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## Geres: Passive Solar Architecture



### Summary

Bioclimatic architecture seeks to tailor housing to its setting (climate and environment) and the inhabitants' way of life.

It can be used both to build new houses and to renovate older buildings. The aim is to improve energy efficiency by capturing solar energy.

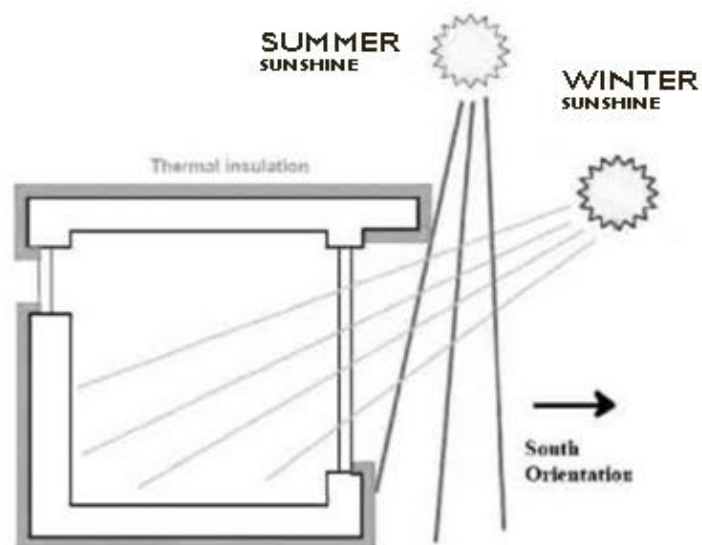


### Objectives:

Lack of financial resources, available materials or know-how means that building quality is often a problem in the Southern countries. In the cold regions of the Himalayas, the thermal insulation of buildings is often inadequate. Heating requires financial outlay and/or time to collect firewood depending on the circumstances. In addition, the energy used for heating can have an impact on the environment when it is sourced from non-renewable biomass. Improving the energy efficiency of buildings and thus reducing fuel needs is an important challenge for Southern countries.

While for rural buildings and homes the issues are different, requiring a tailored approach, the general principles are the same. Bioclimatic architecture seeks to balance housing design and construction with the context (climate and environment) and the inhabitants' patterns of living. It can be adapted to many types of building, both recent constructions and older buildings requiring renovation.

### Methodology:

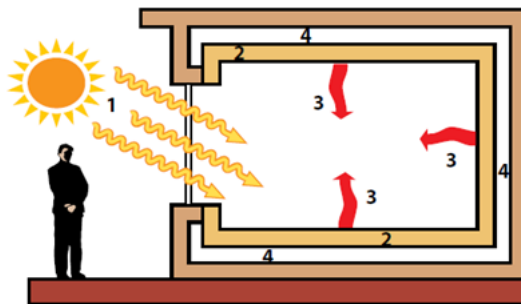


*Importance proper building configuration*

Bioclimatic architecture in cold climates is based on the search for energy saving solutions obtained by maximizing solar heat gains and minimizing heat loss. A number of techniques exist but the general principles remain the same: **capturing solar energy, diffusing and conserving heat.**

Proper configuration of buildings and the addition of south-oriented components optimize heat gain. The south-facing wall has large windows while the north-facing wall has minimal openings. The addition of an 'attached greenhouse' on the south side enables the building to be passively heated. Another system is that of the 'Trombe Wall', in which a double-glazed window fitted in front of a dark-coloured wall increases the amount of energy collected. Heat distribution is achieved by means of 'thermal masses', building components such as floor, wall, covering or partition, which can store daytime heat and release it at night.

**What is a passive solar house?** It is a house built in such a way as to benefit from the sun's energy during the cold season to heat the interior. In bioclimatic architecture, the passive house collects sunshine during the day and releases the heat during the night.



**The blueprints for the houses** in Ladakh must meet several criteria: technical (thermal efficiency); social (respect for local architecture and the owners' personal preferences); and financial (in accord with the target group's investment capacity).

**The materials used** are mostly all locally available at low cost. Depending on the region, the walls may be made of stone, sun-dried brick or adobe, the roof of local wood (poplar and willow for beams and joists) and the floor of beaten earth.

Insulation materials vary according to availability: straw, bushwood, dung, peat, sawdust or wood shavings. When a house is renovated, the work consists in converting the south-facing wall according to the chosen passive solar technology (enlarging the windows; fitting double glazing, a 'Trombe' wall or attached greenhouse) and insulating the roof, floor, walls and any other windows. If a room is added (in the case of an extension or new house), the south wall uses passive solar technology while the roof, floor and other walls are insulated. The insulation is carried out so as to obtain maximum thermal mass, enabling the accumulated heat to be stored and later released.

## Results:

Bioclimatic architecture is particularly appropriate for cold regions. Working on a building's orientation, design and insulation enables the temperature to be raised by 10°C, heating energy needs to be reduced by 50% and, as a result, fuel consumption to be cut by half. Not only does this make users' lives more comfortable but it also improves their health. GERES has carried out a passive solar technology programme in 1000 houses and community buildings (hospitals, schools, etc.) in the Indian Himalayas. This four-year programme ended in December 2012. Thanks to these building techniques, each household saved an annual average of €50, and the length of time children spent in education doubled.

## Sources:

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