

Community participation in household energy programmes: a case-study from India

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This paper is based on findings and lessons learned from an on-going improved biomass cookstove programme in Chibau Khera, a village near Lucknow in India. The paper is concerned with the processes of design, development, promotion, manufacture and dissemination of the stove in the village. The technical details of the stove are not described. Many aspects of the paper will be relevant to projects seeking to promote similar technologies in a number of developing world contexts.

The project in Chibau Khera was characterised by extensive community participation and considerable activity in the village. The value of participatory techniques is illustrated in this paper using examples drawn from this case-study. Community involvement in the design, testing and manufacture of the stove is presented as a way of helping to ensure the effectiveness, suitability and sustainability of a stove programme. In the same way, the importance of field workers discussing issues, listening to stakeholders, observing cooking activities and being open to change is emphasised. Integrated approaches to household energy problems are also discussed.

The paper concludes that gaining a detailed understanding of beneficiaries, including their needs, attitudes, resources and environment, is necessary for the design and implementation of effective and sustainable energy solutions.

1. Introduction

In recent years numerous household energy interventions have been undertaken in the developing world. Most projects aim to increase the efficiency of the cooking process, reduce its emissions, or both. While some projects succeed, many have failed, and the benefits of “successful” projects have not always been long-lasting. This paper presents the approach used in a particular stove project in India and describes some of the steps taken to try and make it successful and sustainable.

The examples used in this paper are drawn from the author’s experience in a household energy project in Chibau Khera, 25 km from Lucknow in Uttar Pradesh, India. This project was characterised by extensive community participation at every stage. The participatory approaches used in Chibau Khera are described in this paper and illustrate ways in which community expertise can be tapped, and how community involvement is vital for ensuring the design of appropriate, effective and sustainable interventions.

Although the project in Chibau Khera involved the promotion of an improved biomass cookstove, the *principles* that shaped the project are transferable. Many such principles would be relevant to development and promotion of other cooking technologies in a variety of developing countries.

It is important to point out that this paper is not about an exemplary project. It simply draws on experiences from the first phase of a simple, small-scale, participatory,

village-based project. Despite the considerable time spent in the village, certain areas of research were neglected because of limitations of time. Shortcomings as well as strengths in the research methodology and project outcomes are described in this paper.

2. Background to the Chibau Khera project

Chibau Khera is a village consisting of around eighty families. Incomes are relatively low, derived mainly from agriculture and manual labour found in Lucknow. There is no electricity supplied to the village, and it is inaccessible by car. In Chibau Khera, the cooks are generally women. Traditionally, they use a simple U-shaped mud stove for all cooking activities, fuelled by wood or dung cakes (dried blocks of buffalo dung). While these stoves are free, familiar and easy to construct, they are poorly ventilated, inefficient and very smoky.

In response to the stated needs of women in Chibau Khera, the Institute of People’s Action and Development Systems (IPADS), a Lucknow-based non-governmental organisation (NGO), set about tackling the cooking-related problems of stove inefficiency and smoke emission. The broad objectives of the project were that:

- it would respond directly to the needs of the community;
- it would involve them at every stage;
- any solution would be affordable to as many people as possible; and
- changes would continue in a sustainable manner after

NGO withdrawal using local materials and expertise. The project team consisted of two Indians (one male and one female) and the author, a white Englishman. The involvement of the national field-workers was invaluable, given their detailed understanding of the local culture and practices. In addition, both Indians had spent considerable time in the area as NGO field staff working on projects related to women's empowerment. As such, they were known and respected in many of the villages, including Chibau Khera.

The project was the author's initiative. The first phase of the project was undertaken over a period of four months between April and July, coinciding with the hot season and the beginning of the monsoon. The project had little funding, and it is possible that this aided some aspects of its participatory nature. This is explained later.

3. Initial investigation

Most of the "participatory techniques" undertaken in Chibau Khera were informal in nature and required only time and open-mindedness.

Gaining a detailed understanding of potential beneficiaries (hereafter referred to as "the community") and their needs is an essential pre-requisite to tackling household energy problems. It enables a project to be tailored to specific groups and conditions. The findings of this stage of research dictated the nature and emphasis of many parts of the project, and were vital in avoiding simple mistakes, which could have cost the project its success.

3.1. Discussion and observation

Considerable time was spent speaking to people, listening to their ideas, experiences and opinions and discussing the issues that cooking and the new stove raised. The two Indian field-workers spoke the local dialect of Hindi (the local language), and acted as translators as necessary. When the author discussed issues with villagers, mostly there was a need for translation. In contrast to direct discussion, observation and demonstration enables learning and knowledge transfer to take place between individuals without the need for any language or the possible problems associated with translation.

In the course of discussion and observation it was possible to determine three main problems women experienced with the present cooking system.

