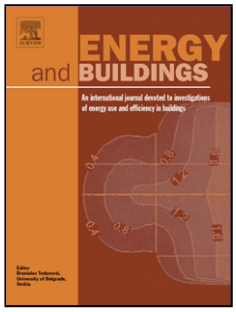

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BUILDINGS ENERGY USE AND HUMAN THERMAL COMFORT ACCORDING TO ENERGY AND EXERGY APPROACH

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Introduction

Residential sector in Ukraine consumes about 30% of total final energy use [1]. There is a problem of low efficiency in energy use for heating and adequate indoor climate in housing stock compared to many European countries. Therefore, requirements for energy efficiency and, at the same time, ensuring adequate indoor climate are increasing due to Ukrainian standards adaptation to European norms. In this case, a compromise between buildings energy use reduction and high indoor air quality provision is important. Using new concepts for the Ukrainian standards, such as energy need for heating, delivered energy, energy use and primary energy according to [2], requires changing the borders of the building system, including utility systems and heat source.

Basic principles of system analysis of building energy efficiency are set out in papers [3, 4]. Building analysis as part of the energy system is necessary at design and operation stage. In this case, exergy analysis, along with energy analysis, is a powerful tool for comparison of different energy sources quality in terms of ensuring adequate indoor climate. This analysis is used to compare different energy-converting systems in buildings and for the design and operation of buildings with low exergy consumption. The paper [5] proposes to consider the building as a “black box” that consumes exergy in order to determine the thermodynamic relations of building with the environment, incoming flows, exergy losses and especially exergy destruction. The authors of paper [6] compare energy and exergy losses in the chain “power plant - heat pump - room air - building envelope” and present exergy approach to the human body comfort. Exergy flow from the heat source to building envelope is analyzed in the paper [7] based on the hourly change of ambient temperature. Over the last years, modern and advanced exergetic analysis is developed [8]. Modern exergetic analysis