
Passive Solar Housing

Impact on Human Health,
Gender and Education
A study in Ladakh Region of
India

GERES India, March 2011



Acknowledgements

Many thanks to the staff of Geres India for advice and help:

- Lydia Adelin-Mehta, Country Director
- Ruchi Mathur, Head of Finance, Administration & Communication
- Ajaz Ahmad, PSH Coordinator
- Gitanjali More, Capitalization & Good Practices Coordinator

Our sincere gratitude to the community, women, children and men who extended characteristic Ladakhi hospitality to us, patiently answered questions and gave us a glimpse of what is essentially their private space and world. This would not have been possible without the accompaniment, facilitation and translation by the project staff of following GERES partners:

- Ladakh Ecological Development Group (LEDeG), Karzoo, Leh-Ladakh, J&K, India
- Ladakh Environment and Health Organisation (LEHO), Himalaya Shopping Complex, Leh-Ladakh, J&K, India
- Leh Nutrition Project (LNP), Housing Colony, Near Council office Post Box-59, Leh-Ladakh, J&K, India

Individuals that I must express my gratitude to, are:

- Eshey Paljor and Namgyal (LNP) for valuable assistance in Gya- Sasoma region.
- Tsewang Tharchin & Iqbal (LEHO) for translation, hospitality and travel in Bodh Karbu region.
- Zulfi, Muhammad Issa and Baqir Ali (LEDeG-Kargil) for excellent support and help in the Kargil region. Rigzen, Padma (LEDeG-Leh) for hospitality, help, translation and travel in Durbuk area.
- Dr Thinlay & Dr Norboo in Leh; Dr Diskit Dolma & Dr Nanda in Tangtse for expert inputs.

A word of appreciation for the expert drivers - Namgyal, Iqbal, Baqir Ali and Padma, for driving us safely across snow bound roads and passes! Finally, my eternal gratitude to Mr Nabi (Sia-La Guest house) and his staff!

This publication is funded by the European Commission with cofunding from Fondation Ensemble, Fondation Abbé Pierre, ADEME, Fondation Lord Michelham of Hellingly, Crédit Coopératif, Synergie Solaire Fondation MACIF, Gaz et Electricité de Grenoble and Fondation Legallais. The views expressed in this publication do not necessarily reflect the views of the European Commission and the partners.

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Glossary

<i>Amchi</i>	Traditional Healers in Ladakh; Practitioners of Tibetan Medicine ¹
AGH	Attached Green-House
Bukhari	A traditional stove for heating purpose (Picture)
DG	Direct Gain
DGH	Detached Green House
FGD	Focus Group Discussion
GERES	Groupe Energies Renouvelables, Environnement et Solidarités
EE	Energy Efficiency
LAHDC	Ladakh Autonomous Hill Development Council
LEDeG	Ladakh Ecological Development Group
LEHO	Ladakh and Health Organisation
LNP	Leh Nutrition Project
LREDA	Ladakh Renewable Energy Development Agency
PSH	Passive Solar Housing
Rs.	Indian Rupees
SECMOL	Student's Educational and Cultural Movement of Ladakh
SHG	Self-Help Group(s)
SW	Solar Wall
TW	Trombe Wall
Thap	A traditional metal stove used for cooking (Picture)

¹ http://www.ladakhAmchisabha.com/basic_sowa.htm

Executive Summary

Geres India has implemented a project in passive solar housing along with its local partners in Ladakh, Lahaul and Spiti region of Indian Himalayas for the last three years. The present study attempts to capture various effects of PSH, on human health, comfort, leisure & creative pursuits, work load related to fuel collection, storage and usage etc.

Sample: A random (cum convenience) sample of 80 households was divided in two: 40 had a PSH intervention completed by 2009 and another 40 families which had no PSH as on date. This entire sample was evenly distributed into four different regions:

1. Kargil (receives much snow fall and has marginally better vegetation cover)
2. Gya-Sasoma (Indus valley, close to Leh Manali highway)
3. Bodh Karbu on junction of Leh and Kargil districts
4. Durbuk region close to Pangong lake

Methodology: A detailed questionnaire was administered to individual households and Focus group discussions/Interviews were conducted with women, children, *Amchi*, doctors and masons. An attempt was made to understand how women and children's lives have changed after building a PSH. Comparing incidence of illnesses in the last six months was methodologically difficult because of lack of control (PSH and Non-PSH families were not comparable in age, size and other variables) and small sample size. Self-recall was used for time taken to collect fuel and reduction in consumption of fuel.

Observations & Findings: Most families are using direct Gain (57%) and solar wall (33%). PSH families are using only Thap for cooking, while non-PSH families have to rely on Bukhari-Thap, which is used around the clock for cooking as well as keeping the living room warm during winters. Thus usage of stove in the main living room has gone down significantly (by 50% at least) in PSH families: 6.1 hours to 11 hrs or more per day on average.

Fuel- Consumption of fuel has reduced considerably, in some families by 70-80%. Dung available in one's own cow-shed or in the village itself proves sufficient for most families. Reliance on wood and bush has decreased. This has resulted in cash saving (up to Rs 5 to 7 thousand per year) and time saving for many families.

Health benefits: Availability of a smoke-free warm room, full of light (due to large clear south facing windows) encourages elderly and sick to spend more time in the PSH room. Arthritis and respiratory problems faced by elderly appears to benefit by resting in the PSH room. Pregnant and young nursing mothers prefer this room too because heat is ambient and gentle, unlike the heat generated by Bukhari. Accidents involving children (scalding, burns) have gone down since there is no hot Bukhari at the centre of the room, burning round the clock. Water, vegetables, etc. do not freeze in the main room anymore. Most people reported better moods amongst the elderly and children, which could be related to two factors: the living room being lit up due to big windows and secondly, more options for work and leisure are available now due to warmth and light.

Hygiene: Bathing by children in PSH room has gone up from once a month earlier to once a week now in winters. Adults now wash their hair more often - but they need a separate place (bathroom) for bathing since they cannot possibly bathe in the PSH room itself, hence adult's hygiene has improved only marginally.

Other benefits: Women and children utilize this room for jobs requiring fine motor skills and light-reading, writing, spinning, sewing, knitting, weaving etc. Time-saving that has resulted from less fuel collection and less tending of the bukhari, has led to more time being dedicated to studying

(children) and income generation activities (handicrafts for women).

Use of the room: Most families are using PSH room as the main living room, kitchen, parlor and bedroom. Since the Thap is used only for a few hours in the morning and evening for cooking, there is little or no lingering smoke. This room is also used for lounging, praying (telling beads, spinning prayer wheel, offering *Namaj*) and social interactions.

Children are able to play indoor games during winters. They are able to read and write near the window, since they do not need to sit close to the Bukhari for warmth anymore ([picture](#)). Many neighboring children join the indoor games in the PSH room. Besides, adults and children are spending more time together since warmth is available in the living room at no extra (fuel) cost. Earlier, children would play somewhere and the adults would sit somewhere else in the village, spinning or indulging in other pastimes.

Quality of housing: Families have learned the importance of big, double glazed, well insulated windows, how passive solar heating works, etc. This is promoting a desire to build better houses, with better finish and insulation.

Some of the constraints of the study were small sample size, logistics (reaching out to villages in late winter), limitations of recall of sickness and accidents over a long period of time and limitations of the design of the study.



Plenty of light and smoke free, ambient warmth of PSH provides a safe & convenient space for every one- to work and relax, besides savings up to 50% in fuel & related workload. A family & neighbor in Kharpoche, in a DG sitting room.

Introduction

Indoor smoke, resulting from bio-fuel contains a range of health-damaging pollutants, such as small particles and carbon monoxide. In poorly ventilated dwellings, indoor smoke can exceed acceptable levels for small particles 100-fold. Exposure is particularly high among women and young children, who spend the most time near the domestic hearth. This "kitchen killer" turns out to be responsible for 1.6 million deaths and 2.7% of the global burden of disease. In developing countries, indoor air pollution is the fifth highest health threat². On a related note, better thermal insulation reduces exposure to extreme temperatures and risk of respiratory and infectious diseases; thermal comfort is also associated with better mental health³. Passive solar housing addresses these two vital facets of Ladakhi rural life with a clean eco-friendly technology. GERES India has been promoting PSH in the Himalayas since 2006.

This activity, which was conducted in March 2011, studies the impact of passive solar housing on human health and related activities (leisure, productivity), in Leh and Kargil districts of Jammu & Kashmir state of the Indian union.

Geography: Ladakh is the largest province within the North Indian State of Jammu and Kashmir, surrounded and bisected by some of the highest mountain ranges in the world. Valleys average at 3500 mt. while peaks in the region easily approach 7000 mt. The region is fenced by two of the world's highest mountain ranges- the mighty Himalayas and the Karakoram ranges. Two others, the Ladakh range and the Zaskar range, lie across each other. The height of these ranges prevents rain clouds from crossing into Ladakh and as a result, it receives only about 2 inches (5 cm) of rain per year, making it a high altitude cold desert.

For convenience, it can be divided in following regions:

1. Kargil in the North, became a separate district in 1979 and shares ethnic affinity with the neighboring Baltistan region of Pakistan. It receives heavier snow fall, since monsoon clouds steal in through Zoji la.
2. Zaskar to the west, a region of high passes and remote valleys, consists of troughs of two rivers, the Stod (Doda) and the Lungnak (Tsarap Lingti).
3. Changthang ('north-plain') to the south east is the high plateau which continues into western Tibet and contains some famous high altitude wetlands. Recently, oil & gas reserves have been discovered in this region on the Tibetan side⁴.
4. Broad Indus valley sheltering major habitations like Leh, Shey, Leh, Basgo and Tingmosgang. And of course the Nubra valley, a large valley to north, separating Ladakh and the Karakoram range.

This study interviewed twenty families each from the above mentioned four regions, a total of 80 families (vide below).

² Fuel for Life: Household Energy and Health (WHO), 2006

³ Health in the Green economy: Housing sector, Initial Review, (WHO) 2007

⁴ http://english.people.com.cn/200410/22/eng20041022_161261.html



(Picture Credit: Wikipedia)

Society: The society is characterized by seasonal migration, temporary communities and nomadic subsistence farming. In urban and rural communities, families supplement income with services to the Indian Army, Border Roads Organization and other government services. The traditional society shows an idyllic calm and contentment, based on frugality which comes from self-reliance and predominantly Buddhist culture, which accepts natural limitations of the environment⁵.

Beneath the surface calm however, there are differences which often account for the twists and turns of the regional politics & development. These differences are along linguistics (Urdu, Ladakhi, Balti etc.), ethnicity (Shia, Sunni, Buddhist, Noorbakhshi, Christian etc.) and political leanings, based on historical connections; for example, Padum is part of Kargil administratively but it feels connected to Leh emotionally. There are many dialects, scripts⁶ and schisms⁷. Ladakh Autonomous Hill Development Council was granted by the central government in 1979 as a compromise solution to the demands of Ladakhi people to make Leh a union territory.

Based on population norms, Ladakh sends only one member (MP) to the lower house of the Indian parliament, the Lok Sabha and this probably is the reason, why the region is not able to influence the regional politics to its advantage. 2.2% of J&K's population lives in Ladakh while 69.5% of its land is in Ladakh. Another reason is the border conflict, which necessitates strong military presence and this pushes down the regional issues in favor of national strategic concerns. The population rose by 17% between 1961-71 census, due to these external factors⁸.

Women in Ladakh have enjoyed considerable freedom and empowerment for centuries. But today

⁵ Ancient Futures: Learning from Ladakh; Norberg-Hodge, H. 1980

⁶ These differences can be important. Melong, a popular regional magazine, was criticized for using the laymen Bodhi script, instead of pure, classical script (Phalskot Vs Chuskot). Ladakhi and Purig are Sino-Tibetan languages, not Indo-European languages like, Dogri or Kashmiri. Counting numbers, for example, are same as in Japanese.

⁷ Kargil is predominantly Shia Muslim but its two sects have given birth to its ding-dong politics: Islamiya school and The Imam Khomeini Memorial trust. No doubt, national parties too have interfered in the local affairs.

⁸ Recent research on Ladakh 4 & 5: proceedings of the fourth and fifth . By Henry Osmaston, Philip Denwood

the status of women in Ladakh seems to be moving backwards. Similarly, J&K Permanent resident (disqualification) bill, discriminates against women and was protested by many women's group. Representation of women in governance (Goba, sarpanch, councillor, MLA, MP) is almost nil^{9,10}. Drinking among youth on various occasions, like *Losar*, is a rising social problem. Corruption is a big issue and local groups are taking initiative against it. Certain castes (musicians and blacksmiths) are still discriminated against at schools, festivals, parties and sometimes even in monasteries¹¹. A recent social movement, *Amai Tsogspa* (Women's Alliance of Ladakh) indicates that women are waking up to their changing reality and new opportunities^{12,13}.

Education: The level of education has been poor since the medium of instruction is not the mother tongue for a majority of children for a long time. Sparse population, remoteness of schools and lack of committed teachers are other reasons. The medium was changed from Urdu to Ladakhi in 1994. The percentage of students passing at metric (class 10) improved dramatically from 5% (in 1996) to 55% in 2004. Twice as many girls as boys are now in the 10th class. Half of the boys drop out of middle and high school (Metric); unfortunately, many boys become soldiers since the Army has relaxed educational criteria for Ladakhi candidates¹⁴. They become unavailable to the local economy and are able to send home only small savings.

