Justification of system of assessment of ecological safety degree of housing construction objects

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Abstract. In article characteristics and properties of competitiveness of housing construction objects are investigated, criteria and points of national systems of ecological building’s standardization are structured, the compliance assessment form on stages of life cycle of a capital construction project is developed. The main indicators of level of ecological safety considering requirements of the international ISO standards 9000 and ISO 14000 and which are based on the basic principles of general quality management (TQM) are presented.

1. Introduction
Within formation of own system of an assessment of degree of ecological safety of the objects of housing construction (OHC) the existing systems of certification for an assessment of indicators of a real estate object at all stages of his life cycle are studied. In the course of the research it is established that the governments of the countries with the developed market economy pay very considerable attention to take care about the health of the citizens: quality of life, comfort and safety of accommodation and activity are the key criteria of an ecological assessment of OHC [1].

The important place and a role in an assessment of degree of ecological safety are played by a compliance assessment. The analysis of international experience of technical regulation, demonstrates that the assessment of compliance is an instrument of definition of compliance to the established requirements of products, services, systems [2].

2. Materials and Methods
According to the developed world practice in order that the real estate object could be called officially "green", it has to conform to certain quality standards and obligatory to be certified on one of the following national systems (table 1). Functioning of such systems assumes a possibility of independent body for an assessment of compliance to demand from construction companies of implementation of the corresponding procedures [3].

According to the legislation, the assessment of compliance can be carried out in the form of certification, monitoring and (or) tests of commodity and construction production or system. In this regard it is necessary to distinguish standards and systems of certification. The first are designed for experts in the field of ecological housing construction, and the second – is exclusive on the end user. Systems of certification contain not just target figures or requirements, but criteria allowing to give points of which there is a total assessment and rating [4].
Table 1. Criteria and points of some national systems of standardization of ecological building

| Country | Name of system and year of its creation | Criteria                                                                 | System of points assignments |
|---------|----------------------------------------|--------------------------------------------------------------------------|------------------------------|
| Australia | Green Star (2003)                      | Management, indoor environment quality, energy, transport, water, materials, land use and ecology, emissions, innovation | 1 Star, 2, 3, 4, 5 (the best in Australia) |
| UK      | BREEAM (Building Research Establishment Environmental Assessment Method – 1990) | Management, energy Use, Health and wellbeing, Pollution, Transport, Land Use, Ecology, Materials, Water | Satisfactory, Well, Very well, Perfect, An outstanding result |
| Germany | GSBC (German Sustainable Building Council – 2008) or DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen) | Environmental quality, economic benefit, social benefit, quality solutions to technical issues, quality management process, the location of the building | Bronze, Silver, Gold |
| Hong Kong | CEPAS (2005)                           | Quality inside, comfort inside, resource consumption, load on the OS, comfort, on-site comfort outside the territory, the impact on the territory, the impact of off-site | Not classified; Bronze, Silver, Gold |
| Canada  | NABERS (2001)                          | Energy, Water, Waste, Internal environment                                     | 1 star (weak), 2 well, 3 very good, 4 perfectly, 5 exclusively |
| Singapore | Green Mark (2005)                      | Energy efficiency, The efficiency of water use, Environmental protection, The quality of the internal environment, Environmental innovation | Certified, Gold, Gold+, Platinum |
| USA     | Green Globes (1996); кроме того, есть еще LEED и NAHB BS | Energy, environment within, the impact on the territory, resources, water, emissions and discharges, management | 1 globe, 2, 3, 4 max |
| USA     | LEED (The Leadership in Energy & Environmental Design – 1998) or USGBC (U.S. Green Building Council) | Sustainable sites, Effect. water, Energy & atmosphere, Materials and resources, The quality of the internal environment, Innovac. and design | Certified, Bronze, Silver, Gold |
| Taiwan  | EEWH (1998)                            | Biodiversity, Vegetation, The state of groundwater, Energy saving, Reduction in CO2 emissions, Waste reduction of p-tion, Asset condition inside, Saving water, Sewerage and solid waste | Certified, Bronze, Silver, Gold |
| France  | HQE (1996)                             | Building and neighborhood, A comprehensive range of building materials and methods, Gentle builds, methods, Control. power consumption, Control. Water, Waste and repair, Humidity, Acoustics, Visual comfort, Odor control air Quality within the water, Quality, Sanitization | Basic, Good result, A very good result |
| Japan   | CASBEE (2002)                          | Quality, internal environment, the quality of services, condition of outside of building, energy, resources and materials | C (weak), B, A, S (excellent) |

It is also necessary to note the LEED system advantage which consists in its priority orientation to criteria of quality and environmental friendliness of OHC. It is very urgent for domestic housing.
construction (especially regarding environmental pollution) though it is labor-consuming and it is difficult performed by.

Having important practical value it is necessary to acknowledge the application possibility in modern Russian conditions of the Core&Shell tools allowing to certify correctly OHC which often are given without internal finishing [5].

One more competitive advantage of the LEED system can be considered a possibility of ensuring economy of different types of resources, and first of all, water and the electric power.

However the German system of certification of the second generation of DGNB quite successfully competes with above-mentioned system by criterion of flexibility. The criteria of steady construction having different "weight" are the basis for system of an assessment of DGNB (in points) and significantly depend on a look and purpose of a real estate object (in total more than 60 criteria for evaluation of ecological quality).

