The Pakistan Chulah - Saving the Environment - Saving Lives

Heritage Foundation of Pakistan is a non-for-profit, civil society organization established to promote the conservation of cultural heritage in Pakistan. It is also engaged in the design of zero carbon footprint and vernacular methodologies for use in humanitarian aid and heritage works.

E-6, 4th Gizri Street, DHA 4,Karachi (75500), Pakistan
Voice: +92-213-5834215
info@heritagefoundationpak.org
www.heritagefoundationpak.org

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The Pakistan Chulah

Life Transforming Zero Caron Fuel-efficient Double-stove

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Yasmeen Lari
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Developed jointly by Heritage Foundation of Pakistan and Pakoswiss Technologies.

Introduction

The publication discusses the benefits of the Pakistan Chulah, based on the experience of thousands of double stoves built in the rural areas of Pakistan by housewives. The low cost double stove has been spread through the efforts of Barefoot Entrepreneurs, trained in the technique of building sustainable fuel-efficient earth stoves. Once the techniques are imparted to rural housewives, they are able to construct and ornament their stoves themselves, showing pride in the products created by them.

The social, health and environmental impacts of the Pakistan Chulah have been beyond expectation. This publication aims to provide an in-depth knowledge of the Pakistan Chulah.

Comparison of Pakistan Chulah with Open-Flame Single Stove

- Can reduce fuel consumption by over 50% for 2.7 billion people.
- Can annually prevent 3.5 million deaths of women and children.
- Reduces time for cooking by 75%.
- Provides dignity to women.
- Provides low-cost dining space for marginalized sections.
- Provides a hygienic environment for improved children's health.

The 3-brick open-flame stove is one of the worst health hazards, also inflicting excessive damage to the planet's ecosystem.

Traditional Open Flame 3-Brick Cooking Stove

Common unhygienic open flame 3-brick cooking stove.

Why the Pakistan Chulah?

The detrimental effect of energy poverty cannot be more appalling than when viewed from the plight of women across the globe. It is well known that 1.2 billion people have no access to electricity, but what is not so well known is that 2.7 billion people have to eke out cooking arrangements through the traditional use of biomass, causing air pollution that is estimated to cause 3.5 million deaths annually (World Energy Outlook 2016). Although half of these people are estimated to be living in India and China, Pakistan and some other South Asian countries are not far behind.

This alarming situation is given insufficient importance perhaps because the worst sufferers are women and children, belonging to South Asia and Sub Saharan Africa. It is the same marginalized population that also suffers immensely from social, environmental and health risks.

However, when seen in the context of ecological damage due to inefficient use of biomass, and environmental pollution by the burning of branches/twigs, animal dung, crops waste, it is clear that the 3-brick open-flame stove is one of the worst hazards inflicting damage on the planet's ecosystem.

Among its other impacts is the hampering of economic development in countries already suffering from economic woes and rising poverty levels. It is estimated that the use of biomass will remain high even up to 2030 at approximately 70% of the present usage. Due to the inefficient open flame single-stove, the restraints inflicted on economic and social development have been well documented in various studies.

- In view of the extraordinary time required for collection of fuel, the time available for farming, craft practising, other income gen-

erating skills and the perusal of literacy and educational activities, is reduced or becomes unavailable.

• Women being the chief users of stoves, along with children who accompany mothers while food is being cooked, by inhaling indoor smoke, suffer from respiratory diseases, asthma, infections, as well as obstetrical problems such as still birth or low infant weight, and even blindness and heart diseases.

• Gathering wood and biomass often results in scarcity within short distances, forcing the users to go farther and farther away in search of fuel. There are even reports of women being subjected to rape as they move farther from their own habitat.

• The removal of biomass results in excessive ecological damage.

• The use of biomass such as agricultural waste and dung in stoves is wasteful as these could be used more efficiently to produce organic fertilizer.

Additionally, it is clear that the makeshift open-fire stoves are also highly vulnerable. These are life threatening as they easily trigger domestic fires leading to loss of property and cause burns to those in the vicinity of the cooking area.

Unhygienic conditions of floor mounted stoves.

Women worst sufferers of open flame cooking stoves.

Increased health issues among children due to smoke inhalation.

In case of disasters such as floods the stoves often get washed away along with the shelters and belongings of households. Once no cooking arrangement is available, it leads to the displacement of families which makes it difficult to restart their lives, sometimes taking many months before the families can return to their original habitat.

Thus, these inefficient stoves not only result in pulmonary, respiratory and eye diseases, but also contribute to excessive environmental degradation, at the same time causing a recurring poverty cycle that deters social advancement of the marginalized populations.

Pakistan Chulah is a low cost, fuel efficient double stove, with minimal smoke emission, self built by rural housewives.

Fuel-efficient, Green Pakistan Chulah

Highly decorated Pakistan Chulah showing the housewife's pride.

What is the Pakistan Chulah?

According to reports on energy and poverty, even if those living at the bottom of the pyramid get access to electricity for lighting, the demand for biomass for cooking and heating will remain high. This cause for concern is in view of predictions that biomass will continue to be used in inefficient and environmentally degrading ways for cooking and heating. Therefore it becomes essential to find ways to minimize its use in order to lessen the adverse affect on health as well as other negative impacts of its use.

Keeping in mind the drawbacks and the widespread implication of the inefficient open-flame 3-brick single stove, the Pakistan Chulah has been carefully designed, and this has substantially reduced the quantity of biomass. At the same time through the use of a chimney reduces smoke emission and prevents smoke getting into the eyes or into the respiratory system of the users.