- Women complain of health problems resulting from the smoke. These relate to their eyes and respiratory systems.
- Women and children collect the firewood used for cooking. This is an arduous task and can threaten the sustainability of local resources.
- Most meals in the village consist of three to four dishes including *dal* (pulses), vegetables, rice and *chapati* (traditional unleavened bread). Cooking four dishes with a one-pot stove is time-consuming and inconvenient. Women said they would not light a second stove because of the extra fuel it consumes.

The observation of cooking activities revealed some important aspects of cooking, and was an essential part of the preliminary field-work. It informed the field-workers

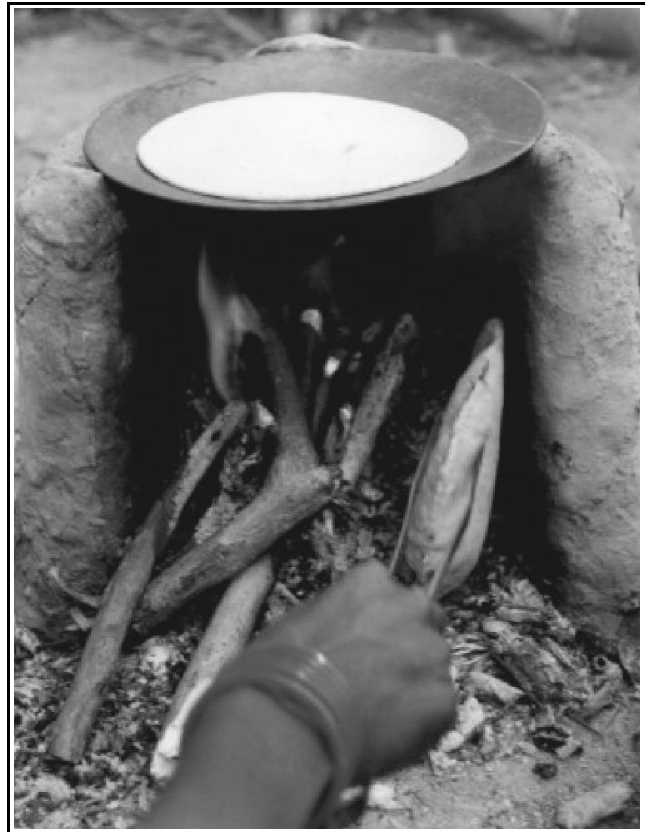


Figure 1. Traditional method of cooking chapatis

about types of food cooked, cooking methods used, time spent cooking a family meal and how a fire is managed. In addition, the problem of smoke became very real for the field-workers as their eyes streamed and breathing was made uncomfortable by the choking smoke.

3.1.1. Chapatis

One specific cooking habit relates to the way in which *chapatis* are cooked. *Chapatis* form an important part of most meals in Chibau Khera, and are eaten with every meal. They are a round, flat bread which is partially cooked on a steel plate heated on a stove, and then baked next to the fire itself. The latter stage imparts a smoky flavour to the bread. It is not considered acceptable to omit this stage.

Figure 1 shows a *chapati* being cooked in the traditional way. It is vital that cooking practices such as this are considered in the design of a stove.

3.2. Learning from other projects

3.2.1. The "GSC" initiative

In the course of discussions with villagers it was revealed that an improved cookstove had been introduced into a nearby village called Utroli within the last year by a local NGO. For the purposes of this paper the NGO will be referred to as the General Stoves Charity (GSC)^[2]. GSC trained three girls in the construction of a two-pot chimney stove. The organisation provided each of their families with a stove, free of cost, to act as demonstration stoves. One family was that of Mina, a 14-year-old trainee. Her family said they used the stove on a regular basis, that it was very efficient and that when using it the kitchen area was completely free from smoke.

The IPADS field-workers asked to see the stove, and found it to be in a good state of repair, but cold to the touch. Upon closer inspection, the firebox was found to contain dusty spider-webs. These observations suggested that the stove had not been used for some time.

After some time, the family admitted that the stove was rarely used. The reasons they gave provided the IPADS project with one of the most valuable pieces of information. This related again to the cooking of *chapatis*.

3.2.2. *Chapatis and stoves*

The GSC stove in Mina's home had a very small firebox opening, and it was not possible to vertically insert *chapatis* for cooking. Mina had to build another fire in the traditional U-shaped stove just in order to cook the *chapatis*. This was costly in terms of fuel and time, and would negate the smoke-reduction benefits of the other stove. It was sufficiently inconvenient to discourage the family from using the new GSC stove.

3.2.3. *Cost issues*

The rationale behind GSC donating three cookstoves to families was that they would act as (positive) advertisements for the stove, which would result in other villagers wanting one installed in their own homes. However, no families had asked for a stove. The reason given was that no one could afford it at 120 rupees (Rs) (approximately US\$ 2.50). It is likely also that the stove had received negative publicity as a result of the *chapati*-cooking problem.

