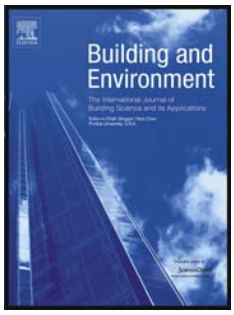
Accepted Manuscript



Materials composition or energy characteristic – what is more important in environmental life cycle of buildings?

Grzegorz Pajchrowski, Andrzej Noskowiak, Anna Lewandowska, Wladyslaw Strykowski

PII: S0360-1323(13)00303-X

DOI: 10.1016/j.buildenv.2013.10.012

Reference: BAE 3540

To appear in: *Building and Environment*

Received Date: 12 July 2013

Revised Date: 18 October 2013

Accepted Date: 19 October 2013

Please cite this article as: Pajchrowski G, Noskowiak A, Lewandowska A, Strykowski W, Materials composition or energy characteristic – what is more important in environmental life cycle of buildings?, *Building and Environment* (2013), doi: 10.1016/j.buildenv.2013.10.012.

MATERIALS COMPOSITION OR ENERGY CHARACTERISTIC – WHAT IS MORE IMPORTANT IN ENVIRONMENTAL LIFE CYCLE OF BUILDINGS?

Grzegorz Pajchrowski[a], Andrzej Noskowiak[a], Anna Lewandowska[b], Wladyslaw Strykowski[a]

Corresponding author: Grzegorz Pajchrowski**, e-mail:** g_pajchrowski@itd.poznan.pl, **tel.:** +48618492412

[a] Wood Technology Institute; ul. Winiarska 1; 60-654 Poznan, Poland
[b] Faculty of Commodity Science; Poznan University of Economics; al. Niepodleglosci 10, 61-875 Poznan, Poland

ABSTRACT
The energy requirement of buildings is directly related to the technology of their construction and the type and amount of used building materials. The higher the cost of purchasing materials, especially insulation materials is, the lower the expected costs of use are, which is connected with lower energy losses. The dilemma between the increased building costs and the higher costs of use is rather common, and the investors usually make their decisions based on the economic criteria. However, in the era of sustainable building and a tendency of introducing environmental factors into the decision making processes, the environmental costs related to the individual decision making scenarios have become a more frequent additional criterion accompanying the process of resolving of such a dilemma. Within the scope of this article, the results of a comparative environmental Life Cycle Assessment (LCA) of four functionally equivalent buildings with different material structure, construction technology and energy standards have been presented. The main goal of the analyses has been providing the answer to the question, what is the key element, from the environmental point of view, in the life cycle of buildings and is it a common element regardless of the technology of construction and the energy standards.

KEYWORDS
buildings, building material, life cycle, environmental impact

1. LCA IN THE BUILDING INDUSTRY
From the point of view of the methodology of environmental Life Cycle Assessment *LCA*) [1-2], buildings constitute very specific objects of studies, which makes it more difficult to perform LCA analyses for them than in the case of the majority of consumer products. Considering the perspective of a full life cycle and the necessity of taking into account the effects occurring at individual stages, constructions are characterised by:

- long periods of use;
- multi-functionality;
- high structure and material complexity;
- uniqueness;
- considerable local character;
- diversity of interested parties.

In the case of LCA studies within the scope of the broadly defined building industry, the object of studies can be examined on two levels: the type of construction and the scope of construction.
In the first case, LCA studies of various structures are addressed, which according to the Polish Classification of Types of Constructions may include [3-6]:

- **buildings**: residential and non-residential;
- **civil and water engineering objects**: transport infrastructure; pipelines, telecommunications and power lines; complex constructions in industrial areas and other civil and water engineering objects.

Even though there quite numerous examples of using LCA in the case of buildings (especially residential) can be found [7-13], the analyses of the other types of constructions are much less frequent [6,14-16]. If we consider the scope of construction subjected to analysis, the literature [4,6,17-18] concerning methodological LCA solutions in the building industry, includes not identical but at least