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Modern Certification Systems for Green Construction

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Abstract. In this research we provide the analysis of the contemporary certification systems for green construction on the example of the buildings of the Skolkovo Innovation Center. A person throughout his life conducts active efforts aimed at transforming the environment. This leads to the formation of an ecological footprint, or carbon footprint. According to the results of the study, it turned out that the certification of industrial and civil construction facilities in accordance with green standards means the search for engineering solutions that can increase the competitiveness of the project, reduce costs during its implementation and maintenance, reduce the "footprint" of human presence and improve the quality of people's lives. In addition, green standards are an effective tool not only in the design, but also in the operation of a building, because of the possibility of evaluating an object at various stages of its life cycle - from creation to improvement or demolition. Existing systems carry out certification at different stages of construction. The categories, by which real estate is assessed, vary depending on the system, but their essence remains unchanged. The improvement and popularization of national green standards effectively stimulates the market of building materials and technologies and in the foreseeable future may significantly affect the housing and communal services.

INTRODUCTION

The problem of irrational consumption of resources and environmental safety is at the forefront of today's world. The famous American writer and public figure Henry David Thoreau said: "Is there much use of a house if you don't have a tolerable planet on which to put it?". The purpose of the work is to study the effectiveness of existing certification systems for green construction and determine their impact on the modernization of buildings and structures. The concept of sustainable development, assessment of risks and opportunities related to climate change, attitude to the environment, respect for human rights and solving problems of society and local communities has become a global trend and will determine the economic and financial agenda in the near future. "Sustainable development" refers to the growth of economies and companies that meets the needs of the present without prejudice to future generations.

In 1990, the British organization BRE Global developed the first voluntary certification system for buildings (BREEAM) related to green construction to assess the energy efficiency of projects and their environmental safety. The incentive to create a certification system was the need for buildings to comply with certain sanitary and hygienic standards, to improve the quality of people's stay in offices of high-rise buildings in large cities [1-2].

Later, in 1998, the American Council for Green Buildings created the LEED system. It provides building owners and operators with a clear framework for defining and implementing practical and measurable solutions for the design, construction, operation and maintenance of a green building.

Today many investors pay attention not only to financial performance, but on whether its activities contribute to making the world around us better. Good performance in non-financial reporting (ESG-criteria) steel in the long run is no less important than the financial. The concept of sustainable development and environmental friendliness global trend and will determine the economic and financial agenda in the near future. “Sustainable development” refers to the growth of companies and states as a whole, which meets the needs of the present without prejudice to

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future generations. ESG certification is a peer review based on the analysis of company data. Companies that received a positive score based on the results of ESG certification are awarded a special certificate.

The National Research University "Higher School of Economics" for exclusive use by Bidzaar developed the work "Methodology of mass remote ESG certification". It describes the basic principles of certification to determine the sustainability of the company, which are based on an assessment in three areas of development: the company's impact on the environment, the company's actions to solve global social problems and effective management of the company itself (ESG criteria, from the English Environmental, Social, and Governance) [3].

The National Research "University Moscow State University of Civil Engineering" has developed and put up for discussion a draft of the national standard "Green technologies of the life environment. Criteria for attribution". This standard will establish criteria and methodology for classifying life environment technologies as green. For the technologies of the life environment, the criteria that are considered when referring technologies to green are defined [4,5].

METHODS

The study applied a review-analytical method of investigating the problem. Consider the first BREEAM standard (Building Research Establishment Environmental Assessment Method). It is one of the most advanced international rating systems and was the basis for the creation of the first Russian certification system for green construction BREEAM RUS, according to which premium eco-apartments HILL8 have already been built and commissioned. The application of this standard in Russia has a number of advantages. First of all, the use of modern technologies and the transition to a new level of development of the industry. What is important is the formation of demand for innovative goods and services in the construction industry, stimulating the emergence of competitive products for use in Russia and export abroad.

The Leadership in Energy & Environmental Design (LEED) certification system covers almost all types of construction projects: new, existing buildings, commercial interiors, residential houses and cottages, as well as territorial development projects. The evaluation and certification process covers the entire construction process: design, construction and operation. After commissioning, the certification facility and the consumption of various resources are monitored for another 9 months.

The system assumes that the building corresponds to the following areas: integrated process, energy and atmosphere, ecological land use, location and transport, water efficiency, materials and resources, indoor air quality, innovation, regional priority.

Depending on the points scored, the building can be assigned the following ranks: certified, silver, gold and platinum. The difference between the two leading systems primarily lies in the certification methodology. During the BREEAM certification process, licensed experts analyze the evidence according to the main criteria and send their report-conclusion to the scientific organization in the field of BRE construction. If the review is positive, a certificate is issued.

