



PASSIVE SOLAR HOUSE EXPERIENCES

Testimonials of PSH users in Ladakh



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Although winters in Ladakh are harsh, traditional architecture is not well adapted to cold climate. Houses are oriented randomly, have small windows and many air infiltrations. They also require a large amount of firewood (a scarce resource in the region), kerosene or other fuels to keep the house warm during the long winter.

Under these conditions, rooms remain cold most of the time which is usually the cause of illnesses and discomfort. Not to mention the high cost of fuel used for heating.

Passive solar architecture is an innovative technology that has been implemented in Ladakh since the 80's. It uses the sun as a source of energy. A Passive Solar House (PSH) collects sun light during the day and releases the heat to the rooms at night when temperatures are the coldest. The construction methods are almost the same as the traditional ones, and the designs rely mostly on the use of local materials.

Since Ladakh has an average of 300 sunny days per year it is the perfect place to use solar energy.

One of the main features of a PSH is that the temperature inside the house remains above 5°C, even when the outside temperature is below -20°C. Major benefits are fuel and time sav-

ings as additional heating is no longer required in most cases. Besides the sunny, warm and smokeless room contributes to better health and living conditions.

Three passive solar architecture techniques have been successfully implemented in Ladakh:

- Direct gain
- Solar wall
- Attached greenhouse

All three types share basic construction principles such as double walls, insulation and double glazing. Together they make the house warm during winter. This technology can be used also for bigger buildings such as schools, community halls, hospitals etc.

Many people don't know what a Passive Solar House is and how it works. People often wonder what is insulation or why it is good to have double glass on windows. In the following interviews you will find opinions and experiences of people who built a PSH and live currently in it. Their first hand experience will help clear doubts and understand why Passive Solar architecture is the best solution for a place like Ladakh.

We also recommend you to visit a Passive Solar House to experience it before deciding to build one.

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Abbreviations used in this document:
PSH: Passive Solar House
LNP: Leh Nutrition Project
AGH: Attached Greenhouse
U.V.: Ultra violet

Narration by Stawa

GERES is a French NGO that has been working in India since 1986, aiming at supporting local NGOs and institutions to promote income generation activities and ecofriendly technologies by using renewable energies. GERES is the leading organisation for this project. The partner NGOs are Eco-sphere, LEDeG, LEHO, LNP and SECMOL.

More information: www.geres.eu



TSEWANG LAMO

*PSH type: Solar wall
House completed in 2009
Village: Sasoma
Age: 40 years old
Occupation: Farmer
Family members: husband (45 years old), one son (20 years old) and two daughters (14 and 17 years old)*

"LIKE ME, MOST PEOPLE DO NOT REALISE THAT WHEN THEIR HOUSE IS SOUTH-FACING, IT RECEIVES MAXIMUM SUNLIGHT AND HEAT!"

In my old house, the rooms were big but the windows were so small and placed so randomly that hardly any sun reached inside. As a result, I would keep the windows closed through the winter and open them only in June. With the windows shut and dust in the house, everyone would get ill often, especially the children.

Furthermore, the house had a big chimney and all efforts to heat the house would fail as the warmth would escape through the large chimney hole in the roof. The worst part was that you would be warm only close to the *bukhari* and freeze if you stepped away. Household chores were difficult as you can barely move or feel your hands when the temperature is -20 degrees Celsius! Even the water in the house would freeze.

In Ladakh, summer is a busy season, during which we either work in the fields or as coolies. The winter is thus the only time when we get any rest but the cold made it difficult for us to sleep. Also, we had to make frequent trips into the mountains to collect firewood and dung to keep the *bukhari* burning through the day. The other option was to bring firewood from Changthang but each load costs Rs 3,000, which is a lot of money.

We first heard of PSH when LNP came four years ago to our village to build a PSH. People said these houses were no good as they were not square, that the plastic in front of the attached greenhouse looked awful and that the black wall of the Trombe Wall was strange. Nobody really understood these ideas and judged the house only by its looks. People simply wanted a good-looking house that faced the road!

Though I was not totally convinced by the idea, we decided to build a PSH hoping it would be warmer than our old house. I kept asking questions to our mason and the LNP people even when it was being constructed as I did not really understand concepts

like orientation and insulation. I was very skeptical about the effectiveness of the insulation materials they were stuffing into the walls.

