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Standards Energy – Efficiency Houses Types

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Abstract

The importance of research on energy efficiency is making maximum efforts to reduce energy consumption, minimal emissions of greenhouse gases and improving the quality of life. Presenting the benefits of adopting the principles of energy eficiency in construction, is very important. This work should contribute to solution of environmental pollution problem and the measures implemented to achieve stability in maintaining stable ecosystems. The theme of this work is the energy efficiency in the construction sector and standards for low energy buildings. Sustainable development in the construction, tends to achieve optimization in reduction of energy consumption and to minimize harmful effects on the environment, taking into account costs and benefits during construction as well as during the life cycle of the facility.

Keywords: energy efficiency, energy consumption, sustainable development

1. Energy efficiency in construction sector

Energy efficiency of building become an important factor that provides a competitive advantage in the real estate market. The facility must have annual energy consumption atest based on the prescribed and realized values of the thermal protection of the building, energy spent on heating and other needs depending on the purpose. An important energy parameter is the shape and orientation of an object that determines its measure of exposure to external climatic influences (temperature, wind, moisture, solar radiation).

Appropriate position of the object, shape and orientation can affect the energy efficiency of the building. Selection of materials to be applied during construction, installation of certain heating systems, as well as hot water production methods, careful planning of ventilation, air conditioning, lighting installation and greater use of daylight, including the use of waste heat and renewable energy are determinating energy efficiency of building.

Reducing the consumption of fossil fuels due to energy efficiency measures and the use of renewable energy sources should result in the reduction of emissions of harmful gases, thatcontributes to environmental protection, as it leads to a reduction of global warming and all the consequences it brings..

Energy efficient building means using planning, design and constructions that lead to a reduction energy consumption in building, using and maintaining an object.Improving energy efficiency in the building sector implies a number of activities that are aimed at reducing the consumption of all types of energy with the same or better conditions for staying in the facility(Demin J., 2013).

Contribution of the construction sector in reduction of energy consumption and thus the sustainable development of a community can be achieved by adopting the principles of green construction, building energy-efficient buildings as well as improving the energy efficiency of buildings that were built earlier and fail to meet the criteria of energy efficiency. Energy characteristics of buildings must be adapted to the climate on which they are located (Demin J., 2013)

In total amouth of world energy consumption, construction sector spends 40%, meaning that the emission of harmful substances into the atmosphere mostly comes from this economic area. This study was done by WBCSD - World Business Council for Sustainable Development and it came to the conclusion that the biggest savings in energy consumption can be implemented in construction.

According to the latest map of the International Energy Agency (IEA), "IEA Technology Roadmap Energy Efficient Building Envelopes 2013", published December 18, external insulation of building is very important in energy efficiency.As one of the key priorities, transformation of existing buildings coversfor"deep

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renovation". This concept represents a reduction in energy consumption by 75%, it limitsenergy spending for the heating, air conditioning, ventilation, hot water and lighting at 60 kWh / m^2 (according to the "Global Buildings Performance Network - GBPN", 2013).

2. Green building standards

Some countries have introduced standards that serve to assess the environmental performance of the building with appropriate labels, certificates and ratings, and this represents a credible assessment of the energy and environmental class of the building.In this way, energy efficiency can start to affect real estate prices, and hence the way of thinking architects, builders, investors and buyers themselves. (Demin J., 2013)

Among the many green building standards, LEED (Leadership in Energy and Environmental Design) is the most prevalent on the ground in the United States, then BREEAM, the standard introduced in Great Britain in 1990, HQE applied mostly in France and the DGNB in Germany.

LEED standardsare applied to produce the "greenest and best buildings in the world", giving directors for achieving green construction. Points are gained in different categories, from energy efficiency assessment (maximum up to 17 points), efficiency of water use (up to five points), housing in accordance with maximum environmental protection (up to 15 points); the total number of points ranks the building and determines its LEED rating. Additional points can be earned by installing special systems such as a renewable energy generator or a carbon dioxide emission measurement system.

It takes at least 39 points to get the building a "golden" rating; 52 points earn "Platinum" rating. The gold rating in the building assessment practically means that the harmful impact on the environment has been reduced by 50% compared to the equivalent in conventional construction, and the platinum rating means reducing the environmental impact of over 70%.

