

ECOLOGICAL MATERIALS FOR SUSTAINABLE BUILDINGS

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Abstract: *Ecological buildings are an important market of the future, fuelled by the need to protect the environment, as well as to improve the quality of life. Human society needs responsible builders who are able to realize constructions with lower impact on the environment, by using sustainable materials, low energy consumption products that are not harmful to human health and the surroundings throughout their whole life.*

Key words: *ecological materials, sustainable buildings, green house, energy efficiency.*

1. Introduction

The concept of sustainable development of human society appeared (in the 9th decade of the twentieth century) as a strategic solution needed for economic development, taking into account the environment and the ecological limits of the planet's limited resources.

Sustainability has come to represent a vital and urgent issue of contemporary society when climate change became apparent, as well as reduction of natural resources. Global warming is now recognized by the governments of industrialized countries. There is also an international structure to tackle emissions of greenhouse gases, represented by the Kyoto Protocol. The agreement is expected to reduce emissions by 5.2 % for industrialized countries during 2008-2012, compared with those in 1990.

The buildings sector is one of the great energy consumer (40 % of final energy consumption) and is responsible for a

significant amount of CO₂ (36 % from all CO₂ emissions), as shown in the accompanying impact assessment document to the proposal for directive on Energy Efficiency in Buildings, prepared by the European Commission – Impact Assessment Summary SEC/2008/2865, [1].

Potential to reduce these emissions is very high, particularly through measures to increase energy efficiency and renewable energy production.

Investment costs associated with these measures are to be returned in the future by saving energy from conventional sources. It is estimated that the price of energy is growing and subsidy measures in place to reduce costs to citizens are not sustainable.

The main considerations necessary to implement green buildings are:

- The need to maintain a clean and life efficient environment by:
 - An efficient exploitation of water resources and raw materials;
 - Proper management of waste through recycling the reusable;

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- Using renewable energy sources, unconventional and clean, instead of fossil fuels, generating CO₂, directly involved in producing global warming;

- Replacing synthetic building materials, generating toxic volatile organic compounds (VOC) with natural materials, friendly to humans and the environment;

- Reduce maintenance costs by making energy efficient buildings, with low energy consumption and clean;

- A price decrease of green buildings construction market by increasing demand and the number of organic materials producers;

- Allocation by the European Union through environmental programs, the structural funds, significant for infrastructure improvements;

Supporting measures taken by the authorities in order to encourage the development of green buildings will have immediately visible effects, such as:

- Reducing dependence on fossil fuels through energy efficiency measures and encouraging the production of renewable energy;

- Using local building materials;

- Reducing production of construction waste by encouraging their reuse and recycling in buildings, which stimulates local economy;

Immediate benefits for citizens will be in decreased energy bills, creating new economic opportunities and jobs, increasing the comfort at homes and offices, as well as living standards, [2], [7], [8], [9].

2. Design Principles of Sustainable House

Each building or building component must meet a set of technical requirements or main economic and technical demands related to durability, structural robustness, fire resistance, strength and stability of construction, physical and hygienic

conditions, architectural, economic, organizational, etc.

An ecological house is an intelligent one, which does not present any kind of energy loss because it is very well insulated and everything is recyclable (even the toilet water comes from rain water). Even the materials from which it is made can be recovered (for example it can be built from pressed soil).

A green home should be a healthy home.

World Health Organization estimates that 20 % of the population of developed countries is affected by Sick Building Syndrome (headaches, nausea, rashes, etc.), determined by the low quality of construction materials and proposed natural materials and eco-sustainable ones for use in new constructions, [3].

A house can be considered organic if partially or fully comply the following criteria:

- Be in harmony with the environment;
- House orientation and arrangement of rooms to be made logically;
- Use materials that do not pollute the environment (do not emit toxic substances) in all phases of the life cycle: manufacturing, transportation, installation, demolition;
- Appropriate technological design;
- Maintenance consume as little energy;
- Uses unconventional energy: solar, wind, heat pumps.

Buildings with house or office destination are the biggest energy consumer worldwide. Therefore the design of buildings which can self-sustain from the energetically point of view, at least partially, is crucial.

Therefore special attention should be paid to ways of reducing energy losses:

- Optimal solution for thermal insulation;
- Improving water and gas distribution systems;

Regarding self-sustaining, there must be chosen ways to use locally available

resources to generate energy through alternative means, in all forms: solar, wind, geothermal, etc.