Agriculture is becoming unsustainable in a region which until 19th century specialized in subsistence and self-sufficiency with intra-region trade of essential items. Here are three main reasons:

1. Subsidized food grain of the Public Distribution System (PDS) makes agriculture unviable. Rice, a water intensive crop, has become a staple and is especially popular among children though it cannot be grown in Ladakh.
2. Tourism brings quick income and the tourist season (May to September) coincides with the only cropping season in the region.
3. The Indian army has increased recruiting young Ladakhi men¹⁵. This has taken away a lot of able bodied men away from the fields.

Tourism is a major industry but is unsustainable in its present form and benefits few, especially in towns, rarely the villages which actually attract the tourist. It is a glamorous industry, especially for Ladakhi youth. It has failed to respect local culture, ecology and has given rise to a sense of inferiority amongst local community¹⁶.

Climate: The region is characterized by climatic and seasonal extremes and challenging terrain. Temperatures in winter drop to -30 degrees centigrade; the summer maximum is around 25 degrees centigrade. Air moisture content is very low. The high-altitude desert supports a unique ecosystem, consisting of some rare animal species and the human communities, which have evolved a complex system of survival in an inhospitable terrain.

Housing: It is only now that the modern houses in the small towns in the region, are being

⁹ Ladags melong 2003

¹⁰ Stanzin Dawa <http://www.boloji.net/opinion/0197.htm>

¹¹ Ladags Melong Jan – March 2005. Dalai Lama, while in the region recently, has appealed against such practices.

¹² This women's group has successfully agitated against use of plastic in Leh town.

¹³ Local Transformation through Global Connection: Women's Assets and Environmental Activism for Sustainable Agriculture in Ladakh, India. Author(s): Leonora C. Angeles and Rebecca Tarbotton

¹⁴ Ladags Melong, July 2004

¹⁵ Especially after their significant role in Kargil conflict.

¹⁶ Ladags melong 2003: ancient rituals are witnessed by tourists bent upon taking pictures, ignoring all local norms.

constructed of cement, concrete and steel, otherwise most of construction continues to be of stones piled on each other with mud caking, flat roofs (due to lack of rains) made up of twigs and mud (to allow a vent for Bukhari), supported by timber, locally available. A central passage, with rooms opening off it, small windows and low doors: the traditional houses were inefficient at conserving the heat and providing enough indoor lighting.

Passive Solar Housing (PSH) The amount of solar energy which falls on the roof of a house is often more than the total energy consumed within the house. Passive solar applications, when included in initial building design, adds little to the cost of a building, yet has the effect of reducing the operational costs and reduced equipment demand. It is reliable, mechanically simple, and is a viable asset to a home. This can be valuable in the western Himalayas, where traditional bio-fuel is shrinking and winter temperatures can be very low, often below freezing in winter. The present study is about the impact of PSH on human health in the villages of Ladakh and Kargil.

Literature Review

Following were some of the main background documents reviewed in the process of this study.

1. **Living With Change:** adaptation and innovation in Ladakh; S. Daultrey and R. Gergan, Feb 2011. This documents explores the ways in which adaptation to environmental change is taking place at community scale, both through the implementation of technologies, especially solar ones, adapted to suit extreme and changing conditions and through decision making by adaptive and resilient communities.
2. **Ancient Futures:** Learning from Ladakh; by Helena Norberg-Hodge. 1991 (book & film). It discusses how the peaceful land of Ladakh changed socially, ecologically and economically when "development" set in. Ladakhis start to enjoy the comfort and convenience of modernization; but at the same time, increasing greed, intolerance, unemployment, inflation, pollution etc. set in and is threatening the ecological balance and social harmony which were maintained over the past centuries.
3. **Ladag's Melong-** issues 2003 to 2005. A local quarterly magazine, offering insider's view and critique on various development and social issues. Unfortunately it had to face opposition from bureaucracy, Buddhist clergy and indifference of voluntary agencies and it closed down in 2005.
4. **Local Transformation through Global Connection:** Women's Assets and Environmental Activism for Sustainable Agriculture in Ladakh, India; Author(s): Leonora C. Angeles and Rebecca Tarbotton; Women's Studies Quarterly, Vol. 29
This essay captures the social events & forces leading to formation of Women's Alliance of Ladakh in 1991, as a disenchantment from "Big NGOs", funded by west and toeing mainstream development models which devaluate Laddakhi women's traditional role in society; There are assets that indigenous women possess that deserve attention, it argues, such as their local or traditional ecological knowledge, social networks, and cultural capital. This essay proposes that such nonmaterial assets of indigenous women are powerful elements for social transformation, especially when translated into environmental organizing, as in the case of Women's Alliance of Ladakh and the Ladakh Farm Project. A good write up to understand the evolution of gender issues in Ladakh since independence.
5. **Health in the green economy:** Co-benefits to health of climate change mitigation- Housing Sector- Preliminary findings – initial review. WHO, 2007;
This document shares salient findings, which include:
 1. The right mix of housing mitigation policies could lead to substantial health co-benefits, reducing health risks from extreme weather and thermal stress, from housing and household-energy related respiratory diseases such as asthma and pneumonia.
 2. Provision of good natural ventilation is necessary to ensure health gains from more energy-efficient and weather-tight housing. Insufficient ventilation is associated with higher risk of airborne infectious disease transmission; dampness and accumulation of indoor pollutants are risk factors for allergies and asthma. Adequate ventilation is also needed to avoid exposures to toxic indoor air pollutants like carbon monoxide (CO) and to naturally occurring radiation (radon).
6. **Fuel for Life:** Household Energy and Health. WHO, 2006
This publication captures technical details of indoor pollution, its effect on women and young children and options available and their economic logic. It proposes that making cleaner fuels and improved stoves available to millions of poor people in developing countries will reduce child mortality and improve women's health- and will be a step towards achieving the Millennium Development Goals.

Purpose of the study

The objective of the PSH project has been to offer improved living conditions (healthier and warmer living areas) to the people living in remote areas of the Western Indian Himalayas. This study is aimed to check the fulfillment of this objective. For this, the impact of PSH will be compared to conventional houses which use traditional bio-fuel (dung, roots, bushes) on human health and gender relations, both quantitatively and qualitatively. This study will also document how PSH has affected the lives of women and children and to learn from the last three years of the program.

Design & Methodology

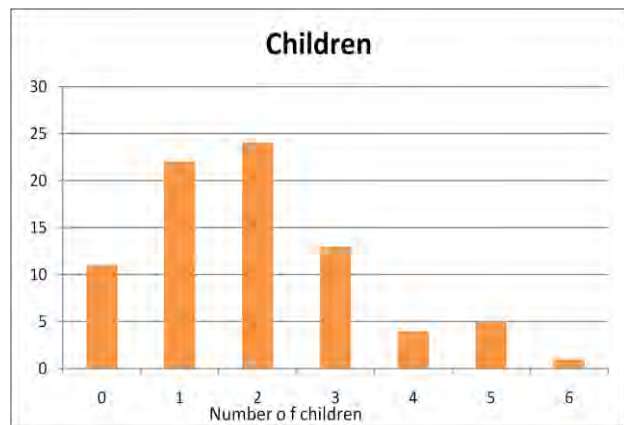
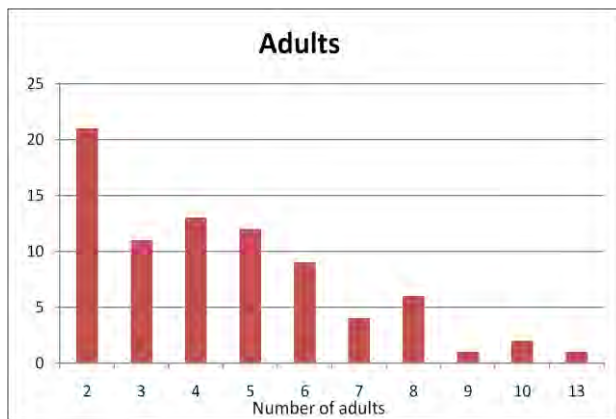
A total of 80 families were administered a detailed questionnaire interview (vide appendix on page 37). Forty families using PSH and another 40 families using conventional housing were selected randomly in the four regions as follows.

Villages: Here are the villages, wherein interviews & FGDs were conducted:

Region	Village	PSH	Non PSH
1. Kargil GM pore and Fokkerfu; implemented by LEDeG (Kargil)	Fokerfu	4	5
	GMpore	4	5
	Trespone	2	0
2. Gya on Leh Manali Highway, close to Taglang-la. PSH program implemented by LNP	Gya	2	5
	Sasoma	8	5
3. Bodh -Karbu near Lamayuru; Implemented by LEHO	Kharpoche	3	3
	Lamayuru	3	3
	Mundik	4	4
4. Durbuk region near Pangong lake, Changthang region. Program implemented by LEDeG-Leh.	Maan,	5	0
	Tangtse,	2	6
	Tharuk	3	4
	Total		40

Year Completed: The families were selected on the following basis: Preference was given to the families which had a PSH intervention completed in 2008 or 2009 so that they could base their responses on 2-3 winters spent in a PSH room. About ten households which completed PSH in 2010 had to be taken due to inaccessibility of certain villages. These last families had completed the last winter in a PSH facility and so were able to answer our questions.

Families: PSH and Non-PSH families were taken from the same cluster in most cases. Most families have been living in the current house for a long period – on an average 16.8 yrs, with a variation from 1 to 70 yrs. People build new houses when the family becomes too large. Most families had 2- 4 adults and 1- 2 children, as below:



The 80 families over all had 5 pregnant women and 15 infants (under 1 year). In most cases, the informant was either the head of the family (65%) or his wife or a close relative.

Informed Consent: Accessibility, family’s consent and their convenience was taken into consideration while selecting the family. All interviews were prefaced by an introduction by the local worker in the local dialect, explaining the purpose of the interview and seeking their informed consent. All photographs were taken with explicit permission obtained through the local staff.

Constraints: Most interviews were translated or facilitated by the local worker; Even though many villagers did understand Hindi to some extent, we always cross checked with the help of the local worker, to make sure that interviewer and informant correctly understood each other. Some villages, like Drass near Kargil, were planned but could not be visited due to roads being blocked by excessive snow drifts.

Qualitative Aspect of the study consisted of personal interviews with *Amchis*, doctors, PSH trained Masons, FGDs with women and children from PSH households (see appendix for the check list of questions); these were supplemented by personal observations during the stay with the families.

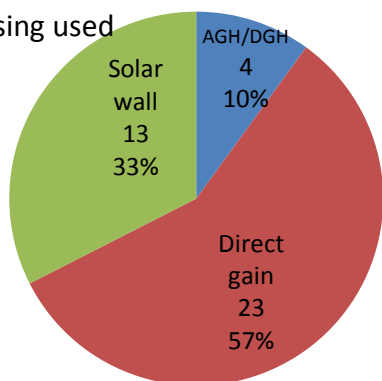
Observations & Findings

This section will offer qualitative findings derived from FGD and interviews, and statistics on 40 PSH and 40 non-PSH households, followed by relevant analysis. Some comparisons were made between PSH and non-PSH households while some comparisons, “before and after” building the PSH rooms were made within the 40 PSH households.

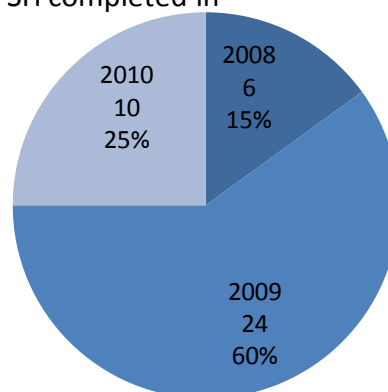
Type of PSH

Most families in this sub-sample (PSH, 40) are using direct gain (57%) and solar wall (33%) as opposed to other options like AGH, DGH or EE. About 60% of the sample came from PSH completed in 2009. Direct gain is a simple way to heat a building during the day. South facing windows admit the sun radiation directly into a living space. Insulation in the walls, roof and floor ensures that the heat remains in the room long after sunset. Solar (Trombe) wall on the other hand is a system of delayed heating: the energy is stored during the day and is released in the night after a lag period. A solar wall is a south oriented black painted glazed wall. The black painted wall catches the sun radiation and by the glass covering, the wall remains insulated from the climate outside so the heat is stored and migrates slowly to the inside¹⁷.

Type of Passive solar - housing used



PSH completed in



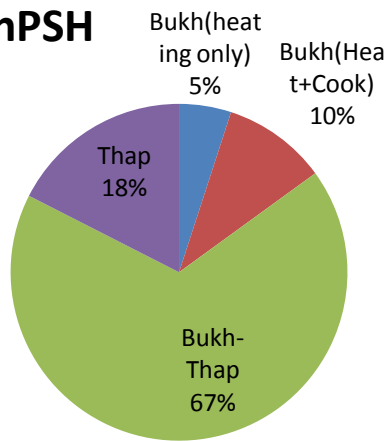
Type of stove

Out of 80 families, most are using Bukhari-Thap or Thap, for both cooking and heating. The PSH households are using Thap alone – mostly for cooking, since the heat generated at that time stays in the room and therefore round the clock heating is not required. Non-PSH rooms are relying on Bukhari-Thap for that very reason- as shown below.

