ANALYSIS OF BUILDINGS WITH REDUCED ENERGY CONSUMPTION

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Abstract: *The energy requirement level for buildings whose energy consumption from conventional sources is almost equal to zero, including that provided from renewable sources, is established by technical regulations, differentiated by areas with energy potential from renewable sources, and is periodically updated, in depending on technical progress. The results of the implementation of the thermal insulation measures, of the already existing buildings, lead to the unconditional conservation of the thermal energy of the buildings, as well as to the actual renovation or construction of a new architectural aspect.*

Keywords: *Building envelope, heat flows, thermal transfer, thermal conduction, convection thermal, thermal radiation*.

1. Introduction

We distinguish several types of building concepts that require energy performance increased, of which the most current trends are oriented towards:

- Buildings with zero energy consumption.
- "Green" buildings.

2. Methodology

Buildings with zero energy consumption.

In modern literature we encounter the concept of "Zero energy building", which is described by a series of mathematical expressions, and characterized from several points of view. [7].

The concept of "nearly zero energy building" has gained a lot of attention in recent years and is now seen as an important factor to consider in the realization of new buildings. Also, the concept of "nearly zero energy building" comes from the English language, being known in different forms: "zero net energy (ZNE) building", "net-zero energy building (nZEB)" or "net zero building" and it is a building with zero energy consumption and zero carbon emissions per year.

The most important aspects of near-zero energy buildings that must considered are:

- Definition of energy balance. The unit of measure applied for "zero energy balance" can be influenced by a number of factors; therefore, several factors can be used in defining the calculation methodology. For example: primary energy, equivalent CO2 emission, energy, cost of energy or other parameters defined by national energy standards.
- Energy balance period. The period of time in which the calculation of the building is carried out can vary greatly. It can be a complete cycle of a building's durability or a building's operating life (50 years).

- The type of energy used included in the balance.
- The type of energy in the energy balance.
- Renewable energy sources accepted. Power supplies may be available at the front place (wind, sun), or requires transport to the place (biomass).
- The connection with the energy infrastructure and thermal efficiency requirements.

The concept is widely debated by researchers at the international level starting from 2008. Among the countries participating in the development of the research program "Solar buildings with consumption of almost zero energy" are the following: Australia, Austria, Canada, Denmark, Finland, France, Portugal, Germany, Italy, Korea, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, Great Britain and the United States of America , each country having specific activities to ful fill certain requirements of the project.

Among the most famous constructions certified as buildings with zero energy consumption are the following:

- Environmental Technology Center at Sonoma State University, United States of America: Figure 1.

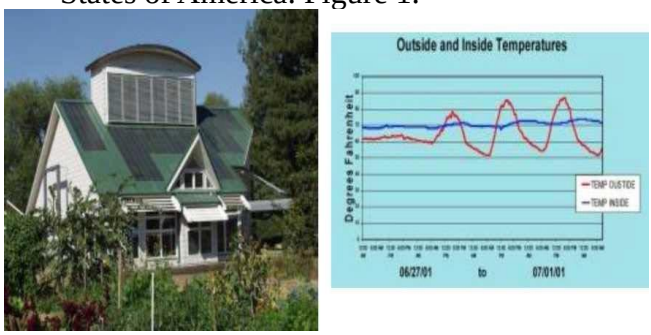

Figure 1. *Environmental Technology Center at Sonoma State University, USA*

The Environmental Technology Center (CTM) is a building of approx. 204 square meters that houses classrooms and laboratories made with the help of the National Science Foundation, the California Energy Commission for the purpose of developing a sustainable construction. The architecture of the Environmental Technology Center was thus designed to use 80% less energy than buildings made according to the Californian Title 24 standard.

- Gateway Energy Center in Hawaii: Figure 2.

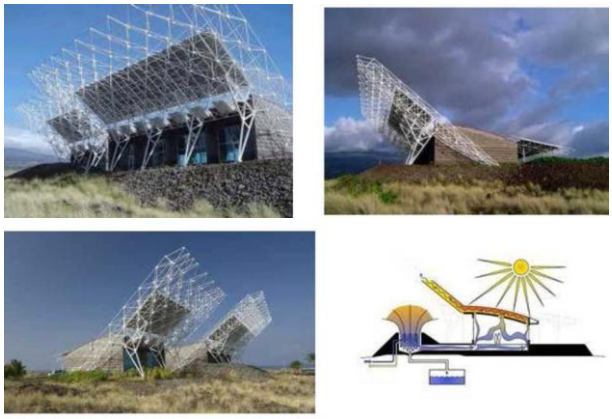

Figure 2. *Gateway Energy Center in Hawaii (ENERGY, 2008)*

- Isolated or semi-detached house "Soleta zeroenergy ONE", from Ploiesti, Romania: Figure 3.

