

Energy Performance of Insulation Material in Houses and Buildings

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Abstract

The residential housing sector consumes a significant amount of fossil fuel energy and thereby the sector generates a large percentage of greenhouse gas emissions that contribute to global warming and climate change. At present, approximately 39% of the total household energy used is required for space heating/cooling and a substantial amount of that energy is lost through the house walls. Additionally, the floor space area and volumetric dimension of modern residential houses are increasing at a constant rate in most developed countries including Australia. This additional space also requires energy for heating and cooling. Therefore, the energy consumption for heating and cooling and greenhouse gas emissions will be increasing rapidly. A continuous upward energy consumption trend in residential housing sector worldwide will continue for years to come unless energy efficient and carbon neutral house wall systems are developed. One of the biggest challenges is to develop a smart house wall system made of thermal mass and insulation materials that can provide reduced energy needs for on-going heating and cooling with lower carbon footprint as most house wall construction materials are very energy intensive and have large carbon footprints. In order to develop a new energy smart house wall system, a study has been undertaken on thermal performance of two house wall systems (one is currently used conventional brick veneer house wall and other is an alternative house wall). The thermal performance (heat gain or loss through the wall) has been determined using computational modelling and experimental measurements. The economic analysis of both house wall systems has also been carried out. The effects of various climate conditions on these two house wall systems have also been determined. The findings indicate that the new house wall system provides better thermal efficiency than that of currently used conventional house wall.

Key Words

House wall system, thermal performance, energy efficiency, thermal mass, insulation material