

Improving indoor thermal comfort in a residential house in Nepal

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How much does a small layer of insulation and smart use of passive solar heating affect the indoor temperature in a Nepalese one-storey stone house?

This article will present the results of a study on indoor thermal effects of applying energy efficient building techniques on a simple residential house in different climate zones in Nepal. Simple solutions like adding insulation and utilize passive solar heating through windows can significantly rise the indoor temperatures during the cold winter months.

Research within the field of energy efficient building techniques applied on Nepalese houses and conditions are a rare sight. Previous researchers have studied vernacular architecture in the country in aspects of climate-responsive design, but it is hard to find case studies on how material or architectural changes can improve the indoor climate in specific house types and climate zones in the country.

The climate in Nepal varies a lot with the topography, from sub-tropical climate in the south to arctic climate in the high mountains. The main part of the population live in the southern and mid-land regions with sub-tropical, warm temperate and cold temperate climate. The building tradition in the country is very diverse, both when it comes to use of material and building design. Locally available materials and ethnic diversity have formed the great variety in the country's building stock.

When it comes to building materials the most common ones are mud-bonded bricks and stones for walls and foundations. Tile or slate are the most common materials for roofing followed by galvanised sheet and concrete. Modern houses are often built with reinforced concrete-bonded burnt bricks or concrete bricks. All these materials have low thermal resistance which make it hard to get comfortable indoor temperatures in winter in the studied areas.

Ghorepani in the Myagdi District in north-central Nepal was chosen to represent cold temperate climate in the study. The house chosen was a simple one-storey mud-bonded stone house with tile roof, a common house type in the region. Different constructional changes were made to improve the thermal comfort without decreasing the air quality.

When adding 50 mm flax insulation to the outer walls, improving thermal bridges and adding 100 mm flax insulation on the attic, the indoor temperature rose 5 °C the coldest winter day, from 0.8 °C to 5.8 °C. When adding two double glazed windows facing south the indoor temperature rose to 11.1 °C. The real magic happened when a heat source was added along with insulation. Then the temperature was stabilized around 20 °C.

The study aimed to contribute to the knowledge within the field of energy efficient building techniques in Nepal and to give examples on what effects these techniques can have on the indoor temperature in the studied regions in the country. Most of the buildings in Nepal have very low thermal resistance which leads to low indoor temperatures in winter in many regions. Many elders in the cooler parts of the country suffers from bone pain as a result of this.

Today the people in Nepal accept a great variety of indoor temperature but in the future they might want to increase their indoor comfort and then insulation can be of great use. The combination of passive solar heating, insulation and an efficient smokeless stove could radically improve the indoor climate and contribute to the long-term sustainable development in Nepal.