Its multifaceted features promote hygiene and sanitation, Disaster Risk Reduction (DRR), as well as energy efficiency. The Pakistan Chulah is built entirely with sun-dried mud bricks carrying an external lime-mud render; it utilizes compost-able agricultural waste and operates on wood gasification techniques. Not only does the Pak Chulah exemplify energy conservation, it also fosters the social uplift of wom-

Use of colours and traditional patterns for decoration.

en in remote conservative societies residing in sub-urban and rural areas of the Third World.

Since it is mostly women who cook for their families, they are the worst sufferers. The eye and respiratory diseases they acquire largely remain unattended throughout their lives. The food cooked on floor-mounted single-stoves leads to unhygienic food and is a major cause of diarrhea, particularly among infants and children.

Using sculptural peacock figures to bring luck.

The double-stove Pakistan Chulah with its specially designed structure incorporating a chimney, presents an attractive and low cost alternative to the inefficient open-flame single stove that is used widely in many parts of the world. It minimizes the cooking time and provides reduction in smoke which is emitted at a higher level. The Pakistan Chulah provides a clean dining space for the family on a raised earthen platform. Fueled by agricultural waste, twigs or sawdust bricks, it prevents women from spending excessive time in the search for fuel. It also minimizes the use of biomass for cooking.

The efficient use of fuel allows cooking on two stoves along with facility for boiling water if a utensil is placed at the top of the chimney. Through these mechanisms, the target of efficient fuel consumption is achieved. At the same time not only the danger to her health has been mitigated, by raising the level of the entire double-stove a couple of feet above the ground the housewife has been provided an elevated status within her community – the earthen platform also providing a hygienic environment for cooking.

Thus, the Pakistan Chulah seeks to transform the status of women in conservative societies through the construction of self build earthen zero carbon double-stoves.

Convenient cooking on the double stove.

Earthen double stove on earthen platform, with chimney, combustion chamber for wood gasification, earthen storage wall, hand washing platform.

Well-designed Sustainable Construction

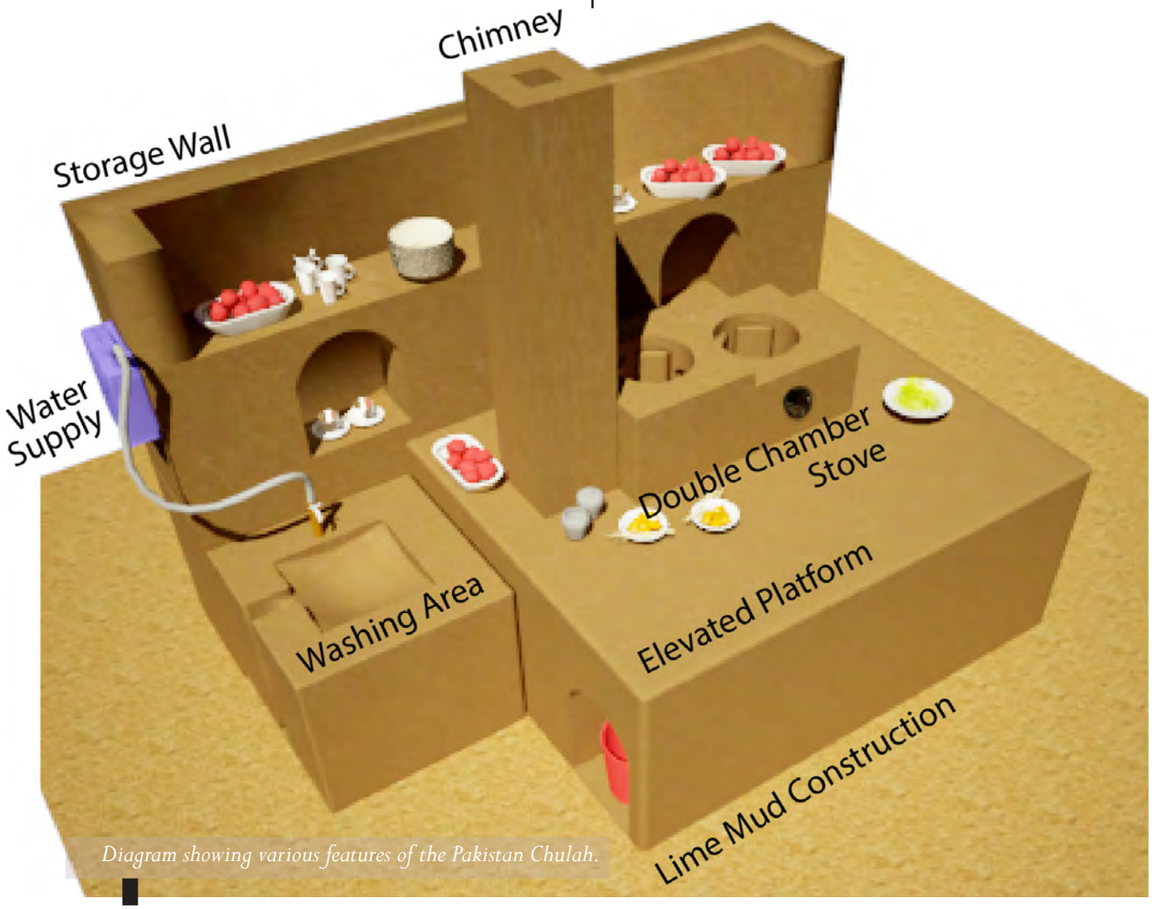


Diagram showing various features of the Pakistan Chulah.