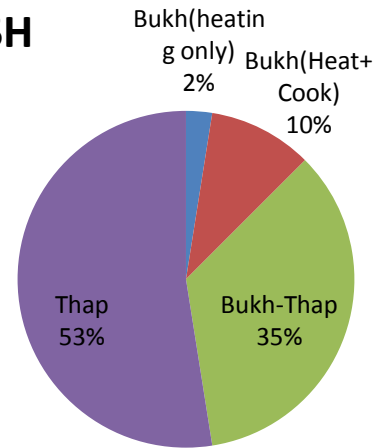
Type of stove used	PSH	Non-PSH
1. Bukhari (heating only)	1	2
2. Bukhari (Heating+Cooking)	4	4
3. Bukhari-Thap	14	27
4. Thap	21	7
Total	40	40

¹⁷ Passive Solar Architecture: Vincent STAUFFER, David HOOPER

NonPSH

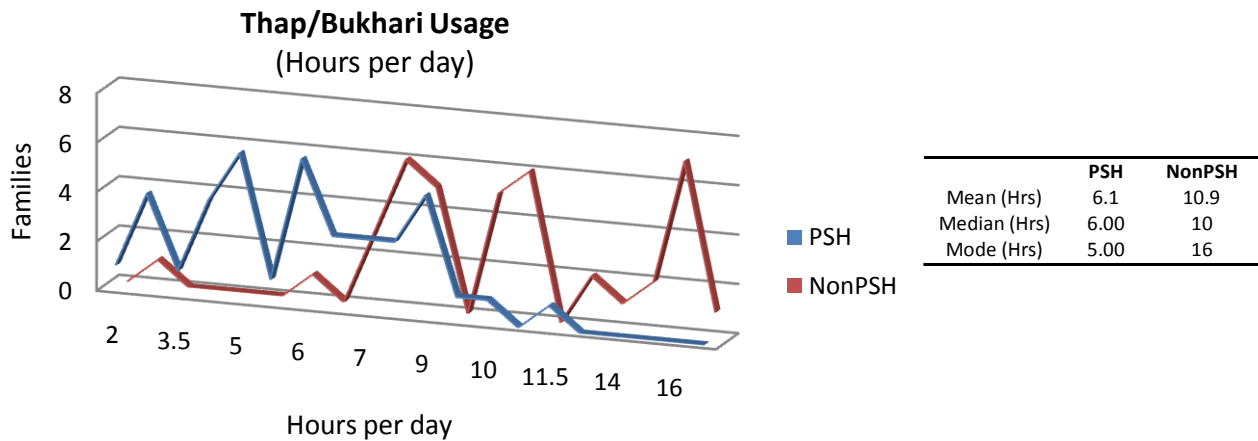


PSH



Stove usage

There is a significant difference between the PSH and Non-PSH households in this regard; Non-PSH families tend to use Thap and or Bukhari round the clock, from 6 am to 10 pm, while PSH families use it for about 4-6 hours every day, mostly for cooking, in the morning and evening. It should be noted that a few families are using LPG and Kerosene oil stoves in addition. In Kargil and Bodh Karbu region LPG cylinders are available, even though they have to be carried home by the villagers over long distances and difficult terrain. Look at the following graph to see the difference: PSH families (blue) are limiting the use of Thap to lesser number of hours per day, compared to non-PSH families. (For data table see appendix 2 on page 36).



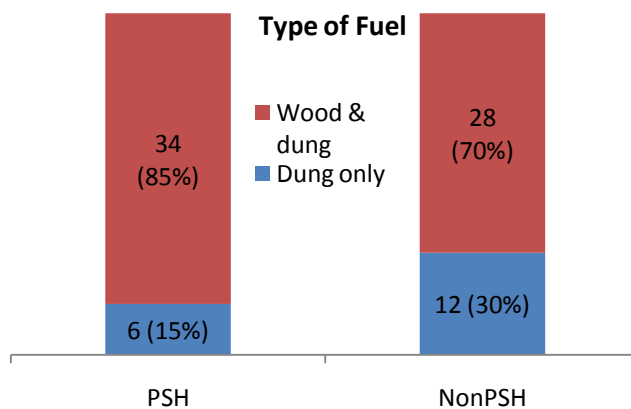


A Non-PSH family near Bodh Karbu. Bukhari (left) is used primarily for heating; Thap (Right) is used for cooking- While both can heat and cook to some extent the design is optimized for one purpose. Non-PSH families are often forced to use both during winters.

Type of fuel

Most families (>70%) use wood and dung both, but dung is the mainstay for both warmth and cooking. While dung (*ches*) is available relatively easily from the cow-shed, or in the surroundings, bushes (*chemang*), twigs and wood (*Shing*) for burning is not easy to come by in a desert region. In GM pore, Kargil, bushes and trees in and around the village provide wood to some extent, while other regions in Kargil, like Fokerfu have to buy truck loads of wood from Srinagar or Kargil.

Parts of Kargil receive more rainfall and better vegetation cover than the rest of Ladakh. A family may typically spend Rs 5 to 7 thousand for wood, enough for the entire winter. Villages in Changthang region often have access to dung (sheep, yak) from the pastures close to Tso-Kar, Tsomoriri, Tanglang-la, Chushul etc. but not to wood. Some families get this dung as barter for other services. Others have to pay up to Rs 70 per sac, with a family of 5-6, requiring 50 to 60 sacks for the winter.

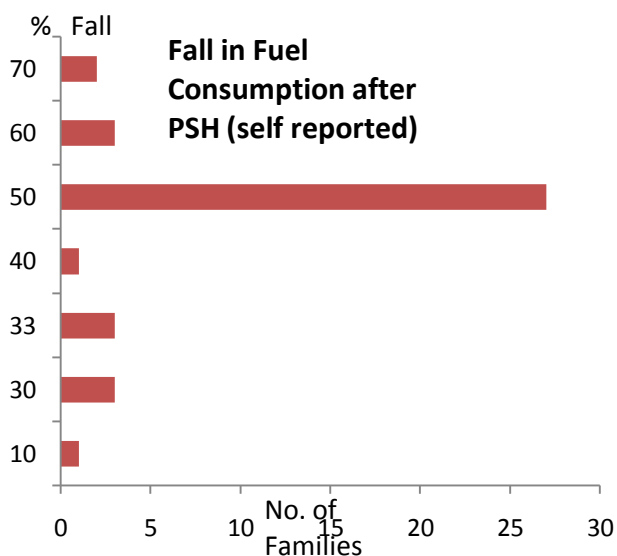


Bush collection is becoming increasingly difficult

Fuel Collection

PSH Families were asked how much time they spent annually collecting fuel- before and after PSH. This was difficult to quantify, since there were many variables: four families said they spent about 20 minutes every day to collect dung from the vicinity; five families said they went to the nearest pasture once in a while. Others bought it from shepherds. Some brought it on mules from the pastures, 2-3 days away. 60% families have a 50% decrease in the time annually spent on fuel collection- 8+ weeks becoming 4 weeks in most cases. The need for large storage space for all the

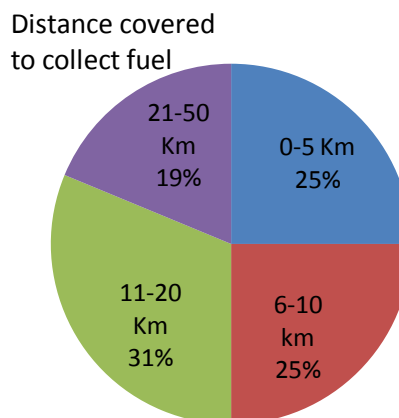
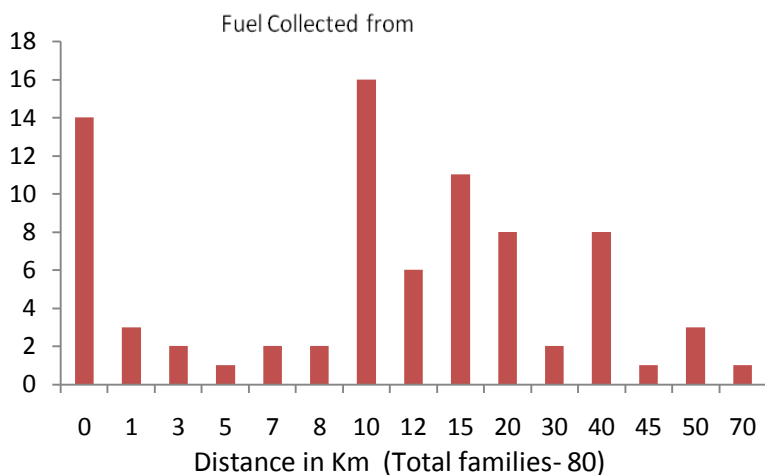
fuel has also reduced. A similar decrease is reflected in the fuel consumption before and after completion of PSH:



Dung collection is women's role and takes time.

Distance to collect fuel from

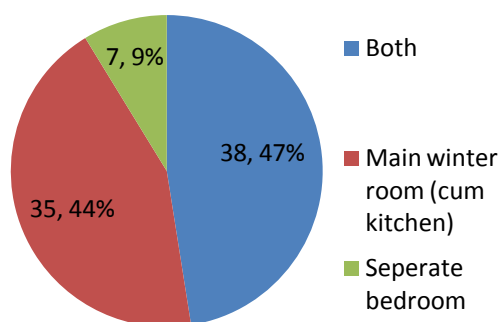
Around 20% of families collect the fuel from the village surroundings itself; another 20%, from 8-10 kms and yet another 20% from 15 or more kilometers. These distances were greatest in Changthang : 20-70 km. There are no boats on the Pangong lake and hence villagers in that region have to do a long circuit of 5-10 days, to get to the other side. During winter, few villagers walk across the frozen lake for safety reasons.



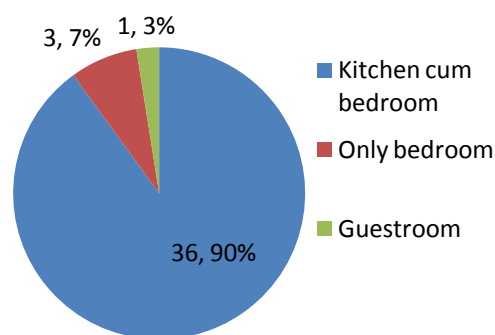
Use of the PSH room

Kitchen cum Bedroom: Most families use the living room for cooking as well as for sleeping; While about 44% use it as main winter room, another 47% use an additional bedroom too. In the PSH sub-sample, 90% families use PSH room in winter both as kitchen cum bedroom (see below). So, usage pattern has not changed much i.e. main sitting room doubled as kitchen and bedroom both in PSH and Non-PSH households to same extent. Very few families are using it as “only bedroom” or as “only guestroom”. Since the use of bio-fuel for heating has reduced dramatically in the solar room, it can be safely assumed that inhalation of toxic gases and other hazards have been reduced considerably. This room is also being used for other purposes- prayers, study, handicrafts and social get-together.

Staying /sleeping arrangement before PSH



Use of PSH room in winter



What was the staying / sleeping arrangement in Winters before PSH?

What is the use of PSH room in winter now? (n=40)

	PSH	Non-PSH		
Main winter room cum kitchen	23	12	Kitchen cum bedroom	36
Separate bedroom	5	2	Only bedroom	3
Both above	12	26	Guestroom	1
Total	40	40		40

Level of smoke: All the forty PSH households had no smoke in the main sitting room cum kitchen or very low, as per observation and self reporting. In Non-PSH households 16 (40%) families and one family reported medium and high level of smoke respectively in the main sitting room. Obviously, chimneys have to be cleaned more often in the non-PSH rooms- once a week or so. Smoke in the room results also from poor design (bend in Chimney, ill-fitting lids etc.), type of fuel used and external factors (strong winds outside). *Rigpa*- compressed cakes of sheep dung mixed with cattle urine is used in Changthang and is known to give off noxious fumes.

Health Impacts

Of 40 PSH families, 26 families who had at least one member suffering a chronic health condition (arthritis, cough) and who answered the question “Did you have some relief in PSH room?” - 23(out of 40) responded in affirmative. 24 were elderly people. See the details below:

Relatives benefiting (PSH)	N	%	Health conditions (PSH)	n	%
Elderly person	24	64.9%	Coughing	13	35.1%
Children	5	13.5%	Eye problems	6	16.2%
Other adults	2	5.4%	Joint pains	17	45.9%
Pregnant woman	6	16.2%	Skin problems	1	2.7%
Total	37	100.0%	Total	37	100%

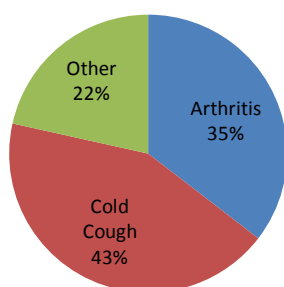
Among the non-PSH families (below), 25 families reported one episode of illness in the last winter (q 5.2 in non-PSH questionnaire) for a total of 42 members, slightly more than PSH sub-group. In this non-PSH subgroup 52% adults reported illness- more than in the PSH group. A plausible explanation could be that the elderly spent more time in PSH room when they were sick and therefore this was recalled better.

Sickness last winter (Non-PSH)	N	%	Health conditions (PSH)	n	%
Elderly person	16	38%	Coughing	15	35.70%
Children	4	10%	Eye problems	5	11.90%
Other adults	22	52%	Joint pains	19	45.20%
Total	42	100%	Sneezing	2	4.80%
			Tuberculosis	1	2.40%
			Total	42	100.00%

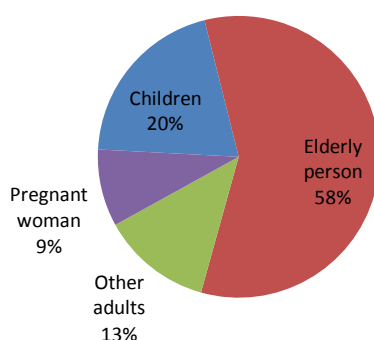
It appears that elderly, children and pregnant women were the biggest beneficiary group in the PSH sub group. Coughing and eye problems, often caused by smoke and dust particles in the air are a common problem, according to the local health care providers. For two pregnant women, the PSH room was the best place to relax, since they did not have to constantly tend to *bukhari*, as revealed in the FGD with women. Pattern of illness is similar in both PSH and Non-PSH families, as seen in the tables above.

