GREEN DESIGN AND EDUCATION OF STUDENTS AT UNIVERSITIES IN THE SLOVAK REPUBLIC

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ABSTRACT

Buildings represent a sector with huge energy consumption. It is necessary to reduce this consumption, therefore green buildings have become a global trend in recent years. Green Building Councils in various countries, which are members of World Green Building Council global network, develop and administer many of the world's ratings tools. World Green Building Council was founded in 1998. There are four predominate ranking systems: LED, BREEAM, GREEN STAR and CASBEE. Slovak Green Building Council was established in November 2010. The first green building in the Slovak Republic received LEED certification in 2012. In the paper it is referred to about 17 new and in-use green buildings in Slovakia which received in period 2012-2019 LEED or BREEAM certifications. In fact, there are more green buildings in Slovakia, where there is still the huge potential in applying a green concept in the sector of existing residential buildings and the public buildings sector. There is a lack of legislative and financial support instruments for green buildings in Slovakia, which are under the consideration and do not exist in practice.

The BBC 1 Plus – Offices in Bratislava, the first certified green office building in Slovakia, which received in 2012 the second-highest certification – LEED Gold, is described and analysed in details. The necessity of improving the education process in the green design and sustainable architecture of students at Faculties of Civil Engineering and Faculties of Architecture is outlined. The plans for how it is possible to achieve it are presented.

Keywords: *green building, Slovak Republic, LEED, BREEAM, education*

INTRODUCTION

The author successfully finished in 2010 3-years bachelor study in study program Environmental Engineering at Faculty of Civil Engineering (FCE), Slovak University of Technology (STU) in Bratislava in. Later in 2015 she finished 3-years bachelor study at the Department of English Language and Literature and 2-years master study at the Department of Romance Languages and Literatures in study program English and Spanish Languages at the Faculty of Education, Comenius University in Bratislava. Currently the author is teacher of English language at the Department of Languages, FCE, STU in Bratislava and also external PhD student at the Department of Romance Studies, Faculty of Arts, Comenius University in Bratislava.

As a teacher, the author is responsible for the courses which are primarily focused on terminology of 20 various FCE departments. In every of 4 semesters, the terminologies of 5 different departments are analysed. It is extremely difficult for students to understand the meaning of special terms, which are not in basic dictionaries and to apply them in solving their task also in other subjects. There are up to 200 Slovak students and up to 25 foreign students in the several study groups. Foreign students consist of small groups of Greek and Spanish students and individuals from various countries: Brazil, Kazakhstan, Kenya, Poland, Russia, Ukraine and others. The participants of the courses consist of Slovak and foreign regular students studying normally 5 years and also Erasmus foreign students studying only 1-2 semesters.

Experience from a 4-years teaching period shows that there is an urgent need to enlarge the amount of part of education relating to environmental engineers and particularly to emphasized the importance of green design and sustainable architecture.

Slovak Green Building Council (SKGBC) was established in November 2010. The ranking of V4 countries relating to number of green buildings is as follows: 1. Poland, 2. The Czech Republic, 3. Hungary, 4. The Slovak Republic. This is also an evidence that in the Slovak Republic there is still the huge potential in applying a green concept in the sector of existing residential buildings and the public buildings sector. Information about the importance of green design and sustainable architecture in the education of the young generation should be therefore substantially improved. The ideas how to improve the the education students and the consciousness of designers in practice as well in this direction is presented below.

MATERIAL AND METHODS

Extremely important is to inform students about the following facts. Green building rating tools – also known as certification – are used to assess and recognise buildings that meet certain green requirements or standards. Rating tools vary in their approach and can be applied to the planning and design, construction, operation and maintenance, renovation, and eventual demolition phases of a green building. Rating tools can also differ for different building types such as homes, commercial, administrative, tall buildings, etc. Green Building Councils (GBC) in a given country, which are members of the World Green Building Council (WGBC) global network, develop and administer many of the world's ratings tools [1]. The WGBC was founded in 1998. In 2008 it was comprised of national councils from twelve countries. Of these countries, there are four predominate ranking systems (see Figure 1): (i) Australia and New Zealand follow GREEN STAR; (ii) the United Kingdom, Building Research Establishment Environmental Assessment Method (BREEAM); (iii) Japan, Comprehensive Assessment System for Building Environmental Efficiency (CASBEE); and (iv) the United States, Brazil, Canada, and India use Leadership in Energy and Environmental Design (LEED), with slight variations [2].