Most adults in villages such as Chibau Khera or Utroli work either locally in agriculture or as labourers in nearby Lucknow. Daily wages are in the region of Rs 30 to 40 per day, so Rs 120 constitutes a major expenditure. People could afford this sum, but would have to be very certain of the benefits to justify such an expense. This certainty was clearly lacking, and as such, no more stoves have been constructed – or used – since GSC left.

The *chapati*-cooking and cost problems illustrate how failing to adequately understand the habits and means of the community in question can lead to project failure. GSC had spent only two weeks in the village, and had not followed up the work since. On account of its design, the GSC stove was likely to be highly efficient and clear the kitchen of smoke and would enable two dishes to be cooked simultaneously. However, it was never used or replicated.

3.2.4. *Benefit from failure*

GSC had invested time in training three girls to build stoves, so it was decided to engage one of them, Mina, in our project. She taught the field staff how to build mud stoves, and collected the necessary local materials. She showed how to construct “arches” and tunnels from mud, fix a grate in place and form the pot-holes. It was clear that Mina was skilled – constructing stoves from mud is more difficult than it may seem. It is hoped that she will be able to play a part in the project in the future.

4. Design and development of a stove

4.1. *Developing design criteria*

After the period of developing an understanding of the

community, their cooking habits and their needs, it was possible to consider methods of tackling the energy problems. It was decided that the introduction of an appropriate, effective and affordable improved cookstove would be the best solution. On the basis of findings so far, a set of design criteria was drafted. The first three criteria were based on village women's needs. They were these:

- decreased smoke emission;
- increased efficiency (i.e., lower fuel consumption for given cooking task); and
- more convenient design.

There were three further criteria, resulting from lessons learned from the previous intervention and the general project objectives of affordability and sustainable village-based manufacture. These were:

- very low cost;
- suitability for local cooking practices; and
- local manufacturability.

The introduction of the stove was to be accompanied by education about fuel-saving techniques, outlined later in the report.

4.2. *Developing the stove: the “village laboratory”*

IPADS does not have any technical facilities or a formal laboratory, so all experimentation and testing was carried out in the village. As such, a “village laboratory” was set up on a piece of ground made available by a local potter. In some ways this could be seen as an advantage resulting from the low level of funding this project enjoyed. It served to force the field-workers into the village and out of a town-based formal laboratory environment. This had a number of very marked benefits, as follows.

- The village presence made the field-workers well known and this made the formation of friendships easier.
- The activities always attracted attention and raised the general profile of the work.
- Construction materials were supplied by villagers, so it could be certain that only locally available materials were being used.
- All experimentation and practical work was undertaken in the village itself, allowing extensive scope for suggestions and criticism, and general two-way discussion and exchange of information.

5. Meeting the design criteria

5.1. *Decreased smoke reduction and increased efficiency*

These criteria were technical issues and are, as such, outside the scope of this paper. There was little local input into meeting these criteria because well-established technical methods were used. These were the introduction of a grate under the firebox and secondary air-holes around it to improve the efficiency and completeness of combustion. It was decided that the stove would *not* have a chimney, for reasons described in Section 5.3 on low cost.

5.2. *More convenient design*

Meeting the third criterion turned out to be one of the most valuable and effective marketing points for the stove. This was achieved simply by having two pot-holes rather than just one as on the traditional stove. Women appreci-

ated very much being able to prepare two dishes simultaneously as most meals consist of at least two dishes. When cooking on the traditional U-shaped stove, simmering dishes were put aside on glowing embers while the next dish was heated. This process resulted in the release of more smoke and was not very effective. Having two pot-holes can also add to the efficiency of a biomass stove, and can reduce cooking time and hence exposure to smoke from the fire.

5.3. Very low cost

Rs 120 (the cost of the GSC stove) was clearly either considered too much for villagers to pay, or too much of a risk for what they felt they were getting. The main expense for the GSC stove was the chimney. A cement chimney could be bought from the local market for around Rs 70 (US\$ 1.50). Additional costs were metal rods for supporting arches of mud, a grate made from steel and construction costs. The cost of the rods and grate together was approximately Rs 30. The labour cost for building a stove is around Rs 20.

The main material used for construction of a traditional U-shaped stove is a mixture of mud and straw, which dries to become hard and strong. It was decided this would be used in the IPADS stove as the main building material as it is freely and locally available. For the first fifty trial stoves built the labour cost of construction (Rs 20 per stove) is being met by IPADS.

5.3.1. Chimneys

Incorporating a chimney on a stove is desirable because it leads to the total removal of smoke from the kitchen area. However, at Rs 70, without subsidy it makes the cost of the stove too high. For reasons of low funding, subsidy from IPADS was not considered an option because on-going support could not be guaranteed. However, a subsidy was available from the Government via the local Block Development Office. The process of investigating this is described below.

