**ABSTRACT**

The need for renewable energy resources and systems has been a global goal for good reason. Throughout the past few decades, research has shown that the building materials used for our infrastructure not only have residual damaging effects on the environment but also represent an inefficient use of energy. The world’s abundant energy dependence is evermore increasing, and fossil fuels nor conventional construction strategies will address waste concerns. The construction industry has been slow to incorporate energy-efficient building techniques due to the conception of high economic investment. The installation of products within the building envelope during the construction process impacts the overall performance and durability of a building. However, when the building construction industry fails to address installation quality, energy consumption increases substantially over time. Improper installation of a product can lead to major deviations in performance that can increase maintenance costs over the product's lifetime, in addition to adverse effects on the product during its normal life cycle. Labor sensitivity is an underrepresented aspect of building construction that contributes to the problem of energy inefficiency.

There has been an evolving culture surrounding our buildings and environmental consciousness. The demand for sustainably built facilities with low environmental impact is increasing due to the rising cost of energy and environmental concerns. The generational shift in building styles includes overall educational awareness and rapid demand for healthy indoor environments. Building regulations such as Leadership in Energy and Environmental Design (LEED) in the USA and European Buildings Directive in Europe have been instituted over the last decade to address such energy concerns. In this research, building construction labor, material, and O&P costs were analyzed for the optimal choice of long-term benefits of cost and performance.

A methodology was developed to analyze operational costs and building energy performance to address how installation quality is a factor in the return on investment in building construction for insulation systems of single-family residential homes. Building procurement strategies and life cycle cost analyses are presented to investigate the further impact of sustainable designs in the beginning stages of residential building projects, in addition to energy analyses of single-family homes in mixed hot-humid climate zones.