leader or *Panchayat* members. This not only increases the rate of acceptance but the collection of beneficiary contribution is also prompt, since the village leader and *Panchayat* members share a rapport with the local people. With such assistance available, the masons identify households for installation of ICs. They often camp in the villages for a few weeks in order to motivate local people to construct ICs. Such demonstrations also generate interest in potential adopters.

In case of the NDDB, its secretary is responsible for creating awareness among people. Usually, the secretary organizes a meeting of the members of the milk union during which the extension officer or the secretary speaks on the benefits of the IC.

Box 2 Involvement of local women self-help groups in IC (improved *chulha*) promotion

In village Varuna, situated in Mysore *taluk* of Mysore district, 371 (92%) households have installed ICs. The district commissioner declared the village a 'smokeless village' on 9 January 2001. This was possible because of the efforts of the bank manager of Kaveri Grameena Bank, a regional rural bank located in the village. The bank took the initiative to form self-help groups in the village. The women members in turn motivated the other women in the village through door-to-door campaigns, contributing significantly to the high adoption rates.

Mode of stove production

The stove production process in Karnataka can be divided into the following broad heads.

1 Identification of villages
2 Procurement of stove parts
3 Construction
4 Operation and maintenance.

Identification of villages

Villages are identified by local NGOs and village-level institutions that are chosen by SEWs. Usually the villages are within the operational area of the institution and are also close to the areas where ICs have been constructed. The motivators (NGOs and SEWs) play a key role in carrying out the pre-installation survey to collect information on the number of households in the village, the number of households with ICs, the number of households willing to get the ICs constructed, etc. This information helps set the target at the village level.

Procurement of stove parts

The major stove parts are the AC pipe (10 feet 3 inches; 50–60 rupees per pipe); the cowl (12–15 rupees per cowl); and the grate pipe cowl (12–15 rupees per grate pipe cowl). These are obtained from AC pipe manufacturers or suppliers located mainly in the Mysore district. The grate pipe cowl is obtained from Bangalore where manufacturers of cast iron products are located. There is usually a 5%–10% loss due to breakage during transportation; the supplier bears this. However, the loss incurred due to breakage during loading or unloading is borne by the SEWs. Stove parts[7] are delivered directly to

[7] The parts of the *Sarale ole* model are a chimney and a cowl made of cement, asbestos, and iron. The *Sukhad ole* model requires pottery lining also. Other materials needed to build ICs are bricks, sand, and mud. These are available locally.

the site. Motivators take the responsibility of storing them.

The pottery lining for use in *Sukhad ole* model is obtained from potters. As mentioned earlier, these potters were persuaded to come to Hassan from the neighbouring state of Andhra Pradesh to construct pottery linings. This helped in reducing costs related to breakage and transportation.[8]

Construction

After SEWs ensure that the materials have reached the village, they send the masons to the field to construct the ICs. The masons camp in the village for a few weeks in order to complete the construction of *chulhas*. Though it is possible for a skilled mason to construct 10–15 *chulhas* per day, he or she is usually able to construct only 5–6 *chulhas* per day. The reasons for this are the unavailability of beneficiaries and delays due to village festivals, functions, etc. The social exclusion on caste basis also delays construction.[9] Some households get the *chulhas* constructed only on auspicious days. The delays in installation of ICs increase the overhead cost to the mason and SEWs. Masons are paid 25–30 rupees per IC. ICs are normally built between September and March. In the remaining period, the masons work as agricultural labourers or construction workers.

The beneficiary provides materials such as brick, mud, and sand for construction of the ICs. Usually, the beneficiaries help in activities such as procuring the material, making a hole in the roof, and removing the tiles, etc. If all the material is ready, a mason takes half

[8] The average additional cost due to breakage and transportation is about 22 rupees per *chulha*.
[9] The masons have to construct *chulhas* in higher caste households first and only then start construction in lower caste households.

an hour to one hour to construct an IC. Two to three days after construction, the IC is ready for use.

Operation and maintenance

After construction, the SEWs physically verify all the ICs. In addition, the project extension officer of the *taluk* carries out a random check. The SEWs have to get a certification from the *Gram Panchayat* secretary and the executive officers of the *taluk* and *Zilla Panchayat* and then submit the papers to claim subsidy.

User training is a part of operation and maintenance of ICs. During construction itself, the masons give information on and demonstrate IC maintenance.

The SEWs are responsible for providing after-sales service for a period of one year. The services provided are repair in case of complaints and regular visits to the villages. Regular visits, however, are not possible for the SEWs due to lack of staff and funds.[10]

Training of and interaction among stove designers, self-employed workers, and users

In order to ensure the quality of the ICs installed, several training programmes[11] are organized—such as main training course (for SEWs, potters), state-level training and district-level training (for state-, district-, and block-level functionaries), user training (for women), and refresher training programmes (for experienced SEWs).

SEWs and masons interact with users during both the motivation and construction stages. They also form the

[10] The primary survey, carried out as part of the case study, also found that the masons did not visit after they installed the IC. Users suggested that a local, trained mason be made available to address this problem.

[11] These training programmes are conducted mostly by project assistants of the KSCST who have been deputed as JEs in the *Zilla Parishads* of various districts of the state.

link between users, the technical support group, and implementing agencies. Due to limited manpower, the implementing agency is unable to organize more user training programmes.[12]

The NDDB trains masons through the Tree Growers' Co-operative Society. Some women have also received training in the state. For example, the *Zilla Parishad* of Hassan district trained some women in 1992/93. These women, however, have discontinued working as masons or stove builders. The women usually construct ICs only in their own villages or nearby villages because they are reluctant to travel long distances.

Usage of ICs

Most stoves (99%)[13] were found to be in working condition. Some of the ICs with pottery lining (*Sukhad* model) were found cracked. However, they were still being used. As many as 60% of users surveyed used the IC for 3–5 hours a day to cook three main meals, primarily of *ragi* balls, rice and *dal*. Further, 26% of IC users had kerosene stoves, 18% used traditional stoves, while 4% and 2% owned biogas stoves and LPG stoves, respectively.

Also, 92% of IC users were found to be landless farmers, or marginal and small farmers with

[12] Discussions with stakeholders indicated the need for more training programmes for users. While 2000 ICs were constructed in Mysore district in 1999/2000, only five user training programmes were organized. Thus, only about 6.25% of users participated in the user training programmes. This is corroborated by survey results.

[13] A sample survey was conducted by TERI (The Energy and Resources Institute), New Delhi, in Mysore and Hassan districts of the state where 129 stove users and 61 non-users were interviewed. In the focus group discussion, 217 women participated. All the ICs installed in the surveyed user households were two-pot ones. The stoves were installed during 1998–2000. The main occupation of the majority of the surveyed IC users was agriculture (52.7%) and agricultural labour (43%). A majority (50%) of the surveyed IC users were marginal farmers having landholdings less than 2.5 acres; 24% were landless.

landholdings of 1–5 acres. This underscores the fact that the target group for the IC programme is the low-income group. Only 7% of the users were medium-sized farmers with landholdings of 5–10 acres, and 1.5% were large farmers with landholdings of more than 10 acres.

Users maintained their ICs by smearing them once a week with cowdung or mud. About 40% of respondents cleaned the chimney once a month, and 17% had never cleaned the chimney. This was one of the reasons for back smoking.

Most users were unaware that the IC is subsidized. Users had paid 35–60 rupees to the SEWs and 10–20 rupees to the masons. The costs varied because the SEWs collect different rates depending on the distance of the villages from the *taluk* or district headquarters.

Customer satisfaction

As many as 92% of the IC users felt that removal of smoke from the kitchen had improved their health. A few women said that their hands are cleaner because it is easier to keep their cookware clean. Respondents living in dwellings of a room and a kitchen said that their children could now study indoors as the IC emitted much less smoke. Most women (57%) said that their eyes did not burn or water and that they have fewer headaches. Also, 68% said that they now took half-an-hour to an hour less to cook. A few elderly women, however, felt that an IC took more time to cook. An overwhelming majority (73%) of women felt that using an IC saved fuel. They use the residual heat of the IC to warm water for drinking, washing or bathing. However, fuel saving did not seem to be a priority for women.[14]

[14] In the districts surveyed (Mysore and Hassan), fuelwood is collected either from private land or from revenue land. Very few respondents bought fuelwood. Most importantly, reduction in fuelwood usage was not perceived to be of significance.

Problems in using improved chulhas

Though the majority of users (80%) were satisfied with their ICs and had not modified them, they highlighted certain problems. Eight per cent complained of back smoking. Some respondents in Hassan district complained that the stoves are badly constructed and that the pottery linings cracked easily. About 4% of users reported that the IC consumes more fuel; this could be because the IC is poorly constructed, or because users feed more firewood than necessary if the flame is not visible. Elderly women felt that ICs took longer to cook with. Some respondents said that certain crop residues could not be used as fuel in the IC.

Modifications observed were plastering with cement, enlarging the pothole to accommodate vessels, removing the grate, fixing an extra pipe to increase the length of the chimney, and removing the chimney during the monsoon season to prevent water from leaking through thatched roofs.

Refurbishment of ICs

A majority of IC users (81%) said they would renovate their ICs. However, this is in contrast to actual practice. Most users in a particular village in Mysore had constructed traditional *chulhas*, retaining the chimney. The main problems in refurbishing improved stoves are: (1) stove parts are not available locally, (2) no skilled masons – in one village (Mysore district) the masons constructed ICs only after the users had bought the *chimney set*[15]; and (3) users who have a chimney are unwilling to buy an IC again.

[15] The chimney set consists of a cowl, a chimney, and a grate in case of *Sarale ole*, and pottery lining along with other stove components for *Sukhad ole* model.

Discussions with the villagers indicated that they are willing to pay an additional price for the IC (perhaps the actual cost), provided the durability and the performance of ICs is assured.

Shortcomings

There are a few shortcomings in the implementation of the NPIC in Karnataka. These are discussed below.

Lack of awareness

Masses need to be made aware about the benefits of ICs. Mass media such as radio and television should be used to spread awareness. Adequate posters and pamphlets should also be printed. These efforts should be continuous rather than one-time or intermittent.

Unavailability of spare parts

The problem of unavailability of spare parts as well as skilled manpower at the local level needs to be addressed.

Inadequate involvement of women

Women's involvement in the programme should be improved. Women SHGs at the block and village levels should be trained and enabled to act as motivators and also build stoves.

Inadequate evaluation and monitoring

Mechanisms to strengthen the evaluation and monitoring system need to be designed and put in place. At present, only one JE, who acts as the technical support person, is available to a district. Further, the evaluation surveys done by the TBU consider only whether the stove is working or not, but not how well it is working. It is also necessary to survey users in detail to assess their needs.

Poor stakeholder interaction

Interaction between stove designers, users, and implementing agencies needs to be improved. There should be a conscious effort made by all the players in the IC programme in the state to meet and interact with one another.

Best practices in the implementation of the National Programme on Improved Chulhas in Karnataka

In Karnataka, more ICs are being installed in a larger number of households in a particular village, rather than covering a greater number of villages. This has led to a substantial and measurable impact of the programme. Discussions in the field revealed that the users are willing to pay more for ICs, provided quality performance and durability are assured. There is, therefore, a need to explore this market. For sustainability of the programme, this market can be explored through commercialization of ICs, by giving adequate training and incentives to the SEW/NGO.

The replicable best practices in the IC programme of the state are discussed below.

Involvement of self-employed workers

The involvement of SEWs in the Mysore district has resulted in better linkages between the various stakeholders involved in the dissemination of ICs. Previously, stoves were procured by the *Zilla Panchayat* and disseminated through the *Gram Panchayat*, and breakage was common due to multiple transit (manufacturer to *Zilla Panchayat*, *Zilla Panchayat* to *Taluk Panchayat*, *Taluk Panchayat* to *Gram Panchayat*, and finally the *Gram Panchayat* to the user households). Also, supervision under such a system was difficult. Involving SEWs has solved these problems to a considerable extent.

Involvement of NGOs

The initiative to involve NGOs in the Hassan district has led to the formation of a network of local NGOs for the dissemination of ICs. This has improved results.

Mould template of IC

Using a mould template for constructing the *Sarale ole* model has helped fix the dimensions of the IC, avoiding faults due to poor construction, and reducing dependency on skilled masons for constructing ICs.