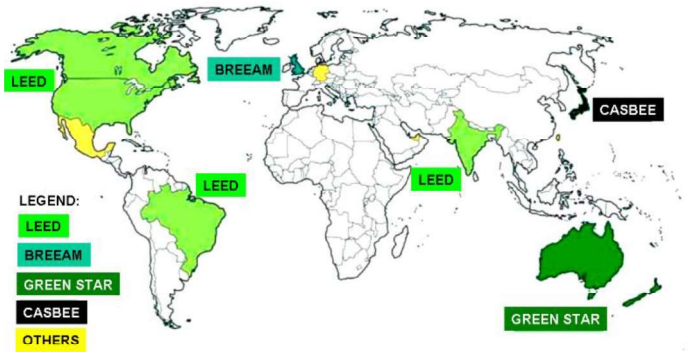

Fig. 1. *World map showing countries using the four predominate ranking systems [2].*

Table 1. *Four rating systems [2]*

LEED points	Certified 40 – 49	Silver 50 – 59	Gold 60 – 79	Platinum 80 +	-	-
BREEAM % of benchmark	unclassified below 30%	pass 30% – 45%	good 45% – 55%	very good 55% – 70%	excellent above 70%	outstanding above 85%
GREEN STAR points	One Star 10 – 19 minimum practice	Two Star 20 – 29 average practice	Three Star 30 – 44 good practice	Four Star Green Star 45 – 59 best practice	Five Star Green Star 60 – 74 Australian excellence	Six Star Green Star 75+ world leadership
CASBEE	CASBEE buildings are designated with the following ratings: C, B-, B+, A, S, with C being the lowest and S the highest.					

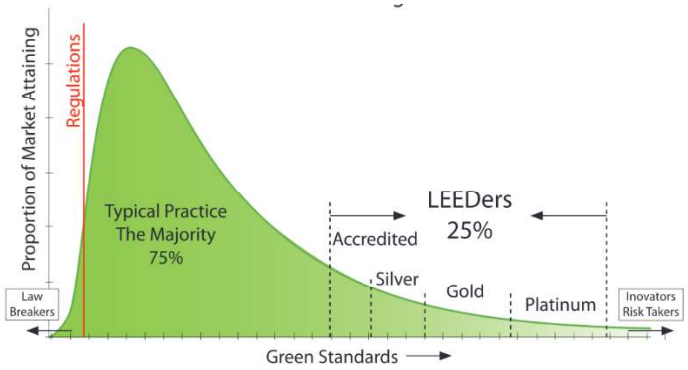

Fig. 2. *Green building markets estimated by USGBC in 2006 [3], [4].*

Currently the WGBC membership directory contains 69 countries. There are a lot of items in the WGBC list of green building rating tools. But number of green building rating tools and certifications that exist are not administered by a WGBC member GBC [1].

Background of LEED. The U.S. Green Building Council (USGBC) was established as a non-profit organization in 1993. The council is made up of construction industry stakeholders including owners, contractors, architects, engineers, product manufacturers, and environmental groups. The USGBC established LEED in 1998. After extensive revisions by the council, LEED New Construction and Major Renovation version 2.0 was released in 2000. Since then, development of different LEED assessment categories has occurred along with version revision.

Information about state of art in the Slovak Republic is also very important.

Examples of some new and in-use green buildings in the Slovak Republic:

1) BBC 1 Plus – Offices in Bratislava [5], Plynárenská street 1, 821 09 Bratislava, is the first certified green office building in Slovakia. It received LEED Gold;

2) Project Forum Business Center I in Bratislava with 18.800 m^2, obtained in 2013 as the first office building in Slovakia certification BREEAM excellent;

3) CBC III, Bratislava, 12.000 m^2, BREEAM in-use very good, 2013;

4) CBC IV, Bratislava, 12.000 m^2, BREEAM in-use very good, 2013;

5) Apollo BC II, Blocks A, B, Bratislava, 32.400 m^2, BREEAM in-use very good, 2014;

6) Project EcoPoint Office Center Košice received in 2014 with 73 points certification LEED Gold;

7) Westend Gate, Bratislava, client J&T Real Estate, 50.000 m^2, BREEAM good 47,4%, November 2016;