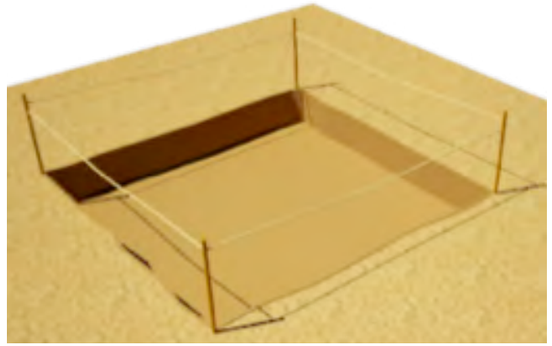
Salient Features

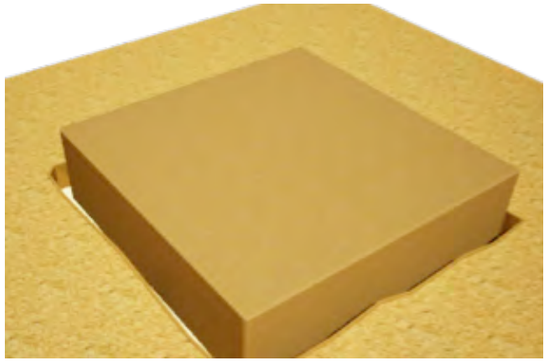
The Pakistan Chulah is mounted on a raised lime-stabilized earthen platform. It is built to be DRR (disaster risk reduction)-compliant, being unaffected by rain, floodwaters or earthquakes. The techniques in earth construction are drawn from vernacular traditions of Pakistan. Rural women are particularly proficient in building earthen structures, which are then covered with a render, lovingly and carefully applied to beautify the core of the earth wall. The plaster is usually mixed with straw and cow dung, providing it with elasticity and smoothness. By adding lime recommended by us, the structures become strong and are no longer prone to usual disintegration of earth surfaces. The addition of lime is derived from Pakistan's own ancient heritage going back to the 16th century, as well as to the pyramids of Egypt and the aqueducts of Rome.

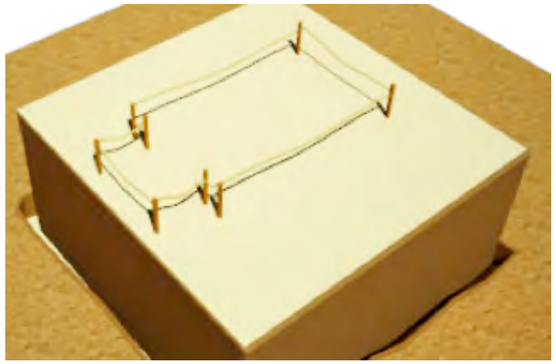
With the placement of the double-stove on earthen platforms, a hygienic environment for cooking is achieved. Animal droppings and dirt that are commonly seen in the floor mounted open-fire stoves no longer contaminate the food while it is being cooked. An air regulation pipe allows the transfer of heat from the combustion chamber to the secondary chamber, thus making it possible to cook on both the stoves even while fuel is used only in one stove. The chimney that is incorporated in the design emits smoke only when the fire

A housewife completing earth chimney in rural Sindh.

Stages of Construction







Stage 1:

This stage consists of marking the foundations by placing 4 pegs on the corners.

It is important to carry out excavations to the extent of 12" depth, which needs to be filled with 4" thick layer of lime concrete.

Stage II:

This stage consists of marking a platform using layers of 1:6 lime and mud. The platform is raised to a height of at least 15" to form a base for the double stove arrangement. The earthen raised platform provides a convenient hygienic space.

Stage III:

Once the platform is completed, the layout for the double stove is carried out by placing pegs marking the location of the two stoves and the chimney. The steps to reach the platform are usually constructed once the double stove arrangement is completed.

Stage IV:

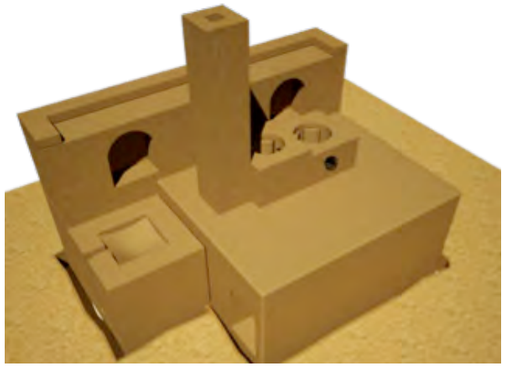
In this stage the double stove is constructed ensuring that that the openings and spaces for the movement of heat are ensured.
The smaller side structure is the chimney which can be taken up to a height which will ensure protection from any smoke.

Stage V

This stage shows the addition of the hand washing arrangement which is a platform attached to the main platform. It has a slightly sunken sink from where the waste water is drained to water a plantation bed, thus avoiding any sewerage water.

Stage VI:

This is the completion stage. After completion of the platforms and double stove, the rear storage wall is taken up with either layered mud or with mud brick. The entire structure is plastered using lime/mud/straw mix to provide water protection to the platform as well as the entire assembly.