Maharashtra

Introduction

Maharashtra has disseminated the improved biomass stove predominantly in its western part that comprises 60% of the state. At the initiative of the TBSU (technical back-up support unit) established under the NPIC (National Programme on Improved Chulhas) in Maharashtra, a programme was developed to train traditional potters to construct, promote, and sell ICs (improved *chulhas*). These entrepreneurs sell stoves both through the national programme as well as in the open market, and make a reasonable profit on their modest investment. The implementation strategy of the NPIC in Maharashtra is common to all 33 districts.[1]

In 2001, under the NPIC, the Government of India began disseminating cement *chulhas* instead of mud *chulhas*. Since most SEWs (self-employed workers) had been trained to build mud *chulhas* only, their number in the state came down to 8 from 25. Potters who used to construct only mud *chulhas* suddenly found themselves 'off' the approved list of SEWs. Subsistence of the SEWs was further jeopardized by the government's decision to withdraw the central government-funded NPIC. The case of Maharashtra is particularly important as it offers a critical insight into the process of commercialization of ICs.

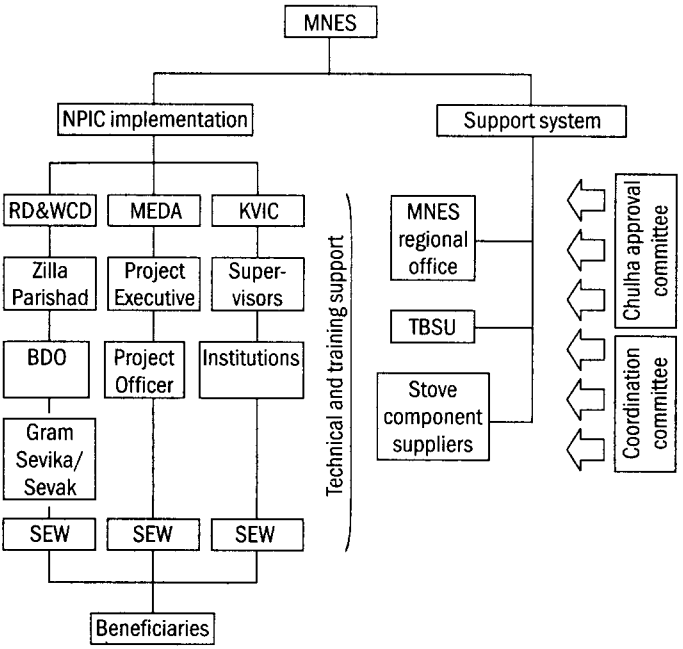
[1] The study was conducted in the three districts of Kolhapur, Sangli, and Satara, where traditional potters are manufacturing and selling ICs as part of the NPIC and even outside of it in open markets on a commercial basis.

Institutional structure of stove production and delivery

The NPIC in Maharashtra is implemented by three agencies. The RD&WCD (Rural Development and Water Conservation Department) is the primary implementing agency, and is responsible for more than 80% of the 120 000 stoves distributed annually. The MEDA (Maharashtra Energy Development Agency) contributes to almost 18% of the state target. The KVIC (Khadi and Village Industries Commission) distributes less than 2% of the total target. The RD&WCD makes use of the government machinery for IC dissemination, while the other two agencies work primarily through NGOs and SEWs.

The RD&WCD's IC programme has been the largest initiative in the state in terms of dissemination of stoves, averaging around 100 000 ICs every year. Under this set-up, the stoves are disseminated through the local government's administrative system (Figure 1). At the district level, the programme is implemented through the *Zilla Parishads*,[2] which are the key bodies for coordination and monitoring. At the block level, the Block Development Officer[3] and his support staff manage the programme. Under the Block Development Officer, the TPO (Tehsil Project Officer) is directly responsible for targets at the block level. Every block has 2–3 Gram Sevikas[4] who are actively involved in promoting and monitoring the stoves programme. The government functionary responsible for implementing

[2] Administratively, the state is divided into a number of districts (*Zillas*). A cluster of villages (typically from 50 to 200) forms a block, and a district comprises a number of such blocks.
[3] The BDO (Block Development Office) is the administrative unit below the district, and the BDO is responsible for the development programmes undertaken by the government at that level.
[4] *Gram Sevika* – development personnel responsible for 5–6 villages.



BDO – Block Development Officer; KVIC – Khadi and Village Industries Commission; MEDA – Maharashtra Energy Development Agency; MNES – Ministry of Non-conventional Energy Sources; NPIC – National Programme on Improved Chulhas; RD&WCD – Rural Development and Water Conservation Department; SEW – self-employed worker; TBSU – technical back-up support unit

Figure 1 NPIC structure in Maharashtra

the NPIC at the village level is the *Gram Sevak.*[5] Primarily, rural potters trained as SEWs and certified by the TBSU undertake *chulha* construction.

MEDA, the nodal agency of the MNES (Ministry of Non-conventional Energy Sources), was set up to promote the use of renewable energy devices in the state. It implements the NPIC in 29 districts. MEDA has a small annual target of around 20 000 ICs. The approach

[5] *Gram Sevak* – development personnel responsible for all developmental programmes.

of MEDA is bottom-up; the target is based on the information provided by each SEW. The SEW, after determining the number of interested households and matching it with his/her construction capacity, forwards it to the district-level project officer of MEDA. The consolidated information is sent to the ministry for approval and target allotment.

Initially, MEDA employed the SEWs as TKWs[6] (turnkey workers) directly and implemented the programme through them. However, identifying and retaining them was always a difficult task, since building and construction work is much more remunerative. Later, it was decided to involve NGOs as TKWs. Each NGO nominates 2–3 SEWs, who are then trained by the TBSU.

The KVIC is a small player in the NPIC in Maharashtra and constructs around 2000 ICs every year. The KVIC implements the programme through NGOs such as ARTI (Appropriate Rural Technology Institute) and through other similar institutions. The ARTI is also the TBSU, which trains SEWs to build ICs in the state.

Approach to stove development and production

The MNES has set up TBSUs to develop stoves. As mentioned, the TBSU for the NPIC in Maharashtra is the ARTI (based in Pune). The TBSU staff includes a senior scientific officer, a senior research assistant, a senior technical assistant, two master craftsmen, and an assistant. Other staff of the ARTI (not supported by the MNES) include field officers on an average of one per district.

Several models of ICs with thermal efficiencies ranging from 24% to 28%, have been promoted within the

[6] Turnkey workers are responsible for promotion and maintenance of the improved cookstoves.

state according to specific regional requirements. Notable among these are *Laxmi, Parvati,* and portable *chulhas.* The *Adhunik* (pottery-lined *chulha*) was also promoted for a while, but was discontinued when feedback was received that it cracked easily.[7] Keeping in mind the specific regional requirements, particular IC models have been developed. For example, users in the Konkan region experience heavy rains and live in houses with roofs made of dried leaves. They need smoke to repel snakes, ants, mosquitoes, and other insects and animals. They need heat to dry their clothes during the long monsoons. The ARTI designed the chimney-less *Grihalaxmi* and *Bhagyalaxmi* models to suit these users' needs.

These models were developed on the basis of TBSU's regular quarterly surveys of users and potters. These interactions enabled the TBSU to incorporate improved stove designs with a number of time-tested techniques that potters traditionally used. For example, learning from the potters' use of fine dust to improve the finish and reduce the chances of cracking, the TBSU introduced the use of stone powder in the construction of cement *chulhas.*

Target allocation between districts is done based on the criteria of population density (areas with higher population density are given preference), forested area in the vicinity, and areas with high Scheduled Caste / Scheduled Tribe population. Within a district, targets are distributed between blocks depending on the population. The *Gram Sevak* is responsible for assessing the demand at the village level. The TPO consolidates the information for all the villages in the block and forwards the demand to the *Zilla Parishad.* The RD&WCD thus receives a block- and district-wise

[7] The *Adhunik chulha* consists of 4–5 pieces that are joined together. The number of joints increases the number of weak points in the *chulha*, making it more vulnerable to breakage than other models.

demand for the following year and forwards it to the MNES for approval. Prior to this, the *Gram Sevikas* and *Gram Sevaks* identify the potential villages at the beginning of each financial year. Within the village, the population targeted for the ICs is the total population of the village, excluding people who use biogas plants and LPG (liquefied petroleum gas).

One of the norms followed by the RD&WCD is that only such villages are to be selected which have a demand for at least 50 ICs. Motivation and identification of potential beneficiaries is done using fora such as the *Gram Sabha* and village meetings. *Gram Sevaks* and SEWs also organize user camps in the selected villages, sometimes with support from the members of the TBSU. Some of the SEWs are also trained to conduct user camps independently, for which they are paid by the TBSU. The beneficiary list is finalized between July and September. As per Maharashtra NPIC guidelines, 20% of the beneficiaries should be from SC and 10% from ST categories, and priority should be given to below-poverty-line families. The beneficiary contribution is collected (typically between October–November) by the *Gram Sevak*, which should be at least 10 rupees. The only women involved in the entire process are the *Gram Sevikas* at the block level and the village *Anganwadi* teachers. The SEW[8] receives the beneficiary contribution after the stove structure (which is mass produced by the SEW in his workshop) is delivered to the village.

The SEW uses the money to buy raw material, such as cowl, pipe, and grate. The ICs are installed between December and the end of March. The raw material is

[8] In Maharashtra, the majority of the SEWs are men. As there is a shortage of trained SEWs, the manufacturing capacity for a SEW normally determines the target he gets.

Table 1 Activity cycle for National Programme on Improved Chulhas implementation

Period	*Activity*
April–June	Villages are identified
July–August	User camps are held
September–October	Beneficiaries are identified
January–March	*Chulhas* are constructed

procured directly from suppliers by the SEWs. The SEWs recover the cost from the TPO upon the installation of the *chulha*. The *chulhas* are inspected by the *Gram Sevaks/Sevikas* after which the SEW fee is released. This is contingent upon the receipt of the same from the central government. The SEW normally gets the fee two to three weeks after IC installation. The activity cycle for NPIC in Maharashtra is given in Table 1.

Training and promotion

The ARTI has been instrumental in introducing several training courses that are now a regular part of training programmes in all states. The ARTI also produces a large amount of promotion material. The main constraint in promotion was that of funds, as the MNES provided two rupees per *chulha* for publicity of which the TBSU received only 10%. Lack of funds for promotion can create a serious set-back for the programme in a state like Maharashtra where there is already a tradition of rural people purchasing stoves.

Interaction between designers, stove-makers, and users

In Maharashtra, each of the implementing agencies receives its targets and operates independently. However, there are two fora that facilitate interaction among the

implementing agencies. One is the CC (Coordination Committee) and the second is the CAC (Chulha Approval Committee). Both comprise of representatives from the RD&WCD, the MEDA, the KVIC, the ARTI, the regional MNES office (located in Bhopal), and one representative each from the involved NGOs. The CC reviews the previous year's guidelines, decides on a detailed district-wise schedule of training programmes, and works out a publicity programme for the NPIC. The CAC meets once a quarter to approve new designs, to empanel manufacturers of stove parts, and to finalize the total unit cost of the *chulha* with inputs from potters and manufacturers.

Stove operation and maintenance

Monitoring is carried out while the ICs are being constructed, which is contrary to the norm.[9] The quality of stoves is, therefore, a serious issue. Most problems stem from the immense pressure on field-level implementation staff to meet targets, the latter, at times, recruit untrained masons to construct ICs. These ICs often cause problems (Box 1). This variation in the implementation model is reflected in the differences that exist in the *chulha* design between districts, and even between villages in the same district. For instance, in Chikli village, most *chulhas* had the grate opening in the front, while in Nagaon, the opening of the grate was on the side, just below the chimney. Many of the *chulhas* in Nagaon were raised from the ground with the help of bricks, but no particular reason was given for this. The SEW did not charge anything extra for raising the *chulha*; the bricks were provided by the beneficiary.

[9] The administrative guideline of the NPIC requires 100% inspection of the ICs installed at the block level and 10% of those at the district level. The *Zilla Parishad* is required to send monthly reports to the RD&WCD on the progress of the programme.

Box 1 IC (improved *chulha*) construction by *Gram Sevikas*

The villages of Deshing and Yogewadi are in the grape-growing belt of Sangli district. The villages are distant from both the block and the district headquarters, as well as spread out over a wide area. The *Zilla Parishad* undertook an IC programme in the villages in 1999/2000. The ICs installed varied considerably in terms of size of the pothole, baffle, placement of the chimney, location, etc. Inquiries revealed that the *Gram Sevika* had constructed many of the *chulhas* and had modified them according to the specification of each household. The self-employed workers often delivers the material (pipe, cowl, etc.) to the beneficiary's house during his absence and does not make another trip to construct the *chulha*, especially when he or she lives at a distance. *Gram Sevikas* are then left with no option but to construct the *chulhas* themselves to complete the target for the village.

Components and raw materials also affect stove quality. Although there is a list of approved suppliers, there is no mechanism to ensure that the SEWs actually buy material from them. The TBSU is required to test and approve samples (for example, grate, and cowl) sent by manufacturers. Based on the report from the TBSU, the CAC finalizes the list of 'approved suppliers'. AC pipes, on the other hand, do not require any clearances from CAC.[10] Further, SEWs who find it hard to make ends meet, start going in for cheaper material to save on construction costs. This adversely affects the quality of the ICs.