Measures should be taken to reduce the impact of long-term pollutant dwellings: they are producing pollution and waste. It is very important to take into account these issues and to implement effect mitigation plans by providing a functional system of separate waste collection by eliminating polluting ways of energy production (wood stoves for example), etc.

Each component of a green building can be characterized by several elements such as natural lighting, passive design, efficient and well-dimensioned heating, ventilation and cooling systems or the possibility to choose alternative energy.

3. Ecological Materials for Green Houses

Building materials industry has widely developed during the last century, replacing natural materials and solutions with others, which presents in their composition amounts of increasingly higher chemical synthesis substances. These substances not only decrease the quality of life in these homes, but in time affect our health.

Today buildings are high energy consumers during their life cycle, which means consequently a high production of greenhouse gas (CO₂).

Reducing energy consumption and decreasing CO₂ production can be achieved in several ways, such as:

- Use of materials that require minimal processing with low power consumption, traditional solutions is often the most effective;
- Ensuring high quality materials, thus ensuring longevity of the building and reducing maintenance costs;
- Economical use of materials, recycling completely if possible, reuse and reduction of waste.

Eco-design philosophy consists to reduce

the negative environmental impact throughout the product life cycle (finished fabric) through better design it, [4].

A green home should have a bio-climatic architecture, which saves energy and benefit the most from solar input, using non-polluting and recyclable materials.

The main environmental effects, in terms of eco-design are reflected in the decrease of the negative phenomena such as diminution of raw materials, high energy consumption and water, the effect of global warming, ozone depletion, [5].

Resources, materials and energy consumption are important factors for the choice of proper materials, in order to reduce their environmental impact.

There is a wide range of ecological materials used for building sustainable homes, among them are:

- Ecological brick, tile (bricks and terracotta handmade items);
- *Soil blocks* (made in wooden molds, being “armed” with dried vegetable aggregates). These materials presents excellent technical characteristics for healthy homes, are inalterable, resistant to water, fire, frost, with good thermal inertia, provides good sound absorption, acts as a hydrometric regulator and improves indoor air quality due to natural porosity.
- *Expanded clay* (in the form of balls of clay) is used for fitting green spaces, insulation, drainage, light concrete. Also, protects against moisture and acts as a sound and heat insulation along with fireproof properties;
- *Terracotta floor tiles* (one of the oldest building materials) can be executed in warm colors, natural regulates humidity and provides better air;
- *Solid wood structures* consists from treated wood which have standard sections and can be in various selection of which the entire structure of the house or its roof structure is made.
- *Wooden coverings* (at traditional houses)

are made of shingles and have the following qualities: light, waterproof, breathable, thermal and phonic insulated, absorb vapor. Application: roof structure covering (or exterior wall claddings).

• *Plant coverings* made of straw having following properties: low weight, sound and heat sealed to air currents, weather resistant. Composition: rye straw, wheat, reed, etc. Application: roofs. These construction materials, easy to obtain (raw material: clay, plant materials) do not require additional energy consumption, technologies are simple, old, known, verified and easy to use, [6], [10], [11].

4. Opportunities for Developing “Green Buildings” in Romania

European legislation includes a set of directives aiming to accelerate the implementation of sustainable development principles and standards in all areas, especially in the construction field, responsible for approx. 40 % of total energy consumption, both globally and in the EU.

In order to achieve the targets from the directives, UE States, including Romania, are required to apply technical and financial measures for:

- Encouraging the use in buildings (new and going through major renovation processes) high efficiency alternative systems such as decentralized energy supply systems based on renewable energy, cogeneration, heating/cooling systems at district or neighborhood level, heat pumps, software equipment for monitoring and control;

- To draw up national action plans with measures to encourage the development of energy efficient buildings to reduce

existing legal and market barriers.

According to experts, our country will recover a significant gap in terms of the ability to build healthy environment, in the available ecological materials, the preparation and execution of the directive on energy efficiency in buildings.

5. Conclusion

“We still cannot say that in Romania green architecture has become a trend. But there is an aspiration on which we hope to arrive soon”, says architect Marius Voica, from Arheco Design. Currently, in our country, there are officially seven projects ecologically developed and informal could be at least twice as many. There are also many smaller projects for green houses and small hotels. Recovering lost ground is only a matter of time.

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