(USGBC i LEED sertifikacija zgrada, 2010).

BREEAM - Building Research Establishment Environmental Assessment Method

The fundamental part of the entire scoring system lies in harmony with the principles of sustainable development measuring the set of environmental influences of an object. With BREEAM standards, these impacts are divided into nine segments, which were created as a combination of the consensus criteria according to the opinion of the expert team. The criteria for assessing objects are divided into nine categories: energy, management, user health, water, materials, waste, pollution, landscape aspect and ecology, transport.(Uzelac M. F., 2012).

HQE- High Quality Environmental

In 1996, High Quality Environmental Association created the HQE Sustainable Building Certification Scheme, approved by the Green Building Council of France. The HQE certification scheme consists of five basic principles: a comprehensive approach, adaptability, best performance, technical expertise and business transparency. (Asharee A., 2017).

This certification is based on fourteen criteria with the ultimate goal of controlling the impact of buildings on the environment while creating a pleasant environment for living in these facilities. From the first interventions on land to the demolition or renovation of the facility, care must be taken to prevent pollution of water resources due to sedimentation and soil erosion, as well as the disturbance of local ecosystems, due to poor characteristics of materials and constructions that promote overheating and CO2 emissions(Asharee A., 2017).

DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen)

The German Sustainable Building Council was established in 2007. as a non-profit non-governmental organization and gathers over a thousand members from the construction and real estate sector, industry and manufacturing, management and public enterprises, non-governmental organizations, science and testing institutions (http://www.knaufinsulation.rs/sr/dgnb-standard). Economic qualitiesare costs associated with the life cycle of a building and sustainability towards a third person. Socio-cultural and functional qualities deal with topics related to thermal comfort in the summer and winter period, interior hygiene, acoustic comfort,

visual comfort, the ability to control the conditions for each user, the quality of the outer space, the safety and the risks of dangerous incidents, accessibility for people with disability, space efficiency, ability to convert object functions, types of public access to object, the possibility of cycling, design and urban development in relation to competition, the quality of positive contributions for different user profiles, social integration (Asharee A., 2017).

3. Energy-efficiency houses types

In order to achieve sustainability in building, heat losses must be reduced, and heat gain increased. These conditions include the obligatory use of renewable energy sources, as well as the maximal increase in the energy efficiency of thermal power systems. In order for an object to be considered energy efficient, it must consume a minimum amount of energy while complying with all comfort conditions.

If we want to give an assessment of the energy efficiency of an object, we must evaluate the quality of its thermal cover, or the surface through which energy is exchanged between the external and internal environment of that building. This thermal coating has its place in determining the amount of energy needed to maintain heat inside the building. This envelope consists of floor, roof, walls, windows and doors of the building. Therefore, in modern design and construction, good insulation of these elements is necessary.

The most important goal of building energy-efficient buildings is to achieve comfort with minimal energy consumption (Harris A., et al. 2005). By energy efficiency, the facilities can be divided into:

1. **"Ordinary" house** that require an average of 80 to 100 kWh/ m^2/ year energy for heating. Such house for heating will consume approximately 9 liters/m^2 of oil well, 9 m^3/m^2 of natural gas or 18 kg/m^2 of wooden pellets(Pavić N., 2013).
2. **Low-energy buildings** - a standard house has no global definition due to different national standards, which means that one and the same facility some of the states can be considered low-energy and on the other not. These houses have good thermal insulation,also walls and roof, high insolation level, so solar collectors can be equipped as well as energy-efficient carpentry, thus reducing the amount of energy needed for heating and cooling. In these facilities, heat recycling technologies can be installed from water that is used for showering or washing(Pavić N., 2013).
3. **"Three-liter houses"** are primary class of a low-energy houses, with an annual need for heating of 30kw/ ^{2}. Such a house will spend for heating about 3 liters / $m^2$for year in oil, 3 m^3/m^2 of natural gas or 6 kg/ m^2 of wooden pellets. Reduction of thermal losses of such a low-energy house can be achieved in the following ways:

- Proper orientation of the house towards the south side,
- the formation and separation of the thermal zone of the house (living room to the south),
- compact construction (material selection and proper installation),
- special attention to the choice of thermal insulation of the complete facility,
- good choice of construction and materialization of doors and windows (eg with 3-layer glass),
- low temperature heating composition,
- controlled ventilation of rooms with recuperation, with quality guidance and using energy potentials.