8) Zelené átrium, Trnava, client ISOVER, LEED platinum, June 2017;

9) Business Centrum Tesla 2, Košice, client Penta Real Estate, 14.538 m^2, LEED gold, December 2017;

10) Einpark, Bratislava, client Corwin Capital, 16.560 m^2, LEED platinum, January 2018;

11) Blumental offices, Bratislava, client Corwin Capital, 18.000 m2, LEED gold, May 2018;

12) EcoPoint 2, Košice, client Bischoff & Compagnons, BREEAM excellent 77,2 %, May 2019;

13) Panorama Business III, Landererova 12, Bratislava, client J&T Real Estate, 22.000 m2, LEED gold, August 2019;

14) Poštová offices, Žilina, client Reinoo, a.s., 15.000 m2, LEED gold V4, October 2019;

15) Green Bay Residence, Trenčín, client TAW, 8.000 m2, LEED silver, October 2019;

16) Klingerka, Bratislava, client J&T Real Estate, 15.000 m2, BREEAM excellent 76,5%, October 2019.

Two longer lists of Slovak green buildings may be found in [6]. The first list contains 10 green buildings with LEED certifications. There are another 21 projects registered for LEED certification [6, 7]. The second list contains 20 new green buildings with BREEAM certifications. Certification of existing buildings, valid for 12 months - BREEAM in-use, includes other 23 projects [6, 8]. In [6] there is also a table with the most significant projects, architects, investors and key local companies in Slovakia related to green buildings.

THEORY

The goals of improved study programs could be: a) to help local students cope with and benefit from international challenges and practices, i.e., "internationalization at home"; b) to attend to the needs of international students and effectively support their learning; c) to address SEDA (Staff and Educational Development Association) values: c1) developing understanding of how people learn, c2) practicing in ways that are scholarly, professional and ethical, c3) working with and developing learning communities, c4) valuing diversity and promoting inclusivity. Continually reflecting on practice to develop ourselves, others and processes; d) to meet SEDA specialist outcomes: d1) to use a variety of appropriate approaches to enable learning, d2) to use a variety of methods for evaluating their role in supporting learning, d3) to inform their professional role with relevant strategy, policy and quality considerations.

The author decided after her university studies to work in 2016 in Henkel company which is located in BBC 1 Plus to have her own experience with such architecture. The paper presents all details of this building and the author may confirm that BBC 1 Plus is really a unique building providing its tenants a high-quality, healthy and comfortable working environment with a pleasant micro-climate.

It is necessary that students should have also their own experience with realised green buildings and sustainable architecture. An example is: thirty students of STU in Bratislava and foreign students from Greece, Ireland, Spain and Syria took part in International student real estate workshop organised by Management Institute, STU in Bratislava, Institute of Technology in Dublin and a leading real estate agency. Students tried to find the convenient administration building in given area. They visited three buildings including BBC 1 Plus green building. The students were happy to see all advantages of this green building. The author plans to organise excursions of students in project and architecture bureaus having experience with green building designs and in green buildings too.

DISCUSSION

Internationalization and innovation of teaching is necessary to apply, therefore the author would like to concentrate more on the most actual problems of human beings: ecological and environmental problems with application in green design and sustainable architecture. These topics are surely the most important ones for students from all countries and the author expects that they will attract their attention.

For young generation in all counties it is extremely important to be acquainted with ecological and environmental problems and their solution. The students at FCE should be better educated in building green design and sustainable architecture. Author plans to use the proceedings of Geolinks Conference together with videos [7], [8] in pedagogical process as efficient tools to increase the student knowledge in this area.

In education of students specific examples are important as it is for example **BBC 1 Plus – Offices** in Bratislava, Plynárenská street 1, 821 09 Bratislava, is the first certified green office building in Slovakia [5]. Details of this green building:

Certification: For certification and evaluation system LEED buildings several aspects are assessed: 1. sustainability, 2. water management, 3. energy consumption and the impact on air environment, 4. the materials and resources, 5. indoor environment quality, 6. innovative approach and 7. regional priorities. Certification was carried out through the American system LEED and the building received the second highest certification - LEED Gold (Table 1).

Fig. 3. *BBC 1 Plus in Bratislava in Slovak republic*

(Courtesy of Tomáš Manina, WOOD & Company).