Both PSH and Non-PSH households report at least one episode of illness in last six months (preceding winter) requiring consultation with *Amchi*, Medical aid center or a doctor. There is no significant difference here. Respiratory infections (cold, cough etc.) and arthritis (joint pains) constitute 80% but there are other, smaller in numbers but significant problems: toothache, eye problems and delivery.

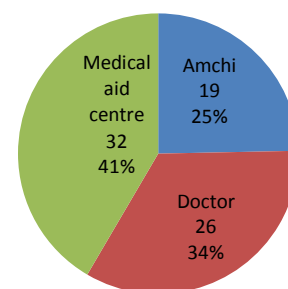
Reported illnesses
in last 6 mo from 80 families (n=79)



Health care needed
in last 6 mo (n=79)



Service provider (n=77)
Approached in last winter



So, on the basis of the study of these 40 PSH and 40 Non-PSH families, it can be said that sickness is slightly less in PSH families. In any case a PSH intervention over last 2-3 years is unlikely to change the incidence of Respiratory illnesses or Arthritis, since- one, these illnesses are outcome of complex and multiple factors (genetics, nutrition & environmental factors) and second, 2 years is a short time to show any health impact. But it is clear that once sick, having a PSH room is a definite advantage in coping with and recouping from these illnesses, especially in chronic conditions among elderly and very young.

Other Health aspects: 8 (20%) out of 40 non-PSH families reported children missing school in the winter for 2-4 days, due to some illness. 17 out of 40 non PSH families reported Bukhari/Thap related domestic accidents- cuts while breaking the ice in the frozen water pot, breaking twigs, children accidentally bumping into Thap/Bukhari (they almost hug it due to intense cold), hot water- which is kept on top of Bukhari, spilling over accidentally and scalding children etc. In the PSH families these accidents are less now: water does not freeze over night; Bukhari/Thap need not be tended round the clock; children don't necessarily sit close to the Bukhari since the warmth is diffused throughout the room, etc.

Hygiene

Bathing and washing clothes in winter are constrained by two factors: intense cold and lack of a wind-proof shelter i.e. bathroom. While young children can be bathed in a tub right in the warm sitting room, adults must find a suitable place, protected from wind. Some adults started having bath in the green house but stopped after objections from others and development workers: soap and dirty water was contaminating the vegetables. Still, a PSH room is an advantage from a hygiene point of view- it offers a warm place to dry up and change. Both children and adults have benefited and are bathing 1-2 times per month more often now, as per their response:

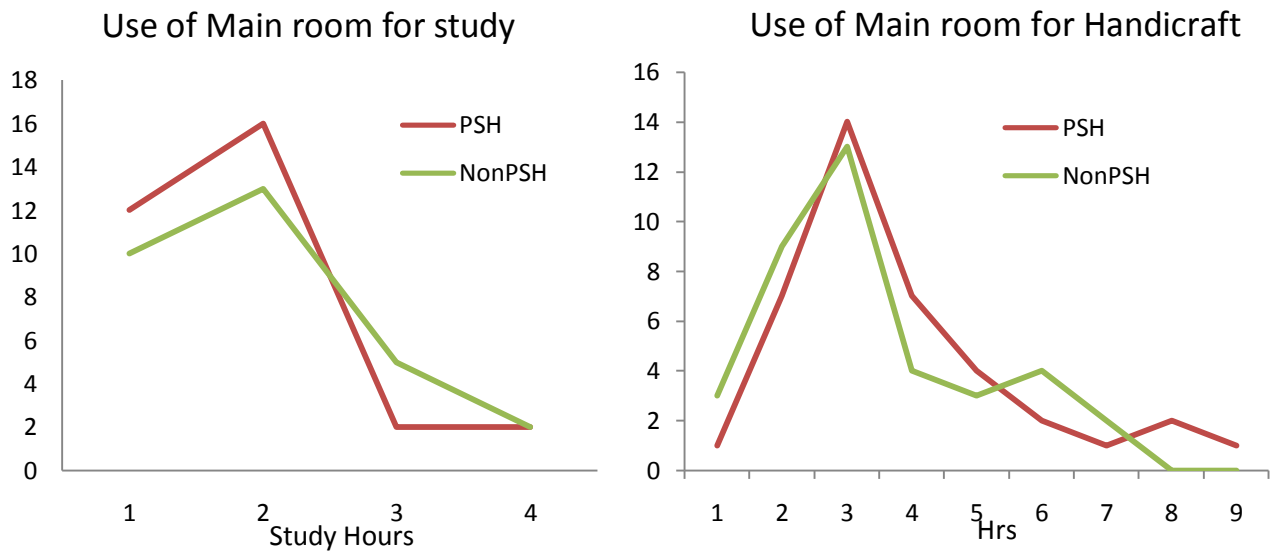
Bathing before & After PSH: change per month		
Increase in no. of bath per month (before & after PSH)	by children	By adults
0 (no change)	14	20
1	6	2
2	8	10
3	5	5
Total	33*	37 [#]

*Some families did not have children staying with them and therefore they declined to answer this question.
[#] In Changthang some families said that adults just don't bathe during winter.

Nine out of ten families have shown no change, especially in Changthang. Lack of water, bathroom and cultural reasons could be responsible. On the other hand, **head washing** by adults has improved much more in PSH households. This indicates that a proper bathroom will be of much use for adults. Most families wash clothes 1-2 times per week, depending on weather and availability of water and time.. In the Kargil region (GMpore) *hamams* (public bathrooms) attached to the local mosque offer hot water for bathing for a nominal fee but women and girls don't use it for cultural reasons.

Other uses of PSH room

35 out of forty PSH families mentioned the following, as *other uses* of the PSH room: Prayers, reading scriptures, social get-together, entertaining guests, just lounging, practicing handicrafts (spinning, weaving, knitting, sewing, carpet making, wood carving etc.), children playing and studying etc. An *Amchi* in Gya uses his PSH room for attending to clients and for personal, month-long spiritual retreats. In Kargil and Bodh Karbu, elderly Muslim males use it to offer *Namaj*. Women use it to practice handicraft in a group. Young mothers nurse baby in the solar room. Tsewang Lhamo from Sasoma, mentioned that she uses solar room to keep vegetables and water, to prevent freezing in winter.

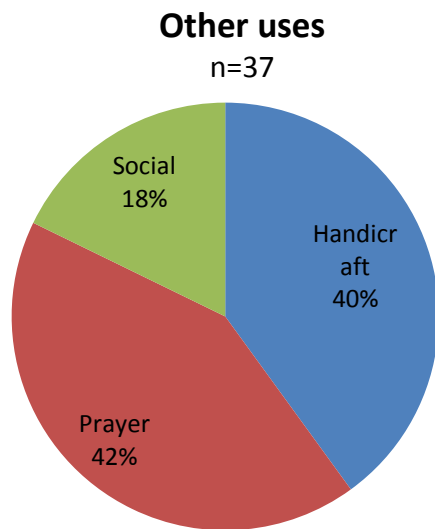


The statistical difference is not very significant due to small sample size but it can be seen that there is an increase in both number of self-reported hours dedicated to study by children and handicraft by women in PSH households but the limited supply of power for light is a constraint.



Practicing handicraft in a group is a traditional strength and is made possible even in bad weather due to PSH (Durbuk)

Earlier children could read only in the evening for an hour or so. Now, they are able to study both in the morning and evening. One child mentioned that he found it easier to write - near the window for necessary light, but away from Bukhari, which does not matter anymore, since ambient heat is present in the entire PSH room ([picture](#)). Children also play indoor games in the warmth.



Indoor games during winters can be very important for children

Acceptance of PSH

Of 40 families, 37 (92%) said that they would recommend PSH to others and offered **fuel saving** and **comfort for children, women & elderly** as two main reasons for their recommendation. Most of them would like to build an additional PSH bedroom. A family in Gya wants to build an additional passive solar *bathroom*. Most of them expected some material contribution. Some had technical constraints- not having a south facing wall, or a poor location of the village or house itself, but most were convinced of usefulness and long term saving accruing from a PSH room.

A health professional in Leh hospital said that PSH is certainly a better option even for public buildings since central heating for SNM hospital in Leh costs Rs 1 crore (156,515 EUR) for one winter, excluding the maintenance and the space it takes with in the room. Schools, hospitals, delivery room at the MAC etc. need to have passive solar architecture in his opinion¹⁸. The region has the precedents of large scale solar applications. In Durbuk, Tangtse village is entirely powered by solar technology (below).

On the other hand a trained mason in Bodh karbu expressed his misgivings about the structural weakness in solar wall design: the joint between the solar wall and the two side walls may not be strong enough to withstand seismic events, he felt¹⁹.

¹⁸ Dr Thinlay, Leh. Personal interview.

¹⁹ Geres India is looking into this- based on interview with Ajaz Ahmad, PSH Coordinator



Tangtse village, in Durbuk block, at 14000 ft is entirely powered by solar. Solar applications have a future in this region.

Analysis

Impact on Health

Warmth: Passive solar heating when implemented correctly leads to ambient warmth in the entire room, which lasts longer and does not rely on continuous use of bio-fuel. Unlike Bukhari, which offers conductive heat with a source localized at Bukhari and its pipes, the warmth in a PSH room is present throughout the room and has a gentle quality. Old and young find it very convenient and helpful. Many women and elderly respondents mentioned that they did not need to put on so many warm clothes and this made movement and relaxation a lot easier. Children don't have to sit too close to the Bukhari and elderly people are able to sit, relax, pray and move around in such a room with more freedom. This promotes better circulation in the limbs and fewer accidents from a hot Bukhari. Thus, smoke free ambient warmth is one of the biggest advantages of PSH, especially for young children, women and elderly- more so, *when they are not well*.



Warmth, light, clear big windows, better finish – all this can be seen in this Solar wall room completed in 2009 in a Durbuk village.

Poly-arthritis, especially among elderly is not just a manifestation of difficult terrain, demanding life style, over use of certain muscle groups and joints (constant use of prayer wheel, spinning, counting the beads etc.) but could also be due to huddling close to a Bukhari, in uncomfortable postures for long. Cold is known to reduce peripheral circulation. Ambient warmth thus could reduce aches and pains caused by immobility in cold rooms²⁰.

As revealed in the FGDs, the sick and aged people now prefer to stay in the warmer room and this has a positive effect on their health condition, particularly those suffering from arthritis, respiratory infections, asthma and other chronic health conditions. The PSH subsample shows a significant increase in the hours spent indoors by women and children, attributable to warmth and convenience of PSH.

Air quality : The smoke and toxic emissions from burning the dung cakes steeped in cattle urine, are greatly reduced in the room since Bukhari or Thap is now used only for cooking, i.e. for a couple of hours in the morning and evening. Earlier the Bukhari had to be burnt through the day, to keep the room warm. Many families are using the LPG stove for cooking. This further improves the air quality, compared to round the clock use of bio-fuel. Even though PSH may not reduce chronic mountain sickness (CMS), which is related to altitude & hypoxia, a local physician felt, it would help by reducing episodes of bronchitis complicating CMS further²¹. At the same time, it should be kept in mind that respiratory illnesses have other contributory factors too, like humidity

²⁰ Dr Diskit Dolma, Tangtse, in an interview on 20th March 2011

²¹ Dr Thinlay, Leh, in an interview on 22nd March 2011

and presence of silica in the air²². Suspended ash particles and smoke is also a cause of eye infections among young and old.



A family in Fokerfu village at 13,500 ft near Kargil: LPG stove (top left) and Thap (bottom right) is being used, only for cooking. A Solar wall has made heating redundant even in deep winter.

Mold (fungus) is a common pollutant of indoor air, related to high humidity. Since the region is generally very dry, one does not expect that to be a major problem in high altitude Ladakh²³.

Light: Traditional houses have small windows to keep the small rooms warm. Some studies point to the potential of additional exposure to light therapy as a preventive strategy for winter Depression in people²⁴. SW and DG have promoted large clear windows which allow much more light for fine work, like reading-writing by children, handicrafts and reading prayer books by elderly. Earlier, window size bore little relation to floor size. In PSH, a ratio between floor area and window has to be followed which ensures adequate sunlight. Also, since the PSH windows are insulated properly with putty, there is no need to stick a plastic sheet on the outside- a common practice in non-PSH houses (vide picture at page 31).

²² Dr Norboo, Leh, in an interview on 22nd March 2011

²³ Aude Petelot, November, 2010; Literature Review - Main Findings, Health Impact Study - PSH Project,

²⁴ Prevention of Mental Disorders, Effective Interventions And Policy Options, [Summary report](#), WHO 2004



Traditional houses have small poorly designed windows. This allows insufficient light in and is rarely wind proof due to poor finishing.

Besides making various indoor activities possible, light also elevates the mood. Depression is seen in the Ladakhi villages due to isolation, long winters and dark rooms²⁵. Most respondents, including children said that more light in the room, meant more activity and interaction with others, thus lifting the mood and promoting initiative. Earlier, women would stay home in bad weather, since there was no warm indoor place for them to sit together and practice handicraft. Now, with a solar room, considerable social interaction takes place, for women and children, even during bad weather.