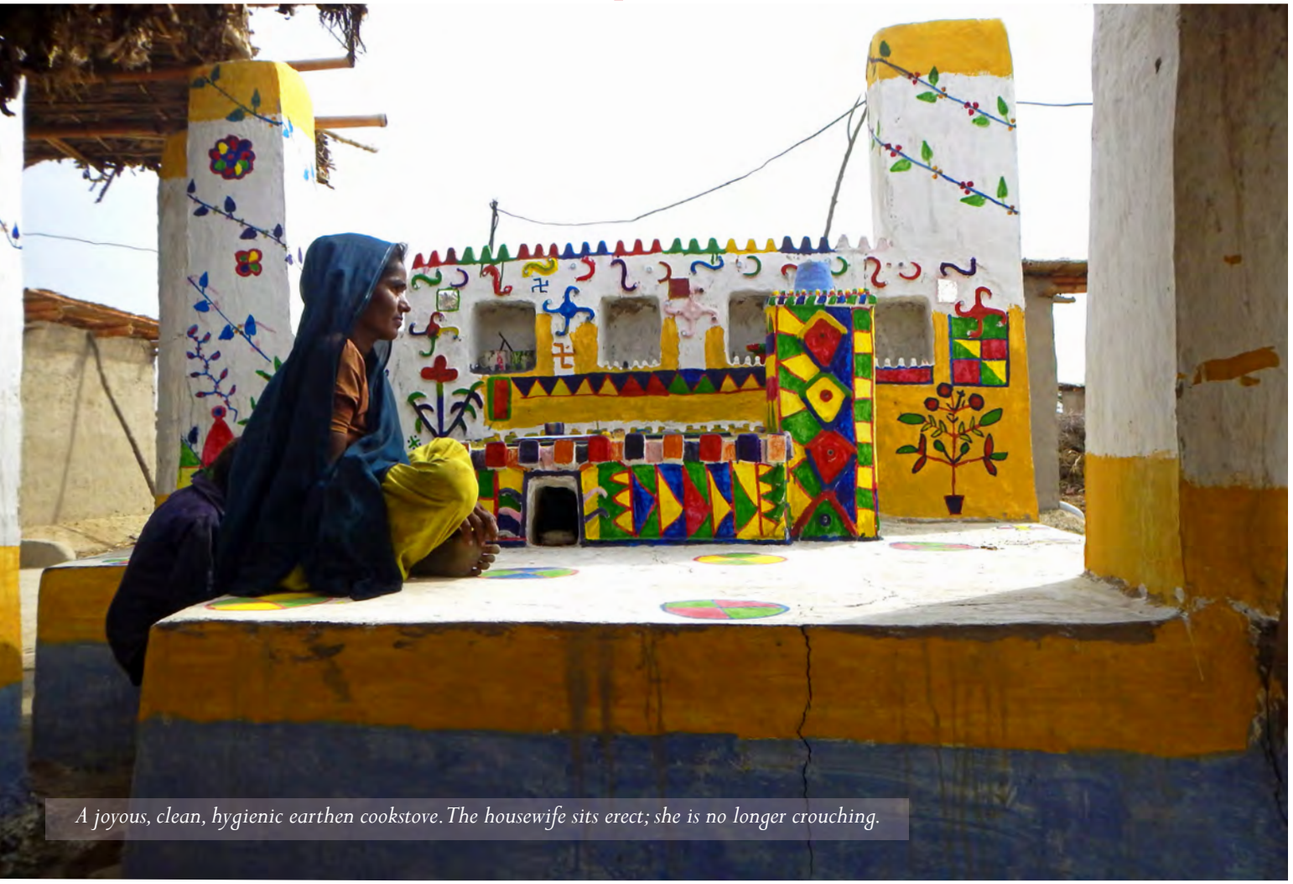
The housewife's innovation at play.

is lit and that too at a higher level, thus avoiding the diseases commonly associated with the traditional makeshift 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.

- Double-stove: Capacity to accommodate two pots, requiring less total cooking time.
- Wood gasification combustion techniques: prolonged fire burning and reduced usage of costly wood fuel.
- Elevated earthen platform and storage wall: hygiene advantage of zero contamination of food from animal droppings and dirt on the floor, DRR-compliant as not within reach of flood waters:
  - Provides clean family dining and socializing space.
  - Creates a domain exclusively dominated by the mother, elevating her status in the eyes of both the family and the community.
  - Expression of the housewife's creativity.
  - Use of layered lime-mud in construction and lime-mud: protection from damage from flood/rain.
  - High placement of chimney: ensures that smoke is emitted at a higher level, thus providing a comfortable way of cooking as compared to the traditional method by which smoke constantly gets directly into the eyes of the housewife, effectively helping to avoid respiratory and eye diseases commonly found among rural women.
  - Earthen platform: building the stove on an earthen platform helps reduce various hazards, such as animal contamination, flood risk, fire accidents etc.
  - The platform allows for a clean gathering or a sitting space for meals.
- Washing area: the installation of a washing area creates a hand washing regimen
- before cooking and eating.
- Double stove arrangement: the double stove arrangement has been designed
- keeping in mind the work load on rural women. This arrangement saves time while allowing to cook food twice as fast with half the quantity of fuel.
- Air regulation pipe: the pipe regulates the air in the combustion chamber, by allowing the heat to transfer from the combustion chamber to the secondary chamber.
- There is a high degree of heat transfer from one chamber to the next, so that while wood is burnt under one pot, the food in the other pot also gets cooked due to heat transfer. This allows a highly economic arrangement for fuel.
- Storage: within the platform, a space is created where firewood can be stored,
- while a wall provides arched alcoves for storing utensils at a high level. The arrangement for storage can be altered depending on space available, while the creativity of the housewife transforms the ordinary storage alcoves into spectacular works of folk art.