Field-workers approached the Block Development Office (BDO), a local administrative body based 5 km from the village. One of the responsibilities of the BDO is to provide support to NGOs undertaking work that complements their own activities. One of their official activities is the promotion of improved cooking technologies. They were equipped with a store of chimneys and were able to offer substantial subsidies for providing them to, particularly, lower-caste villagers. IPADS was informed that it would be possible to sell these cement chimneys to villagers as part of their stoves for as little as Rs 10.

Two weeks, and a number of visits, later it was realised that actually procuring the chimneys was not easy. Although the field-workers had a motorcycle and the necessary credibility to be able to meet the BD Officer, they were still unable to procure the chimneys. The main difficulty was said to be because no one had a key to the storeroom in which they were kept. It is likely that other, more complex and hidden, reasons existed.

The villagers of Chibau Khera had no motor transport and would find it more difficult to meet the BD Officer than the IPADS field-workers did. They would probably

experience problems similar to those encountered by the IPADS staff in procuring chimneys. Given this, and the desired objective of sustainability without the need for IPADS, it was decided that the stove would be chimneyless. A chimneyless stove would only reduce, rather than eradicate, smoke emissions.

5.3.2. Grate and supports

The cost of the steel grate and supports required for stove construction was Rs 30 and was still too high. If these and the construction comprised the total expense for the stove, the cost would be around Rs 50 (US\$ 1). At 40 % of the cost of the GSC stove, this is considerably cheaper, but still expensive for some – equal to a full daily wage of many. In order to make the stove financially accessible to the poorer members of the community, a lower-cost alternative to the metal grate and rods was required.

A grate and supports were designed which could be made more cheaply by a local potter using freely available local clay.

The clay grate consisted of five clay rods fixed over the ash-hole. The only material required is clay. In Chibau Khera there is an abundance of potters who work making traditional ceramic tea-cups. They could make the grate rods for around 1 rupee each. Supporting rods could also be made from baked clay, and would cost a further Rs 4 for a set. In total, therefore, the cheaper alternatives would cost Rs 9, instead of Rs 30 for those made from steel.

In addition to being cheaper, the clay grates could be manufactured by villagers, in the village. The fires do not burn any differently according to which grate is used. There is likely to be a difference in lifetime of the grates – the metal grate lasting longer than the clay. However, it may be that the benefits of lower price outweigh the disadvantage of shorter life.

5.4. Suitability for local cooking practices

This aspect has already been discussed in some detail with regard to the baking of chapatis next to the fire. While it is ideal to have a firebox closed off as much as possible (i.e., a small opening for fuel insertion), experience showed that it is necessary to have an opening sufficiently large to admit a *chapati*. For this reason the stove firebox was designed with a triangular opening, high enough on one side for a *chapati* and closed off on the other to help direct heat and gases to the second pot-hole. This constituted a further technical compromise in the interest of usability.

5.5. Locally manufacturable: building Chibau Khera's capacity for manufacture

Local production was considered a high priority in this project for a number of reasons.

- If a stove can be constructed locally using only local materials and skills, the chances of its continued manufacture are increased because it is not dependent on external supply or prices.
- Locally produced stoves and components are likely to be cheaper than “imported” products.
- Local production can generate income for villagers. This can also generate an incentive for dissemination as there is a business interest.

Use of the clay grate in the stove has already been discussed in Section 5.3 with reference to low cost. In addition to low cost, the clay grate brought the above benefits to the village of Chibau Khera.

5.6. The Mina stove in brief

The process of developing a suitable stove involved considerable experimentation in the village laboratory. A number of stoves were tested before reaching the final design. This was named the "Mina stove" after the girl in Utroli who helped construct the first prototype.

It is useful to have an understanding of the technical details of the Mina stove as it is the result of all the processes described in this paper so far. This section briefly presents the stove.

The Mina stove is a simple two-pot, mud-constructed cookstove with no chimney. The stove is shown in Figure 2 in cross-section. Figure 3 shows the stove being used to cook a meal in Chibau Khera.