The LEED certification process is more convenient and takes place on the LEED online web page. Project teams upload the collected package of documents to the website. After reviewing the documents, the Green Building Certification Institute (GBCI) assigns the applicant company one of the LEED certification levels.

The standard also takes into account the economic efficiency, socio-cultural and functional aspects of the facilities. There is the only sustainable construction certification system in the world that focuses on the specifics of the functioning of a building for 50 years when assessing the life cycle of a building and analyzing its cost. This is the German Sustainable Building Certificate that was developed by the German Council for Environmentally Friendly and Sustainable Buildings DGNB together with the Federal Ministry of Transport, Construction and Urban Development (BMVBS). It also takes into account the economic efficiency, socio-cultural and functional aspects of the facilities.

Bidzaar uses ESG certification that is a set of basic company management characteristics, in which the company participates in solving environmental, social and managerial problems. Consider the meaning of the abbreviation of the system.

Environmental (E) – ecological development. The system evaluates the degree of involvement of the company in the field of environmental protection. For instance, the introduction of control over harmful emissions, the creation of a waste disposal system.

Social (S) – social development. There is an assessment of the working conditions of people in the company, the creation of equal employment opportunities, etc.

Governance (G) – company management. This position implies compliance with ethical and anti-corruption standards, openness of purchase and accountability of corporate management.

The evaluation of the company is carried out using several sources. Firstly, the survey data of the company with the attached documents are used. Secondly, financial and legal information is collected from databases. Thirdly, information from external specialized databases. The company can receive the I, II or III degree of the ESG certificate, depending on the number of points scored. If the company scored less than 25 points (100-point system) then it has not fulfilled the necessary conditions and is considered unattested.

We were analyzed green construction projects (buildings of the Skolkovo Innovation Center) that have been certified by the LEED and BREEAM system.

The building of the Hypercube business center is certified according to the international green building standard LEED. The facility is aimed at the certification level with the target indicator LEED "Silver" - LEED "Gold".

The «Hypercube» Business Center uses a comprehensive DESIGO Insight building management system covering all its services, including heating, ventilation and air conditioning systems, lighting and energy distribution. The data is output to the central control room.

The glasses are selected depending on the orientation of the building so that double-glazed windows with a higher degree of protection from solar radiation in summer and higher thermal insulation in winter are installed on the southern and western facades.

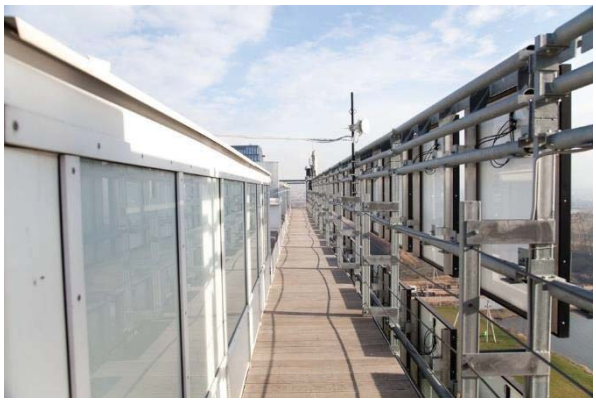
Despite the fact that glass of maximum translucency is used in the building, at a room depth above 9 meters, the use of additional light conductors is required. For this reason, light traps were installed, which are located on the facade and roof. They turn after the sun. After filtering, sunlight through the optical fiber enters the under-illuminated parts of the building, which contributes to significant energy savings. The advantage of light guides is that they practically do not require maintenance. One light guide is capable of transmitting a luminous flux of 5000 lm, which is enough to illuminate 30-40 sq. m space.

The use of solar panels provides technical lighting of the business center building and parking. Accumulators are used to accumulate electricity during the day.

Water supply is provided from an artesian well and approximately 50% of water consumption covers the collection and use of rainwater.

The building implements a system for cleaning and lifting domestic wastewater for irrigation of green spaces.

