

# 'Stove Sisters' – Chulah (smokeless earthen stove) - Pakistan

## Organisation implementing the project

The Heritage Foundation (HF) of Pakistan was established as a family trust in 1980 by its current CEO, architect Yasmeen Lari and her husband. In 2008, it was incorporated as a non-profit organisation under Section 42 of the Companies Ordinance 1984. It currently has 14 staff in its Karachi head office and in the field. Its mission is to document and conserve the traditional and historic built environment of Pakistan; create an awareness of Pakistan's rich and diverse historic architecture and art; and to promote cultural heritage for social integration, peace and development.

HF is known for its work on vernacular construction. It is involved in post-disaster reconstruction where the organisation uses recycled materials such as stone, mud and wood from collapsed houses, adding lime and traditional cross-bracing to create stronger buildings. HF also plays a leading role in the diffusion of zero carbon footprint structures using local materials such as bamboo and earth in their heritage preservation and housing projects. In early 2013, HF began its smokeless Chulah (stove) programme. Aiming to provide Disaster Risk Reduction (DRR)-compliant design options, HF sought to improve cooking methods particularly for the benefit of Pakistani women in post-disaster communities.

## Project Description

Pakistan Chulah is a low cost, fuel efficient double cookstove on an elevated lime-stabilized earthen platform. It is built entirely with sun-dried mud bricks and rendered with lime. The mud plaster is usually mixed with straw and cow dung; the addition of lime strengthens the structures. With lime mud bricks and an elevated earthen platform, the Chulah can withstand rain, floodwaters or earthquakes making it a DRR-compliant product.

An air regulation pipe allows the transfer of heat from the first stove to the second, making it possible to cook two pots from the same fire. The chimney that is incorporated in the design emits smoke only when the fire is lit and at a higher level, thus avoiding indoor pollution commonly associated with the traditional open flame stoves. Other features include an earthen storage wall in the rear of the stove where cooking utensils can be stored or displayed. A small platform for hand washing is also available and, in the absence of running water, it incorporates a can of water at a higher level to facilitate hand washing. The multifaceted features of the Chulah promote energy efficiency, hygiene and sanitation and disaster risk reduction.

The project has been implemented mostly in villages in Lower Sindh but some Pakistan Chulahs have also been built in Upper Sindh, Shangla and Dera Ismael Khan districts. Since 2014, over 40,000 stoves have been built by women through training and self-building using locally available materials. HF has trained 35 Barefoot Village Entrepreneurs (BVEs) as "Stove Sisters." These are rural master trainers, who are mostly non-literate women who, after implementing the scheme in their own village, visit neighbouring villages to market the product and train housewives to build the Chulah. The popularity of the stoves has spread mainly by word of mouth recommendation. Friends and relatives who visited the villages often express an interest in building for themselves and BVEs take these opportunities to market the product and spread the technique.

## Aims and Objectives

Pakistan Chulah has been designed to provide health and dignity to women in the form of a sustainable, DRR-compliant zero carbon, smokeless double cookstove. It aims to replace the traditional three-brick open flame stove prevalent in South Asia and sub-Saharan Africa which causes massive respiratory problems and deaths<sup>1</sup> due to indoor pollution.

Participants and beneficiaries of the Chulah are women in remote conservative societies residing in rural areas of Pakistan. Almost 80 per cent of women in rural Pakistan lack access to a clean cooking resource and are therefore keen to have better cooking facilities. They have been instrumental in popularizing the Chulah for their own use. Over 300,000 family members have benefitted with improved health and better food.

The project aims to build 100,000 Chulah per year which would require funding for large scale training of new Barefoot Village Entrepreneurs from various parts of Pakistan in order to market the product and train housewives in the construction process. This would enable the Chulah to be used in even the remotest corners and the most marginalised sections of the country.

## Context

Impoverished households in Pakistan still depend on inefficient wood-burning stoves for food preparation. This means arduous hours collecting fuel and smoke-filled homes that lead to acute respiratory infections and eye soreness. Women suffer the most as they are the ones who cook for their families. In rural communities where there are high levels of poverty and illiteracy<sup>2</sup> women are very disadvantaged and restricted to the domestic sphere looking after the family as well as their livestock and crops. The food they cook on floor-mounted single cookstoves often gets contaminated with dirt and is a major cause of diarrhoea, particularly among children.

As an essential part of living, HF believes that cooking needs to be part of an integrated housing solution. Pakistan Chulah addresses the following issues: affordability and ease of construction, fuel savings, environmental degradation, energy efficiency, health and hygiene and smoke related hazards.