The first pot-hole is situated directly above the firebox,

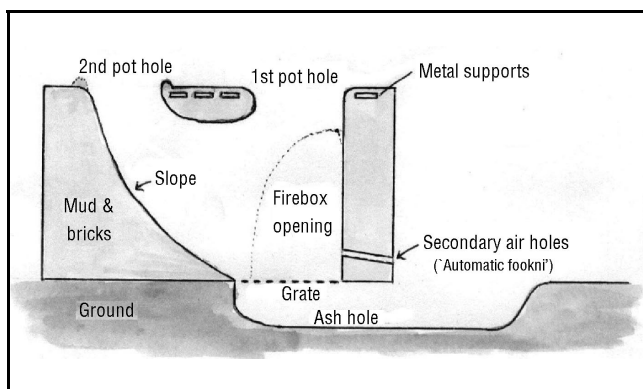


Figure 2. Mina stove in cross-section

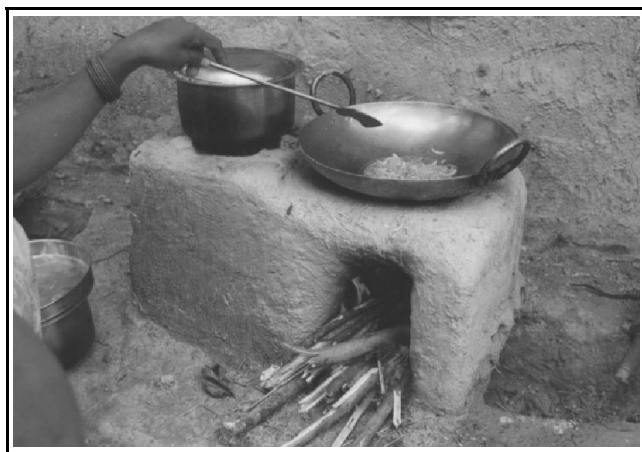


Figure 3. Mina stove in operation in Chibau Khera

and is flat to produce a smokeless seal between the stove and pot. The second pot-hole is displaced from the firebox, and also acts as the exit for the hot gases from the fire. A smooth sloping tunnel connects the second pot-hole to the firebox. A grate provides primary air to the burning fuel from underneath. Around the firebox, air-holes provide secondary air to the hot, flammable gases in the firebox. The firebox opening is indicated by the dotted line.

6. Testing the Mina stove

Testing is important, but a number of important questions need to be asked about the nature of the testing and testers.

6.1. Why is testing carried out?

Testing is usually undertaken for two main reasons.

1. To make sure a stove is safe to use. Testing can highlight health and safety problems associated with the operation of a stove. In particular these may involve the identification of harmful (or even lethal) emissions from the combustion process.
2. To measure the performance and efficiency of a stove, usually for purposes of comparison. It is important to be able to compare the performance of two stoves to be sure that a new stove is an improvement on what it replaces.

In both cases, *users* should be the focus of the testing. Tests should be undertaken to ensure that users' health will not be harmed by a stove, and that they are being provided with a more efficient, convenient and cleaner burning stove than that which they use at present. Test data can also make a valuable contribution to the pool of knowledge relating to cooking devices.

6.2. Who carries out the testing?

Improved cooking stoves are generally developed to improve the comfort, ease, safety and efficiency of cooking. Many are developed for use in rural areas of developing countries, often for illiterate, low-income, female domestic cooks. Despite this beneficiary profile, much of the testing of stoves is performed in *urban* areas, by *highly educated, high income, male scientists* who may have *little or no experience of domestic cooking*. This is a flaw in much of the testing that is undertaken for stove projects.

Scientific testing *is* valuable. Testing can be undertaken using standardised scientific methods to enable accurate comparison of particular characteristics of stoves, particularly thermal efficiency and emissions. In addition, it is only by using scientific instruments that emission testing can be undertaken.

Laboratory efficiency tests usually involve a known mass of water being heated, usually to boiling point, for a measured period of time. The amount of fuel consumed is measured and a "percentage heat utilised" (PHU) figure is calculated for the stove. In such tests the stove may be operated in a way quite different from how a woman would use it in a village, for a different period of time, using different fuel and cooking pots. Laboratory testing may be conducted in "optimal" ways as there may be a wish to make the stove appear as efficient as possible. Finally, domestic cooks (the end-users) would be cooking meals consisting of a number of dishes, not just water. In terms of intervention communities, many scientific tests could be described as somewhat irrelevant.

The alternative to laboratory-based scientific testing is in-village practical testing. This form of testing is based much more on the operation of stoves performing "real-life" cooking operations. These tests can provide informa-

tion more directly relevant to end-users as well as useful and valid comparative data.

6.3. Village-based testing in Chibau Khera

The IPADS stove project aimed to undertake testing which was relevant and appropriate to the end-users. In the village of Chibau Khera the Mina stove was developed for use by mostly female, domestic cooks. These were therefore chosen to be the testers, and the basis of the test was cooking a typical family meal in the village.

In Chibau Khera, public tests were held in the “village laboratory”. They simulated the cooking of a typical family meal sufficient to feed six people. Two women cooked identical meals side by side, one on the Mina stove, the other on the traditional U-shaped stove. The same type of wood was provided to both women and the amount used by each was weighed.

The purpose of the tests was described to the women. They were told to use the stoves as they would in their own homes, and to try to use the fuel efficiently by keeping small fires for simmering and keeping burning wood well inside the firebox. No other instruction was given to the women, and they were left to cook without any interference from the field-workers.

The tests revealed that the Mina stove saved 30 minutes (35 %) in cooking time and used 0.5 kg (25 %) less wood than the traditional. In addition, considerably less smoke was emitted. The women using it commented on this and the convenience of having two pot-holes.