Now, having lived in a PSH for two years, I am amazed at how effortlessly the house heats up while maintaining a clean environment. Winters are suddenly not as hard anymore! The warmth remains till eleven in the night, with the children studying, adults spinning wool, praying, working or simply resting.

Nobody complains of joint, knee or back problems and our health has definitely improved.

The house remains warm and the water does not freeze even in January, when the winter is at its coldest. And we use much less fuel for heating than we did in a conventional house. Even our neighbours come over to warm themselves! People often comment that though we only have two (not very big) windows, the room is very warm.

Even people in the village have changed their opinion and are convinced of the effectiveness of PSH. People now ask me questions about which PSH type is better and how to build a PSH house. I usually advise them to pay attention to the orientation of the house and the windows. Like me, most people do not realise that when their house is south-facing, it receives maximum sunlight and heat!

People are willing to build a PSH but are afraid of the expenses. The only thing I tell them is that while we did spend a lot of money building the PSH, it was worth it.





TUNDUP NAMGYAL

*PSH type: Direct gain
House completed in 2008
Village: Sasoma
Age: 38 years old
Occupation: Mason
Family members: wife (34 years old) and two daughters (10 and 12 years old)*

"SINCE THE HOUSE IS HEATED BY THE SUN, LESS FUEL IS BURNT AND AS A RESULT THERE IS LITTLE OR NO SMOKE GENERATED INSIDE THE HOUSE."

We have had PSH in our village for the last 3 to 4 years. Initially, only a handful of people adopted this idea. When I decided to construct a PSH, I chose the Direct Gain and built it with support from the NGO Leh Nutrition Project (LNP), who provided some of the materials that were needed to construct the PSH.

I did my research and learnt that there are three kinds of PSH: Direct Gain, Trombe Wall and Attached Green House. I observed that Direct Gain is particularly good during the day but not as effective in the evening. I also observed that Attached Greenhouse is warmer than Trombe Wall during the day. However, though the construction of Trombe Wall is more expensive, in my opinion it is the most effective of all the PSHs in a place like Ladakh.

The PSH enjoys many advantages over conventional homes. Our traditional homes are invariably cold and smoky in the winter with small windows that hardly let in any sunlight. Also, they are built without any regard to their general orientation. PSHs, however, are always built facing the south as it maximises their exposure to the sun. The windows in a PSH not only face south but are also bigger and have double glass panes to retain heat inside the house. Furthermore, since the house is heated by the sun, less fuel is burnt and as a result there is little or no smoke generated inside the house.

However, insulation is a very critical aspect of keeping a PSH warm. Any room that is not insulated will be colder, no matter how it is heated. Thus besides

south-facing windows, it is important that the walls are insulated as well as the ceiling. The insulation of the ceiling is very important as most heat, coming from any heating system including the sun, escapes through the ceiling. Thus, the ceiling must be well insulated to prevent heat from escaping.

I am a mason by profession and actually went through additional training provided by NGOs in Leh. I am now a certified mason to build PSHs. Having experienced the benefits of a PSH, I personally think it is the most practical solution for building houses in a cold place like Ladakh. In fact, nowadays more people are interested in the idea of having a PSH, but only after they are convinced of its benefits. In fact, people from neighbouring villages, and even those from our village, have started to ask me for help and guidance to build a PSH. I find that unless people themselves experience a PSH and realise its benefits it is very difficult to convince them to opt for it rather than a conventional home.



TSERING DORJE

*PSH type: Attached greenhouse
House completed in 2008
Village: Ursi
Age: 45 years old
Occupation: Farmer
Family members: wife (43 years old), one daughter (19 years old) and three sons (23, 17 and 15 years old).*

"THERE WAS NO USE HAVING A HOUSE THAT ONLY LOOKED GOOD WHEN WE COULD HAVE ONE THAT IS WARM!"

Our lives have been transformed after we decided to build an Attached Greenhouse PSH. Gone are the days when we lived in a conventional house where we burnt a lot of fuel to keep the bukhari running day and night but yet were constantly struggling to stay warm. The whole family would suffer from various illnesses like common cold, body aches and a host of other illnesses. The little warmth in the house would disappear the moment we shut the thap after cooking. All these problems disappeared after we constructed the Attached Greenhouse.