Building facts: Developer/Investor: CA Immo Group is one of SKGBC founding members; general contractor: Bilfinger Berger; architect: Bogár, Králik & Urban (BKU) in Bratislava; construction start: 6 December 2010; construction end: September 2012.

Building characteristics: Floors: 1 underground / 13 upper floors; total effective area: 15,900 m^2; parking places: 313 indoor parking spaces. The mixed-use building contains: administrative premises: 14 568 m^2; storage premises: 805 m^2; retail premises: 485 m^2; self-service restaurant: 400 seats; café, tobacco shop,

pharmacy, hairdresser, nail studio, sport bar with billiard, table tennis and table football, terrace with seating and smoking zone. High standard, use of modern technologies and high energy efficiency of BBC 1 Plus will provide its tenants a high-quality, healthy and comfortable working environment with a pleasant micro-climate.

Standard floor plan: Flexible partitioning – up to 8 separate lease units per floor is possible; independent office units from 130 m^2; individual metering of energy consumption for lease units enabling a transparent summarising through the BMS system.

In building there are: Entrance hall with elevators featuring natural stone façade; two reception desks; entrance into parking space secured by ramps, access to elevator hall through turnstiles;10 personal elevators – 3 elevators in 2 halls, one elevator with extended capacity for cargo transport, 4 elevators (2 x 2) for transport between parking house floors; parking house – machine-smoothed reinforced floor sloping down towards evaporation gutters, intelligent ventilation with CO2 detector; fire detection system throughout the building, electronic fire signalisation (EPS), electronic security signalisation (EZS); intelligent building management system (BMS); building's critical systems have a backup diesel power supply unit; connection to optical line; aluminium-glass façade with isolation glass, raster at 1.3 metres; bicycle stands in monitored-access area; changing rooms; showers.

Reduction of thermal gains and losses: Costs of heating, but especially of cooling represent a large portion of total operating costs of a building. The glass used on BBC 1 Plus has excellent isolation characteristics, which significantly contributes to the reduction of thermal intake in summer, and losses in winter, thus helping to achieve an economic operation of the building. In the southern and western sides, where the thermal gains are the greatest, BBC 1 Plus features semi-automatic exterior blinds.

Cooled ceiling system: Administrative premises are cooled with a cooled ceiling system, which naturally dissipates coolness into the environment and it gradually and evenly cools the individual offices. Unlike the usual cooling systems that use fan-coils, the cooled ceiling does not create unhealthy airflow, does not stir dust and does not create noise and it contributes to overall comfort and healthier working environment.

Green environment: The quality of interior environment in BBC 1 Plus is supported not only by the cooled ceiling system, but also by an air humidification system which improves air quality especially in winter. Heating is executed via low-heat radiators that heat up the premises evenly, without local overheating and undesired larger thermal differences within individual offices. The overall positive micro-climate is achieved also thanks to green roofs and terraces that make up over 50% of all roof area. In order to reduce water consumption, the sanitary facilities feature economic faucets and flushers. Certain mutual premises are lighted with motion-activated sensors that reduce energy consumption as well. The building is prepared for waste separation. BBC 1 Plus also supports alternative modes of transportation – it offers bicycle stands and relevant accessories (changing rooms, showers).

CONCLUSION

The importance of green design and sustainable architecture in education of young generation in all countries is analysed and stressed. The plans how to improve such education are outlined. The results and effectivity of proposed education improvement could be evaluated after next semester.

The paper gives basic information about the WGBC global network, its history and about Green building rating tools – also known as certification. Details of four predominate ranking systems (Fig. 1): LEED, BREEAM, GREEN STAR and CASBEE are given too (Table 1).

Slovak Green Building Council (SKGBC) was established in November 2010. 17 Slovak green buildings with LEED and/or BREEAM which received certifications in the years 2012-2019 are presented. They are located in the capital Bratislava (12), Košice (2), Trenčín (1), Trnava (1) and Žilina (1). About more green buildings with LEED or BREEAM certificates in Slovak Republic it is referred in [6].

Details are given about BBC 1 Plus – Offices in Bratislava, the first certified green office building in Slovak Republic (Figure 3). Total costs 30 millions EUR.

In Slovak Republic there is still the huge potential in applying a green concept in the sector of existing residential buildings and the public buildings sector and related education at universities as well.

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