Compare the size and clear design of the SW (left) and traditional (right) windows.

Infants – a study in 2004 indicates that Ladakhi newborns, compared to those in Andes & Tibet, are smaller and more vulnerable to respiratory illnesses²⁶. But they seem to fare well because mothers are better nourished, nurse their babies soon after birth and child care patterns which do actively discriminate against them, especially the girl child. A PSH room is an advantage for mothers caring for a new born, as revealed during the FGDs.

²⁵ Could Mongoloid races, like Nordic races, have a genetic predisposition to depression? Dr Dolma wondered.

²⁶ An ecology of high-altitude infancy: a biocultural perspective By Andrea S. Wiley, 2004

Personal hygiene has improved from bathing once a month (in some areas, even once per winter) to once a week for children in most families interviewed; Adults bathing habits do not seem to have changed much for two reasons: while children can be bathed in a tub right in the solar sitting room, adults still need a proper bathroom; secondly, adults represent an older generation which will take more time to adapt and change. In some areas head washing, if not bathing, appears to have improved even among adults. Water can be pre-heated and clothes can be washed in a warm space. PSH had little bearing on the washing of kitchen utensils as it was part of the overall cooking / eating routine and had to be done.

Impact on Gender

To understand the position of women in Ladakhi society, and changes therein- we will have to consider her role in farming and at home vis-à-vis men's role; Men's absence from six to eight months of the year due to military and other duties (like tourism) has intensified women's household and farm work. A Save the Children Fund study (1997) shows that while 65 percent of men sell their labor outside the village for at least half of the year, women have to work twice as hard looking after the children, domestic chores, animals, fields, and marketing of cash crops.

Traditional farming practices are rapidly being taken over by the formal economy of fruit and vegetable marketing, a shift from subsistence to cash crop (e.g. from barley to potato) and the tourism-related service industry; In such market integration, women's traditional knowledge and role gets devalued. Besides the degradation of the environment also takes place in a fragile ecosystem. The modern educational system and media (television and cinema) has created idealized images of womanhood that lead to declining self-esteem and unrealistic social expectations²⁷. Women also claim that they have little decision-making authority, as their perspectives are rarely taken into account even when they participate in village meetings (SCF 1995).

Thus the overall impact of modern development on women has been an increased workload accompanied by a devaluation of their traditional way of life. In this situation any intervention, which reduces her workload can be a significant step forward. Now let us look at her work load in concrete terms. In Zanskar, summer fuel consumption varies between 15-18 Kg per Thap per day and during winter, it increases to 23 -25 kg per Thap per day. It comes to about 475 kg/person per year, which is 19.3% higher than Tarai region. One adult girl collects 30 kg dung/ day; one woman 22kg/day and a child 10 kg/day. Usually girls scour the countryside for dung-pats; dung which is dropped in the stables each night is molded into cakes and dried. Men play a role too, even if limited to wood collection, from a few existing forests on nearby river banks. 340 kgs of thorny bushes are collected by a family every year²⁸ but vegetation cover has shrunk drastically and they have to walk further, to get enough wood²⁹.

²⁷ Local Transformation through Global Connection: Women's Assets and Environmental Activism for Sustainable Agriculture in Ladakh, India : Leonora C. Angeles and Rebecca Tarbotton

²⁸ High pasturelands of Ladakh Himalaya By Prem Singh Jina, 1995

²⁹ Recent research on Ladakh 4 & 5: proceedings of the fourth and fifth .. By Henry Osmaston, Philip Denwood



An over-logged fodder tree in Kargil valley. Vegetation cover is rapidly shrinking. Dung therefore is the mainstay of household fuel.

Fuel saving up to 50% is an important benefit of PSH for women, as shown in this study. Most families are less dependent now on wood, bushes, twigs etc. Availability of wood and bush is steadily decreasing in western Himalayas, as per a study in Afghanistan³⁰. The dung available in their own cowshed or in the vicinity of the village is enough. This reduces the dependence on distant pastures and forests. Time & effort involved in cleaning the Bukhari and the room itself has gone down considerably now³¹. Their workload has reduced. This free time is being used by women and children for other leisure or productive activities. Dorjey Tsewang (Sasoma) mentioned that his wife is now free to get construction work on the road and earn up to Rs 5000 per month, which she uses largely at her own discretion like making a donation to the local Gompa, etc. Poor availability of light in the night and undeveloped markets are a constraint on local handicraft.

A woman-headed PSH household in GMpore, Kargil is another good example: Zahara Bi is 45 and lives with her old father; there are no children. She has no cow but is able to collect enough dung in 10-15 minutes from the village itself for her much lessened fuel needs. Her main sitting room was retrofitted with direct solar gain technology in 2009 by LEDeG (Kargil). Her total fuel consumption has gone down by 70-80% in her estimate. Now, she is able to devote 4-5 hours (earlier just 1-2 hours) every day to sewing, knitting etc. She is able to sell a suit or two, among other regular items, every month in the village and can thus sustain all her needs. She uses just a Thap for cooking, few hours in the morning and evening. Her old father, suffering from joint pains sits in the same warm room, while she works on her sewing machine close by (below). Sometime village girls come and learn from her in the same room.

³⁰ http://www.fuelnetwork.org/index.php?option=com_docman&task=doc_download&gid=322&Itemid=57

³¹ Earlier, a common practice was to take out cinders from the Bukhari, and spread it out around it, before going to sleep, so that room could remain warm for a long time in the night. This used to spread the ash and smoke in the room and also make cleaning of the room a big and messy job.



Zahara Bi at work & her father resting in a DG room in GMpore, Kargil.

Finally, gender relations in Ladakh are perhaps not as skewed as in mainstream communities elsewhere³². So PSH interventions may not show a big impact on women's decision making power vis-à-vis men in home and related spheres of life. What is obvious is a reduction of the work load (fuel collection, tending to Bukhari etc.) on women and girls. The resultant time saved is being dedicated to handicrafts and other "work for cash" alternatives. This does make her life less burdened and open to creativity & leisure. However, it may not automatically convert into better social status or empowerment of women. As other authors have pointed out, while practical needs (warmth, light, reduction in chores) are important, it is addressing the strategic needs of the women, namely education, political empowerment and strengthening of their traditional roles, which will change her status in the long run³³.

Children's Perspective

Children in Ladakh play a significant role in the home and on the farm; many of these chores & plays are gendered and shaped by seasons: Girls don't play 'bow and arrow' or cricket while boys are not supposed to skip rope; '*Senchali*' a Ladakhi game is not played in winter, due to snow and archery is rare during summer. They help mother in caring of cattle, feeding calves, filling water, collecting fuel etc. They also remove snow from the path and around the house and serve adults (hot water, tea, meals etc.). Both girls & boys collect dung from fields and within the village -not much gender difference, especially in Changthang. Girls collect water more often than boys and boys are expected to collect wood and bush, etc. The four FGDs in the four regions indicated that their life has undergone subtle changes due to PSH, especially during winter.

- Now, they have more options: they can play indoor games, when snow in fields makes outdoor games difficult.
- They have to wear fewer clothes while indoors.
- They are able to study in the morning as well as at night, since Bukhari need not be tended to frequently, to keep the room warm.

³² [Julia Harte](#) : Cultural Survival;

³³ "Its projects are strategic rather than practical in goal, and this challenges the assumption that women in developing countries are mainly interested in survival, as opposed to political action. Its focus on education, empowerment, and support of traditional culture, as opposed to enabling women to simply adjust to the needs of the modern economy, makes WAL unique in reaffirming and utilizing women's nonmaterial assets to achieve its goals and in the process, create spaces for the flourishing of sustainable agricultural practices." Local Transformation through Global Connection: Women's Assets and Environmental Activism for Sustainable Agriculture in Ladakh, India: Author(s): Leonora C. Angeles and Rebecca Tarbotton

- The PSH room has diffused warmth, so they can sit near the window and read and write
- They are also able to bathe and change in the PSH room more often than before
- Less cleaning of the Bukhari and chimney since it is not being used round the clock
- Children are spending more time with adults in the PSH room, during winter

Accidents related to Bukhari, to water freezing in the living room etc. have gone down. As women in Durbuk said : *children can be safely left behind in a PSH room, without the danger of accidental burns or hypothermia* while women could attend to other chores. Breaking the frozen water in the morning, breaking twigs/ wood for Bukhari constantly and movement around hot Bukhari often gave rise to small but painful accidents.



Children can work near window now since ambient heat is present all over the room; Adults and children are likely to spend more time together in the main sitting room now.

Socio-economic Issues

The cost of PSH is estimated at about 10% of the cost of the traditional room construction. In the local context, a room will cost about Rs 1 lac and the additional cost will be about Rs 10,000 for the double glazing of the windows and the insulation of the inner walls etc. Families spend about Rs 6-7 thousand per year on fuel. If the consumption of fuel goes down by about 50%, it could be said that fuel saving of Rs 3 thousand per year will take place due to PSH. Other intangibles, like more light, ambient warmth etc. add even more value to this saving. However, attitudinal issues and low awareness continue to be major constraints: a trained mason³⁴ in Durbuk, mentioned that house owners often do not wish to invest in the insulation of wall and floor, even after making the SW or DG windows.

A housewife in Bodhkarbu on the other hand, mentioned that the PSH project has encouraged them to ensure better finishing of the room and attention to other significant details. For example traditional houses were built in a rough and ready fashion earlier; windows used to be small, highly decorated but poorly designed and poorly insulated. As a result, in the windy regions, a thick plastic sheet had to be invariably put across the window from the outside- further reducing the light.

³⁴ Konchuk Gyaltzen, male, 40 yrs, trained Mason, Maan Village, Durbuk.



Traditional windows were small, poorly designed. Often needing to be insulated with a plastic sheet from outside in windy winters. Similarly walls too have generally lacked the finish. Family and masons are paying attention to these details now.

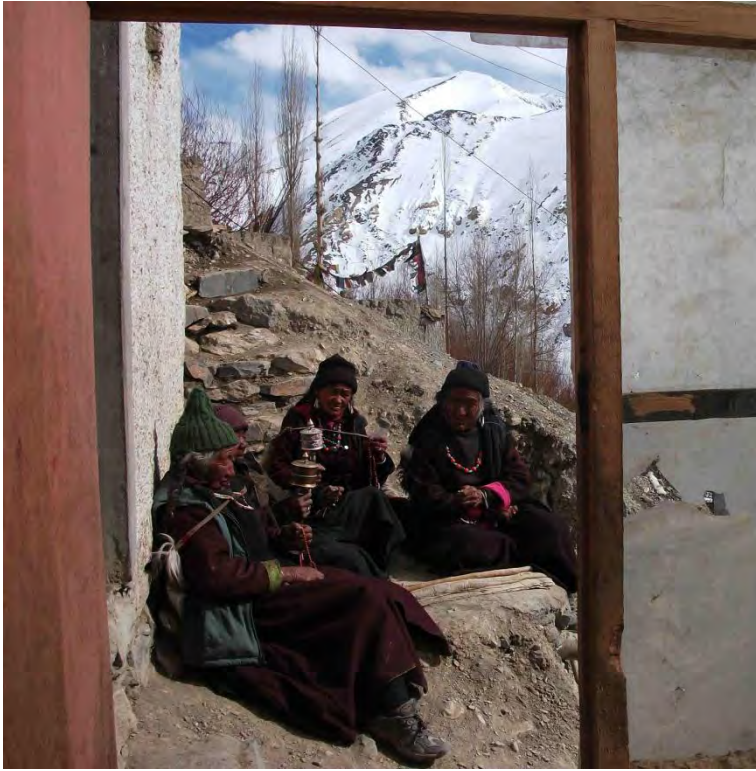
This project has changed the mindset and practices in these regards. Local masons are beginning to see the advantages of a clear big window facing south. For many, the idea of double glazing has been a quantum leap in understanding of their habitat & houses. As Tamches Dolkar said in Durbuk: *We have known about glass windows for ages. But how putting two glasses together can keep the heat in- was not known to us. This is like magic to us.* A mason in Bodh Karbu eagerly wanted to learn how to operate a modern compass, so that he could orient houses better. Many children now have a better understanding of solar radiation, its use and the harmful effects of green house gases. In other words, PSH has promoted a functional learning for the community which a plain IEC campaign may not have achieved otherwise.

Constraints of PSH

The study did not come across any serious problem caused by PSH. Two *Amchis* said that a PSH room with no or little ventilation could be bad for health if someone stayed indoors for long or if others in the room had an infectious cough. They agreed that statistically risks were much less compared to those of constant Bukhari smoke & related problems. Some adults mentioned that children sometime run out suddenly, from hot solar room to very cold outside and may run the risk of developing pneumonia. Some women complained of dizziness, especially in AGH or in DG, when it becomes too hot. A mason said that when it becomes too hot, opening the main big window is inconvenient. A smaller vent or shutter (e.g. 6"x20") in the design would have been better for this purpose. One family in Mundik, Bodh karbu, did not replace the inner glass because the room was getting too hot for comfort.

One child in Maan, Durbuk mentioned that Milk curdles easily now, thanks to PSH. Another girl in Bodh Karbu mentioned that her workload has gone up- adults tend to sit in solar room and send her for various chores, like watering the cattle etc. This deals more with children's place in familial hierarchy, perception of child's rights rather than PSH itself.

Some people (especially elderly) who have adapted to the cold for a long time, find it difficult to cope with 'high' temperature in a PSH room. Near Lamayuru, a group of elderly women, simply refused to sit in the warm AGH (vide picture below).