Many women, men and children attended the tests which were followed by an announcement of results, and a very good meal. These public tests did much to raise the profile and popularity of the stove.

7. Stove promotion

7.1. What do people use now, and why?

The process of devising a strategy for stove promotion can be approached by asking the following questions.

- What do people use at present, and why do they use it?
- What does the new stove do that is so much better and worth the expense?
- How can we convince prospective users of these benefits?

At present, villagers in Chibau Khera mostly use the traditional U-shaped stove or just an open fire. Why do they use this? It is important to recognise that there must be a reason, even if it is simply because no alternative exists. Where alternatives do exist, and people have chosen one stove over another, their reasons can be useful for enabling field-workers to “tune into” their priorities for a cooking device.

Despite its relative inconvenience (only one pot-hole), inefficiency and smoky operation, the U-shaped stove does have advantages. It is familiar, easy to use, requires no imported parts or expertise for construction, and, perhaps most importantly, it is free. The Mina stove has advantages over the U-shaped stove in that it is more efficient, convenient and cleaner burning, but it also has disadvantages of cost and *unfamiliarity*. The question both

NGO and prospective buyer will be asking is “Do the benefits outweigh the disadvantages?”

People will buy and use a stove if they believe they will benefit from it in some significant way. It is important to promote stoves according to people’s expectations and not necessarily just what the developers see as the main strengths or benefits. For example, a stove may be highly efficient and emit just 10 % of the harmful emissions that a traditional stove emits, but people’s interest in the stove may be purely because it is more convenient to use.

7.2. Public tests for promotion

There are a number of ways of promoting a stove, but one of the most powerful tools is building its reputation through public tests and getting people using it in their homes. Tests can show a direct comparison with traditional technologies. Home use is potentially an on-going form of promotion which should continue for as long as people use the stove, appreciate its benefits, and talk to their neighbours.

Most concerns are comparative. It does not matter to villagers if the stove is “good”, “efficient” or “clean-burning” *per se*; it matters whether it is *better, more efficient or cleaner-burning* than what they already use. The only exception to this is price, which does not necessarily have to be lower, but does have to be outweighed by the advantages the stove will bring to the user. The comparative nature of people’s concerns illustrates the value of comparative testing.

Public testing can do much to promote the reputation of a stove – providing the results are favourable. Public tests speak louder than words coming from an unfamiliar (and perhaps not totally trusted) field-worker. If public tests do not show its merits, how clear and real are they? If an organisation does not “dare” conduct open tests, how sure are *they* of its benefits?

7.3. Culture and beliefs

There may be subtle cultural idiosyncrasies that affect people’s response to, and willingness to adopt, a new stove or stove component. One example that arose in Chibau Khera related to the material from which the grate for the stove was made. In Hindi “*pakka*” means permanent, and “*kachcha*” means temporary. These words have meanings which run deeper than just how long something will last, and can be used in such a way as to describe quality. Metal, or bricks for houses, are considered *pakka* materials, while mud is considered *kachcha*. This attitude was possibly the cause of some of the problems encountered when the clay (*kachcha*) alternative to the *pakka* metal grate was introduced.

A further unexpected issue arose with the promotion of the clay grate wherein promotion as a “cheap alternative” may actually have led to people *not* wishing to use it. Despite its low cost and assurances from IPADS team members that it was technically sound, people say they do not trust the grates because they are made of clay - a *kachcha* material. It is possible that in addition to this, the grates have become stigmatised by their promotion as “cheap alternatives”. They may have become a “poverty

indicator” in the minds of villagers, because of their strong association with low cost. In turn, the metal grates may have become indicative of affluence. The appearance of affluence may be sufficiently important to people to motivate them to spend the extra on the metal grate. It has not been possible to verify this, but it highlights how the way in which something is promoted can have an unexpected – and unwanted – effect.

7.4. *Styles*

In addition to attitudes, styles must be considered, and it is necessary to try to understand what a particular stove, and the way it looks and operates, will mean to them. Fashion is important, and if having a beautiful stove is important to members of a community, this must be accounted for in the design process.

7.5. *Politics and relationships*

Local politics and interrelationships may be worthy of note. In Chibau Khera, a long-standing argument existed between an influential government representative and one of the potters who was manufacturing parts of the new stove. This may have affected people’s attitude towards the potter’s business pursuits.

7.6. *The Chibau Khera promotion strategy*

At the initial stage, IPADS field workers were the only promoters of the Mina stove. However, it was felt that the best promoters of a stove would be villagers themselves, and that if the stove did bring genuine benefits then it would promote itself by virtue of its good reputation.