A life-transorming element
for women, bringing improved health and
improved status and
elevated position in society.

Instrument of Women's Empowerment



A joyous, clean, hygienic earthen cookstove. The housewife sits erect; she is no longer crouching.

Social Advantages

Based upon data from the WHO, women and girls bear the largest health burden not only from domestic pollution sources, but also often from related fuel-gathering tasks. Available survey data from 13 countries shows that girls from Sub-Saharan African homes with polluting cookstoves spend about 18 hours a day collecting fuel or water, while boys spend 15 hours. In homes mainly using cleaner stoves and fuels, girls spend only 5 hours weekly collecting fuel or water, while boys spend just 2 hours (Burning Opportunity, WHO, 2016). Women continue to carry out household chores and duties such as cooking, gathering fuel for fire, and cleaning, in addition to working in the field or other duties within a home. Their efforts are overlooked as there is no monetary compensation, while men are considered breadwinners and are able to pursue an education. The scientifically designed Pakistan Chulah is women-centric making it easier and less time consuming for the housewife to carry out cooking meals for her family, and has a number of advantages: health and hygiene, DRR-compliance, ease of cooking and environmental benefits. Moreover, benefits in social development in rural areas are sizeable and will only continue to rise as the knowledge and success of the initiative continues to spread. The utilization of commonly found waste materials with zero

The earthen chulah platform is now a socialising place.

biomass, such as saw dust or rice husk, prove a low cost alternative to marginalized communities. The easily replicated methodology enables rapid widespread of construction information, specifically targeted towards the housewife. Thus, women, typically the least empowered members of a household, are able to learn about the construction technique using unfired clay and lime, in order to self build and self decorate their double-stoves to express their own identity.

After the construction of over 40,000 Pakistan Chulahs, it is clear that it is a life-transforming element for women, raising their status to a height that was unimaginable prior to this intervention. Women, who would be normally crouching on the floor, showing their helplessness and apathetic state, have acquired an elevated status. The earthen platforms are literally synonymous with a throne – an earthen throne though it might be - allowing them to sit with an erect posture. They now appear as real providers of food for the family who now sit in front of them as if supplicants. The raised earth platform has become a dining room, where for the first time in

The Pakisran Chulah is a social hub where womne and children can socialize.

their lives, the family members socialize with each other, and where grandmothers can now indulge in their story telling.

In addition to the family space, it has also become a community social space, where women from neighboring houses can sit or stand around, interacting with each other. In the absence of any working space available to women, the earth dais has become their work platform. When they are not cooking they are using it to carry out their craft activity: embroidering, stitching, even practicing the ancient craft of glazed-tile making.

And above all, women have been able to express their creativity and innovation. They have vindicated my belief in forcefully pursuing social architecture where architectural design is but a canvas inviting the unleashing of the artistic impulse of the user. The creative expression of women who built their cook-stoves has been outstanding. Keeping the original elements of the stove design, they have adjusted these to their own requirements. They have used their imagination to embellish their stoves with folk motifs that have been taught to them by their mothers

The chulah or cookstove area is carefully delineated.

floor mounted smoke emitting stove, mixing dust and ground pollution with the food that she cooks. Come rain or floods, the stove gets washed away, leaving her with no possibility of cooked food for her family even if some philanthropists provide bags of rice or flour.

Her life has transformed ever since she has received training in building the zero carbon, smokeless, fuel efficient Pakistan Chulah. By using Pakistan Chulah the health of her family and herself have improved enormously. She has much more time at her disposal which she used to spend in gathering wood for cooking. Her own health has improved enormously as she does not have to inhale smoke

Kareema, once a beggar, now uses the Chulah platform for income generating activities. .

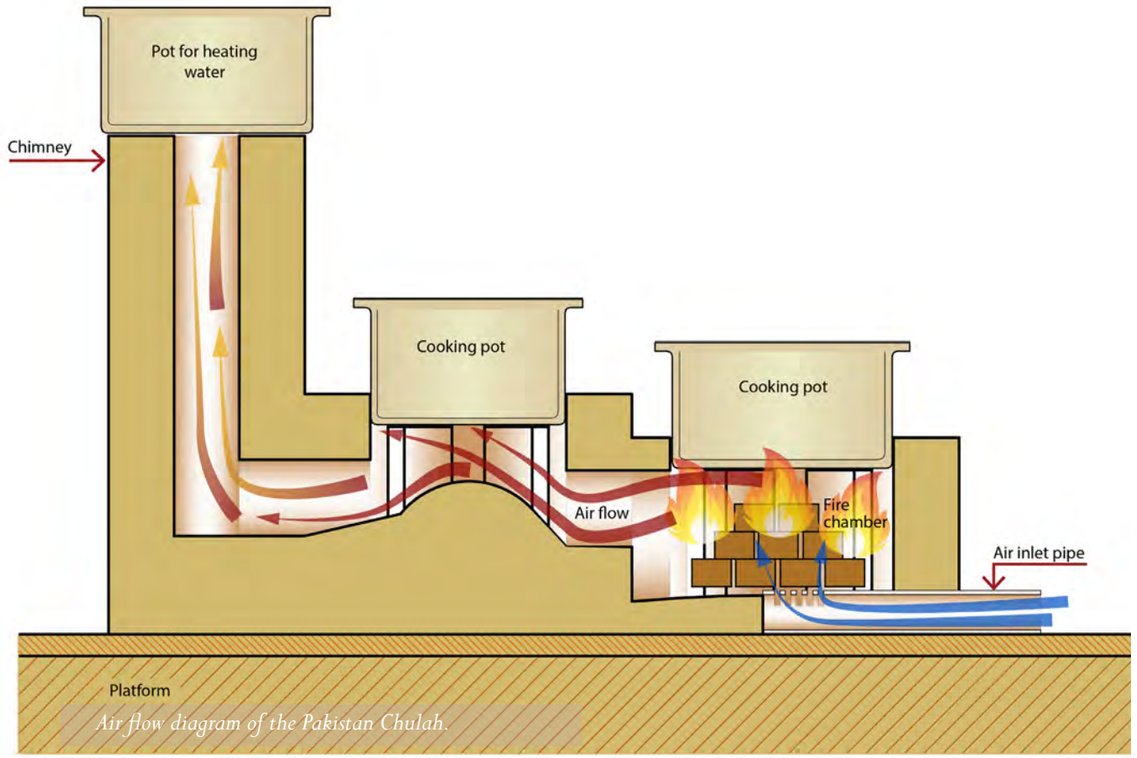
and their mothers before them. They have brought the excitement of vernacular design and traditions to personalize what are usually seen as mundane earth cook-stoves. Thus, they have customized each one as a designer stove, showing the pride and ownership of the initiator. Due to the ingenuity of the rural women of the country, the Pakistan Chulah is not a cook-stove; it is akin to a work of art!

