Improving Thermal Efficiency and Environmental Sustainability of Building Insulation

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With an increasing consumer demand for environmentally friendly building products and materials, sustainability is becoming a paramount concern to key stakeholders in the construction industry. Additionally, insulation materials used in homes and commercial buildings play a primary role in their overall energy efficiency, and the production and disposal of the voluminous amount of foam or wool commonly utilized as insulation poses a significant environmental challenge. In this context, this study investigated an alternative insulation for use in residential and commercial buildings. A prototype exploring the use of evacuated packets of a silica compound substituting for conventional insulation was assessed. Assessment criteria included experimental comparison of heat transfer characteristics, as compared to a control facility. Additionally, a comprehensive environmental life cycle assessment was performed. Pilot study results indicate that in the new insulation design applied to the unit, heat flux decreased by an average of 3%. The new insulation design also improved environmental sustainability, resulting in a savings of 1.2 metric tons of CO_2e over 20 years per 100 sq. ft. of insulation replaced. Results provide an alternative insulation design for use in construction, and a framework by which to assess the efficiency and environmental performance of sustainable building products.