(a)



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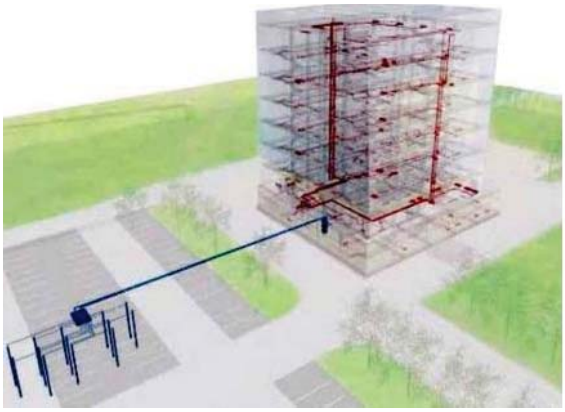

(c)

FIGURE 1. Automation technologies of the «Hypercube» business center: a – the use of light guides to ensure sufficient natural lighting of the space; b – the use of solar panels to generate electricity; c – the heating or cooling system of the building, depending on the season.

Currently, the Hypercube building is undergoing certification under the LEED international green building system. The innovative facility claims to be certified with the level of LEED "Silver" – LEED "Gold".

On the issue of buildings that have passed or are passing the certification system of green construction, it is worth paying attention to the business center "MATREX". It is a multifunctional complex that has absorbed almost all the qualities of green construction. This building was the first of the Skolkovo Innovation Center complex, which was certified according to green standards by the BREEAM system, for which the object was rated as "good".

The building of the business center has the shape of a truncated pyramid, inside which there is a matryoshka-shaped atrium with a height of 50 meters (figure 2). Despite the complexity of the architecture of the building, the engineers managed to achieve a high level of energy efficiency. Automatic process of heat consumption, in which heat is released by means of programs according to the hours of the day and days of the week, which helps to reduce energy consumption during non-working hours. The facade has an inclined surface, which accumulates heat from solar radiation.

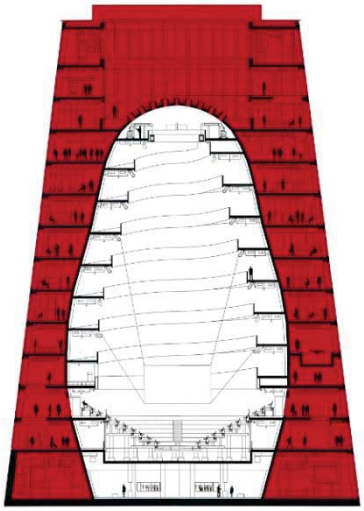

FIGURE 2. The internal structure of the Matrex business center. The building has the shape of a truncated pyramid, in which there is an atrium in the shape of a «matryoshka».

Besides, resource efficiency was ensured at all stages of the construction life cycle. During the construction, waste was reduced or recycled. During operation, water consumption decreased due to the use of economical plumbing, as well as the installation of a leak control system. Special measures are provided to protect finishing materials from destruction in the delivery areas and active pedestrian traffic.

Zoning of space provides for all employees the location of workplaces facing the street, reducing the risks of eye diseases, helps to keep in touch with the outside world and increases work productivity. Various types of wild plants that grow in this region are used in landscape design, which does not require additional water consumption for irrigation, getting by with rain moisture.

We had considered the methodology for assessing environmental safety in buildings, including assessing the thermal property measurements for green roofs [6-8]. Thermal inertia assessment of an experimental extensive green roof in favorable climate conditions was investigated by Bevilacqua P., Bruno R. and others [9-11]. Considering unstable cold climate of most of Russian territory, we analyzed the energy-effective technologies for buildings using a case study of energy saving construction technologies in Russia [12-15].

RESULTS

The given graphs (figures 3-5) reflect the effective consumption of energy resources by the systems of the Matrex business center. The energy efficiency of the facility is 27.5% better compared to the baseline values, given the fact that it was difficult to achieve such values due to the complex architecture of the structure. The use of LED lighting devices, cold storage batteries, as well as frequency regulators and highly efficient heat generation.

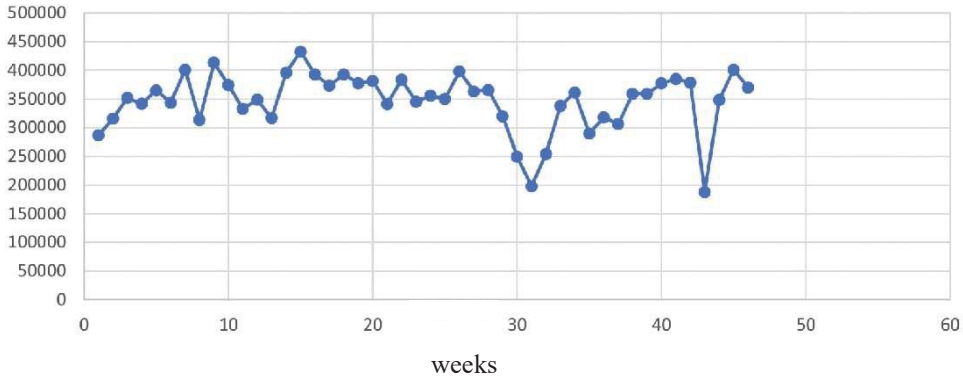

FIGURE 3. Electricity consumption for the period November 2017 - August 2021, kWh.