Take Kareema, a beggar woman who lives with her family of mendicants in the shadow of the World Heritage necropolis Makli, Thatta. All her life she has used the 3-brick floor mounted smoke emitting stove, mixing dust and ground pollution with the food that she cooks. Come rain or floods, the stove gets washed away, leaving her with no possibility of cooked food for her family even if some philanthropists provide bags of rice or flour.

Her life has transformed ever since she has received training in building the zero carbon, smokeless, fuel efficient Pakistan Chulah. By using Pakistan Chulah the health of her family has improved enormously. She has much more time at her disposal as she does not need to spend in gathering wood for cooking. Her own health has improved as she does not have to inhale smoke any more. She is now engaged in making glazed tiles and selling them at the necropolis, thus increasing her earnings.

Reduction in time for cooking: 75%
Reduction in fuel: 56%
Minimal smoke emmission
Zero carbon construction

Reduced Bio-mass & Time Usage, Minimal Pollution



Air flow diagram of the Pakistan Chulah.

Environmental Impact and Energy Efficiency

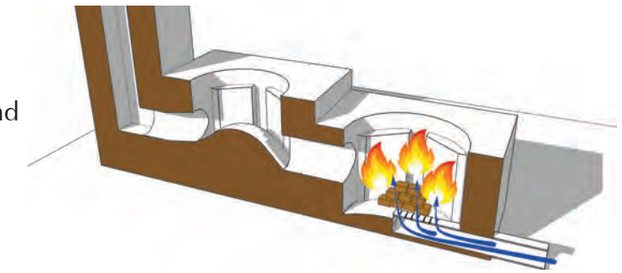
What the Pakistan Chulah strives to achieve is a solution to the issue of energy for the poor, who have not had access to simple solutions which they can control themselves.

The introduction of fuel efficiency for the disenfranchised masses, who can easily adapt and integrate it into their daily routines is among the foremost objectives. The Pakistan Chulah has been designed with its core objectives leading to greater environmental, social justice, and public health trajectory.

It is a low cost solution that is based on locally available techniques and materials and is therefore entirely sustainable.

The clean burning, fuel-efficient double stove uses small sticks or twigs. Built on raised earth platforms, it is DRR-compliant as it can withstand rain and floods. Chulah uses local mud brick and local skills. It saves 50% - 70% firewood, and the chimney reduces carbon emissions.

The earth double stove has been tested and shows that in comparison to single open flame stove it requires less than 50% reduced fuel and takes 25% time in cooking. In case saw dust or rice husk bricks are used the use of firewood or biomass is reduced further to only 25%.



Sectional deatail showing air movement in Pakistan Chulah.

Clearly, considerable savings in green-house gas emissions are possible along with saving in time and health benefits accrued through green construction.

Advantages of Pakistan Chulah Demonstrated

Earthen folk decoration creatively applied to the chulah ensemble.

Test Results: Traditional Open-Flame Versus Pakistan Chulah

The components of Pakistan Chulah include double stove, combustion chambers, chimney, air regulation pipe, firewood storage, earthen platform, and washing area.

A fully controlled cooking test was completed assessing the performance of the Pakistan Chulah double-stove as compared to that of the prevalently used Three-brick 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). It was concluded that not only did the Pak Chulah out-perform the Three Stone Cookstove in average total cooking time, but it also consumed less fuel in that shorter time. Additionally, a main feature of the Pak Chulah is its ability to burn fuel through regulated, high thermal intensity methods, which results in prolonging the duration of wood-burning and also emits significantly less smoke from the chimney.

Pakistan Chulah Double-stove

- *Average Fuel Consumption for 2 utensils*: 577.7 g/kg; for 1 utensil: 288.8 g/kg
- *Average Cooking Time for 2 utensils*: 19.3 min; for 1 utensil 9.65 min

Three brick Open-flame Single Stove

- *Average Fuel Consumption for 1 utensil*: 593 g/kg
- *Average Cooking Time for 1 utensil*: 35.7 min

Pakistan Chulah Savings

- Fuel consumption saving one utensil: **55.5%**
- Cooking time saviing for one utensil: **86.5%**

The PakChulah has total energy conservation of over 50% of firewood through its utilization of not only smaller firewood and twigs but also saw dust bricks and agricultural waste.