The on-going strategy is to give fifty stoves free of charge to households in five villages, including Chibau Khera. So far around 30 stoves have been built. Without exception, all users of the Mina stove say they are happy with it and have noticed marked improvements in its efficiency, reduced smoke emission and more convenient use. The stoves are being built by a trained local woman (described in the next section). These fifty stoves are effectively being tested at house-level, and after three months they will be assessed by IPADS staff. Until they have been proven over longer periods, it was felt that it would not be right to charge users for the stove.

It is hoped that in future, all expenses can be met by the buyers of the stove. This, however, requires that individuals be sufficiently convinced that the benefits the Mina stove will bring them will outweigh the (approximately) Rs 50 they would need to spend on materials and labour. Presenting the figures of fuel and time savings and the reduction in smoke released could be used as a way of convincing individuals that this sum constitutes an investment – which will show returns – rather than just an expense. Smoke reduction and time-saving can be linked to better health and greater productivity which can lead to less spending on medicines and higher incomes [Smith, 1998].

8. Local manufacturing capacity

Building capacity for local production has already been discussed in Section 5.5. In addition to trying to design stoves and components in such a way that they can be

manufactured by villagers, it is necessary to consider the training of individuals, the business systems by which they will work and the systems by which they will (hopefully) continue to be paid.

8.1. *Training locals*

Training the local woman to build the stove was a task undertaken over a number of days. It began with demonstration and explanation, followed by the woman building Mina stoves in her own home. She took increasing responsibility for its construction in village houses until she was able to confidently build them alone. She was paid for each stove made during training, and for each subsequent stove made by herself in the villages.

8.1.1. *Principles*

During the construction of the Mina stove in one woman’s house, one of the field-workers correctly remembered that the firebox had holes through its side and back. He proceeded to construct the stove with these holes – but instead of putting them at the bottom, he made the holes near the top of the firebox. After the stove had dried and was tested, instead of air being drawn into the firebox to feed the fire at secondary combustion stage, smoke passed out of the firebox through the holes. The holes were in fact worse than useless – they were not performing their intended task and were resulting in a loss of heat.

When the *principle* behind the holes was explained to the field-worker, instead of considering simply “the need for holes in the firebox”, he considered “the need for extra air at the level of the burning fuel”, and as such knew where they should be placed.

The experience described above demonstrates that explaining principles is an invaluable part of training, and how knowing the *reason for* (rather than just existence of) a given aspect of design can lead to more accurate construction. Other examples included *why* the firebox opening was shaped as it was, *why* the first pot-hole formed a seal with the pot, and *why* there was a smooth slope connecting the firebox to the second pot-hole.

With stoves, the dimensions and position of features such as the secondary air-holes can be a critical part of their design. Many stove producers prepare wooden moulds by which the stove can be built to relatively precise dimensions. This is a well-tried and tested method, but was not used in Chibau Khera. Instead, forms of “appropriate” measurement were used to try to ensure the stove was replicated accurately, with mixed success.

8.1.2. *Appropriate measurements*

In addition to explaining aspects of stove design, the construction process was simplified by making measurements understandable to those unfamiliar with formal units of measure. Alternative units included the length, width or height of a “standard” brick, or the width of a hand or a certain number of fingers for a given trainee.

8.1.3. *Written instructions*

A pamphlet was also prepared explaining how the stove was constructed. It used photographs, diagrams and a brief explanation to describe the process methodically. The intention was that it would be possible to build the stove

using the manual alone. Figure 4 is an example of the diagrams used. The manual was aimed more at field-workers than villagers, but was compiled with the less-educated or less-literate reader in mind.

There were two problems with the pamphlet. The first related to the requirement of a certain level of literacy, but more importantly, a competency with *translating ideas on paper to "reality"*. The latter skill may come naturally to the author after spending sixteen years in a mostly technical education, but it must be acknowledged that interpreting printed images is a skill, and that the problems ran deeper than literacy alone.

The second problem was that there was a reluctance to use the manual – particularly in the methodical way required. This was frustrating, but indicative of the value of practical demonstration.

9. Integrated approaches

"The skilled use of a three-stone fire is more efficient than the unskilled use of many improved stoves" [Karakezi, 1991, p. 7].

How a stove is used has a very significant impact on its performance. In terms of cooking on a stove, there are various ways in which fuel efficiency can be increased and smoke be reduced without any physical changes to the design of the stove. These mostly relate as much to the use of a three-stone fire as to an improved stove such as the Mina.

Some examples of practices relating to the use of the stove include: drying fuel before use, chopping fuel small, extinguishing partially burned fuel when cooking is finished and using "hay boxes" (insulated chambers) to keep pots warm and allow food to cook in its own heat. Other practices relate to cooking itself. These include: pre-soaking beans, pulses and even rice to reduce long (and fuel-thirsty) cooking times, and using lids during cooking.

Such techniques can very effectively complement a new piece of technology, and can lead to significant improvements in performance. No improved stove programme is complete without their promotion.

