

Methodological Approach for Historical Building Retrofit Based on Energy and Cost Analysis in the Different Climatic Zones

Authors : Selin Guleroglu, Ilker Kahraman, E. Selahattin Umdu

Abstract : In today's world, the building sector has a significant impact on primary energy consumption and CO₂ emissions. While new buildings must have high energy performance as indicated by the Energy Performance Directive in Buildings (EPBD), published by the European Union (EU), the energy performance of the existing buildings must also be enhanced with cost-efficient methods. Turkey has a high historical building density similar to south European countries, and the high energy consumption is the main contributor in the energy consumption of Turkey, which is rather higher than European counterparts. Historic buildings spread around Turkey for four main climate zones covering very similar climate characteristics to both the north and south European countries. The case study building is determined as the most common building type in Turkey. This study aims to investigate energy retrofit measures covering but not limited to passive and active measures to improve the energy performance of the historical buildings located in different climatic zones within the limits of preservation of the historical value of the building as a crucial constraint. Passive measures include wall, window, and roof construction elements, and active measures HVAC systems in retrofit scenarios. The proposed methodology can help to reach up to 30% energy saving based on primary energy consumption. DesignBuilder, an energy simulation tool, is used to determine the energy performance of buildings with suggested retrofit measures, and the Net Present Value (NPV) method is used for cost analysis of them. Finally, the most efficient energy retrofit measures for all buildings are determined by analyzing primary energy consumption and the cost performance of them. Results show that heat insulation, glazing type, and HVAC system has an important role in energy saving. Also, it found that these parameters have a different positive or negative effect on building energy consumption in different climate zones. For instance, low e glazing has a positive impact on the energy performance of the building in the first zone, while it has a negative effect on the building in the forth zone. Another important result is applying heat insulation has minimum impact on building energy performance compared to other zones.

Keywords : energy performance, climatic zones, historic building, energy retrofit measures, NPV

Conference Title : ICEEB 2020 : International Conference on Energy Efficiency in Buildings

Conference Location : Vienna, Austria

Conference Dates : June 18-19, 2020