Apart from the one-time inspection of stoves by the *Gram Sevak*, the local government does not have much control over the quality of the ICs constructed by the SEWs. This is primarily because the SEW charges are

[10] The rationale for not having any quality check for the pipe is that AC pipes are used for a variety of purposes in villages. Further, unlike other stove components, chimney pipes are easily available.

not linked to the functioning of the stove; the payment is made in a single instalment once the *chulha* is constructed. In most villages, neither the block-level official nor the SEW goes back later to check whether the *chulhas* are functioning or not.

Financial structure of programme and subsidy flows

Government subsidies have made the improved stoves affordable to a large number of households, especially those who could not afford it. According to central government policy, a 50% subsidy[11] on the stove cost is given to all NPIC beneficiaries as a direct discount. This way, beneficiary contribution for a two-pot mud stove with chimney (costing 180 rupees) amounts to 110 rupees. At the village level, however, contributions vary widely across household categories. In some villages, the general category (non-SC/ST) pay 160 rupees for mud ICs, of which 50 rupees is the transportation cost of the potter-entrepreneur. In other cases, if the beneficiaries provide mud and contribute labour, the cost comes down to 75 rupees. Backward class (SC/ST) households pay 0–20 rupees due to an additional subsidy from the village *Panchayats*. The *Panchayats* are officially required to spend at least 15% of their development-related funds towards the upliftment of SC/ST households.

The policy of subsidizing stoves has also had some undesirable implications. It was generally seen that households that purchase subsidized stoves do not maintain them properly. Maintenance is best in households that have purchased stoves from the open market for 300–325 rupees. Some of these stoves have been used for 8–9 years and continue to be maintained well. This may perhaps be related partly to the education

[11] For cement *chulhas*. For two-pot mud ICs the subsidy is almost 40%.

of these families and partly to their owning other cooking equipment as well.

Ironically, the condition of the improved stoves in the SC/ST households, which have benefited from the largest subsidy, is dismal. Having paid nothing, these households do not appreciate the benefits of the stove and do not value the product. According to them, the local administration did not inform them about the benefits of maintaining the stove, or how to maintain it. As a result, their stoves fell into disuse within six months due to poor maintenance. Also, they are totally dependent on only one *chulha*, and heavy use has worn out their single stove. Another reason that the totally subsidized stoves are in disrepair is that beneficiaries have very little say in stove selection or installation quality. For example, in the village of Murud in Satara district, households were not given cowls to protect the tops of their chimneys. Also, the chimneys that vent out of tin roofs are not sealed properly. Users improvise by covering their chimney tops to prevent water leakage, or by using pieces of cloth to plug the gap between the chimney and the roof. Persistent problems make most people abandon their ICs and revert to traditional *chulhas*. Many of the stoves are also cracked badly (Box 2).

Non-users of improved stoves are categorized into those who did not buy subsidized stoves because they did not have the space to install them or because they had inadequate information about the NPIC, and those who are keen to install stoves but were not selected as beneficiaries. Sometimes, preference is given to people of SC/ST/OBC (Other Backward Classes) categories. It is important to mention here that SC and OBC groups are subsidized further by the *Gram Panchayat*. The amount that the beneficiary pays depends on the proportion of the user's contribution that the *Panchayat* has paid (Box 3).

Box 2 Subsidies and stove maintenance

The influence of the subsidy on stove maintenance was studied in two villages, Murud and Vajroshi, in the hills of Patan *taluka* in Satara district. In Murud, most villagers got the stoves free (some people paid 15 rupees to the SEW (self-employed worker) who organized mud for them). In Vajroshi, beneficiaries paid 60 rupees. In Murud, six out of the seven stove users interviewed had stopped using their ICs (improved *chulhas*). The SEW had not provided cowls along with the ICs. Not having paid anything for the stove, people had been unwilling to purchase cowls and instead used small tin vessels, etc. to cover the chimney top. The houses had tin roofs, and the gap between the chimney pipe and the roof could not be sealed properly. Again, people had made make-shift arrangements like plugging the gap with a piece of cloth or paper, etc. As a result, water seeping into the kitchens during rain was a continuous problem and by the end of the first rainy season, most people had abandoned their ICs and reverted to their traditional *chulhas*. Many stoves were also cracked badly. On the other hand, all the stoves in Vajroshi were in use and in good condition. They were mud-plastered regularly and women were aware that they would crack if precaution was not taken.

Box 3 Subsidizing stoves through *Gram Panchayats*

The Maharashtra government requires every *Gram Panchayat* to spend 15% of its total funds for the upliftment of SC (Scheduled Caste) and OBC (Other Backward Classes) groups. To meet this requirement, and also the local administration's need to meet its target, ICs (improved *chulhas*) are commonly constructed free of cost for SCs and OBCs. Most often, beneficiaries know that their *Gram Panchayat* has paid in part for their ICs, but are not interested in finding out how much. This procedure also flouts the Ministry of Non-conventional Energy Sources' policy that the beneficiary must pay at least 10 rupees for the IC.

Hence, due to dissatisfaction, households not selected as beneficiaries are also reluctant to purchase unsubsidized stoves. The subsidies, therefore, create problems for those using the stoves and also generate a feeling of dissatisfaction that prevents others from adopting them.

Approach to marketing of stoves

In rural Maharashtra, pottery is a traditional occupation and potters usually make clay pots for household use. There is also a tradition of purchasing stoves, both chimney-less and those with a chimney, from village potters. Typically, every cluster of 3–4 villages has at least one potter constructing and selling *chulhas*. These potters have an established business, selling around 500 *chulhas* a year.

Maharashtra is possibly the only state that promotes potter-entrepreneurs as part of its well-defined commercialization strategy. Its main elements are discussed below.

Developing chulha *models that can be mass-produced*

All the models promoted by the TBSU can be constructed using a mould in a central workshop. These models, therefore, have two distinct advantages over a mud *chulha*—better control can be exercised over quality, and installation can be completed in 1–2 hours. A mud *chulha*, on the other hand, cannot be used until the clay has dried out, which may take as long as 10–15 days.

Building capacities of traditional potters in IC construction

Most SEWs perceive *chulha*-making as a temporary job, and not as a profession. Hence, drop-out rates are very

high. Potters who make and sell traditional stoves as a profession continue to stay in the improved stoves business.

Providing entrepreneurship development courses for SEWs

ARTI trains SEWs in *chulha* construction and also in other skills necessary for running a business, such as market surveys, costing, inventory control, quality control, preparing project proposals for financial institutions, tax and labour laws, salesmanship, and advertising, etc.

SEWs in western Maharashtra have shown significant initiative in setting up businesses in *chulha* construction. For SEWs, a large chunk of the business comes from the targets they get from the government. Being traditional potters, they have been able to find synergies with their other business of manufacturing and selling earthen products such as pots, idols for worship, decorative items such as dolls, etc. However, with the shift towards cement *chulhas*, most of these potters are facing problems related to profit margins and working capital. Further, being traditional potters, they are familiar with working with mud, and are hesitant about working with cement.

Table 2 shows quite clearly that the margin in cement *chulha* production has come down significantly. The average margin per mud *chulha* is 50 rupees, while potters making cement *chulhas* just manage to break even. Potters use the economies of scale of cement *chulha* production to lower the cost to about 190 rupees, but margins are still very low. Moreover, cement ICs require additional investment as they have to be mass-produced at a central place and cured for 10–12 days.

Working capital requirement

The RD&WCD does not provide any working capital and the payments come more in the form of

Table 2 Unit cost of *chulhas* in rupees*

	Cement chulha			
Mud *chulha*	*Laxmi*	*Parvati***	*Bhagyalaxmi*	*Grihalaxmi*
130	200	180	100	95

* The market prices a mud *chulha* at 150 rupees, and the *Laxmi* model, (cement *chulha*) at 300 rupees; the corresponding NPIC figures are 180 rupees and 200 rupees, respectively.
** The *Laxmi chulha* has a grate while the *Parvati* model does not, therefore the difference in cost.

reimbursement once the *Gram Sevak* receives the beneficiary contribution. However, the MEDA and KVIC give an advance to the SEW to buy the required material. In addition to this, the KVIC also provides additional loans to the potters through one of its cooperatives. However, the money is often used in ventures other than those for which they are sanctioned, and is often not repaid.

One source of funds in the region are the local cooperative societies that offer loans for establishing small businessmen such as potters, blanket weavers, idol makers, and ironsmiths. One such cooperative is the VGUS (Vikas Gram Udyog Sangh) in Kolhapur, which lends money to small entrepreneurs (Box 4). The loan amount is between 5000–15 000 rupees, but can go up to as much as 100 000 rupees at an annual interest of 12.5%. The repayment period is 3–5 years, in 2–3 instalments. Approximately 900 loans have been disbursed to various kinds of entrepreneurs so far. Potter-entrepreneurs are also eligible for loans from this cooperative, but they have to be its members with a certain share in the credit cooperative, which again requires capital. Out of the 900 loans disbursed so far, only six were given to potters.

Box 4 Finance for the stove business

Rajaram Bapu Kumbhar is a traditional potter living in the village of Vasargade in Kolhapur district. Rajaram constructs *Laxmi* model mud ICs (improved *chulhas*), traditional *chulhas*, *Ganapati* idols, idols for other festivals like *Naga Panchami*, etc. Rajaram was an approved SEW until the government decided to shift to 'durable' or cement *chulhas*. On an average, Rajaram constructed 1000 ICs every year, 40% of which he supplied to the government. He sold the remaining 60% in the open market at 350 rupees a piece. He had taken several loans from the VGUS (Vikas Gram Udyog Sangh), and had been able to repay them successfully each time. He has received an award from the VGUS in appreciation. Rajaram specializes in baked mud *chulhas* and claims that they too, last for five years at least. He has sent in his *chulha* (mud version of the *Laxmi* model) to the technical back-up support unit for approval, and is yet to hear from them. The other potters interviewed did not seem to know about this cooperative.

To understand the issues of profit margins and working capital, cash flows for a sample of potters has been worked out in the case study. Cash flows (Figures 2 and 3) for five different scenarios have been generated, based on actual data collected from potters. These are discussed below.

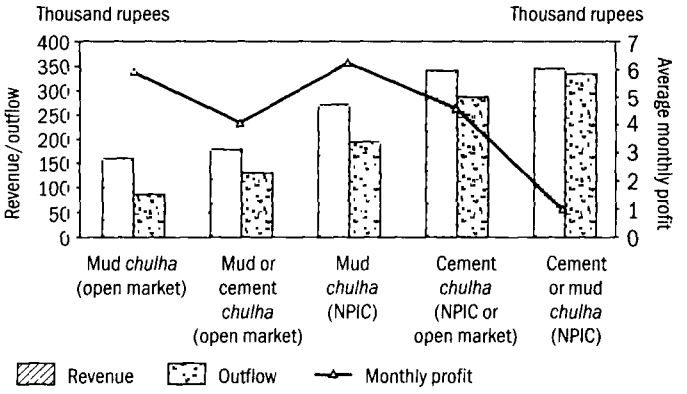
Scenario 1 Potter-entrepreneur selling cement *chulhas* in the open market

Scenario 2 Potter-entrepreneur selling mud and cement *chulhas* in the open market

Scenario 3 Potter-entrepreneur selling mud *chulhas* under the NPIC (approved until 2001)

Scenario 4 Approved SEW selling cement *chulhas*, both under the NPIC and in the open market

Scenario 5 Approved SEW selling cement *chulhas* under the NPIC and mud *chulhas* in the open market



NPIC – National Programme on Improved Chulhas

Figure 2 Cash flow for different scenarios of entrepreneurial ways of disseminating improved *chulhas*

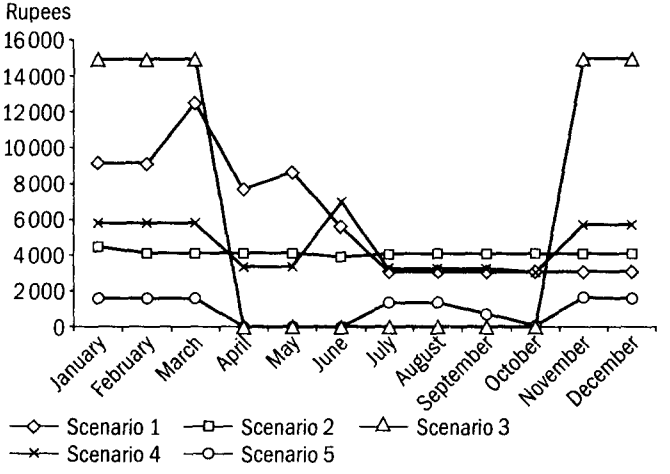


Figure 3 Seasonality affects cash flow in different scenarios

The analysis of different scenarios brings out the following important discussion points.