Near Lamayuru: A group of elderly women lounge in the windy and cold outdoors, next to an attached green house (AGH). They found it too hot and stuffy and preferred to sit outside, next to it. It appears that the older generation, having adapted to cold, will take some time to get used to the new PSH interventions.

Conclusions

This study shows that maternal and women's health conditions are significantly improved and number of cold-related illnesses of children is decreased since reduced human exposure to harmful indoor gases and suspended particles has gone down by at least 50% in PSH households interviewed. The less frequent use of heating stoves has reduced the toxic gas emissions and improved the indoor air reducing the chances for cases of respiratory infection and associated diseases. Children, women and elderly people have been the most significant beneficiaries of this improvement. Adult suffering from arthritis are much relieved with the warmth in the room. As the room temperature is controlled, women use heating and sometimes cooking stoves less often and some have adopted the gas stoves. Thus the indoor air has been even more improved. More light and activity have lifted moods too, for most adults and children, during long winters. Water and food do not freeze in the main room anymore. Minor accidents, related to excessive use of *Bukhari/Thap* have gone down.

The impact on hygiene is more tangible for children than adults: they are bathing more often in winter now- once a week as compared to once a month; adults are constrained by not having a bathroom but the frequency of washing hair has increased amongst adults; The washing of kitchen utensils and clothes also has been impacted since it can be done in a warm space. Lastly, the sick and aged persons stay in the warmer room and this has a positive effect on their health condition, particularly those suffering from arthritis problem.

On the economic front, there has been saving of cash where fuel (especially wood) had to be bought; women, no more burdened by time consuming dung collection chore, are free to work on other construction projects and earn cash, up to Rs 5000 per month. Children have a warm and safe place for playing indoor games during long winters. Overall, PSH has enriched traditional knowledge and skills of people, as applied to house building. PSH houses tend to have better finish, insulation and better designed windows to permit lot of light in while keeping the cold draft out.

Other significant benefits noted are reduction in fuel collection time, less dependence on bush & wood, availability of smoke free well-lit warm room to practice handicraft by women, to study (by children) and social/spiritual pursuits like offering *Namaj*, meditation, praying, studying scriptures etc.

Constraints of PSH

The major constraints are:

- Older people and adults will need some time to get used to the technology and its requirements, like need for insulation in the side walls, insulating windows properly rather than putting a plastic sheet across the window, remembering to pull curtain across DG windows at sunset etc.
- People will expect subsidy for sometime because subsidy has become a regular fixture of state sponsored development scene in the region.
- Maintenance - replacing a broken glass for example, needs to be emphasized again and again.
- Ensuring that other players- state & private builders too, buy into this initiative would be the crux of the problem. Policy level interventions are going to be important therefore.

Another aspect to be considered is- ensuring convergence of other resources/ services: if power supply for light is not available beyond 10 pm, people will not be able to use the PSH room for

handicraft or study. Availability of suitable glass at competitive price nearby also has to be ensured. Again, if water has to be brought from a long distance, bathing children will not be possible in spite of warm PSH room. Other traditional practices like eating smoked/ stale meat³⁵ over a long period and new trends, like smoking among young, will also have an effect on human health, unmitigated by advances in housing, such as PSH. There is a scope for various agencies to collaborate and act in the sector of housing, human health and energy.

Constraints of the Study

The study, in the spirit of community participation, tried to consult the families in the field, both who had used PSH and those who had not. The time chosen was significant: late winter, March 2011. However there were constraints, which may hold important lessons for the future. The sample size of 80 families distributed equally in the four regions was selected keeping in mind the constraints of logistics and of not having a large user base at the moment. For example, road to Drass near Kargil was closed and therefore those families which had spent only one winter in PSH had to be included in the survey. On the whole only 60% (24/ 40) families had their PSH completed in 2009, i.e. had spent two winters in PSH. Obviously, the other 16 families were still trying to absorb the advantages of PSH at the time of the survey.

The methodology greatly depended on recall (memory). Recall of events over last 6 month to a year, among the untrained subjects can be troublesome and less than perfect. Then, the 'Total Birth Rate' for this region is 10.02 per 1000 people (1995-2000) – low, compared to other regions. This will translate roughly to birth of only two babies in forty families in a given year. So, sickness, birth, pregnancy etc. in a small sample will be rare and therefore getting more information on impact of PSH on these events will suffer from methodological constraints. The study, nevertheless, tried to supplement these deficiencies through FGDs and interviews with service providers, wherever possible.

The questionnaire had some repetitions and could not be pilot tested due to shortage of time. FGDs should have been recorded for later analysis.

Researcher

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³⁵ The traditional way of smoking the meat, generates certain Hydrocarbons, associated with cancer risk: Dr Norboo; Personal Interview.

Appendices

Appendix 1 : Activity Schedule

Date	Place	Activity	Remarks
28 th Feb 11	Delhi	Meeting with Lydia, Country Director and Ruchi, Head of Finance, Administration & Communication; discussion on questionnaire; received background information etc.	
1 st March	Fly to Leh	AM: Meeting with Gitanjali, Capitalization & Good Practices Coordinator. PM: Meeting with Ajaz, PSH Coordinator, Kunchuk (LEHO), Eshey (LNP) and Gitanjali, Capitalization & Good Practices Coordinator; Feedback on questionnaire and FGD tool; Planning of study till 14th- logistics etc. Sent an email for feedback.	
2 nd March	Leh	Editing, printing of questionnaire; preparation for field (Gya) visit	
3 rd March	Travel to Gya, sasoma	Sasoma- 6 PSH, 1 non-PSH interview; 1 FGD with PSH women	Snowed in the morning, making travel slow..
4 th March	Sasoma, Gya	14 questionnaire; Interview with (2) <i>Amchi</i> ; one FGD with children	Return to Leh in the evening..
5 th March	Leh	Transcribing FGD & Interview; Review of questionnaires	
6 th March	Leh	Documentation and preparation for Bodh Karbu and Kargil	
7 th March	Travel	Interviews at Lamayuru, Bodhkarbu	
8 th - 9 th March	Bodhkarbu	Kharpochey village; Interviews and FGD with women and children	
10 th March	Travel	Bodhkarbu to Kargil	
11 th March	GM Pore, Kargil	Interviews, FGD with women and Children	
12 th March	Fokerfoo, Kargil	Interviews & Questionnaire	
13 th March	Kargil	Documentation	
14 th March	Travel	To Leh	
15 th March	Leh	Documentation and office; interviewed an <i>Amchi</i> from Kanji village	
16 th March	Leh	Permit from DC office, Meeting at LEDeG's office, documentation; Preparation for Durbuk	Submitted interim work report
17 th March	Travel to Durbuk	Interview Dr Nanda at Tangtse; Maan Village at Pangong Lake; Questionnaire interviews	Halt at Maan Village
18 th March	Maan, Pangong	FGD with women and Children; Travel to Tangtse- Questionnaire interviews	Halt at Tangtse
19 th March	Tangtse, Tharuk	Questionnaire interviews at Tharuk and Tangtse	Snow fall, Chnag la closed
20 th March	Tangtse	Interview Dr Diskit (Tangtse PHC); documentation; Could not return since Chang la is closed	Halt at Tangtse
21 st March	Leh	Return to Leh from Tangtse	Snow on Chang La
22 nd March	Leh	Documentation and follow up Interviews -Dr Norboo, Dr Thinlay; Meeting with Gitanjali, Capitalization & Good Practices Coordinator	
23 rd March	Return	Flight to Delhi and return	

Appendix 2 : Thap/Bukhari Usage

PSH (40)		NonPSH (40)	
Hrs	Freq	Hrs	Freq
2	1	3	1
3	4	6	1
3.5	1	7	3
4	4	8	6
5	6	9	5
5.5	1	10	5
6	6	11	6
6.5	3	13	2
7	3	14	1
8	3	15	2
9	5	16	7
9.5	1	16.5	1
10	1		
11.5	1		
Total	40		40

Stats	PSH	Non PSH
Mean (Hrs)	6.1	10.9
Median (Hrs)	6.00	10
Mode (Hrs)	5.00	16

HEALTH IMPACT STUDY QUESTIONNAIRE
PSH HOUSEHOLD

March 2011

Name of the NGO: _____

Name & role (compared to family head: father, mother, etc.) of Interviewed Person:

Name of the district and village: _____

Date: _____

1. PERSONAL DETAILS

- 1.1. Household name:
- 1.2. How long have you been living here?
- 1.3. Number of adults:
- 1.4. Number of children (i.e. below the age of 14):
- 1.5. Pregnant woman:
- 1.6. New-born baby (younger than 1 year):

2. PSH DETAILS

Quantitative

- 2.1. Type of PSH:
 - 2.1.1. Direct Gain
 - 2.1.2. Solar Wall
 - 2.1.3. AGH / DGH
 - 2.1.4. EE
- 2.2. New or retrofit:
 - 2.2.1. New
 - 2.2.2. Retrofit
- 2.3. Completed in year? _____

3. FUEL DETAILS

Quantitative:

- 3.1. The type of fuel used:
 - 3.1.1. Wood only
 - 3.1.2. Wood and dung
 - 3.1.3. Dung only
- 3.2. Distance travelled to collect fuel:
- 3.3. Time spent to collect this fuel:
 - 3.3.1. **Before** PSH
 - Two weeks a year
 - One month annually
 - Two months annually
 - More than two months annually
 - 3.3.2. **After** PSH
 - Two weeks a year
 - One month annually
 - Two months annually
 - More than two months annually

Qualitative

- 3.4. Has there been any change after getting PSH regarding type of fuel/quantity??? If yes, how?

- 3.5. Type of **stove** used
 - 3.5.1. Bukhari (heating only)
 - 3.5.2. Bukhari (heating + cooking)
 - 3.5.3. Thap
 - 3.5.4. Bukhari-Thap

- 3.6. Timings during when stove is used:
 - from _____ to _____
 - from _____ to _____
 - from _____ to _____

- 3.7. Levels of smoke in the PSH room:

- 3.7.1. Very smoky
- 3.7.2. Medium-smoky
- 3.7.3. Low-smokey

4. LIVING DETAILS

Quantitative:

- 4.1. What was the staying/sleeping arrangement in winter before PSH?
 Main winter room (cum-kitchen)
 Separate bedroom
 Both?
- 4.2. What is the purpose / use of PSH room in winter?
 4.2.1. Only kitchen
 4.2.2. Only bedroom
 4.2.3. Kitchen-cum-bedroom
 4.2.4. Guestroom
 4.2.5. Other (please specify): _____
- 4.3. After getting PSH, any additional time that women and children dedicate to
 Handicrafts
 Studying
 Any other: _____

Qualitative:

- 4.4.** Any other room used in winter apart from PSH room:

5. HEALTH DETAILS

Quantitative:

- 5.1. How often did you go to Medical Aid Center/*Amchi* this winter?:

Who	Purpose (which Illness)	How often
Elderly person		
Children		
New-born baby		
Pregnant woman		
Other adults		

- 5.2. Have the following illnesses been reported amongst any family member?

Illness	Person (name & family role)	Main activity	Age	Started after PSH?
Coughing (pls also specify whether smoker or not)				
Sneezing (pls also specify whether any allergy)				
Flu				
Joint Pains (arthritis)				
Skin problems (irritation, redness, etc.)				
Tuberculosis				
Eye problems (infections, irritation, etc.)				

- 5.3. Health Issues with Elderly and Young members in the family

	Illness	Cause	Since when?	Persists throughout the year or only in winter	Relief in PSH room?
OLD PEOPLE	Coughing/Bronchitis	Does the person smoke? Smoke in the room?			
	Joint Pains	Gets worse in the cold?			
	Tuberculosis				
	Eye infections/Irritation	Smoke in the room?			
	Skin irritation/redness	Sitting too close to the stove?			
CHILDREN	Coughing				

	Sneezing	Allergy?			
	Eye infections/ Irritation				
	Skin irritation/redness				

5.4. Did the children miss school or tuition classes this winter due to illness? Yes- No-

5.4.1. Number of days: _____

5.5. Domestic Accidents

Before PSH: bruises/cuts/burns with stoves, ice, etc.

After PSH:

Qualitative:

5.6. Have you noticed that the sunlight affects the mood?

Of yourself how? _____

Children how? _____

Elderly people how? _____

5.7. **Is there any 'permanent' health problem for one or several** members in the household?
(joint pains, asthma, etc.)

5.8. Have you noticed any improvement this winter?
If yes, in which way?

5.9. Expecting mothers this winter

5.9.1. Current pregnancy month or age of new-born baby:

5.9.2. Health problems faced before delivery:

5.9.3. Any problems during delivery: Yes- No -

5.9.4. Health of new born baby:

Good

Any complications faced: _____

6. HYGIENE DETAILS

Quantitative:

6.1. Number of times the children get a bath per week:

Before PSH

After PSH

If any change, reason:

6.2. Number of times the adults bathe in a month in winter

Before PSH

After PSH

If any change, reason:

6.3: Number of times the adults wash head in a month in winter

Before PSH

After PSH

If any change, reason:

6.4 Number of times they wash in a week:

Clothes

7. Would you recommend PSH to other families? If yes, which specific reasons would you give regarding:

Health

Hygiene

Fuel saving

Comfort for children and women?