10. Withdrawal strategy

It is vital that the withdrawal of an organisation from project activities is a carefully considered part of an entire stove project. In some cases withdrawal will be complete, whilst in other cases (such as this phase of the project in Chibau Khera) withdrawal will not be complete, but involvement and presence decreased as communities begin to run and perpetuate project activities by themselves.

10.1. Supply-chain analysis

Unless withdrawal is carefully considered, a village may be left unable to access materials, components or expertise necessary for stove production, promotion and dissemination to continue. It is necessary to look carefully at all the requirements for the project and to look at the path (physical and institutional) by which goods and services reach the village. Below are some examples of questions an implementing body should consider before initiating the withdrawal process.

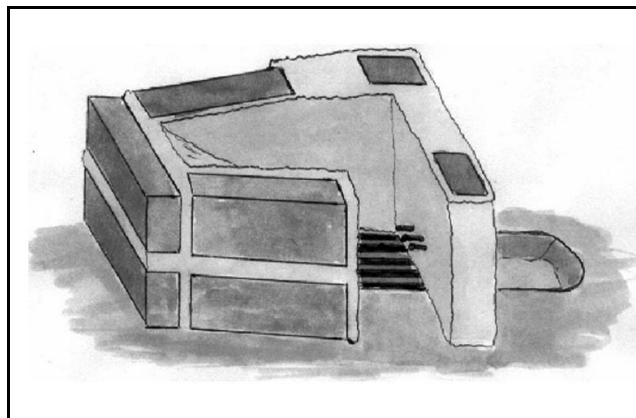


Figure 4. A diagram from the construction manual

- Are any materials delivered to the intervention area by the NGO?
- Are project workers relied upon for negotiations with suppliers or key figures in the supply process?
- Do the people in the community have all the necessary skills and knowledge to make and use the stoves? Do they know how to run the business side of the stove dissemination?
- Is the supply of any components or materials seasonal? Are the trained individuals available to work all year, or do they have other, seasonal, commitments?
- Are money or materials being supplied to the project or villagers by the NGO? What is going to replace this supply after withdrawal?
- Are there any subsidies in place? What long-term plans are in place for their continued provision or what is the subsidy withdrawal strategy? Are there any indirect subsidies in place?
- Is there a way by which the NGO can be contacted should there be a problem or the community need advice or help? If other villages may wish to initiate schemes, could they contact the NGO for help and advice?

These questions should help identify weak or missing links in the supply chain so that they can be addressed. Further considerations are hypothetical (but realistic) situations which may arise in the village. For example, what would happen if the trainees all left the village? What would happen if the grate manufacturer raised his prices? What would happen if the stove began disintegrating after a year? What would happen if the stove trainee became pregnant?

11. Summary

This paper has presented the ways in which IPADS included the community of Chibau Khera in a household energy project from its inception through to its design and implementation. The approach sought to introduce a lasting solution to the problems of the community, which could continue without external materials, money or subsidy.

As a result of the close contact with the community, the Mina stove design is ideally suited to local cooking habits, resources and fuels. Each woman who has used

the stove has been happy with its operation, and a number of people are asking for one to be built in their homes. However, despite its good reputation, its uptake has not been as fast as was hoped. This could be accounted for by a number of factors.

Reports from the field indicate that people are still not willing to pay for the stove – despite its low cost. This suggests that the stove requires further promotion and that people are not yet sufficiently convinced of its benefits to justify spending the money. Further public demonstrations may be required as these were found to be the most effective promotion tool in Chibau Khera. Another problem is that there is an attitude amongst villagers of *expecting* subsidy. This is based on villagers' (in some ways accurate) perception of the field-workers as rich. Overcoming this may be difficult, though the extent to which this is holding back promotion is not exactly known. IPADS does not have the resources to provide an on-going subsidy.

The basis of investigation was observation and discussion. Observation was found to be the "tool" that elicited the most valuable – and probably most accurate – information. Studying other successful (or unsuccessful) projects was also shown to be useful and provided vital information used for designing the Mina stove. Experience has also shown how it can be necessary to compromise "technical ideals" in the interest of making a stove appropriate. In Chibau Khera the major compromise (for economic and logistical reasons) was not using a chimney.

The benefits local production can bring to a community have also been discussed. These include lower costs to the customer, reduced dependence on external markets, income generation and an in-village business incentive for stove promotion. The Mina stove and clay grate can be built entirely at village level.

Considerable time and energy are required to understand a group of people and their context. Communities hold much important knowledge and only by drawing on this can appropriate stoves be designed and successfully promoted and bring genuine benefits to communities. The project in Chibau Khera has been a learning experience. It is hoped it will go further, that more will be learned, and that many more women will be able to benefit from the Mina stove in the future. ■

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Notes

1. The author was affiliated to the Institute of People's Action and Development Systems

for the purpose of this research.

2. This NGO is not named since permission could not easily be sought to cite its project.

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