Now, the house warms up as soon as the sun rises and remains warm for hours even after the sun has set. We never use the bukhari in the day anymore. The best part is that the AGH works even when the sky is overcast or when the temperature outside is way below zero degrees. In fact, people who visit us often tell us that the house is very warm and keep looking around for the bukhari! Even at the height of winter, we often sit and do our work in the greenhouse as it is very warm. I used to wonder if the AGH would work in snow but the slope of the greenhouse makes it very easy for us to dust off the snow.

Only after living in a PSH, did I realise the importance of some simple principles. For instance, an Attached Greenhouse is based on ensuring that the house faces the south to maximise exposure to the sun. This is a simple concept but I think most Ladakhis do not know its importance. In addition, using double walls, insulation and large windows with double glass panes prevent heat loss is a crucial but often neglected feature in conventional Ladakhi homes. In fact, we filled our double walls with wood shavings and also use trekking mattresses on the sides of the walls to prevent heat loss. As a result of this, I find that Attached Greenhouses are three times warmer than conventional houses, with much less effort on our part!

Once people experience the benefits of a PSH, they ask me about costs. I tell them that building a PSH is

more expensive than a conventional house but that even if you are spending the money from your own pocket, the benefits make it worth every rupee! For example, some people have asked if they can make an AGH with a conventional plastic sheet. I actually did try using a conventional plastic and a single glass pane in the windows but the house was not very warm. Based on this experience, I advise people that they should only use UV-resistant plastic, double-glaze their windows and plaster their walls to really benefit from the sun's heat and the PSH technology. The UV-resistant plastic sheets are a little expensive but last for many years if you take care of it! As of now, only one room of our house has an AGH, but if we can get some money we plan to build another room with an AGH.

Initially the plastic sheet in front of the house did feel a little strange, especially since we could no longer see anything outside. I have now got used to it and once you are in the warmth of the house, you forget to the cold outside. In fact, people would tell us that the house did not look good with the plastic in front, but we told them that there was no use having a house that looked good when we could have one that is warm!





MOHAMMAD HASSAN

*PSH type: Direct gain
House completed in 2010
Village: Barchey
Age: 65 years old
Occupation: Farmer
Family members: wife (55 years old), one son (25 years old) and two daughters (21 and 24 years old)*

"THE BIGGEST BENEFIT OF THE PASSIVE SOLAR HOUSE IS THE MARKED IMPROVEMENT IN OUR GENERAL HEALTH"

Before opting for a PSH, we used a local thap for cooking and a separate heating system to keep ourselves warm. As a result, we would spend a lot of money to buy firewood and fuel. This was a big financial burden on the family and we were forced to make some very difficult choices, like using money to buy fuel instead of paying school fees and buying ration for the household. However, even with extra heating, we still had to wear several extra layers even when we were inside the house. In fact, at night each of us would sleep under two blankets and three quilts but still struggle to stay warm through the night. We would end up sleeping in a fetal position to stay warm but would be very stiff by the time we woke up in the morning.

Now with the PSH, we are all warm and comfortable even at the height of winter. We need to use just one blanket with a quilt and we can stretch our legs when we sleep and wake up refreshed. And, of course, we don't need the bukhari at night! Once the sun rises and the house warms up and we no longer wear layers of clothes. In fact, we are also able to do all the household activities very comfortably. Earlier the cold would freeze our hands, making them so numb that it was extremely difficult to do activities that needed manual dexterity such as knitting or wool spinning. Now women knit and the boys, and even our grandfather, do wool spinning. Not only can we can do more work now but we are also doing it comfortably and much faster!

Also, even since we constructed the PSH this year, our fuel consumption has reduced drastically compared to last year. Instead of spending money on extra fuel we now spend money in getting extra ration, pay the children's school fees etc. However, the biggest benefit of the PSH is really the marked improvement in our general health. This year there were no illnesses at all



among us, whereas the previous years we suffered from cold, joint and back pains and other illnesses.

People who visit us are pleasantly surprised by the warmth in the house and start asking us about PSHs. It makes me very happy to see so many people wanting more to learn more and I really hope more people will build PSH houses. In my experience, PSH is very useful and practical for everyone, but especially so for the poor.