## Key Features

HF provided training for low or no cost techniques to rural and marginalised communities, particularly women, in order to provide them with technical skills that would enable them to improve their living conditions. Pakistan Chulah fully engages women in its construction and implementation. Initial training, supported by the International Labour Organisation (ILO), was carried out in Lower Sindh villages for 35 women selected because of their willingness to be trained.

Initial progress was slow with only three of the 35 trained women who became BVEs being successful in marketing the product in surrounding villages. They were joined by their male partners and they formed three teams. Over time these teams became master trainers and trained many more teams of BVEs in different villages.

**Team 1:** Champa and Kanji have trained 19 women and four men.

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<sup>1</sup> According to World Health Organisation, 3.8 million people die every year because of smoke from cooking <http://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health>

<sup>2</sup> UN Women report shows Pakistani women from marginalised ethnic groups fare worse across a variety of well-being and empowerment <https://tribune.com.pk/story/1634815/1-un-women-report-shows-worrying-degree-gender-inequality-pakistan/>

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**Team 2:** Sara and Juman have trained nine women and four men.

**Team 3:** Jama and Shagun have trained seven women and four men.

The BVEs demonstrate the entire process of construction - from providing the layout, to the use of lime with mud and the intricacies of the stove construction itself. They also provide hygiene training to encourage hand washing prior to cooking or handling food. BVEs earn a living from promoting the technology to others and teaching them how to build a Chulah. As the materials are readily available and utilise local building traditions, with guidance from BVEs, the housewives can easily build it themselves at a very low cost. The housewives also decorate the earthen structures allowing them to make each product a unique work of art. It takes two days to build and another two days to decorate a Chulah. The approach is scaling up through marketing by the BVEs and word of mouth.

HF is also working closely with the International Organization for Migration (IOM) in the role of Technical Partner for the construction of 40,000 zero carbon shelters. Through this role training has been given to women in other parts of Pakistan such as Upper Sindh, Shangla and Dera Ismail Khan.

## Funding

The only donor funding used was for the initial training of 35 women. This was supported by ILO as part of the 'Livelihood Restoration, Protection and Sustainable Empowerment of Vulnerable Peasant Communities' project in Sindh province. This cost approximately USD\$5,000 but also included the cost of training in some other components as well. Slaked lime was initially provided by HF but later on once the BVEs and households were trained they started slaking their own lime.

BVEs were encouraged to market the methodology to housewives and train them at a charge of a small fee (USD\$2). This includes mud brick training and construction of a Chulah. The housewives also pay for the building materials. One bag of lime used in the construction costs USD\$3, while other sundry materials such as sand and gravel cost another USD\$3. Clay/earth is locally sourced and is freely available. There is no labour cost as housewives carry out the work themselves. In some cases where women construct the earthen platform with mud bricks, instead of using layered mud, they incur an extra cost of USD\$2.

The BVEs are now spreading the message on their own, at the same time earning an income. This makes the project a 'no-cost' solution for HF as sponsors. However, to further scale up the project HF is currently seeking funding to carry out large scale training of new BVEs in different parts of Pakistan.

## Innovation

Pakistan Chulah addresses the issue of fuel poverty for marginalised communities by providing them access to a simple and low-cost solution. It deals with one of the basic requirements of a household in any marginalized community - a place to cook food - while keeping it:

- easy to learn even by non-literate women;
- even simpler to implement and build using readily available local materials and building techniques.

Pakistan Chulah also provides a:

- hygienic, environment friendly, DRR-compliant, community space;
- livelihood opportunity for women;
- physical canvas to express beneficiaries' artistic abilities with simple materials.

## Environmental Impact

Traditional floor mounted stoves often get washed away during floods. The Pakistan Chulah, having been designed on an elevated lime-stabilized earthen platform, continues to function even when floodwaters have accumulated around it. Thus, households are able to cook food in disaster or emergency situations.

The Chulah is fuelled by agricultural waste, small twigs or sawdust bricks which prevents women from spending excessive time in the search for fuel and prevents further deforestation or environmental degradation by reducing the use of firewood by 50-70 per cent. The use of waste briquettes such as sawdust and rice husk are also being encouraged which will considerably reduce biomass and fuel consumption.

The self-built earthen stove has an extremely low/zero carbon footprint compared to steel stoves. The techniques in earth construction are drawn from vernacular traditions in Pakistan. Since the construction relies almost entirely on the use of unfired-clay its life cycle analysis (LCA) and life cycle costing provide positive results. The LCA shows that the material is rapidly renewable, that it can be recycled effectively at any given time and that in case of breakage it can easily be reclaimed.