- Selling mud and/or cement *chulhas* in the open market (Scenarios 1 and 2) can be stable business throughout the year.

- Selling mud *chulha* under the NPIC (Scenario 3) is profitable during 5–6 months in a year.
- Relying primarily on cement *chulhas* under NPIC seems to be the worst-case scenario (Scenario 5).

In terms of commercialization, Maharashtra has a comparative advantage over other states in many ways. First, it already has a tradition of villagers purchasing ICs on their own. As part of the NPIC, the beneficiaries here seem to have been paying a much higher price for mud *chulhas* (75 rupees) than states such as Haryana where they have been paying only 22 rupees. As the beneficiary's contribution towards a cement *chulha* is marginally more than towards a mud *chulha*, the extra burden on those who want to acquire cement *chulhas* is insignificant. Hence, it may be inferred that beneficiaries in Maharashtra are better prepared for the commercialization of the NPIC.

Circumstances are not quite so comfortable on the stove production side. The above analysis shows clearly that selling cement *chulhas* to the government means a high working capital requirement, but does not offer commensurate earnings. The problem of working capital is one that is worrying most SEWs. For those relying just on NPIC targets, there is now an additional pressure to sell *chulhas* in the open market, which brings better returns (against 200 rupees that a cement *chulha* fetches under the NPIC, the same *chulha* can be sold in the open market for 300–350 rupees). This seems to be a desirable trend, and perhaps a real move towards commercialization. However, unless, these potters are assisted in promoting the product, and supported in their working capital problem, there is a risk that they may not be able to survive the transition. This will be a real setback for the drive to commercialize the NPIC in Maharashtra.

Many of the monitoring and quality problems described above stem from the target nature of the programme; users are not purchasing stoves of their choice from a variety of different models but a model – pre-specified within the NPIC's guidelines – is given to them. As a consequence they get a model that does not suit their convenience or habits, and then they modify the IC accordingly. The target nature of the programme also does not allow an environment that fosters competition among the potters to provide after-sales services to the users.

The feature of subsidies in the programme works against its larger objectives as well. Large stove subsidies in certain parts of the state ensure distribution of stoves, but not necessarily their sustained demand. Many stoves fall into disuse or there is a complete lack of inclination on part of the households to repurchase the improved stove. Thus, while the practice of providing ICs at a subsidized cost has helped the state government meet its targets, in the long run it has made people dependent on the government, without them ever properly understanding and appreciating the benefits that can be derived from ICs.

The transfer of the NPIC from the centre to the state is a desirable trend, because it offers an opportunity to the state government to develop new, commercialized stove programmes rather than continue subsidizing the user extensively. Subsidies could be used to support and enable entrepreneurs to build stoves that match user requirements and to create a viable market for them, to support quality control facilities for testing stoves, to finance surveys to discern stove functionality and user opinion, and to train and educate people on technical issues relating to indoor air pollution and stove construction. All these could be integrated with the design and construction process of stoves for ease of use.

The state government could support the commercialization process by formulating policies and encouraging entrepreneurs to produce, distribute, and sell stoves. This can be done by providing them credit facilities through cooperatives and banks; by providing technical standards; and by facilitating the availability of raw material. To ensure that the poorest are not left out of the programme, the government can innovate and support programmes for financial assistance.

Profile of stove users

The average family size among the stove users was found to be 5.53.[12] Of the households surveyed in the three districts (Figure 4) landless farmers make up 37% of the population, 56% own less than five acres of land, and only 7% own more land than five acres. Households in

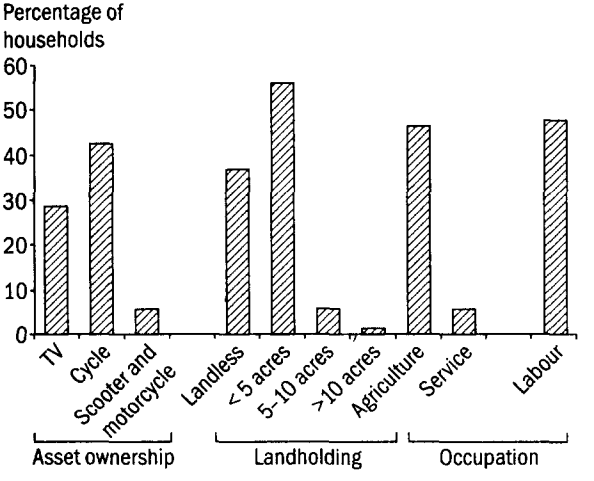


Figure 4 Profile of stove users

[12] The case study covered the districts of Kolhapur, Sangli, and Satara. In each of the districts, 2–3 villages were selected (total 7). A sample of 73 stove users were interviewed. Fourteen focus group discussions with users were also conducted.

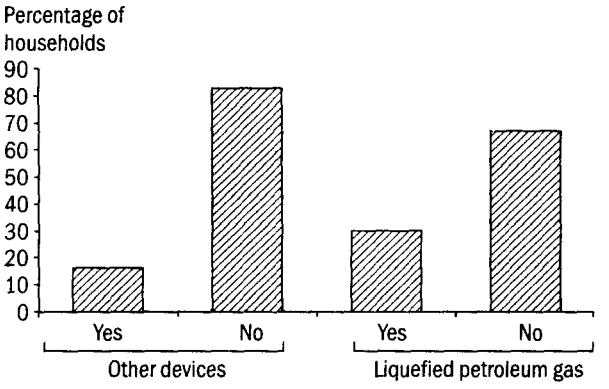


Figure 5 Use of other stoves by households having improved *chulhas*

the last category can afford clean fuels like LPG, and so are not encouraged to become beneficiaries under the NPIC. Most villagers who live in mud houses burn sugar cane residue or wood in their ICs.

The survey found that underscoring the multiple-fuel strategy, 16% of households that own NPIC-subsidized stoves also use traditional *chulhas*, and 30% also use LPG stoves (Figure 5).

Stove operation and maintenance

All the IC owners surveyed had two-pot stoves. In fact, in all the villages covered, none of the respondents even knew that they could get one-pot *chulhas* under the NPIC. Most *chulhas* covered by the study were found to be in working condition (Figure 6). It must, however, be noted that the women who participated in the focus group discussions were largely those who had working *chulhas*.

A few users (19.18%) had made modifications to their stoves (Figure 7). Reducing the pothole size and removing the grate are common modifications. Unlike some states in the north, the tendency here is to make the potholes smaller. The grate is removed because

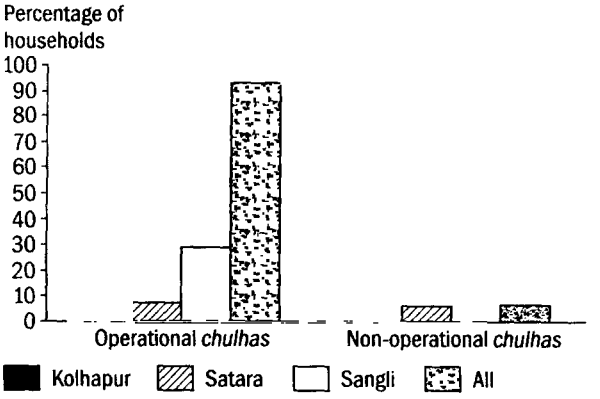


Figure 6 Operational status of *chulhas*

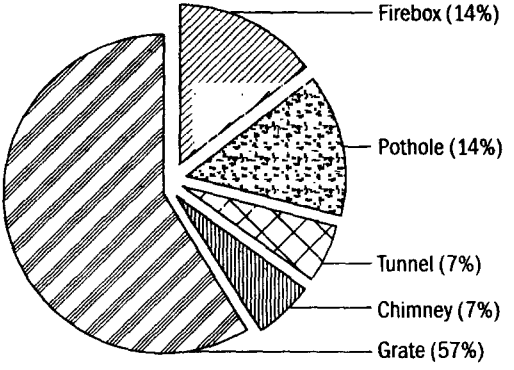


Figure 7 Type of modifications made (percentage of total sampled households)

women find it difficult to remove hot ash from under the grate, and because the space in the firebox on top of the grate cannot accommodate large pieces of wood.

General category households who paid for their stoves generally maintain their stoves better than SC/ST/OBC households who are almost fully subsidized under the NPIC. ICs that had been purchased outside the NPIC for 300–350 rupees were maintained very well; some had been in operation for 8–9 years. It is

evident that people value a stove that they pay for, more than one that they get for free.

There are several cultural practices that also affect stove maintenance in Maharashtra. Overall, stoves in Maratha households are better maintained than those in SC/ST/OBC households. The latter generally depend totally on a single traditional *chulha* or IC. These *chulhas* are therefore used more and so suffer much more wear and tear than *chulhas* in Maratha households that generally own more than one cooking device (IC, LPG stove, kerosene stove, and biogas stove).

Another cultural practice in rural areas is mud plastering of ICs which is more common among Maratha households than among SC/ST/OBC households. This is probably because the Maratha community has a large number of festivals and religious ceremonies throughout the year that customarily require *chulhas* to be mud-plastered as part of a cleansing ritual.

Other than mud plastering, there does not seem to be any maintenance at all. Almost half the respondents admitted to cleaning the chimneys of their ICs only once in three months or even less frequently. Many were not even aware that the chimney has to be cleaned.

Perceived benefits

Users reported two major benefits. One is the ability to cook on two pots at the same time, and the other is cleaner vessels and kitchens because of less soot. In 50% of the villages covered in the study, people buy fuelwood at an average price of two rupees per kg. Fuel shortage is almost never mentioned as a serious problem, but fuel saving is the most commonly stated benefit of improved stoves (Figure 8).

After fuel saving, the most commonly stated benefit of an IC is that of reduction or removal of smoke. Among the users interviewed, 47% said that they

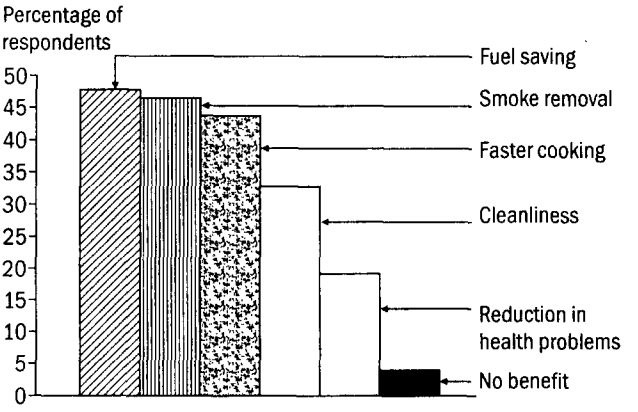


Figure 8 Perceived benefits of improved *chulhas*

experienced a cleaner cooking environment when cooking on ICs. Smoke in the kitchen is a problem, especially in villages where sugar cane residue is the primary fuel.

In this part of the country, houses are set close to each other. Courtyards, if any, are very small. Unlike in Haryana where the kitchen is usually a separate room in the courtyard, kitchens in rural Maharashtra are located inside the houses, typically in the innermost room, and open out into other rooms. Because of this layout, smoke from the kitchen gets into other rooms as well. Most women felt that the smoke is injurious to the health of their children and greatly appreciated the IC. On the whole, users' response to ICs was positive.

Problems faced in IC usage

No major inconvenience was reported in the usage of ICs (Figure 9). Five per cent of users said that the pothole is too large; but people who face this problem either rectify it themselves, or place a metal plate on top of the pothole and put smaller vessels on it. These metal plates are easily available in most villages at the local ironsmith. Another problem that has been discussed earlier is the grate.

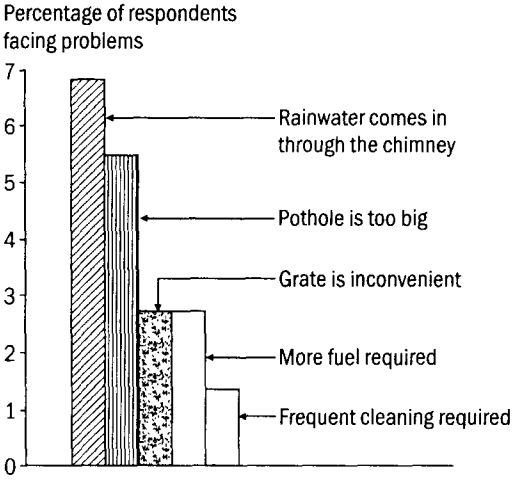


Figure 9 Problems faced in improved *chulha* usage

Discussions with non-users suggested that the two most important reasons for not using ICs are lack of space to install them, and lack of clarity and complete information about the NPIC. It is worth noting that a good number of households use ICs, even outside the purview of the NPIC. In villages within the NPIC's purview, many people said that while they would like to install ICs, the programme mainly covered only the SC/ST/OBC categories.