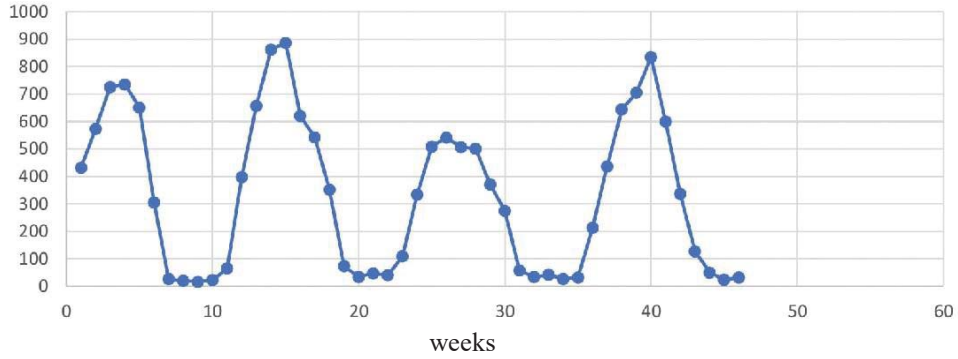

FIGURE 4. Heat consumption for the period November 2017 - August 2021, Gcal.

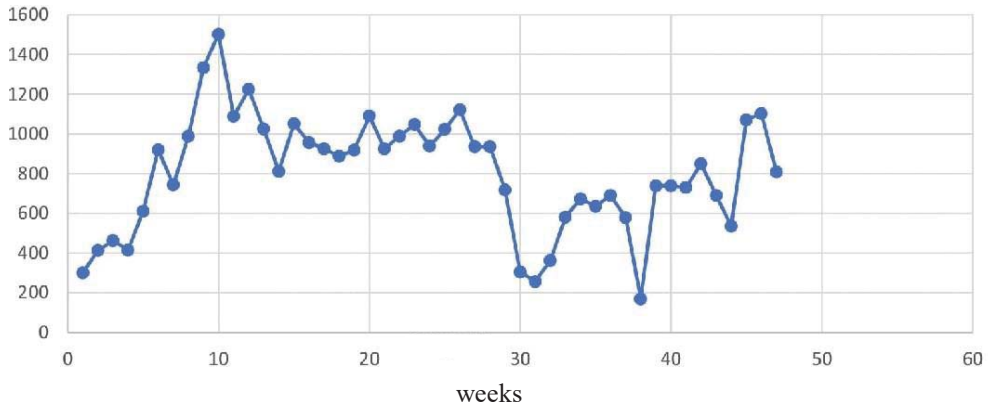

FIGURE 5. Water consumption for the period November 2017 - August 2021, m^3.

In summary, the assessment of a structure by the green building certification system is an effective motivation for the construction of structures that can provide a comfortable and safe life for a person and reduce the negative impact on the environment. Admittedly, about 40% of the total construction cost was spent on internal engineering systems and technologies in the building, they will pay off during operation.

European green roof norms and guidelines are unsuitable for direct use in Russia due to the climatic conditions. In this case green standardization processes should adapt to the environmental aspects of the choice of building materials in certain zone [16-18]. Research and modern developments in the field of energy-efficient and green construction are the current tasks for further implementation of green standardization in Russia [19-20].

CONCLUSION

The assessment of the green building certification systems in the construction structures of buildings of the Skolkovo Innovation Center showed results that in-built engineering systems and technologies can provide energy-saving consumptions of water, heat and electricity and reduce the negative impact on the environment. However, despite the fact that about 40% of the total construction cost was spent on internal engineering systems and technologies in the building, they will pay off during operation. Modern green standards are unsuitable for direct use in Russia due to the cold climate in the most of it. In this case green standardization processes should adapt to the local environment conditions.

Buildings that were evaluated by certification systems of green construction must have a high degree of automation of various processes, be autonomous, energy-saving and energy-efficient systems. Eco-principles that reduce the impact on the environment should be used at all stages of construction. In addition, the location of the building site should be convenient, provided with transport accessibility, the availability of public utilities and institutions providing basic services. The landscape of the territory should be in harmony with the environment and minimally disrupt the ecological balance. Architectural planning and design solutions of office and residential buildings should have a high level of comfort for people.

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