Its prevention of loss of heat and retention of 80% heat to be directed towards cooking; lime-stabilized mud plaster, a thermal reactor which prevents energy/heat loss, is incorporated into the design. Moreover, in terms of Disaster Risk Reduction, the elevated mud platform protects from flood and rain waters and allows space for placement of clean drinking water, pots and pans.

A welcoming dining platform for the family.

Clean cooking environment, reduced respiratory and other illnesses, reduced incident of child mortality.

Improved Health for Women & Children

Attractive earthen decoration with peacocks as symbol of luck.

Effect on Women's Health

Women's health is one of the least addressed issues in rural areas of most developing countries. As the primary domestic worker in a household, a woman typically spends most of her time cooking, cleaning and caring for children, effectively spending most of her time at home and thus having the most direct impact from negative household air pollutions.

The Pakistan Chulah is designed to provide several hygiene and health advantages. The raised platform of the design promotes sanitary living conditions and encourages families to consider a change in lifestyle choices for the better. The strategic placement of the chimney directs fumes and smoke away from the cooking housewife and children who may be in close proximity to the stove, while the elevated platform solves the issue of floor waste and animal contamination.

Innovative chimney forms for providing distinction.

Clearly, considerable savings in greenhouse gas emissions are possible along with saving in time and health benefits accrued through green construction.

Self Build, Environmental/Social Benefits

The chulah platform provides a welcome opportunity for socializing.

Key Benefits

Ease of Construction

The stoves are easily constructed using mud brick and local skills. Since women are proficient in the use of mud they are able to easily fabricate it as long as they are guided about the key elements. The use of lime is an added factor, however, whenever HF's methodology is being promoted, communities have learnt the use of slaking and mixing lime with mud.

Saving on Fuel

The obvious saving on fuel is an incentive for marginalized communities where the saving of every rupee counts. The promotion of the Chulah through a network of trained Chulah Adhis –Stove Sisters – has shown that the methodology can easily be replicated. On the one hand, rural housewives learn to make their own stoves, while on the other, the creation of entrepreneurs such as the Stove Sister

Women learning about the benefits of the Pakistan Chulah.

Housewife comfortably overseeing food being cooked.

can spread the methodology rapidly to rural communities.

Many of the trained Stove Sisters have now become HF's Barefoot Village Entrepreneurs or BVEs and Master Trainers.

Environmental Impact

The design of the Pakistan Chulah double-stove allows the saving of 50 – 70% of fire-wood compared to the traditional floor-level open fire chulah. It also allows the use of smaller firewood and twigs, and as such is ideal for industrially less developed countries (LDCs) such as Pakistan, since it prevents deforestation. Keeping trees from being de-stroyed also helps in preventing soil erosion and reduced danger from flooding etc.

Improved Efficiency

The design of the chulah double stove pre-vents loss of heat and makes it possible for 80% of the heat to be used for cooking. It is calculated that only 10% to 40% of heat is used in the case of the traditional floor mounted open fire stoves. By improving the heat transfer from the fuel to the pot, there is

Children watching their lunch being cooked on a clean earthen platform.

considerable saving of firewood. The use of double collars enables simultaneous cooking of double the quantity of food in two pots with the same amount of firewood, thus providing considerable reduction in overall cost of firewood.

Improved Health

The highly insulated structure of the double stove as a result of its construction with mud and lime-mud render, allows the firewood to be fully burnt in the combustion chamber. The reduction in harmful smoke and reduced carbon monoxide emissions due to the use of the chimney contribute to cleaner environment for women and children. The stove hardly produces any smoke, as it is produced only when the fire is lit. Women have found it a boon. Respiratory diseases due to inhalation of smoke and burning of eyes are avoided. There are no longer tears or smoke saturated clothes.
Since the chulah is constructed on an earthen platform a couple of feet above the ground, it provides instant hygiene benefits.

Crawling insects, dirt, filth, animal droppings, that the floor is normally littered with while cooking with traditional open fire stove, can no longer find their way into the cooking pot as it is well above the floor level.

Disaster Risk Reduction (DRR)

The construction of earthen double-stove, elevated above the ground has the added advantage that it is protected from flood waters. The Lari Principles for DRR are applicable in all constructions and the earthen platform provides space for placement of drinking water as well as pots and pans. The construction therefore provides the possibility of restarting the fires immediately after flood waters recede or rain comes to a stop.

The Pakistan Chulah is among key elements that can provide the impetus for the families not to have to move away from their homes, since their stoves will not be washed away as in the past. These will survive the flood and rain and will allow the housewife to continue to provide meals to the family when the rain stops.

Creating a highly decorative, clean and hygienic environment for the enjoy-

Life Cucle Analysis (LCA) and Life Cycle Costing (LCC) application yieldiing positive results

WELL BEING ASSURED BY GREEN PAKISTAN CHULAH

A proud housewife with an array of clean cooking utensils.

THE PAKISTAN CHULAH CONTRIBUTING TO GLOBAL WELLBEING

LIFE CYCLE ANALYSIS AND COSTING

Since the construction relies almost entirely on the use of unfired clay its life cycle analysis (LCA) AND life cycle costing (LCC) provide extremely positive results. The LCA shows that the material is 'rapidly renewable', that it can be 'recylced' effectively at any given time, that in case of breakage it can easily be 'reclaimed'.