TUNDUP TASHI

*PSH type: Solar wall
House completed in 2009
Village: Sasoma
Age: 50 years old
Occupation: Mason
Family members: wife (48 years old), two sons (26 and 18 years old) one daughter (23 years old) a daughter in law and a grandson*

"...THE ADVANTAGES OF A PSH IN TERMS OF COMFORT AND HEALTH BENEFITS FAR OUTWEIGH THESE INITIAL COSTS."

Earlier we lived in a traditional Ladakhi house built by our forefathers. They were not aware of the relevance of things like orientation, ventilation and insulation. Our house had many tiny windows facing in different directions. As a result of this, even the inside of the house would be freezing cold in the winters. A lot of our time and effort would go in collecting large quantities of wood, dung and other fuel to burn, as this was the only way to heat the house. But no matter how much wood or dung you burnt, the house would be cold again, the moment the fire was put out. In addition, the smoke from the fire would also linger in the house. The cold and smoke meant that all of us were perpetually suffering from illnesses like cold and cough, while the elderly also suffered from intense joint pains.

Despite all these problems, when LNP (Leh Nutrition Project, a Leh-based NGO) suggested we build a passive solar house (PSH), we had our doubts. We were taken on a tour and even visited PSHs in Sakti. I was still unsure if it could keep the house warm but in the end decided to take support from LNP to build a PSH rather than a traditional house.

Now, having lived in a PSH, all my doubts have been removed. We no longer have to spend so much of our time and energy in the tedious task of collecting fuel and firewood for warmth. Also, the house stays warm from sunrise till almost 9 in the night rather than growing cold the moment the fire is put out. More importantly, illnesses like cold, cough and joint pain have reduced considerably after we moved into our PSH house. It also allows us to do our household activities more comfortably, while the children study without complaining of the cold!

Some people did comment on the look of the house but stopped after they experienced the efficiency and

warmth of a PSH. In fact people have asked me for advice on how they can also trap the sun's heat. I tell them about south facing windows and also to build double walls filled with hay or saw dust, which act as insulation to keep the warmth from escaping.

As people experience the benefits of a PSH, mind-sets are changing too. There are many other like me who like it and want to build a PSH but find the cost a little high. I do try to tell them that the initial cost is only marginally higher than a regular house. Also, I share my experience that the advantages of a PSH in terms of comfort and health benefits far outweigh these initial costs. In fact, in the long run the PSH more than even out these costs in terms of time and money saved, which would otherwise be spent in collecting fuel and visiting the doctor.





PADMA ANGMO

PSH type:

Attached Greenhouse

House completed in 2010

Village: Sasoma

Age: 30 years old

Occupation: Farmer

Family members: husband (42 years old) and two daughters (20 and 18 years old)

" THE PSH IS NOT ONLY KEEPING US WARM BUT ALSO HELPING US TO IMPROVE OUR LIVELIHOOD."

I have been living in an Attached Green House for over a year now. This has many benefits especially in terms of warmth, less dependence on fuel and a cleaner atmosphere in the house. Thanks to all this, everyone at home from children to adults do their work comfortably without feeling cold. Often the whole family, including the children, is crowded into the greenhouse doing our work there. In fact, the greenhouse has also provided us with an opportunity to improve our lives. We have set the loom in the greenhouse and now the women make carpets, blankets, traditional Ladakhi gonchas, other knit gloves, sweaters, etc sitting in the greenhouse, while the boys make sacks, coarse blankets and spin wool. Thus, the PSH is not only keeping us warm but also helping us to improve our livelihood. The best part is that it feels very nice to return to a warm house when it is very cold outside.

I really cannot express the many benefits the PSH has brought to our family. Earlier water used to freeze in the house and we had to warm it before use. Now, this is one of the biggest advantages of an Attached Green House. We no longer have to use the stove to heat water for use in the house, at least in the day. We simply leave water out in the greenhouse and by the afternoon it is lukewarm, making household activities like washing dishes and clothes very easy. In fact, the water is warm enough to even have a bath even in winter!

Some people have complained that the view outside is blocked with the plastic sheet used to create the greenhouse. We actually do not mind the plastic sheet and it has never really been a big issue with anyone at home. In fact, the plastic serves to keep dust and wind out of the house. Other people have told me that the house looks ugly with the plastic sheet covering the front. I usually tell them that beauty is not everything and that I am very happy with a PSH as it has many benefits. In fact, now that our neighbours have experienced the efficiency of the PSH, they often come to just sit in our house even if they have no work with us!

