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CHARACTERISTICS OF IMPLEMENTATION ENERGY EFFICIENCY MEASURES IN EDUCATIONAL INSTITUTIONS

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ABSTRACT
This paper is based on a review how human behaviour influence on sustainability, where beside rules that follow implementation of energy efficiency measures, way of life significantly determines will those measures result with satisfied outcome as in economic, social and environmental aspect. Unfortunately, most people in society still do not understand the importance of living with the nature in spite of efforts to popularize sustainability in Bosnia and Herzegovina.
Special emphasis is given to educational institutions, where school environment has significant influence not only on daily activities of students, but also on their productivity. Most schools do not satisfy basic criteria for quality and healthy environment, and mostly are characterized with facades without thermal insulation, overage windows that do not provide sufficient daylight, inadequate ventilation and poor acoustic insulation.
Beside financial savings and rational consumption of energy, aim has to be to educate society, to learn not to be only passive observers than active participants in protection of environment and finding efficient solution.
One of barriers for social awareness and implementation of sustainable concept is lack of local authority, inferior behaviour of society and unsatisfied educational program for promotion of sustainability.
Beside architectural, functional and economic design of sustainable buildings, it is necessary to overcome constraints which we daily encounter, with the education, researches, community support, to be able to create models for raising awareness of society and to make vision of „green future" real.
Keywords: Energy efficiency, sustainable development, green schools.

1. INTRODUCTION
In modern architecture, the concept of sustainable building is very often neglected by competitiveness in creation of unusual shaped forms that do not satisfy basic functional requirements. It was best described by American architect Frank Lloyd Wright: „*Form follows function – that has been misunderstood. Form and function should be one, joined in a spiritual union.* "[1].
Today, we can notice presence of a large number of buildings that with its appearance and form leave observers breathless, giving impression of magnificent but cores of these buildings are mostly enveloped with the cold shell. The question is what is the reason for complex appearance and shape, when the basic function of building is not satisfied and why there is lack of elements necessary for creating the sense of comfort in space?

It can be concluded that the importance of sustainable building in creating of quality life space is very often underestimated. The significance is not reflected only in creating ambience space and experience of the same, but also in large part has considerable impact on human life.

2. REVIEW OF THE ISSUE

School represents important part of the human life and has significant role in development of psychical and physical abilities [2]. Neither institution except school has that strong influence on life in creation of us as individuals. Schools develop intellectual and social habits of children, strengthen their personality, form their views of the world and create treasury for permanent gathering of knowledge. However, beside „favour"of providing knowledge, it needs to contain important element, as space that is used. School environment has great influence not only on daily activities of the users, but also on their productivity. Most schools in Bosnia and Herzegovina do not satisfy basic criteria to create healthy and quality environment. These buildings are mostly characterized by facades without thermal insulation, overage windows that do not provide sufficient daylight, inadequate ventilation and poor acoustic insulation. Concern about the quality of indoor air in schools in recent years has been increased, for the reason that exposure of young human organism to such conditions, leads to the occurrence of various infections, allergies, asthma and respiratory disease [3].

Primary role in building of schools and reconstruction of existing ones have architects and constructors that should not follow traditional steps for construction of school buildings, but should expand their horizons to meet physical, psychological and social factors. Objective should be to create healthy and comfortable ambience, with fulfilled health and working conditions in terms of productivity and achievement.

Energy efficiency is a complex system, consisted of several individual units and technical measures that need to be incorporated into building systems without distortion of basic building concept. Every measure in the concept of sustainability that is implemented requires detailed and extensive approach to achieve quality for the functioning of system.

In school, social factor is very important, although it is most of the time in the shadow of engineering aspect of construction. Social factor does not only represent human sense of space, but also considers use of space and behaviour in environment. As long as architecture in harmony with the nature contributes to energy saving and reduction of environmental pollution, human with his actions also influences on same factors, rigorously improving them or exacerbating them.

2.1. User behaviour in space

An obvious example of user behaviour in the building is during heating season. Optimal temperature in space according to the *Regulation on technical requirements for thermal protection of buildings and rational use of energy* [4] should be 20 °C . Users do not often think about energy consumption and mostly do not understand essence of the quote „ *There is no bad weather, only inappropriate wardrobe"*[5]. Besides regular heating, they more often use additional heaters. Soon space becomes uncomfortable for work, and instead of reduction of heating or turning it off, most users open windows until space is cooled completely. Although building has quality windows, additional thermal insulation as some of energy efficiency measures, results of inappropriate user behaviour are heat losses and increased heating costs.

