Improving Thermal Efficiency and Environmental Sustainability of Building Insulation

Celine F. Manoosingh, Ph.D.
Georgia Southern University
Statesboro, GA

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$_2$e 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.