Best practices in the Maharashtra NPIC programme

Maharashtra has a better success rate than other states primarily because the ARTI, the state's TBSU, encourages rural potters to take up stove construction as a business. The success of its effort is evident today in the desire of rural potters to expand their business, and influence other potters to take up IC construction as a commercial venture, despite the central government's decision to withdraw subsidies and transfer the NPIC to the states.

The presence of three implementing agencies and the active participation of the district and local governments has ensured high penetration levels of the IC programme in the rural areas of the state. A strong TBSU has also contributed to the programme's success. It has made valuable contributions in technology development and capacity building. Further, the IC models propagated do not have complicated features, and are similar to traditional stoves in appearance and function. Regular feedback from IC users and design of new stoves based on such feedback has also contributed to strengthening the IC programme in the state. The TBSU has also been able to integrate indigenous knowledge of traditional potters on stove-making into improved stove development, and has involved potters quite effectively in the process.

Given the existing tradition/practice of buying traditional stoves in Maharashtra, the overall level of preparedness of the beneficiaries for commercialization is quite high. The stove programme implementers are consciously trying to build on this existing strength, and over the past few years have promoted commercialization in a systematic manner.

To sum up, the key success factors in the Maharashtra NPIC model are as follows.

- Programme implementation through a decentralized government network
- Building a strategy based on an existing tradition of stove construction and its sale by potters
- Focused IC commercialization strategy
- The TBSU's close involvement with the commercialization process
- The TBSU's interaction with stove users and manufacturers.

Conclusion

While Maharashtra is far ahead of other states in commercializing the NPIC, it also faces significant challenges in order to sustain this effort. The study identified three key issues: (1) subsidy withdrawal and its effects, (2) general dissatisfaction with many features of ICs, and (3) the need to have better stoves for a more focused market. To address these, policies are required that will provide an enabling environment to IC entrepreneurs. Reaching the poorest households will however remain a challenge.

West Bengal

Introduction

In West Bengal, three programmes – the NPIC (National Programme on Improved Chulhas), the IREP (Integrated Rural Energy Programme), and, on a limited scale, the IAY[1] (Indira Awas Yojna) – disseminate ICs (improved *chulhas*). The state forest department has also made sporadic efforts to install ICs in villages within the vicinity of protected areas. Most ICs in the state have been installed under the NPIC. It was initiated in 1984, and runs in all 18 districts through a network of 150 NGOs (non-governmental organizations). The key nodal agencies for the NPIC are the SWD (Social Welfare Department),[2] the KVIC (Khadi and Village Industries Commission), and the WBREDA (West Bengal Renewable Energy Development Agency). The KVIC has installed the maximum number of stoves (49% of total installations) (Box 1). The SWD and WBREDA suffer from paucity of manpower and associated infrastructure. Further, pressure from the state government on these agencies to install ICs in socially

[1] The IAY is a housing programme for people below the poverty line under the charge of the Planning Department, Government of West Bengal.

[2] The SWD is the most experienced stakeholder in the country. It is possibly the only state agency to install more than 1 million ICs.

Box 1 KVIC (Khadi and Village Industries Commission): the leading nodal agency for the National Programme on Improved Chulhas in West Bengal

The high penetration levels achieved by KVIC may be attributed to its having an exclusive division for disseminating renewable energy technologies, fewer districts targeted, a network of six non-governmental organizations working exclusively to disseminate improved *chulhas* and biogas plants, and direct infrastructural support from the Government of India.

and economically backward districts has resulted in low penetration levels.[3]

IC penetration varies in different districts. Between 1995 and 2000 more cookstoves were installed in the southern districts of the state (1 210 332) than in the northern districts (883 403). Fewer stoves were installed in north Dinajpur, Purulia, and south Dinajpur because fewer NGOs are involved in the NPIC there. Districts closer to the state capital, Kolkata, are at an advantage of getting targets approved and funds released largely because of political influence.

Both fixed mud models (*Sugam*, *Sohini*, *Kalyani)* and portable metal models are disseminated. However, the scale of dissemination of portable ICs is much smaller, both in terms of installations (1.34%) and geographical area covered (Box 2).

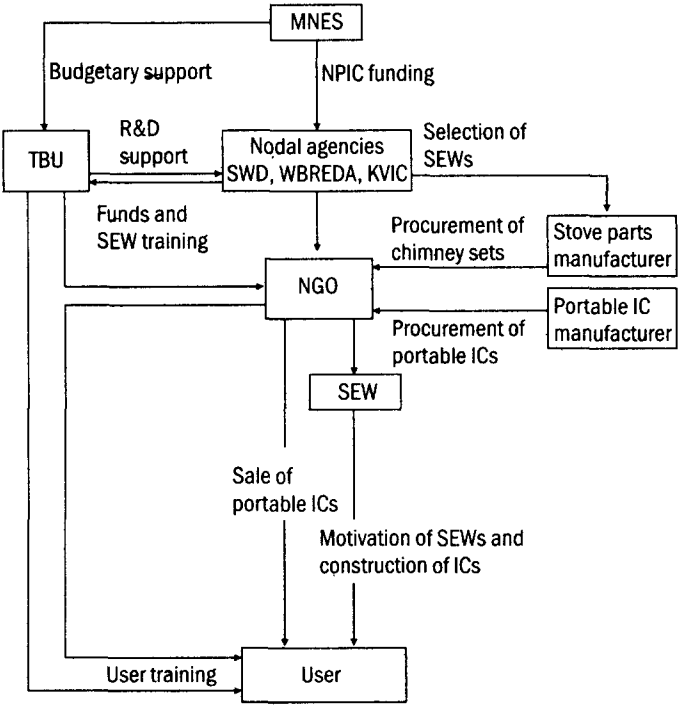
Institutional structure for improved *chulha* dissemination

As mentioned in the previous section, the responsibility for all NPIC-related activity in the state is vested with the SWD, the WBREDA, KVIC, and the TBU (technical back-up unit) (Figure 1). All the nodal agencies are

[3] Low literacy, high poverty, and poor awareness about ICs act as deterrents.

Box 2 Portable, metal ICs (improved *chulhas*): conditions for acceptability

Dissemination of portable ICs is affected by high cost (160 rupees) and low incentives for self-employed worker (five rupees). However, these are popular in the hilly regions, tribal belts, and flood stricken areas of the state because of (1) local cooking practices such as curing meat and vegetables, and drying firewood; (2) need for space heating; (3) portability; (4) durability (a portable stove lasts more than five years); and (5) the ability to endure climate extremes.



IC – Improved *Chulha*; KVIC – Khadi and Village Industries Commission; MNES – Ministry of Non-conventional Energy Sources; NPIC – National Programme on Improved Chulhas; NGO – non-governmental organization; R&D – research and development; SWD – Social Welfare Department; SEW – self-employed worker; TBU – technical back-up unit; WBREDA – West Bengal Renewable Energy Development Agency

Figure 1 Institutional set-up for the NPIC in West Bengal

based in Kolkata. The TBU is located at Kalyani in the district of Nadia. The SWD has a separate NPIC cell that has staff dedicated to disseminating ICs. The WBREDA is involved mainly in disseminating renewable energy technologies, with a thrust on solar energy.[4]

Like the SWD, the KVIC has a non-conventional energy cell that disseminates ICs and biogas plants. The TBU provides technical support[5] to nodal agencies, implementing agencies, and suppliers of stove parts. The nodal agencies' network of 150 NGOs forms the backbone of the state's IC programme (Box 3).

Depending on its reach, an NGO may be able to cover 20–150 villages in a year across 2–10 districts, but

Box 3 NGOs in the NPIC (National Programme on Improved Chulhas): lending a multi-sectoral approach to implementation

Many agencies have accepted the nodal agencies' invitation to participate in the NPIC. It is a recent activity for most NGOs (non-governmental organizations) except for the Ramakrishna Mission Lokashiksha Parishad and the Gram Seva Sangh, which have been involved in cookstove activities since 1984/85. NGOs associated with the cookstove programme primarily implement rural development schemes directed towards health, primary education, sanitation, rural microcredit, and afforestation. The NPIC has, therefore, been taken to complement these existing programmes.

[4] The WBREDA has just two persons (an additional director assisted by a supervisor) implementing the NPIC.

[5] TBU's activities include (1) R&D initiatives entailing modification of existing IC models, design of new stove models, field trials of ICs and testing of portable IC models; (2) capacity building of SEWs, unemployed youth and IC users; (3) feedback surveys; (4) design and production of publicity material; (5) adoption of villages in collaboration with local government agencies for 'smokeless' settlements; and (6) measurement of indoor air pollution. Its operations are based on an annual action plan for the current financial year.

household coverage is generally less than half of this. Motivators and SEWs report to supervisors,[6] and monthly meetings that include Panchayat members are held to review the progress of the NPIC and also to prepare a joint action plan for the next month.

As mentioned above, the responsibility of providing technical inputs to the implementing agencies lies primarily with the TBU. Nodal agencies also impart technical training to SEWs and beneficiaries on the lines of the TBU's main training curriculum and the MNES' (Ministry of Non-conventional Energy Sources) 'hands-on' training schedule, organized in association with NGOs. For resource persons, assistance is taken from the TBU (SWD), as well as from trained and experienced SEWs (WBREDA).

Mode of programme implementation

As in most states, the IC programme in West Bengal is target-oriented. MNES allots annual targets to nodal agencies based on their requests[7] and past performance. Target beneficiaries of the NPIC are rural households. Twenty-two per cent of the target is reserved for providing ICs to socially backward (scheduled castes and scheduled tribes) and economically backward (below poverty line) communities. By the month of April, NGOs give their targets along with details of blocks, villages, and households to be covered for that year. The nodal agencies finalize their annual action plans based on the NGOs' requests.

After approval from the MNES, targets for ICs and training courses are allocated to the respective NGOs based on their past performance and requisition. Once

[6] A supervisor is usually in charge of a block, assisted by 4–5 motivators and 2–3 SEWs.

[7] The agency provides details regarding the number of districts, blocks, and villages it plans to cover.

Box 4 Measures taken to enhance effectiveness of the National Programme on Improved Chulhas in West Bengal

- All households (100%) in at least one village should be covered in every target block (KVIC)
- Selection of a cluster of villages to facilitate M&E (KVIC)
- In selected villages, 80% of all households should be covered (WBREDA)
- With regard to NGO (non-governmental organization) autonomy after the sanction of a target, the modalities of implementation in the field are left to the NGO's discretion
- For collaboration/subcontracting, the Ramakrishna Mission Lokashiksha Parishad identifies clusters of youth clubs that operate at block level (maximum of eight blocks). The clusters are accountable for the selection of villages and households, and for the construction of cookstoves.

the NGOs' targets are finalized,[8] the nodal agencies begin preparing quarterly action plans. These include planning training camps for users and SEWs, awareness generation campaigns, management training courses, and feedback surveys in the districts of operation. Post-installation verification of *chulhas* is undertaken by the nodal agencies themselves, which submit quarterly reports to the MNES, outlining their progress (Box 4).

Stakeholder interaction

Interaction between SEWs and the TBU or the nodal agency takes place during SEWs' main and refresher training courses, feedback surveys, and training programmes held in target villages. These programmes are, however, sporadic. Users prefer working with NGOs and SEWs more than with nodal agencies or the

[8] NGOs' targets range between 200–20 000 installations. For a newly established NGO, the target is generally low: less than 500 ICs.

TBU—their frequent gestures of giving the SEWs 10–50 rupees extra for their services underscores this. Depending upon the time an SEW spends, users often pay an additional token sum of 5–10 rupees for repairing the IC.

At the state and district levels, monthly, quarterly, and annual meetings are organized to discuss action plans, progress of implementation, and other issues. Nodal agencies,[9] NGOs, suppliers of stove parts, the TBU,[10] SEWs, etc. attend these meetings. Nodal agencies, however, have no formal mechanism to address the concerns of NGOs.

Marketing of improved cookstoves

Fixed *chulhas* are marketed differently from portable ones. While fixed *chulhas* are marketed by NGOs (Box 5) and state nodal agencies, portable ones are marketed directly by their manufacturers.

Box 5 Use of personal contacts to promote *chulhas*

Non-governmental organizations rely greatly on personal contacts to win the confidence and commitment of potential users. They use the contacts they build during the implementation of other rural development schemes to persuade households to invest in improved *chulhas*. Very often, self-employed workers act as both builders and motivators. Demonstrations too have an impact on target communities that is usually greater than simple verbal communication.

[9] In the case of the KVIC, the action plan is drawn up by its head office, based on inputs from its state office. As a result, there is often duplication of work in the KVIC's target villages and the other two nodal agencies.