8. Would you consider making a second room? (yes/no) Why?

HEALTH IMPACT STUDY QUESTIONNAIRE
NON - PSH HOUSEHOLD
March 2011

Name of the NGO: _____

Name & role (compared to family head: father, mother, etc.) of Interviewed Person: _____

Name of the district and village: _____

Date: _____

1. PERSONAL DETAILS:

1. Household name: _____
2. How long have you been living here:
3. Room used in winter (Glass room, closed room with small windows?):
4. Number of adults:
5. Number of children (i.e. below the age of 14):
6. Pregnant woman:
7. New-born baby (younger than 1 year):

2. FUEL DETAILS:

Quantitative:

1. The type of fuel used:
 - Wood only
 - Wood and dung
 - Dung only
2. Time spent to collect this fuel:
 - Two weeks a year
 - One month annually
 - Two months annually
 - More than two months annually
3. Distance travelled to collect fuel:
4. Type of **stove used**:
 - Bukhari (heating only)
 - Bukhari (heating+cooking)
 - Thap
 - Bukhari-Thap
5. Timings during when stove is used:
 - From _____ to _____
 - From _____ to _____
 - From _____ to _____
6. Levels of smoke in the PSH room:
 - Very smoky (...)**
 - Medium-smoky (...)
 - Low-smoky

3. LIVING DETAILS

Quantitative:

1. What is the staying/sleeping arrangement in winter?
 - Main winter room (cum-kitchen)
 - Separate bedroom
 - Both?
2. How much time (in a day in winter) women and children dedicate to
 1. Studying
 2. Handicrafts
 3. Other activities

4. HEALTH DETAILS:

Quantitative:

1. How often did you go to Medical Aid Center/*Amchi* this winter?

Who	Purpose (which Illness)	How often
Elderly person		
Children		
New-born baby		
Pregnant woman		

Other adults		

2. Have the following illnesses been reported amongst any family member?

Illness	Person (name & family role)	Main activity of the person	Age
Coughing (pls also specify whether smoker or not)			
Sneezing (pls also specify whether any allergy)			
Flu			
Joint Pains (arthritis)			
Skin problems (irritation, redness, etc.)			
Tuberculosis			
Eye problems (infections, irritation, etc.)			

3. Did the children miss school or tuition classes this winter due to illness?

Yes

No

1. Number of days: _____

4. Domestic Accidents: cuts/bruises/burns due to ice, stove, etc.

5. Is there any 'permanent' health problem for one or several members in the household?
(joint pains, asthma, etc.)

	Illness	Cause	Since when?	Persists throughout the year or only in winter
OLD PEOPLE	Coughing/Bronchitis	Does the person smoke? Smoke in the room?		
	Joint Pains	Gets worse in the cold?		
	Tuberculosis			
	Eye infections/Irritation	Smoke in the room?		
	Skin irritation/redness	Sitting too close to the stove?		
CHILDREN	Coughing			
	Sneezing	Allergy?		
	Eye infections/Irritation			
	Skin irritation/redness			

6. Expecting mothers this winter:

1. Current pregnancy month or age of new-born baby:

2. Health problems faced before delivery:

3. Any problems during delivery: Yes- No-

4. Health of new born baby:

Good

Any complications faced: _____

5. HYGIENE DETAILS

Quantitative:

1. Number of times the children get a bath per week:

2. Number of times the adults have a bath in a month in winter:

3. Number of times they wash in a week:

9. Clothes: _____

10. Utensils: _____

6. Would you get PSH? (yes/no) Reason?

PSH • HEALTH IMPACT STUDY

FOCUS GROUP DISCUSSIONS (FGD) & INTERVIEWS OF EXPERTS • STUDY IN LADAKH, MARCH 2011

The present document defines the main guidelines for the FGDs with women and with children and for the interviews with health-related 'experts'.

We don't consider that FGD with men and meetings with school teachers are relevant enough regarding this study. The focus shall be on the core target groups.

I. FGD with women from PSH household (one per village)

Participants- about 10-15 women from diverse background from the village

- 1) What is your role in the family (elicit gender roles etc.)?
- 2) Fuel:
 - a) How many days does it take to collect bio-fuel for heating for one entire winter?
 - b) How far do have to go to collect wood?
 - c) After using the PSH, has it gone down? How many days less?
- 3) What do you do more now or new **in winter** than before having a PSH?
 - a) In winter, do you do any activity that brings additional income to the family? If yes, which one?
 - b) Are you involved in handicraft activities?
 - c) How many hours do you spend on those activities? Do you remember how many you used to spend before PSH?
- 4) Where is it more restful to live: in a conventional room (living standard / habits have been transmitted from generation to generation) or in a PSH (new habits)? Why? Please elaborate.
- 5) In what other ways has PSH changed your way of life?
- 6) How does PSH influence your children's lives? Do they have more time to play/study? Do you get yourself or some other family members more time to spend with the children?
- 7) How often did your child bathe now vs. before PSH? And yourself?
- 8) How has PSH changed your status vis-a-vis men in your families? Give specific examples.

II. FGD with Children (8-12 years) from PSH Household

Participants- about 10-15 girls & boys from the village

- 1) What games do you play in winter vs. summer? Why?
- 2) What are your daily activities during winter vs. summer? Why?
- 3) What is PSH? How does it work?
- 4) What is your role in bio-fuel collection? Before PSH, how many hours would you spend collecting fuel for the winter?
- 5) Who played a bigger role in fuel collection- you or your sister/brother? Why?
- 6) Did PSH change any of your activities: studies, leisure activities? Give concrete examples.
- 7) Have you observed any change after PSH in your parents / grand-parents health or behaviour?
- 8) How often did you bathe now vs. before PSH?
- 9) Of all the winters, which has been the best in your memory, and why?

III. Interview with available *Amchi* in villages

- 1) How long have you been practicing as *Amchi* in the area?
- 2) What are some of the common ailments you get to treat in winter as opposed to summer?
- 3) Is there higher incidence of respiratory and eye infections during winter? If yes, why?
- 4) Do you know which families in your village have adopted PSH? And why?
- 5) Have you noticed any reduction in respiratory or eye infections in these families?
- 6) What could be the drawbacks of PSH, in your opinion as *Amchi*? And advantages?
- 7) Any suggestions or concerns?

NOTE: Significant Events- In the above interviews and FGDs, if it is appropriate, we would carefully raise the question of any deaths

or accidents in previous years, which could have been associated to cold (hypothermia) or use of bio-fuel (accidental burns/ fire etc.). Such incidents will be further researched and presented in the report as specific case studies.

IV. District Health Officer or local Medical Officer

- 1) How long have you been practicing in this area?
- 2) What are the major representative illnesses and infections in Ladakh according to your experience? (+ reasons for those)
- 3) What are some of the common ailments you get to treat in winter as opposed to summer?
- 4) What do people complain the about in winter? What, in your opinion, is the cause for this?
- 5) Do you know some families who have built a PSH? Where, which one?
- 6) Have you noticed any reduction in some of the illnesses or infections in these families? What could be the connection?
- 7) Even if you do not know any case of PSH, what can be the drawbacks of PSH, in your opinion as a doctor? And advantages?
- 8) Any suggestions or concerns regarding PSH?

Appendix 4 : FGD with Children



(Children in Ladakh play many games defined by gender, season, age, traditions and resources available)

Games: Children play many games: Thaple (bouncing a bunch of rubber bands on one foot), Football, Skipping ropes, Kho-kho, Kabaddi, Cricket, Senchali (stone pile and 2 teams- one tries to beak it, other tries to make the pile; also called Samtoliya), skating on ice, Machis, “*Ghora hai jamal ka*”, Archery (boys only), Jack-stone (tok), Khana (hop-scotch), Chor police, Sher-bakri, Ibli (hide and seek).. Also Indore games like Chess, Carrom board, snake and ladder. During summer especially, they play- Cricket, bolley ball, Kabaddi, Badminton, rope skipping, Thapley. In Maan village, they are not supposed to go near the lake (Pangong) for safety reasons. Gender and availability of open ground plays a role: girls don’t play Cricket and boys don’t skip rope. ‘Senchali’ is not possible in winter, due to snow.

Roles: Help mother in caring of cattle, feeding calves, filling water, collect fuel, Help in washing utensils and clothes and remove snow from the path and around the house- and serving adults (hot water, tea, meals etc.). Children collect dung from fields and within village. Earlier, one hour morning and evening- now only in the evening, due to PSH. Not much gender difference in dung collection. Girls do play a bigger role in fuel collection; if a boy put a basket on his back, some people laugh. But yes, girls will collect water more often than boys.

PSH: children stated as some of the big advantages: warmth without smoke and without having to tend Bukhari constantly; water no more freezes, can play indoor games during winter and easier to write and read indoors during winter and easier to bathe indoors. One child said- due to PSH, milk curdles easily now. Neighboring kids often come and join them in play and studies in the PSH room.

Before: studied only in the evening; now in morning too. Play games too in the PSH room: Carrom board, snakes and ladders; Ludo and Toke; sometimes roll on carpet just for fun. No fixed time for study or play- Neighborhood kids too come and join them in their games and fun- but not study, because they dont come prepared with their books or bags.



(Children play many indoor games)

Children are able to write better and for long in the PSH room. Washing and drying clothes in the PSH room has increased as chores for them. Spend more time with adults. One girl mentioned that adults now sit in PSH room more often and ask them to run errands for them, like water the cattle etc.

Hygiene: Bath- before once in 2 weeks or so. Now every week.

How does PSH works? Children have a basic understanding: double layers of glass, allow light to come in but prevent heat from going out. They know about Green house gases, Ultra-violet ray and Ozone layer!

Participants: Primary school, Maan, Durbuk, 18th March. Mixed group (some without PSH and some with PSH built under ICEF program).

Name	Age	Sex	Type of PSH
Jigme	10	M	DG,SW (ICEF)
Sonam	9	F	AGH
Ringchen	8	M	No PSH
Sonam gyaltsen	9	M	DG (geres)
Tenzin	10	M	DG (Geres)
Tsering	8	M	DG, SW (ICEF)
Phuntshok	5	M	DG, SW (ICEF)
Tsering	10	M	DG (Geres)
Tenzing	5	M	DG,SW (ICEF)
Padma	10	F	DG,SW (ICEF)
Eshe	10	F	DG,SW (ICEF)
Jigme	9	M	No PSH
Tashi	11	F	No PSH
Karma	15	M	DG (ICEF)
Tsering	6	F	No PSH
Dorje	9	M	SW (Geres)

FGD, Children, GM pore, Kargil on 11th March

Name	Sex	Age	Type of PSH	Year
Mohammad Hasnain	M	6 yr	SW	2010
Mohammad Ali	M	8 yr	SW	2010

Salma	F	8 yr	DG	2009
Mohammad Issac	M	10 yr	DG	2009
Asghar Ali	M	12 yr	DG	2009
Mohammad Ilyas	M	15 yr	DG	2009

FGD: Children, Mundik, Bodh Karbu 9th March

Name	Age	Sex	Type,	year
Tsering Chsophel	10	M	DG	2009
Issa Khan	7	M	AGH	2009
Naseema Khatun	10	F	DG	2010
Ahmad Khan	12	M	AGH	2009
Dorje Tsomo	8	F	SW	2009
Tenzin Dawa	7	M	DG	2009

4th March 2011, Sasoma Village.

NB: Due to snow fall, severe cold, and school just opening, getting enough children meeting our criteria (PSH families) was difficult. We finally found the two children, but midway, realized that only one child was doing all the talking and even he was giving superficial answers.

Rigzin Dorjey, M, 10 yr

Jigmat Tso tso, F, 10 yr

Appendix 5 : FGD with Women



Role distribution

Women collect fuel (bushes and dung) from nearby pastures and village itself. After PSH, the burden of fuel collection has gone down appreciably. Women are not supposed to do ploughing (and archery). As to advantages of PSH, women agreed that it offered: more light to see, move around and work, bigger nicer rooms, warmth, low fuel consumption and less maintenance chores like cleaning of bukhari. As to disadvantages: it requires additional inputs and expenses- like insulation of the side walls, roof etc.

Many farm related activities are considered women's role like weeding etc. while men are responsible for making of furrows, ploughing (often with a tractor). Caring of cattle is women's role while earning wage at construction sites (road, building etc.) is by and large male domain- (this last- especially in Kargil, not so much in other three areas).

Starting the day: Morning- Cleaning the house; making and serving the tea, hot water to other family members, Feed yaks, horses; care for children and get them ready for the school.

About 11 am, women used to gather at one place outdoors for handicraft, in good weather only, and be there till about 4 pm. Now, they dont need to as they have their own PSH room to sit in and knit, spin and weave etc. Some, if not all, men too practice handicrafts like spinning etc.

After 4 PM: Feed livestock, milk cattle, prepare dinner; Handicraft after supper (knitting, spinning, weaving etc.).

Women's role in Agriculture: A clear division is only for these two activities:

Seeding- women; Ploughing – men (exception: Changthang region, where horses are used; woman can hold the rope to guide the horse, when men not available for the task). Elsewhere a hybrid of

Yak and cow – called Dzo locally, is used for ploughing. These traditional practices may have something to do with soil, availability of horses and other factors. Other activities are done by both men and women but more often by women: Irrigating & preparing the field, manuring, harvesting etc. Taking cattle to pastures- is a role played by both women and men. But cattle grazing between May and August is mostly women's role.

Additional cash income: Roadside labor is provided both by women and men; usual income is about Rs 4000-5000 per month and the work is not as demanding as working as farm hand under someone else.

Decision making: Most spending & buying decisions are undertaken by men like selling live stock, handicraft products or grains; even ornaments for women are bought as a joint decision of the man and women concerned. Probably not same as elsewhere.