Figure 3. *Zeroenergy ONE insole (Construction21.eu, 2012)*

The systems used for energy production and storage:

- heating system: heat pump, geothermal heat pump, underfloor heating at low temperature, fan convector, solar thermal;
- hot water: heat pump, thermal solar panel, other hot water preparation systems housekeepers;
- cooling system: VRV (Variable Refringent Volume) systems;
- ventilation system: free cooling;
- renewable energy conversion systems: photovoltaic solar panel, thermal solar panel, wood boiler, groundwater groundwater pumps, deep well geothermal pumps, solar absorption cooler, micro wind power plants;

According to the energy performance certificate, the building consumes specific annual energy of 124.62 [kWh/m year] and the CO2 equivalent emission index of 69.98 [kgCO2/ m2 year].

3. Results and discussion

"Green" buildings.

Green buildings-Eco-buildings or sustainable buildings are buildings that refer to a structure built and used in a responsible way towards the environment, throughout their life cycle, starting from the design, construction, operation phase , maintenance, renovation and modeling.

Besides being energy efficient, these houses fit into the landscape, have shapes inspired by nature, are built from ecological materials and use renewable energy sources (solar energy - solar panels, geothermal energy or wind energy).

An ecological house does not mean only a wooden house or a passive house. Although their definitions are similar, there are many differences. First of all, an ecological house is a house that does not show significant thermal losses, because it is very well insulated. Then almost everything is recyclable (toilet water comes from rainwater), including the materials from which it is made, which can be recycled [6].

The realization of green buildings has become a very well-known practice at the international level, developing legislative measures, standards and certifications specific to each country.

One of the most important objectives is to design green buildings with the aim of reducing the impact on the environment and on human health. The fulfillment of this objective is achieved by applying some strategies:

- efficient use of energy, natural resources and water;
- building office buildings that have a low impact on the health of the company's employees who use them;
- reducing waste, pollution and environmental destruction;

To create a green building, we must consider the following aspects:

- Insulation of external walls using natural materials (for example: wool - natural, renewable material that does not cause side effects to human health, biodegradable; cellulose fibers or insulation with plants (hemp, cotton);
- The windows should have a high thermal insulation for the substantial reduction of the energy consumption of the house. The recommended materials for making them are laminated wood and glass.
- The use of solar panels to ensure the thermal energy needed for the home. In practice, combustion with the release of CO2 is eliminated , which substantially reduces the thermal energy bill, going all the way to energy autonomy
- Use of green roofs. Green roofs are roofs with vegetation, especially different types of grasses, small bushes or even shrubs. Green roofs can make a big difference to a city's environment. They keep the air cooler, absorb CO2 and give buildings a pleasant and natural appearance. Also, the climate in the buildings is much improved, the roof absorbing much less heat.

The use of temperature conversion cooling systems reduce energy consumption by up to 90%. Temperature converters cool the air while also providing a freshening of the air in the house. The new insulating carpentry systems greatly reduce the ventilation of the building.

The use of natural materials for flooring can substantially improve the standard of living in the home as well as the environment. Bamboo bundle is a highly renewable resource. The use of biodegradable washable paints, which can eliminate uncontrolled emissions of substances harmful to health. There are already plant-based paints on the market. There are also paints that function as thermal insulators [3].

Buildings that have been classified as energy certified green buildings with a higher class, is the Residential Complex building,

Luceafȳrul Figure 4 and the Multinvest Business Center building, Figure 4.

Figura 4. *Ansamblul Rezidenţial, Luceafărul, Oradea, România.*

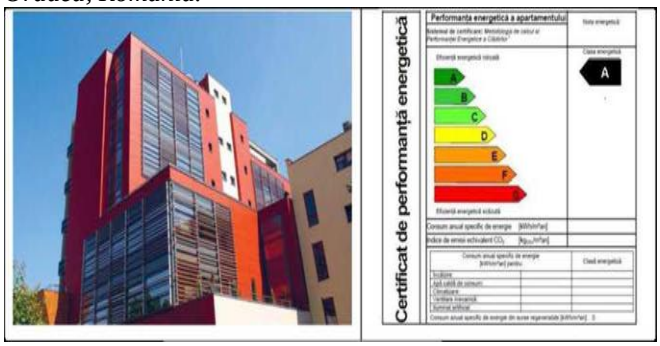

Figura 5. *Multinvest Business Center, Târgu Mureș, România.*

4. Conclusion

Both at the national level and at the level of the member countries of the European Union, more and more emphasis is placed on the most efficient use of energy in buildings. It is well known that the building sector is responsible for 40% of final energy consumption. Considering this aspect, energy efficiency spending should be seen rather as an investment that can lead to the revitalization of the construction sector and, in the long term, to a decrease in consumption and, implicitly, energy costs.

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