The stabilization of earth with lime has been tested extensively by HF while building over 40,000 zero carbon shelters in Sindh since 2012 (in collaboration with IOM), as well as other zero carbon structures built with other funding sources. Tests on these shelters show that mud stabilised with lime (in combination with bamboo) has provided safety from water, floods and seismic jolts.

Subsequent to the introduction of lime and mud methodology by HF, IOM published a *Lime Stabilized Construction Manual and Practical Guide* in 2015 which shows that lime stabilized mud provides water resistance. A lime mud brick has been tested by submerging it in water for three years showing no sign of deterioration. Since the Pakistan Chulah is mostly constructed with layered mud lime mix, these have survived extremely well. Sometimes, plaster may be damaged but it can easily be repaired by the beneficiaries themselves.

## Financial Sustainability

The USD\$2 fee to the BVE is paid in two instalments: USD\$1 is paid in advance, then the housewife is provided with the layout and shown how to build the stove. Finally, USD\$1 is paid once the stove has been completed. This also ensures the self-built stove is properly functioning as the BVE checks and verifies its performance. Additionally, the Chulah has a self-checking mechanism: if two pots can be cooked at the same time and the smoke emits through the chimney, the stove is functioning well.

The project has no running costs as the stove making is currently a self-sustaining/marketing activity which is mainly spread by word of mouth and propagated by BVEs. This shows the popularity and acceptability of the product which is happening without any promotional activity by HF.

A case HF has cited on their submission is of one BVE named Champa who along with her husband, belonging to a minority community, has helped to build 20,000 stoves and earned USD\$40,000. Champa has often acted as master trainer to provide training to women in remote areas of Pakistan. Due to Champa's dedication, she was awarded the Idol Award by the Governor of Sindh at a ceremony in Karachi.

Barefoot Village Entrepreneurs are providing training to women in different villages, some of whom in turn become trainers themselves. As more and more women are trained each of them can support the building of thousands of stoves over a comparatively short time. The more training that can be provided by HF in other parts of Pakistan, the more rapidly the stove construction will spread.

HF aims to build 100,000 Pakistan Chulahs per year, which would require funding for training and a special marketing budget for the teams. Each BVE can help make an

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average of one thousand Pakistan Chulahs (earning USD\$2,000 each) covering 150-200 villages. Currently for every 90 to 100 people trained by HF, ten become BVEs. Training for ten BVEs carries an estimated cost of USD\$5,000. HF aims to train in at least 100 locations across the country.

## Social Impact

HF believes that unless women are empowered, and they are able to live with dignity and respect, many of the SDGs (Sustainable Development Goals) will not be achievable. The Pakistan Chulah project provides women with the skills and potential to earn income for their families and improve their living conditions. Through training and self-building, Pakistan Chulah is helping to empower marginalised women in the country. The stoves require less than 50 per cent fuel and takes 25 per cent less time in cooking, enabling families to save money and time. Women can spend the extra time they get doing other chores or income generating activities for the household.

Although initiated by HF, the use and spread of the stoves are entirely driven by the women beneficiaries - from the construction and decoration of the stoves, to product promotion in rural villages. With a BVE's guidance the stoves can be built and decorated by the housewives themselves helping to improve their dignity and self-esteem. The acceptability of the Pakistan Chulah is evident in the extraordinary effort made by rural housewives to build and decorate the stoves themselves, using their creativity based on vernacular traditions.

The Chulah stove improves the health of women and their families by reducing indoor pollution. The raised earthen platform can be used as a dining space where family members can socialize with each other, and a community social space, where women from neighbouring houses can meet and interact. The platform also serves as a workplace allowing women to carry out their activities for the benefit of their household. It has helped disaster-stricken families to have a place to cook their food in emergency situations.

## Barriers

Due to the low status of women in conservative rural communities in Pakistan the project encountered some initial difficulties. Men are not used to women working independently (except when working in agricultural fields and carrying out household chores). The stove making was considered unusual work particularly for the women trained as BVEs as they had to travel to the next village to teach other housewives. At first, they faced opposition from their male partners until they learned that this could bring substantial income for the family. HF has witnessed a visible change in the attitude of males due to the introduction of no/low-cost Pakistan Chulah. In many cases men joined their female partners which led to the success of the programme.

In some places the BVEs encountered difficulties as they had no official certificates and some influential people even objected to the payment of USD\$2 for providing training. Sometimes there were also hurdles created by local government officials. In all cases HF intervened by confirming that it had devised the programme.

It was also found at the beginning that housewives found it difficult to pay USD\$2 on the first day. So, the BVEs came up with the solution to receive the payments in two instalments: first an advance of USD\$1 for providing guidance in building the stove and the second instalment a few days later when the housewives have completed the stove construction and can afford to pay the second USD\$1.