Fuel

Before PSH, winter fuel was collected in about 15-20 days, from a distance of 5-10 Km, from Taglangla or Tsokar region. Some women would hire a mini-truck and get their winter supply from a distant region at one go but will have to pay a substantial amount (Rs 1500-2000 per family).

The difference after PSH: Many women are free of dependence on distant source of fuel (traditional pastures- Taglangla, Tsokar etc.). They just collect cattle dung from the vicinity or from their own cattle shed. Some women, who have cattle in the pasture, do get their fuel from there in the normal routine of things and do not need bush or wood, as in the past. On the whole, fuel consumption in PSH households has gone down by 50% at least on an average.

Fuel Collection for winter takes about 2-3 months; it depends if the family has cattle or not, also on family size. If yes, then they may have a lot of dung from their own cattle shed, which still has to be dried and stored for later use. Those families which have few cattle, will collect the dung from the village or get it from the nearby pastures on payment (Rs 80 per sack; while 50-60 sacks might be typically needed by a family for the winter). Men help by lopping the branches of the fodder trees in the village and surroundings. After the use of PSH, 20-30% reduction in fuel consumption has been experienced.

Children's education & handicraft have benefited from PSH since now a room is available with more light and 'even' warmth without smoke or bukhari, needing constant attention. Earlier women, used to go outdoors and sit somewhere between 11 am to 4 pm to practice handicraft - provided it was fair weather. Children and elderly are able to rest and walk about in PSH room more comfortably, since the heat is evenly distributed and there is no burning bukhari in the middle to be avoided while moving around with in the room.

Additional cash income

Women are able to go out and earn cash as road side construction labor, since fuel collection, after PSH, has considerably gone down. Handicrafts as of now, is mostly for self-consumption; There is no marketing potential or strategies in place at the moment.

Handicraft: All women were involved with handicraft practices. Earlier they were able to contribute about one hour per day- now it is 1.5+ hours per day on an average. There are many other constraints on handicraft: other duties (children, cattle, farm, religious duties) and lack of other helpers. Handicrafts made by women (and by men to some extent) are used for self-

consumption, rarely for sale. One woman who had learned tailoring from a government run program is able to earn about Rs 800-1000 per month by sewing ladies' suits and children's garments, sold in the village itself. While solar room is definitely an advantage for practicing handicrafts, limited power supply (for lighting purpose) remains a constraint. Some women will use solar lights, after the power goes off, to spin, stitch or sew for another 1-2 hours in the night. They also make a local variety of coarse carpet- *Phema*.

Warmth: Traditional sitting room cum kitchen with Bukhari had many constraints which have been solved by PSH: at times even Bukhari was not enough to keep people warm in the non-PSH rooms; the heat from Bukhari was uni-directional, not evenly felt in the room; Bukhari needed regular cleaning and smoke was a regular problem. No women complained of feeling suffocated in a PSH room because it was supposed to be 'airtight'. There were more instances of cold, cough and eye inflammation. Old, non-PSH houses had a poor finishing. Most women found solar (PSH) room restful, full of light, warmth and cleaner, since Bukhari need not be used so much. Children study more, even in the morning, due to PSH. There is no smoke, and the heat is all round, giving children freedom to sit and work wherever they want to, in the room.

Maintenance: Cleaning the bukhari and the room in non-PSH households was a time consuming tedious chore. Collecting enough fuel to last winter took lot of effort and storage space.

Children and PSH: Children can study, watch TV and play in PSH room for many more hours now. Bathing children is easier. They can bathe in a small tub in PSH room or come to PSH room for changing and drying themselves. Common cold (especially suffered by children) and joint pain and body aches (especially suffered by elderly) is less or more tolerable now in a PSH room. Many women felt that PSH room was the best thing for a child: they get to spend more time with adults- (earlier, mother will go for handicraft with other women to an outdoor location while child will be playing somewhere else- *both* are now in PSH room); children can be safely left behind in a PSH room, without the danger of accidental burns (or hypothermia) and women could attend to other chores: getting water, feeding cattle etc.

Children bathing: Before PSH: 1-2 per month, depending on weather; after PSH: once every week. The change in adults is less obvious because, there is no bathroom in the houses traditionally. So, they have to find a wind proof corner and enough privacy to have bath in the first place. Some adults have tried bathing in Green house but others have objected to that.

Less dependence on fuel, so workload has decreased to some extent. But status not much changed, since it is a function of many other variables functional literacy, ability to earn cash, control and access to expendable cash resources. Gender based violence unheard in rural areas.

There are regional differences:

Kargil

In these areas, almost 90% mosques have attached Hamam, with hot water, to facilitate ritual washing (*wuzu*) before offering Namaz. These hamams are used by men and children to bathe as well, for a nominal fee (Rs 10-50 per head). Women do not use these public hamams and prefer to bathe at home. Some families have a proper bathroom. So, for many women, not having a bathroom, is *still a constraint*, even though they do have a PSH room to dry themselves and change after the bath. Children appear to have more freedom in this matter: they have a shower in some corner and shift to PSH room soon after for drying and changing.

Kargil - Gender roles: Handicrafts- women more often deal with spinning task and with sheep hair while men mostly wind the yarn into balls and also work with rough Goat hair. Women deal with cooking, gardening, irrigating the fields, dung collection; Men go for construction work with BRO (never women unlike other areas); ploughing etc.

Women get up early around 5 am prepare hot water, tea etc. cleaning the house, feed cattle and then serve breakfast. Smaller cattle like goat have to be fed 4 times a day, while cow and yak are fed twice a day. They fill water etc. Any spare time is devoted to handicraft. Afternoon nap for women is unusual and considered “shameful”. Men get up at 8 am and go to work after breakfast. If not in regular job, they may practice handicraft. Women are not blamed if no child is born for a long time after marriage- or only girls are born. The birth of a boy is celebrated more than that of a girl though. If handicraft is sold, the cash remains with women as her discretionary funds.

Fuel: It takes about 2 months every year to collect fuel supply for winter. Collect it from higher pastures, 8-10 km away. They go with mules and it is a whole day trip.

Handicraft: Before PSH, they would practice handicraft latest till 9 pm. Now, it goes on till 11 pm since the room is warm and they dont have to light bukhari all the time. Children too study 2-3 hours extra in PSH room. Handicraft is not often sold- but is consumed within the family, especially in a family with many children. This saves the money, which would otherwise be spent on buying their woolens from the market. Some small families are able to produce enough handicrafts that can be sold in the market for cash. Time devoted to handicraft has increased in most cases from 2 to 4 hours. Some do tailoring too. More restful to be in the PSH room. Have to open window in very sunny weather.

In what ways PSH has changed their lives:

“We have seen and understood the concept of double glass windows for the first time”. Big windows allow more light- easier on eyes, while kids read or women knit. Praying, telling beads (or prayer wheel), offering Namaz- all this has become easier and comfortable.

Children and adults spend more time together in PSH room. Neighbors also sometime come and sit. Children play, just sit, study more indoors now.

Hygiene: Kids bath: before 1/m, now 1/W ; Adults: 1/m, not much change due to lack of bathrooms.

Effect on life:

Less dependence on fuel; less smoke; less cleaning of bukhari, Have to wear less clothes; very good and safe for children.

Problem: two families have reported glass (inner) breaking for no apparent reason. Glass costs Rs 300 to 400 per piece.

Structural weakness: Solar wall- joining between the solar wall and the two side walls? Safe during earth quake?

FGD with women, Maan Village, Durbuk, 18th March:

Name	Age	Type of PSH	Year
Nawang Lhamo	40	DG	2008
Tamches Dolkar	45	DG	2008
Skarma Yangchen	35	DG,SW (ICEF)	2004
Dolma Palkit	20	AG	2010
Tundup Dolkar	35	Incomplete	
Sonam Yangdol	40	Incomplete	

FGD with women in GM pore LEDeG, Kargil, on 11th March

Name	Age	Type of PSH	Year
Hawwa Bi	35	SW	2010
Zahira Bano	40	DG	2009
Sakina Bano	30	DG	2009
Fiza Bano	50	DG	2009
Mariyam Bi	60	Interested	-

FGD: women Mundik, Bodh Kharbu, Kargil, 8th March

Name	Age	Type of PSH	Year
Norzin Angmo	30	DG	2009
Sonam Paskit	50	SW	2009
Khateeza	29	DG	2008
Kulsum Biwi	25	DG	2009
Fatima	40	AGH	2009
Syeda	16	DG	2009

FGD: with PSH women on 3rd March at Sasoma

Only six women- because it was a festival day (last Amavasya of the year)- cold was severe and houses were scattered and women had other pressures..

Name	Age	Type of PSH	Year
Phuntsok Angmo	43	AGH	2010
Spalzes Angmo	49	AGH	2008
Stenzin Dolkar	19	DG	2010
Tsering Chhoden	48	Solar wall	2009
Sonam Angmo	49	DG	2009
Stenzin Dolkar	22	DG	2009

Appendix 6 : Interviews with Amchi

15th March: Amchi Interview at Sia La guest house.

Skerma Tsering is an *Amchi* from Kanji village in Bodh Karbu region. His village could not be visited due to access road being blocked due to a bad avalanche. Since he was in Leh for a training, this interview became possible.

He has 35 years experience as *Amchi*. He is 57. He learned the healing arts from his father, who had learned it in Tibet in early 30's. He had other teachers too, especially to learn astrology, which he combines with his healing practice. He is a practicing carpenter, drift wood carver and a mason. He attracts clients from a large area, extending all the way to Chiktan.

Winter brings many health problems related to cold and especially in very old (60+) or very young children (under 2 years). During summer time, young people fall sick, due to working very hard, overuse of local beer (*chhang*) or other acts of indiscretion. Respiratory problems during winter is largely due to sudden and steep change in the temperature of inhaled air and its effect on not just lungs but on constitution (*sard-garam*). This could be true of people (and children) suddenly leaving the PSH room and going out into very cold weather outside.

He himself is using PSH (2010) and offers ambient warmth and fuel saving as two of the big advantages of PSH. Possible drawbacks, from his perspective, could be: sudden change in temperature on coming out of PSH room; possibility of spread of infection from one to another.

Leho- Bodh Kharbu , Yokmal, Kharpoche 8th March : Amchi Interview

Tsering Tsamanla, 40 y, M

Has been serving a wide area between Haniskote to Shakar (30 km) for 4-5 years. Has learned it from his father who has been practicing as *Amchi* for many more years before him. Visits sick at home on invitation but has a practice at home mainly. No fixed fee- people pay according to the services and capacity.

Winter: gets to see joint pains, cough, cold, body-ache, headache, earache, urinary problems etc.

Summer: dizziness, lethargy etc.

Higher incidence of respiratory and eye problems during winters- could be caused by smoke and dust. Smoking tobacco is commoner among young people. Rum (alcohol), available through local defense personnel is catching up both among young and old. Considers *Chhang* better for health than liquor available in market or Army canteen.

Knows the PSH families. Yes, incidence in respiratory and eye problems have gone down in these families.

Drawback: Dizziness if too hot; or if come out too suddenly; PSH is Better for arthritis.

Has seen burn cases in the past from non-PSH families – of accidental burns (burn from Bukhari or hot water)

4th March 2011, Sasoma Village, Amchi Interview

NB- since two *Amchi* were present at the venue, both were invited and interviewed together.

Amchi Phuntshok Tashi, 59 yr, has practiced for 40+ yrs.

Amchi Skarma Tsultin, 46 yrs, has practiced for last 24 years.

Both *Amchis* had training of their healing skills under their fathers and later under another teacher, an uncle in the case of Phuntshok; Skarma had a training under LNP too. Both attract clients in this valley from Rumtse to Upshi.

They get to see a lot of cough, cold, flu, joint pains during winter; During summer they come across indigestion, heartburn, and High Blood pressure (this last is seen during winter too). During spring season, they come across more eye and respiratory infections- because of dust factor, according to them. Cough, they felt is more often caused by infections, rather than just smoke or cold air.

Both *Amchis* knew the families using PSH and were themselves PSH users. They felt that the respiratory and eye problems have gone down in the families using PSH since, there is less smoke and there is less to clean.

As to drawback: they felt that if you close up everything and stay in such atmosphere, it may not be good for you. Also, if one person has an infectious cough, it may spread to others in such a closed environment. But these risks were far-outweighed by many advantages in terms of health, hygiene and comfort. They mentioned that accidental burns were common earlier and such cases have reduced in their experience as *Amchis* serving a wide area.

As to their motivation for adopting PSH: one (Skarma) was taken on an exposure tour which convinced him of the health, hygiene and fuel saving benefits and the other was simply attracted by the comfort factor.

Appendix 7 : Interview with Masons, others

Interview: Mohammad Issa, 40, M, Mason, (Mundik, B.Kharbu, Kargil)

Has worked as a mason for 6 yrs in this area.

Had one 7 day solar training. Refers to trombe wall of Tashi Tondup, made in 2009. It got so hot that they removed one glass of the double glazed windows. He suggests, that a small shutter (6x20 inches) should be provided in the window itself, to regulate the heat..

Could it be heat, which has caused inner glasses to crack within a month in Tenzin's PSH (DG-2009)

Interview: Mohammad Ibrahim, 48, M; Nursing orderly at Haniskote (under PHC- Chiktan)

Lives in Mundik village and has served this region for last 20 years.

Winter- he gets to see Cough, cold, stomachache, body-ache, backache and high BP. More eye infections too, probably due to dust and smoke in the room caused by Bukhari.