[10] The TBU has formed (1) an advisory committee that meets once a year to formulate its annual action plan, and (2) a coordination committee (formed of TBU and nodal agencies) that takes decisions, such as testing of IC models, capacity building programmes, etc. The frequency of such meetings is sporadic and need-based.

Fixed stoves

Fixed stoves are marketed through public campaigns, village institutions such as the *Gram Panchayat,*[11] and rural development scheme workers (such as ICDS staff, *Mahila Mandals*, self-help groups, and primary-school teachers). Motivators are paid a monthly honorarium of 20–300 rupees. They also earn a fee or commission of 2–5 rupees per IC they install. Stove builders, who also act as motivators, rarely take any fee because their income is already linked to the number of ICs installed.

Nodal agencies complement the NGOs' promotional activities in public events. Their contribution includes production of publicity material (user manuals, SEW manuals, leaflets, banners, booklets, posters in regional languages, prototype models); and holding exhibitions at fairs, conferences, workshops, etc. They also participate in awareness camps organized by NGOs.

Portable stoves

Portable ICs are marketed directly by the two manufacturers based in Kolkata. To generate awareness on portable stoves, they participate in trade fairs, seminars, exhibitions, etc. The main buyers of portable ICs are NGOs, state government agencies such as the forest department, and renewable energy development agencies of the north-eastern states. The high cost of the stove (160 rupees) and low incentive for dealership support (five rupees) can act as deterrents to marketing portable improved stoves by SEWs, NGOs, and shops selling solar energy devices. However, despite low sales, manufacturers feel that the portable IC market will grow if the government subsidizes portable IC as much as it does a fixed stove.

[11] The panchayat deputes a person (educated and with field experience) to work as motivator (on commission basis) in the selected villages. This person is also required to assist the SEW during stove construction.

Production of stoves

Fixed stoves

SEWs produce and install fixed ICs. These SEWs are identified and trained by the NGOs.[12] This process has many features. NGOs identify and select villages on the basis of their rapport with the village headmen and village-level institutions—small NGOs generally select villages located within a 10–15 km radius, while bigger NGOs operate in more than one district. NGOs survey[13] households to assess their need. Most NGOs document the dissemination process, including the user's contribution. Users procure raw materials that are locally available and free, such as clay, sand, cattle dung, straw, and husk. The chimney set (stove, chimney, tunnel, cowl) is procured from sanitaryware manufacturers; the nodal agencies have empanelled eight manufacturers based in Kolkata. NGOs pay a landing cost of 60–67 rupees for each chimney set, which includes transportation charges.[14] The NGO spends 2–7 rupees per set in transporting the chimney set to the target village.[15] The construction takes place simultaneously in a number of households to save time and effort. The SEWs construct 3–4 one-pot stoves per day on an average (Box 6). During the building stage, the SEW visits the household at least three times.

[12] If the target is small, the NGOs try to allot an equal number of ICs to the SEWs.

[13] If the demand for the stoves is more than the target, the issue is discussed with panchayat members, and households are shortlisted hamlet-wise on a priority basis. Preference is given to beneficiaries on a first-come first-serve basis and to those from socially and economically backward communities. The objective is to cover the maximum number of households in a village rather than cover a larger number of villages.

[14] Organizations based in northern Bengal districts such as Jalpaiguri and Cooch Behar pay as much as 85 rupees for the sets.

[15] The beneficiaries are sometimes asked to share the carriage cost if the distance is too great, and sometimes themselves carry the sets from the warehouse.

Box 6 Sub-SEWs (self-employed workers) of the West Bengal IC (improved *chulha*) programme

Construction is undertaken by SEWs individually or with the help of assistants also known as sub-SEWs. When sub-SEWs gain some experience they graduate to the SEW level. After one to two years of probation, they are recommended for formal SEW training at the TBU or at training programmes organized by the nodal agencies. The quality of construction of ICs by sub-SEWs is ensured by the main SEW who inspects the stove and verifies its technical specifications.

Portable stoves

Portable ICs of cast iron and mild steel are bought readymade from manufacturers that are registered SSI (small-scale industry) units and have BIS (Bureau of Indian Standards) certification. These manufacturers are based in Kolkata, and have been identified by nodal agencies in consultation with the TBU. They arrange to transport the stoves to the distribution site at the buyer's cost.

Stove parts

Eight manufacturers of SSI stove parts[16] in the vicinity of Kolkata have been approved by the nodal agencies. There are two approaches in this—the 'open' and the 'fixed'. The WBREDA and KVIC take the 'open' approach that provides a list of approved suppliers to the NGOs for them to choose from. The SWD takes the 'fixed' approach that allocates specific suppliers to NGOs to ensure equitable allotment of orders and thereby to restrict the number of suppliers each NGO can approach.

[16] Selection of suppliers is based on the lowest bid system.

Each supplier gets an average of 10–15 client NGOs annually, who procure IC sets according to their targets. The sale of stove parts to the NGOs, on the other hand, is transacted directly between the supplier and the NGO. The stove parts are generally sold and supplied as sets.[17] The delivery of stove parts is the responsibility of the supplier, who generally pays 2200 rupees per truckload of 200 sets to be delivered to a site 350 km from Kolkata. Suppliers prefer to deliver goods to centralized locations close to the roads so as to ensure public delivery and minimal damage. Most suppliers replace the sets if more than 5–10 sets are damaged.

Quality control

All stove parts and portable ICs are certified by the TBU. Inspectors from the BIS also check the sets regularly. The following measures have been put in place to ensure the quality of stove design and construction.

- Only applicants with a certain minimum educational qualification are allowed to enrol in SEW main training courses.
- Only those who the TBU or nodal agencies certify as SEWs are eligible to construct ICs.
- No SEW can conduct training on IC construction and installation without the approval of the TBU or of the nodal agency.[18]

[17] Each set comprises two pieces of AC pipes (3 cm diameter, 1 cm pipe plus one 4 cm); one tunnel (2 cm diameter, 18 cm length, permitted up to 30 cm); and one cowl. These parts are made of asbestos and cement and are popularly referred to as chimney pipes.
[18] This directive is often disregarded as non-certified stove builders are also involved in stove building, particularly sub-SEWs. For example, in a target village in the tea belt of northern Bengal, the users had discontinued the use of ICs because of inadequate heat generated by the stove. This was a result of a constructional defect in the firebox opening (it was made smaller than the designed specification).

- Panchayat members and block- and district-level rural development officers are required to physically verify and then certify ICs (in a prescribed format) constructed in target villages within their purview.
- NGOs engage their supervisors as well as their staff to verify the installation of ICs.
- The TBU and nodal agencies carry out concurrent feedback surveys[19] to assess the operational status of ICs disseminated by the NGOs.
- Users are accountable for the operation and maintenance of their ICs and also participate in the user training courses.
- SEWs train users and make periodic visits.
- NGOs are obligated to provide free after-sales service for a year (Box 7).

Constraints to quality control

There are two main constraints in maintaining IC quality. One is that, generally, users are reluctant to pay for services rendered because there is no formal mechanism for payment, and the other is that because there is no monetary incentive for SEWs, sometimes they take more than a week to attend to complaints. Also, to ensure quality control, some NGOs release the service charges after a couple of months.

As a result, users, more often than not, request modifications,[20] which SEWs accommodate to retain the

[19] These are annual sample surveys carried out in all the districts. Attempt is made to cover the maximum number of NGOs and blocks. Out of every ten target villages identified, two villages are randomly selected for evaluation, in which a 100% user survey is conducted.

[20] The commonly sought changes include (1) increase in the pot hole diameter and the depth of the firebox for feeding fuels (dung cakes, leaves, straw) other than wood, (2) use of bent chimneys for preventing fire hazards, (3) increase in the diameter of the chimney for ease in cleaning and smoke removal, (4) increase in the tunnel diameter in the two-pot stove for uniform flow of heat, and (5) use of bricks in the construction of the firebox.

Box 7 After-sales service of non-governmental organizations: innovative measures

- Quarterly inspection of improved *chulhas*
- Weekly and monthly meetings between supervisors and SEWs (self-employed workers)
- Repairs carried out during feedback surveys
- Procurement of new stove parts on payment
- Replacement of parts within one year
- Assistance in maintenance, such as cleaning the chimney
- Block-level consumer assistance cells manned by SEWs who redress complaints and accept orders for new installations
- Provision of payment-based after-sales service after expiry of the warranty period

popularity of ICs. On the other hand, households are willing to pay SEWs for changes made, and also for the cost of new stove parts. Despite the TBU's efforts to incorporate features suggested by users, neither they nor the NGOs have been able to stop users' requests for modification during or after installation, because of following reasons.

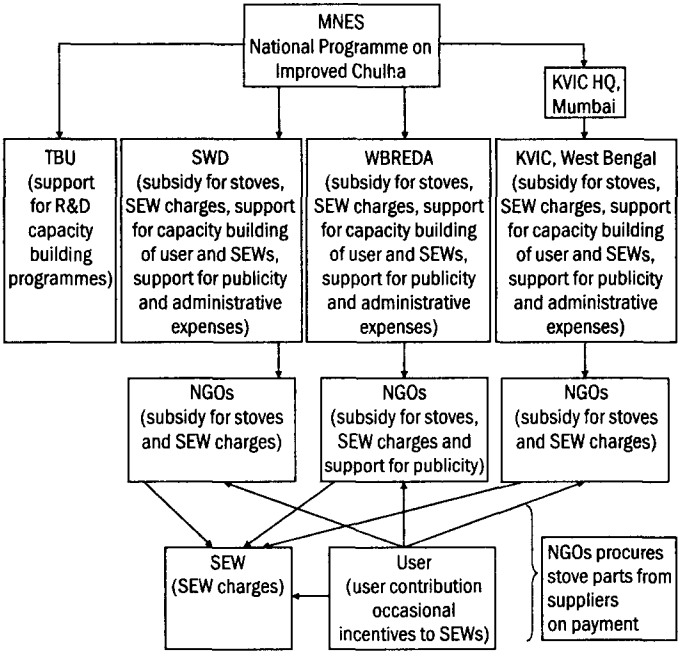
- The TBU has no uniform policy to approve changes requested by NGOs.
- User training courses have been too few and are unable to explain the impact of modifications on the original stove design.
- Although models of stoves using loose biomass have been developed by the TBU, they are not disseminated.

Financial structure and subsidy flows of the stove programme

The NPIC in West Bengal subsists entirely on the MNES' subsidy towards the cost of the stove, SEW service charges, and associated activities such as capacity building and awareness generation. Subsidy towards the stove cost accounts for over half of total

support. While the SWD and WBREDA receive funds directly from the MNES, funding for the KVIC is routed through its central office (Figure 2). The state government does not support the cost of the ICs, but bears part of the administrative cost and salaries of the regular staff of nodal agencies associated with the NPIC. The prices and subsidies for the popular fixed models are given in Table 1.

Both the nodal agencies and TBU receive financial support for R&D (research and development) and capacity-building activities from the MNES. This accounts for only six per cent (1999/2000) of the total



KVIC – Khadi and Village Industries Commission; MNES – Ministry of Non-conventional Energy Sources; NGOs – non-governmental organizations; SWD – Social Welfare Department; SEW – self-employed worker; TBU – technical back-up unit; WBREDA – West Bengal Renewable Energy Development Agency

Figure 2 Funds flow of the National Programme on Improved Chulhas in West Bengal

Table 1 Financial contribution by government and users for popular models

Model	*Raw material cost* (rupees)	*SEW charges* (rupees)	*Total cost* (rupees)	*Government subsidy* (rupees)	*User contribution** (rupees)
Sohini seva	130	20	150	60	90
Sugam seva	150	30	180	70	110
Kalyani	110	20	130	60	70
Parivarbandhu	220	20	240	100	140
CPRI type I	160	5	165	45	120

* Includes contribution in kind in the form of mud, dung,-straw, and labour

funds received by them annually. The TBU receives an annual grant of a million rupees from the MNES, and 500 000 rupees from the state government for R&D and staff salaries. It also gets funds for conducting training programmes. The MNES provides two rupees per IC towards publicity and staff training. The SWD and KVIC use this to produce publicity material to distribute to NGOs. The WBREDA releases this sum to its NGOs for publicity operations.

Nodal agencies also avail of funds from the IAY that provides a few free ICs to BPL (below the poverty line) households, and from state-sponsored rural sanitation schemes that offer households large discounts on stove parts if they accept ICs along with the sanitary facility package.

The funding pattern of the NPIC in West Bengal has the following features.

Advances The WBREDA advances half the target (26 rupees per IC) for stove operations[21] to its NGOs,

[21] All expenditure incurred by NGOs on the stove programme is reimbursed by the nodal agencies after the activities are complete on a monthly/quarterly/annual basis depending on the volume of the work. NGOs are required to submit utilization certificates supported by vouchers and certificates of installation from the Panchayat, etc., for the release of payments.

but not the SWD or KVIC. This puts their NGOs under financial stress and has also prompted many to change affiliations to WBREDA.

