

## ABSTRACT

The existing building stock has been identified as one of the major contributors to both global energy consumption and environmental damage. The main focus of this research was to examine the benefits of renovating educational facilities with the concept of Passivhaus. It will also determine the value of applying Passivhaus principals and its components in renovating existing school facilities. Retrofits that have been completed to the Passivhaus standard across Europe have already demonstrated a very high level of energy performance, however in Ireland few Passive House retrofits exist to date; and for this reason, design and cost information for such retrofits is lacking. Before elaborating on the refurbishment potential, an investigation is carried out on relevant good practice examples of recently refurbished educational buildings to Passivhaus standard, the results of which are used to develop a set of best practice guidelines. It was also decided that an evaluation on the impact of such a refurbishment must be carried out, thus a model school building built in 1979 was selected and used as a demonstration; this was then followed by the carrying out of a detailed survey and energy audit. The information acquired from this audit was then used in a building energy simulation which allowed for the calculation of the heating demand with the aim of meeting the Passivhaus requirements for retrofit. Finally a life cycle costing analysis was carried out which aimed to demonstrate the benefits of this type of retrofit from a financial perspective. The end findings of this research show that one of the most important and most successful methods in any retrofit is the improvement of the thermal envelope, however in doing so one must carefully consider the impact of thermal bridges.

The final conclusions would suggest that the building at its current state is very wasteful in its use of energy and, thus, huge potential lies in a refurbishment to Passivhaus standard. This design approach could be a catalyst for reducing running costs and lowering the carbon footprints of schools buildings, but above all will create a better learning environment for students and also improved working conditions for teachers.

**Keywords:** Passive House Standard, Energy Efficient Retrofitting, Energy Saving potential, reduced running costs, improved thermal comfort.