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## Lessons learned

Rural women in Pakistan have embraced the Chulah stove with great enthusiasm. The features of fuel efficiency, minimal smoke and two stove combination have improved their lives. Acceptance is also due to the opportunity to personalise the product. Positive feedback and requests for stoves have referred to the innovative folk designs and personalised decoration.

While the Pakistan Chulah has spread well in Lower Sindh, it has not been possible to reach out to communities in Upper Sindh and in other areas of Pakistan due to the distances involved. Difficulties were also encountered when HF conducted training in mountainous northern areas of Pakistan. A major hindrance was the restrictive social norms for women, as they are not allowed to move out of their neighbourhoods, and could not help in spreading the methodology. There is a need to train new BVEs and master trainers in all parts of Pakistan in village clusters to scale up the technique and product.

Instead of using the Chulah stoves mainly for cooking food, the chulahs were also used for heating during winter. A different design needs to be developed so the heat of the stove could be directed inside rooms for heating.

## Evaluation

HF has carried out a fully controlled cooking test to assess the performance of the Pakistan Chulah double stove and compared it with the prevalently used three-brick open flame single cookstove. Both stoves were tested under similar conditions with the aim of comparing total specific fuel consumption and overall cooking time required for two basic foods, rice and daal (lentils). The test showed the Pakistan Chulah requires less than 50 per cent fuel consumption and takes 25 per cent less cooking time than the traditional single flame cookstove.

No external evaluation has been done yet on the project.

## Recognition

Pakistan Chulah was selected by the Government of Pakistan to be showcased at the 2017 Energy Expo at Astana, Kazakhstan. HF helped design Pakistan's pavilion which presented low cost solutions and initiatives in energy conservation and renewable energy that benefit the low-income population. It received positive responses from visitors.

Only a few visitors have been to see the Chulah stoves, as the project areas are located at some distance away from urban areas in Pakistan. HF's partners Spiritual Chords from South Africa, Swiss Pakistan Society and Scottish Pakistan Association have seen the project.

The project has been featured in Domus, an Italian architecture magazine: [https://www.domusweb.it/en/architecture/2017/01/03/the\\_pakistan\\_chulah.html](https://www.domusweb.it/en/architecture/2017/01/03/the_pakistan_chulah.html)

The story of Meerzadi, a BVE, has also been featured in Express Tribune, a major daily English-language newspaper based in Pakistan: <https://tribune.com.pk/story/592061/determination-personified-17-year-old-meerzadi-can-ride-a-rickshaw-make-smokeless-stoves/>

An earlier video of Pakistan Chulah (which was formerly called Karavan PakoSwiss Chulah) is published on YouTube: <https://youtu.be/PVz6DW8xud4>

## Transfer

The project was replicated in collaboration with IOM in 2015 in Upper Sindh and in 2017 in Shangla. In 2016, training was provided in Dera Ismael Khan district to engage women in a UNDP-funded community centre.

In Upper Sindh 100 teams of men and women were trained and approximately 7,000 Chulahs were constructed. In Shangla 150 women in six villages participated. However only 15 women became BVEs with only 150 Chulahs constructed as women were not allowed to venture outside their villages. In Dera Ismael Khan where women are restricted to their homes, training was conducted in two villages where five women learnt the technique and 50 Chulahs were built.

Pakistan Chulah is a key element of the shelter programmes that HF is implementing hence it is being expanded and implemented at HF's various development and disaster preparedness projects. HF is currently implementing it as part of its 10,000 Green Shelters programme at Makli, Sindh.

HF believes that Pakistan Chulah can transform the lives of rural women in low- and middle-income countries. All the components of Pakistan Chulah are constructed with readily available earth. Since the methodology is based on the use of mud brick and lime, it can be easily replicated in less developed countries in areas where earth and lime are readily available.

So far, it has spread due to the hard work of BVEs as they are motivated by substantial earnings. The following have been the main barriers:

- Holding large scale training programs in different parts of Pakistan because of lack of dedicated funding.
- With pressing requirements from other sectors, the Heritage Foundation has not been able to allocate any funds specifically for this purpose.

For HF, an integrated approach to housing can play an extremely important role in poverty alleviation. A rights-based holistic model needs to be promoted which includes shelter (house), eco toilets (sanitation), water pumps (potable water) and Pakistan Chulah (clean cooking arrangement), along with emphasis on income generation through green skills and crafts, particularly for women. Having a holistic model and working with the communities in their projects allowed HF to transform the mind set of communities who have not only improved their own lives but taken active roles in the implementation.

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