From the point of view of LCC it is clear that the extraction of earth is quite simple and easy, that the manufacturing of earth bricks happens at the site, which means there is hardly any distance from the place of extraction or manufacture to the site of its usage, its installation is comparatively simple and is based on age-old techniques with which the communities are familiar. Since the outer render is mixed with lime, its maintenance cycle is fairly limited, as repairs can be carried out with a mix of lime and earth. Its recyclability is assured and disposal can be carried out effectively without resorting to any landfills. It has a long life as no rain or water affects it as long as the external lime earth render is maintained. The use of lime is minimal. It is brought to the site from less than 500 miles away (the limit for LEEDS certification). Although it emits a small amount of CO_2 while being kiln fired, however, in view of the fact that lime absorbs CO_2 from the air, it neutralizes the original CO_2 emissions.

A charming Pakistan Chulah.

Since both the materials are regional, they reduce both LCA and LCC due to the following aspects:

There is minimum transportation which is limited only to the smaller component of fat lime. The earth bricks are fabricated from locally available earth which has no energy requirements. Sourcing local means that the local economy is helped. By staying small, the environmental system is protected.

Thus, in an age when half a billion ton of waste material is produced annually, such small scale enterprises, that ensure zero waste or zero filling of landfill sites, are among important factors for environmental sustainability.

Training Barefoot Entrepreneurs

The earthen platform is used by children for study under the watchful eyes of the mother as she cooks their lunch

Local trained women barefoot entrepreneurs marketing Pakistan Chulah to rural hosuewives by demonstrating its benefits

Scaling up by Women Barefoot Entrepreneurs

Self-built clean smokeless environment benefiting the mother and her children.

Implementation Methodology: Training Local Barefoot Entrepreneurs

Heritage Foundation of Pakistan has trained several Barefoot Entrepreneurs as "Chulah or Stove Sisters." These are rural master trainers, who are mostly non-literate. They visit neighboring villages to impart training to housewives for building the Pakistan Chulah.

They also provide hygiene training to encourage hand washing prior to cooking or handling food. Each Stove Sister charges US$2 to provide guidance in mixing lime with mud as well as guidelines for stove construction. Take the case of one Chulah Adhi (Stove Sister), Champa, along with her husband, belonging to a minority community, has helped to build 20,000 stoves out of 40,000 that have been built in the last 27 months, thus she herself earning US$ 40,000. This shows the popularity and acceptability of the product, which is happening without any promotional activity by the Foundation.

Since these are self-build structures by housewives themselves these are zero cost to donors. The family incurs a cost of $8, including the fee paid to the Stove Sister. This is a prime example of zero cost/zero carbon elements that are essential for reaching out to those found at the bottom of the pyramid.

The only donor funding that has been utilized is for initial training of groups of Stove Sisters. These Barefoot Entrepreneurs are now spreading the message on their own, at the same earning a substantial amount themselves.

The Pakistan Chulah has not only lifted the Barefoot Entrpreneurs out of poverty, it has positively impacted thousands of women who now live a life of dignity and good health, spreading benefits to their families. Since the stoves are self built, they are well maintained, and having learnt the use of lime, these can be repaired by the housewives themselves.

Housewives learning to make the Pakistan Chulah.

Spreading learning techniques in rural areas.

Husband & wife team as Barefoot Entrepreneurs.

Women comparing notes during training.

A woman in the process of completing her Pakistan Chulah.

Meerzadi, the first Barefoot Entrepreneur, conducting training.

Karavan Pakosiwss Chulah training, Village Allahbad, Jacobabad.

Benefits of green sustainable stoves outweigh factory manufactured steel stoves.

Steel Stove Versus Pakistan Chulah

Successful completion, after having received training from Bareofoot Entrepreneur.

Steel Stove Compared with The Pakistan Chulah

The Pakistan Chulah

Salient Features

- Incorporates raised platform for hygienic conditions
- Zero cost to donors, self build unit
- Provides hygienic environment by incorporating washing area
- Zero carbon footprint
- No transportation or distribution costs; requires training of village barefoot entrepreneurs for training housewives
- DRR (Disaster Risk Reduction)-compliant as platform is elevated.
- Monetary benefits accrue to village barefoot entrepreneurs
- Creates a social hub
- Elevates woman's status in society
- Materials can be recycled
- Locally sourced materials; requires low or no transportation
- Local manufacturing with no cost for transportation
- Locally produced, enhances local economy and environment systems
- Child friendly and safe
- Retains heat in stove after fire is extinguished - less fuel needed to re-start.

Single Steel stove e.g. Rocket

Salient Features

- Compact and Portable
- Donor driven
- Unhygienic environment when mounted on floor
- Uses high energy in its production
- Transportation and distribution costs
- Can be stored at higher level during disasters
- Monetary benefit to manufacturers
- No social attributes
- No impact on status of women
- Limited recyclability of materials
- Local sourcing not possible, requires transportation over long distances
- Distant manufacturing with additional cost and carbon emission
- Distant manufacturing with no benefit to local economy
- Unsafe for children – danger of burning from hot steel
- Immediate extinguishing – no heat stored in stove

Play time with mother - the earthen platform transforms into family socializing.

UN Recognition Award for Promotion of Culture and Peace, 2002
Islamic Development Bank Laureate 2013 for Women's Development
Emirates Airline Greener Tomorrow Award 2013-14
Finalist World Habitat Awards 2014-2015

E-6, 4th Gizri Street, DHA 4, Karachi
www.heritagefoundationpak.org info@heritagefoundationpak.org