Indoor lighting in building spends about quarter of annual budget, and reducing of lighting costs is one of the easiest ways of energy and financial savings. Users very often because of habit, occupation with the work, leave light on during all night or more often when space is not used. Recurrence of such „habits"during all year leads that energy consumption for lighting is higher than it should be. These actions can be partly understood because most users do not have raised awareness about energy consumption and lack of education about energy conservation. Energy efficiency system that incorporates natural lighting with artificial lighting in combination with interesting play of light and shadow in space creates creative and comfortable ambience and improves visual and thermal comfort.

3. DEFINING AND APPROACH TO THE PROBLEM

Fast and stressful way of life leads us to a selfish state, when we do not think about nothing that is not related to our current living needs, and even less about what will happen to future generations if continuity of carelessness and negligence to the environment would be integral part of our behaviour.

Huge expenses in use of building, use of asbestos panels on facades, insufficient natural lighting, lack of thermal insulation on the school envelope, leads not only to financial and heating losses, but worse consequences are frequent health problems of children.
Analysing situation in Bosnia and Herzegovina and its participation in the field of sustainability, several barriers could be observed. Bosnia and Herzegovina along with the rest of world has been influenced by difficult economic situation. Financial power is the main driver of energy efficiency trend in the world and at the same time is one of barrier for developing countries in implementation of „green school"concept.
School represents major factor in promotion of sustainable development, it creates quality environment for children and educates future actors for green rights. According to [6, 7], schools demonstrate how greater awareness about sustainability can lead to reduced financial costs and better management of resources and estate. Children from an early age should learn and be introduced with the problem, so the awareness about environmental protection and better ambience for life space would be raised. Users should not only be passive observers but active participants in determination of weakness of area where they live and they should be able to find possible solutions. The objective is not only to achieve financial benefits, than to build foundations for further development of quality environment and expansion of energy efficiency aspect to other areas as households, that are one of the largest energy consumers.
Social factor is important part of this process because society is the main driver of all changes around us. Low influence of local authority can be an indicator for a lack of awareness about sustainable schools. If there is not strong support for the schools in certain fields from local authority then there is certainly barrier for development of sustainability. Reason for that can be lack of capacity, although some results can be achieved through appropriate training programs, practice and concrete examples. National policy should develop capacities of local authorities to support schools in sustainable development. Many schools see local authorities as significant barrier for adoption of the concept of sustainability [7].

4. PILOT PROJECT " ENERGY EFFICIENCY" FACULTY OF MECHANICAL ENGINEERING, UNIVERSITY OF SARAJEVO

Pilot project „ Energy efficiency" implemented on Faculty of Mechanical Engineering Sarajevo is the first pilot project that was realized as a result of joint work of UNDP program / MDGF „ Environment and climate changes", USAID 3E project „ Economy of energy efficiency" and Faculty of Mechanical Engineering in Sarajevo.
Project was consisted of three important aspects: Architectural-building measures, thermo-technical measures and organizational-educational measures.
Architectural measures included reparation of facade from energy aspect, or thermal insulation of building envelope and replacement of old windows. New windows were consisted of PVC profile, low E-coating, double glazing, and heat transfer coefficient of the window had to be maximum U=1,4 W/m^2K. Predicted construction works on facade included termal insulation as thermal insulation panels of expanded polystyrene for facade, EPS-F, thickness 10 cm, with the heat transfer coefficient U= 0.23 W/m^2K.
Thermo-technical measures considered upgrading of heating system, with the replacement of existing boiler and circulatory pump, establishing a system control unit, installation of balancing valves vertically and hydraulic balancing verticals.
As organizational and educational measures, Faculty of Mechanical Engineering is organizing symposiums, seminars and education of the people, with the aim to raise their awareness about energy efficiency. In accordance with this approach, Faculty satisfied energy concept in every aspect, and represents successful example for other public buildings.[8]

4.1 Verification of results

First measuring results and comparison of energy consumption before and after reconstruction, show significant savings in heat consumption than before reconstruction. Energy savings for the first heating season after reconstruction in year 2012. was 40,3 %, while reduction of CO_2 was 40.559 kg [9].

5. CONCLUSION

Incorporation of architectural buildings and natural environment is the basis for adoption and development of the concept „ Green school“, where laws of the nature should be followed, benefits provided by nature should be used, and at the same time should be careful not to disturb its balance. With raised awareness about nature and what it gives on completely simple and unselfish way, with creative and innovative solutions, society can contribute to development of sustainable building, reduce unwanted impact on the Earth, and not only concentrate to satisfy their needs.

School as a central point of every society represents important factor in further development of current and future generations. Beside education that is provided daily, school has to possess healthy and quality environment for the progress of young people. Constraints that we daily encounter are possible to solve if community works and acts as a collective, for the reason that only with active participation and wish to progress, small movements can be achieved, movements that will in the future represent inestimable value for every society, environment and the Earth.

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