User contribution Since no money is advanced for constructing fixed stoves, NGOs under the SWD and the KVIC mobilize resources from users and also use their own funds to initiate activities. The users' contribution is generally advanced to suppliers of stove parts. For portable stoves, the scope of charging a variable user contribution is negligible[22] (Box 8).

NGO's costs NGOs spend 5000–20 000 rupees annually on administration and travel in excess of government support. Nodal agencies support the NGOs to the extent of 20 rupees per one-pot fixed chulha and 30 rupees per two-pot fixed chulha towards SEW service charges. The funds are paid in two instalments. For a one-pot IC, 10 rupees is released after construction (the corresponding figure for a two-pot IC is 20 rupees). The remainder, meant for maintenance and supervision, is paid after a year. However, most NGOs pay SEWs without waiting to be paid by the nodal agencies. In the

Box 8 Facilitating uptake of the improved *chulhas* by the poor

The state has no formal policy for pricing improved *chulhas*. The size of the user's contribution depends, therefore, on the NGO's policy. To facilitate installation, NGOs assist willing but poor households by

- treating contributions as instalments;
- soliciting political parties to finance installations totally;
- accepting lower contributions from economically backward communities; and
- sharing the cost with Panchayats.

[22] The price (160 rupees) is fixed by the manufacturer.

case of portable ICs, suppliers are paid in full after they deliver the goods. The NGOs claim the subsidy due when they submit their accounts.

Fund diversion To compensate for inadequate funding and delays, NGOs divert resources from other development schemes that have either contingency grants or rolling funds to meet additional administrative expenses.

Membership fee Some NGOs charge a membership fee from the SEWs for administration and publicity expenses.

Loss-making proposition for suppliers of stove parts Stove parts are supplied to NGOs at 60–65 rupees per set as per the government (nodal agency) rate.[23] However, these sets sell for 70–80 rupees in the open market and BIS-marked sets cost as much as 160–165 rupees. The suppliers, however, have to abide by the purchase rates fixed by the nodal agencies.

Consumer satisfaction

User surveys and focus group discussions[24] suggest that 90% of stoves constructed during 1995–2000 were operational. Users feel that the IC's primary benefit is a smoke-less, clean kitchen where women can cook and supervise their children's studies simultaneously. Walls and utensils stay clean as the chimney vents out the smoke. Users also feel that ICs reduce the risk of burn injuries and irritation of burning and watering eyes (Figure 3). Users did, however, mention a few problems.

[23] NGOs under the KVIC operating in northern Bengal pay 40–50 rupees per set as they have decreased the length of the chimney to six feet and use a bend instead.

[24] In the study districts of Medinipur, Jalpaiguri, and South 24 Parganas, 103 stove users were interviewed and more than 106 users participated in the focus group discussions on consumer satisfaction. Almost all the ICs installed in surveyed user households were Sohini Seva and Sugam Seva.

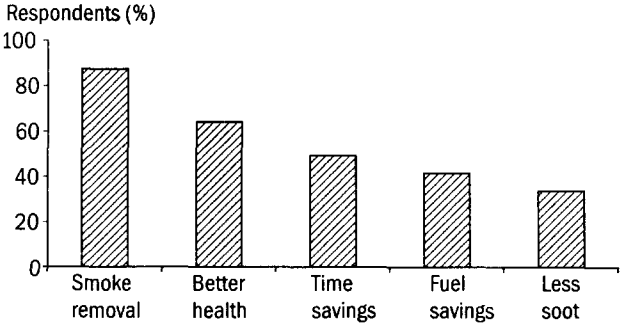


Figure 3 Perceived benefits of ICs

One is that women find it difficult to climb onto the roof to clean chimneys—men usually do not help. Another is that the IC cannot accommodate the vessels households use and so limits the quantity of food that can be cooked at a time. Also, because the flame in an IC is not clearly visible to elderly women, they tend to use more fuel.

SEWs and NGOs say that 5%–6% of ICs are demolished. This may be to avoid the risk of fire to thatched roofs, to avoid the problem of maintenance, or the kitchen has been shifted, or because of damage by natural causes.

Plan to repurchase

Users as per the study area rarely, if ever, repurchase ICs. They usually modify their ICs or build new ones. User may spend up to 1000 rupees to buy the chimney, cowl, and tunnel. They may also pay the SEW 15–25 rupees to carry out extensive repairs. Users copy the dimensions of existing ICs and use discarded chimneys to build new ones.

Best practices in the National Programme on Improved Chulhas in West Bengal

Many practices of the NPIC in West Bengal may be replicated in other IC and household energy programmes as effective strategy (Box 9).

Box 9 Successful practices in the implementation of the NPIC (National Programme on Improved Chulhas) in West Bengal

- Village-level dissemination through extensive network of about 150 NGOs
- Autonomy to the NGOs for programme implementation, with no interference from nodal agencies
- Involvement of village-level institutions in marketing and monitoring of stoves
- Intensive marketing and linking of the NPIC with other rural development schemes
- Emphasis on 100% household coverage in target villages rather than on increasing the number of villages covered
- Involvement of many educated youth as SEWs (self-employed workers) owing to dignity of labour associated with *chulha* building
- Cost sharing of ICs (improved *chulha*) by NGOs and the Panchayat for economically backward households as part of their social responsibility
- Close interaction among users, SEWs, and NGOs
- Regular testing of stove parts and portable ICs by the technical back-up unit for quality control
- Informal training to users on operation and maintenance of stoves and for carrying out minor repair
- Regular after-sales service to users
- NGOs carry out R&D without financial assistance from the MNES or from nodal agencies
- Flexible stove pricing policy

Network of NGOs

The most laudable aspect of the IC programme in West Bengal is the high degree of penetration. This has happened because the nodal agencies' affiliate NGOs have extensively disseminated ICs at the village-level.

West Bengal is possibly the only state that has enlisted an extensive network of 150 NGOs for stove activities. As a result, the reach of ICs has been extended to the entire state.

Review and planning

Nodal agencies have their peers review their annual action plans. This lets each agency target blocks and villages unique to itself so that the agencies may collectively reach more people.

Active stakeholder interaction

Nodal agencies meet every month and quarter to discuss and try to solve the problems they face during implementation. They meet SEWs and users during training programmes, and also meet informally to learn about field operations in detail.

Adequate after-sales service

SEWs visit beneficiaries to provide after-sales service, even after the mandatory inspection period of one year is over. These visits let them know how the ICs are working and supervise the design modifications that users request.

Extensive marketing efforts

Adequate thrust is given to marketing and motivation at the community and household levels by providing monetary incentive to motivators. Besides commonly used publicity aids such as posters, handbills, and video films, demonstrations of IC technology have been used to create a greater impact.

Appropriate quality control measures

The regular testing by the TBU for quality control of stove parts for fixed ICs has ensured the delivery of quality stove-parts to the users.

Appropriate stove designs

The popular Sohini and Sugam models are modified versions of the earlier, locally developed IC. The TBU is a pioneer in the development of the coal-based Kalyani model of ICs, designed in response to the needs of households in the state's coal belt. The SEWs also modify stove design according to users' specifications. Hence, even though the custom-built stoves do not conform to the original design blueprint, it is ensured that the device will be to the user's satisfaction. To counter the expensive but durable IC developed by the TBU, some NGOs have designed cheaper models without any technical inputs from the TBU.

Flexible stove price

Due to the absence of clear guidelines, stove prices are flexible, and depend on the policy of individual NGOs; the nodal agencies do not interfere. Consequently, in periurban areas, where the beneficiary has to purchase firewood, SEWs claim a higher contribution from users than in rural areas—this has helped stove builders earn some incremental income. The flexibility in pricing has also helped in meeting the demand for ICs made of superior raw material by users with higher purchasing power. Wider reach has also been achieved in this manner.

Conclusion

The following suggestions may further strengthen the programme. These are general in nature and cut across state boundaries, so they may be useful for stove and

household energy programmes in other countries as well.

Extension of microcredit facilities

In order to further improve the penetration of improved ICs, there is a need to explore opportunities in extending credit to consumers to buy ICs, and thereby foster its market. In the Indian context, with the policy directive to disseminate only durable models, credit would need to be provided to consumers. Incentives in the form of higher service charges and technical training could then be given to the SEWs as part of an effort to promote the commercialization of ICs.

Framing of a policy on service charges

Lack of a policy on after-sales service charges has given most SEWs a reason to complain about the reluctance of users to pay for repairs or services rendered after the warranty period. Moreover, some Panchayats have also instructed the SEWs not to charge the users for repair work. This has discouraged many SEWs from undertaking repairs, hence affecting the performance of the *chulhas*. The nodal agencies need to formulate policies on these issues based on the type of repairs undertaken. Such a policy may stipulate fixed rates for repairs so as to make after-sales services viable and effective. This will ensure immediate rectification of problems, increasing the functionality rates, and providing additional income to SEWs.

Support for administrative expenses

In absence of funds under the national programme for meeting administrative expenses, the nodal agencies have decided not to increase the current level of dissemination, especially those related to M&E. There are no mobilization funds provided (except in the case of

WBREDA) to initiate chulha-related activities. As a result, NGOs cross-subsidize from their ongoing projects. The quality of work, therefore, gets affected since this has implications for the travel budget, salaries offered, etc.

Need for improvements in programme monitoring and evaluation

Some potential improvements that can be undertaken are as follows.

- Inclusion of technical performance in concurrent feedback surveys, including testing of smoke emission levels and exposure levels
- Increasing scale of evaluation
- Allocation of a separate budget for measuring technical performance
- Mechanisms to check violations of technical specifications
- Enhanced interaction between the TBU, SEWs, NGOs, and the users
- Third-party evaluation studies

Need to reconsider appropriateness of new models

Introduction of the durable model – using bricks and cement – has already become a cause of concern for SEWs. They fear that the transportation of construction material to villages in the interior will be difficult, though some NGOs suggested that unfired bricks could be used instead. Modifications to the pothole and firebox desired by users may not be easy to implement owing to the concrete body of the durable stove.

Users' perceptions also need to be taken into account in this context. For instance, the contribution that the user is expected to make in case of durable ICs would determine whether they would buy them. Sums higher than the existing rate (20 rupees) would not be

acceptable, more so because the head of the household, (primarily a male member) would have to be convinced of the advantages of a durable IC over prevalent models. Users in periurban areas may be more willing to contribute up to 150–200 rupees towards the cost but only after getting a five-year guarantee. Similarly, demonstrations would be required before potential users consider buying the new model. Other apprehensions and doubts that would need to be countered include intense heat cracking the stove, inability to carry out modifications or repairs as required, and dependence on SEWs and NGOs for construction material.

Building on user awareness levels

As per the survey conducted by TERI, users are aware that a subsidy is provided but did not know its pattern or the current price of ICs. For this reason, they do not question the contribution requested by NGOs or SEWs towards the cost of the stove. Half the users surveyed paid between 30–60 rupees. In some cases, mainly in periurban areas, users paid as much as 120 rupees per fixed IC. User awareness on these issues needs to be built.

Bridging the gender gap: training women SEWs

One of the main objectives of the NPIC is to provide gainful employment to chulha builders, particularly women. However, the ratio of male to female SEWs in West Bengal is in the favour of men. Women SEWs tend to discontinue their jobs, as *chulha*-building activity involves frequent travelling, irregular working hours, and staying away from home. In about 10%–15% of cases, the low volume of work acts as a disincentive. There is, hence, a need to consider such deterrents and provide enough incentives, skill-building, and motivation to encourage women to become SEWs.

Conclusion

Comparisons of the six stove programmes

The NPIC (National Programme on Improved Chulhas) has been implemented in a diversity of ways. The IC (improved *chulha*) programmes in the individual states have some unique distinguishing features, and that include both strengths and weaknesses. This section contains a discussion of the institutional structure, commercialization, design problems, and subsidies as regards the six state programmes. It is evident that addressing these issues can enhance the overall effectiveness of the programme.

Chulha design issues

The NPIC recognized that *chulha* design is an important component of the programme, and thus assigned the tasks of *chulha* design and development to the TBUs (technical back-up units). However, after many years of *chulha* development by these TBUs, the study reveals that users either still had complaints about the ICs or had modified the design to improve usability. Users are not particularly concerned by the fact that *chulhas* need to conform to technical specifications; their primary interest is a smoke-free kitchen, and adequate heat generation in the firebox that suits their cooking needs.