4. **Passive houses** are buildings that consume up to 15 kWh / m^2. energy for heating. Such houses are also called "oneliters houses". Such a house would spend about 1.5 liters / m^2 for heating in oil, 1.5 m^3 / m^2 of natural gas or 3 kg / m^2 of pellets. The needs for heat energy are obtained through a sophisticated ventilation system with recuperation, which allows heating or cooling of the air that is inserted into the room through the exchange of temperature with the "waste" air that is pulled out of the object. In these facilities, geothermal energy is used as well as solar energy collector systems. It is a thermally isolated object so there is no need for any alternative heating or cooling. Construction and equipping of other necessary house systems are need to be adapted to the climate and geographical conditions for the development of a passive house as an adequate solution for each location. In order for an object to be regarded as a passive building it must have some characteristics. Annual energy requirements for space heating must be less than 15kWh/m^2. Consumption of

total primary energy for all housing needs of a passive house in Europe should not exceed 120kWh /m^2 annually for the total energy needs that include heating and cooling of the space, heating of domestic hot water and household electricity or starting of the device (Jelić I., 2016). Also, the maximum value the heat transfer coefficient (U) through the outer thermal coat of the object must not be greater than 0,15W / (m^2K). During 1990/91. according to the Bott / Ridder / Westermeyer project, a four-family building was built in Darmstadt-Kranichstein. This facility is considered the first passive house, which is still inhabited and built according to the Passivhouse standard (Pavić N., 2013).

5. **"Zero" energy house** is an object that gets all its energy needs using solar energy, wind energy and the use of geothermal sources, with good thermal insulation. Such a house fights a surplus of energy for years, while the same winter returns back and in this way its annual energy balance is equal to zero. If the conditions for the production of energy from renewable sources are favorable, there is more energy production than the one that represents the current energy needs of the facility, and this surplus is redirected to the public network. The first house of this type was designed by Prof. Vagn Korsgaard 1973 Copenhagen, and this project was called "zero energy house". This house exists today, solar collectors are outdated, but all the other technologies that are built into this project work. This house is now classified as a low-energy house (Ascione Fabrizio, et al. 2016).

6. **Energy independent facilities** are characterized by complete independence from public energy networks and traditional energy sources. They achieve their independence by integrating all the environmental and environmental systems and methods of solar energy, as well as the application of bioclimatic and thermodynamic principles for the functioning of the object structure. This type of building is not connected to the public network and all surplus of produced energy is most often used for directing and keeping for use in the winter months, through the system of energy reservoirs and accumulators.

7. **"Energy plus" objects**uses the same systems as energy independent houses, only it is connected to the electricity distribution network and through solar photovoltaic cells and all the surplus of collected, produced energy is transfered to the public energy network(Pavić N., 2013).

Conclusion

Energy security and stability arethe key issuesof global economic and social system. The interconnection of the energy sector with the competitiveness of the economies leads to ignoringthe importance of the struggle for sustainable development due to profit. Along with the industrial revolution, the man began aggressively and without thinking about the far-reaching consequences, to exhaust the natural resources creating polluters of the environment. Degradation has reached a degree in which the survival of the living world on Earth is seriously undermined.Protection of the environment have become a global problem and all companies regardless of their business, should include them in their business policy. Thereis a need for harmonizing their business with economic, social and ecological sustainability principles.

Sustainable development, have been recognized as global, and the main reason for holding world forums related to energy, ecology, economy and economy. This topic has become important because of the uncertainty of future energy supply, the alarming situation in environmental pollution and global climate change.

From construction perspective of sustainable development the main goal of optimization during the design is reduction of energy consumption and harmful effects on the environment, taking into account the level of costs, ie profitability both during construction and during the life cycle of the building. Experience shows that high energy efficiency implies higher costs for materials and equipment. The task of a designer or investor is to choose a solution that will represent an acceptable, optimal compromise between environmental and economic aspects.Better energy efficiency of buildings, thermal insulation of objects together with the rationalization of the use of all forms of energy, turning to renewable energy sources, and environmental protection became the basis for sustainable development.

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