On the whole, the most common modifications made by users in various states included altering the pothole size, removing the grate, changing the size of the firebox,

and modifying the chimney. Each of these modifications could lead to more smoke inside the house and reduce *chulha* efficiency. For instance, in Karnataka, a few users attached a spare broken pipe to the chimney to increase its length and make it exit the roof. In several states, chimneys have been removed during the rainy season to avoid leakage through the thatched roofs. In Gujarat and Haryana, fireboxes have been enlarged to fit bigger pieces of wood or to bake larger *rotis* (Indian bread). In West Bengal, the diameter of the tunnel was increased to facilitate heat flow to the second pothole. Also, the diameter of the chimney was increased to facilitate cleaning and smoke elimination. In Maharashtra, users commonly reduced the pothole size and removed the grate. All these problems suggest that the *chulhas* were not properly designed for actual usage conditions.

Non-users identified several reasons for not opting for ICs, including inability to afford a one-time payment; lack of space; and potential for leakages through the thatched roof during rains.

Interaction among *chulha* users, producers, and designers

In most of the states, the interaction between *chulha* users, producers, and designers is found to be minimal, which is in contrast to the best *chulha* programmes in the world. Although the NPIC entrusted the TBUs with the task of *chulha* design and quality control, with the exception of Maharashtra and, to a certain extent, Haryana, there have been significant problems in getting the TBUs to interact with *chulha* producers and users. One outcome of this lack of interaction is that priorities of the consumers are considered less important than technical efficiency of the *chulhas*. As a result, users request the SEWs (self-employed workers) to make modifications in *chulhas* to suit their needs. An

Table 1 State-wise ranking of perceived benefits of improved *chulhas*

State	*Better health* (less eye irritation, coughing)	*Cleaner kitchen due to less soot*	*Faster cooking*	*Fuel savings*	*Smoke removal*
Andhra Pradesh	2	4	1	3	4
Gujarat	5	4	3	2	1
Haryana	5	2	4	3	1
Karnataka	5	4	3	2	1
Maharashtra	5	4	3	1	2
West Bengal	2	5	3	4	1

Note 1 is the highest rank and 5 is the lowest rank.

interesting finding that could have significant implications for the design of the *chulha* programme is that users rank removal of cooking smoke from the household as higher than energy savings (Table 1).

Thus, role of the TBU can be expanded to develop new designs, and testing and quality standards for *chulhas*, and to formulate implementation strategies based on their interaction with *chulha* users, producers, and the implementing agencies. Greater monetary assistance is needed to improve the effectiveness of their training programmes. Further, surveys to assess the working status of *chulhas* should cover issues of design and efficiency, and not be restricted to whether households have adopted the ICs or not.

Successful *chulha* programmes have developed designs based on extensive interaction between the designers, users, and producers. As a result, their *chulhas* are easy to use, and meet engineering standards for removal of smoke and energy conservation. In China, and in a few of the successful programmes in Africa, there has been extensive consumer testing and marketing before the programmes achieved success. In

Rwanda, several different types of charcoal *chulhas* were given to consumers for determining which one would be suitable to their cooking needs (Barnes, Openshaw, Smith, *et al.* 1991).

Quality control issues

The case studies identified quality control problems that involved a combination of materials and institutional issues. As indicated earlier, the size and dimensions of the *chulhas* are often altered in the process of custom installation, resulting in efficiency loss. In many cases, uncertified SEWs install *chulhas* leading to defective construction and early problems with the *chulhas*, even though the NPIC permits construction only by SEWs certified by the TBUs. Further, *chulha* parts are supposed to be purchased from TBU-approved suppliers (except in the case of Gujarat), but are often purchased from the open market, thus compromising on quality. In most states, the SEWs do not fulfil their role of providing one year of follow-up service to the users.

Many of the problems cited above highlight the need to design *chulhas* that take user preferences into consideration so that users do not have to make further changes. In addition, many of the quality problems stem from the target nature of the programme, in which users are not choosing and purchasing the *chulhas* themselves from a variety of different models. The consequence is that they get something that is not quite right for them, and so, modify it accordingly. The use of more standardized parts of the *chulha* can lower cost and improve quality. With a few factories producing parts, the process of quality control becomes easier.

Most successful international programmes on improved stoves have a system in place to ensure quality. In many countries, this is accomplished through the central production of stoves. For example, this may be a

solution for the improved charcoal stoves used mainly in urban areas, as metal stoves can be produced and sold in the marketplace along with other consumer goods. In China, stove designs are based on durable components that can be manufactured in factories (Smith 1993; Smith, Gu, Huang *et al.* 1993). However, it is more of a challenge in countries like India, where many households have *chulhas* built inside their houses. Such *chulhas* require customized installation, which can alter their dimensions in many ways, and thus reduce effectiveness.

Role of subsidies

The impact of subsidies in India's programme is mixed. NPIC subsidizes technical support, *chulha* dissemination, and also its cost. The large subsidies for *chulhas* in the programme have ensured distribution, but not necessarily their sustained use or demand. In the six states surveyed, the unit cost of a fixed-type mud IC varies between 110 rupees and 190 rupees, while the central subsidy accounts for half the *chulha* cost (Table 2). However, the use and maintenance of *chulhas* has been extremely poor among the households that got them highly subsidized. In some parts of Maharashtra, the poorest households received the highest subsidies under the national programme, but unfortunately, their ICs fell into disuse due to poor maintenance and a lack of appreciation. In Haryana, many users declared that they would use their IC as long as it lasted, and would then revert to their TCs (traditional *chulhas*). The duration of most ICs distributed under the national programme is very short – on average, two to three years – so the benefits from such programmes are very few.

Another reason why subsidies have not led to sustained demand is that for rural people, attractiveness of ICs differs in proportion to local shortage or surplus of

Table 2 Subsidy structure under the National Programme on Improved Chulhas

State	*Type of* chulha	*Unit cost of* chulha* (rupees)	*Central subsidy* (rupees)	*Subsidy given by district administration* (rupees)	*Beneficiary contribution*** (rupees)	*Contribution of beneficiary* (percentage)
Andhra Pradesh	Two-pot (mud)	148	70	63	15	10
	Two-pot (mud)	135	70	0	65	48
	Sukhad (cement)	190	100	0	90	47
Haryana	One-pot cement	130	100	10	20	15
Maharashtra	Two-pot (mud precast)	180	70	0	110	61
	One-pot and two-pot cement	220	110	0	110	50
Gujarat	Two-pot mud	110	60	25	25	23
	One-pot and two-pot cement	280	110	145	25	9
West Bengal	One-pot mud	150	60	0	90	60
	Two-pot mud	180	70	0	110	61
	One-pot cement	240	100	0	140	58
Karnataka	Two-pot mud	140–190	70	23	43–93	31–49

* This includes cost of *chulha* material, and *chulha* construction charges of 20–30 rupees paid to the self-employed workers.
** Beneficiary contribution gets further reduced by 10–20 rupees whenever the beneficiary arranges for *chulha* materials such as mud or cement.

wood or other fuels. People value *chulhas* more in wood-scarce areas because the time saved in collecting fuel is much greater in regions where biomass fuel is scarce. In these states people spend much time collecting fuel, they have already had to move down the energy ladder to straw and dung, or pay cash for fuelwood. In such areas, the programmes have a better chance to work without subsidies or with small subsidies at the beginning. For instance, such a programme has been relatively successful in Maharashtra, where people typically purchase *chulhas* and commonly pay for wood fuels.

The international experience of *chulha* programmes is that subsidies are not a sufficient condition for a programme's success. This is because the distortions caused by subsidies do not appear to be worth their meagre benefits. The most successful programmes involve little or no subsidy for the *chulha*, but for technical assistance and activities such as *chulha* design, marketing, and information dissemination on the *chulhas*. For example, in China and Sri Lanka, the lower cost of supply in centralized production of components has enabled local people – who are poor and who spend much time collecting fuel – to afford *chulhas*. The best international *chulha* programmes have also been developed in regions that need to conserve energy the most. Therefore, it is recommended that villages be chosen for programme participation on the basis of biomass shortage, health hazards of the TCs and the need to inform rural people about them, and supportive local governments or administrative units (Table 3). Thus, the key is that the government should provide support only as an incentive for good products and strategies to develop and reach the consumer, who will appreciate that using ICs will improve health and reduce the drudgery of collecting fuel.

Table 3 Characteristics of the NPIC (National Programme on Improved Chulhas) compared to international experience

International practices in stove dissemination	*NPIC practices*
There is focus on need-based users.	There is a target-based approach; stress on number of villages to be covered rather than number of households. Demand for *chulhas* is not taken into consideration.
There is minimal subsidy for the stove from government or donors.	Subsidy on *chulha* accounts for the largest share (50%) of government support. Users may be willing to pay more for better *chulhas*.
There is maximum support for R&D (research and development), production and distribution of stoves, credit, capacity building, and public awareness.	The programme funds technical back-up units, but funds R&D and NGOs inadequately. Support for capacity building and awareness generation is also insufficient.
There is close interaction between designers, producers, and users of stoves	There is adequate interaction between producer and user, but negligible between designer, producer, and user.
There is a dependence on centralized production of stoves and its parts to reach more people, because cost of production is less.	For fixed *chulhas*, there is no scope of centralized production as these are built at user's homes. There is mass production of *chulha* parts (chimney, cowl, etc.) undertaken by private manufacturers, but no mass production of firebox is in existence.
There is onus on the producers and designers to meet the needs of consumers.	Consumer needs met by self employed workers / NGOs through changes in *chulha* design. Low inputs from designers.
There is provision for long-term funding.	There is long-term target-based funding by the government, routed through nodal agencies and disbursed through NGOs for implementation.

Conclusion

The case studies reveal that while the overall performance of the programme fell short of the best international practices, there is a significant positive impact achieved through the programme that allows us to draw useful lessons.

Commercialization at the state level

All state governments should consider promoting a commercial approach for *chulha* dissemination, where subsidies are directed towards technical assistance to entrepreneurs, *chulha* design, information dissemination and market analysis. Incentives should be designed to encourage participation of private sector operators in *chulha* building and selling. The government could also focus on setting technical standards, providing credit facilities, and encouraging promotional support to *chulha* makers.

Collaboration between designers, manufacturers, and consumers

Technical assistance for ICs needs to be reoriented so that TBUs are more involved with manufacturers and consumers, particularly women consumers. This could include the design of models that are more durable and better adapted to consumer preferences.

Need for new strategies to reach the poorest

In India, increase in subsidies for the poor has not led to increased participation in the programme, indicating that approaches need to be innovative so as to convert these non-users. One possible approach is to combine the promotion of better *chulhas* and healthier kitchens with housing finance. Participation of the poor in the programme could benefit from the collaboration of TBUs and NGOs.

Emphasizing smoke removal and health benefits

Users consider smoke removal and cleaner kitchen air among the main benefits of the ICs. In the future these aspects could be given greater attention in *chulha* design and dissemination strategies.

Coordination at the national level

Coordination of information on *chulhas* and capacity-building activities should be stronger at the national level. An overall group should be responsible for evaluating different aspects of the programme, conducting training and experience sharing seminars, and, in general, ensuring that information is shared among all the state programmes.

Building on positive lessons

Despite past problems with the NPIC, it would be unwise to ignore the potentially high social benefits of ICs and the achievements of the best programmes in India and elsewhere. Improvements in the health of rural women and children alone are enough to justify the continuation of efforts to provide a clean home environment for millions of people in rural India. The Government of India's decision in 2002 to transfer the responsibility for the NPIC to states creates both a risk (that any government support to ICs may eventually be discontinued) and a unique opportunity for developing a new generation of state-level programmes based on the lessons learnt.

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The improved biomass stove can become an important alternative source of household energy for the millions of poor in India who are unable to afford expensive commercial fuels. The GoI's (Government of India's) NPIC (National Programme on Improved Chulhas) introduced about 33 million biomass-based improved stoves in rural areas during 1984–2000, becoming the second largest such programme in the world after China's.

The GoI's decision in 2001 to transfer the responsibility for the NPIC to the states provides a unique opportunity to develop a new generation of state-level programmes but also represents a risk of eventual discontinuation of government support to such schemes. Improvements in the health of rural women and children alone are enough to justify the continuation of efforts towards providing a clean domestic environment for millions of rural Indians.

Fire without smoke highlights the results of a study of household energy, indoor air pollution, and health, supported by the South Asia Region of the World Bank and the joint United Nations Development Programme / World Bank Energy Sector Management Assistance Programme. It evaluates the NPIC through six case studies and anticipates possible impediments to similar planned programmes. The NPIC is evaluated on the basis of stove design, consumer satisfaction, capacity for quality control, and the role of subsidies in reaching a greater number of people. This evaluation has been designed in partnership with the Ministry of Non-conventional Energy Sources, GoI, and undertaken by TERI and Winrock International India.

This book is intended for a wide readership covering policy-makers, practitioners, and professionals in the areas of rural energy, environment, and health. It provides an in-depth insight into the good practices found under the NPIC and the lessons learned, shedding light on ways to improve the design of future stoves programmes.

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