At the same time, studying and reconsideration of the invoice given above about the existing systems of an assessment of degree of ecological safety allows to draw a conclusion that the LEED system is an undisputed leader of ecological certification in ecological design of buildings and constructions. It gives the grounds to claim that in Russia the most considerable prospects of an assessment of ecological quality of OHC at LEED.

3. Results

A specific place in development of technical regulation of a domestic construction complex holds the System of a Voluntary Assessment of Compliance ("SVAC NOSTROY") created in the year of 2011 by the National merging of the builders (NOSTROY).

Main objectives of its creation were the organization of the certificate of compliance of construction production, processes of design, engineering researches and construction to technical regulations, sets of rules, national and international standards, standards of self-regulatory organizations and NOSTROY and ensuring control of observance of requirements to issue of certificates on the admission in the form of control (figure 1)

Corporate "SVAC NOSTROY" provides not only a conclusion of own certificates to the existing segments of the certified market for the construction sphere. But also and formation of new segments of this market for producers and consumers of construction production, including ecological housing construction. The central body of "SVAC NOSTROY" is National merging of builders which activity is carried out on a nonprofit basis [6].

Summarizing the above, it is possible to draw some conclusions.

1. To qualify anthropogenous impact on the environment and the person negative (harmful), it is necessary to measure it quantitatively in certain parameters. For this purpose it is necessary to decide on evaluation criterion correctly. The above testifies to lack of methodology of such assessment.

2. Positive result of an incorrect assessment of negative impact the public supervisory authorities of the enterprises causing damage to the surrounding environment (including, construction a housing profile), is only replenishment of revenues of the budget. However the negative effect is much more large-scale: the main problem is not that value judgment of inspectors, in most cases, isn't adequate to actual ecological damage. And that in absence at the state of the effective organizational and economic mechanism penalties in itself don't influence an ecological situation in this or that territory at all and are than other as the state racket.

3. Within the allowing and project nature protection documentation existing in our country absence uniform for economic entities and the state of methodology of an assessment of degree of ecological safety doesn't allow, in particular, construction companies of a housing profile correctly (in figures) to prove ecological safety of the built OHC.
Thus, in view of merits and demerits of the approaches existing now revealed by us, we believe possible to formulate basic provisions of system of an assessment of degree of ecological safety of OHC adequate to modern requirements of consumers of construction production and construction business.

It is necessary to carry to the main indicators of such system: indicators of realization of environmental policy and program; indicators of performance of the regulating norms; financial performance; indicators of the public relations; indicators of efficiency of functioning; indicators of state of environment; environment components which activity of construction company can influence (the atmosphere, the hydrosphere, the earth, flora, fauna, people, esthetic factors).

Economic efficiency of functioning of system of an assessment of degree of ecological safety of OHC depends on the economic effect gained as a result of introduction in construction company of a housing profile of concrete actions for environmental protection.

Economic effect in this case has to be defined as a difference between the achieved results and costs of realization of actions. The integrated indicator of ecological safety of OHC has to include the components presented in table 2.
Table 2. Main indicators of level of ecological safety of OHC

| Indicator                                                                 | Expert assessment | Assessment’s result |
|---------------------------------------------------------------------------|-------------------|---------------------|
| Level of ecological safety of the housing construction sphere ($l_1$)     | $E_1$             | Total of level of ecological safety of ready OHC ($L$), based on a total expert score ($\sum E_i$). |
| Level of ecological safety of the used construction materials and designs, and also finishing materials ($l_2$) | $E_2$             | Higher $\sum E_i$ that ecological safety of ready OHS is higher |
| Level of ecological safety of the used technologies ($l_3$)               | $E_3$             |                     |
| Level of ecological safety of the building site ($l_4$)                   | $E_4$             |                     |
| Level of ecological safety of building area and adjacent territories ($l_5$) | $E_5$             |                     |

Definition of the integrated indicator of level of ecological safety of OHC has to be carried out by method of expert evaluations owing to lack of data on ecological safety of the housing sphere in open official sources.

In the developed modern difficult financial and economic conditions, and also competition aggravations among construction companies, ecological characteristics of OHC can become competitive advantage of those from them which are engaged in real "green" construction, but not a green washing. Moreover, contrary to the widespread myth that ecological housing construction is more expensive traditional such companies will be able to earn quite concrete profit on "green" construction.

At the same time, economic effect of functioning of system of ensuring ecological safety of OHC can be defined by a gain of profit of the construction organization of a housing profile on forms. 1:

$$\Delta P_{coo\text{hc}} = [\Delta E + \Delta Pr \cdot Q] - \Delta(Qcs + Qt + Qep),$$

where: $\Delta P_{coo\text{hc}}$ – the annual profit of the construction organization of a housing profile got from realization of actions for environmental protection, thousand rubles.;

$Q$ – planned (initial) annual volume of release (sales) of finished goods of the construction organization of a housing profile, thousand rubles.;

$\Delta E$ – decrease in the expenses connected with payment of payments for causing damage to the environment, thousand rubles.;

$\Delta Pr$ – gain of the price of production of the construction organization of a housing profile, owing to realization of actions for environmental protection, thousand rubles;

$\Delta(Qcs + Qt + Qep)$ – gain of additional expenses at realization of actions for environmental protection, thousand rubles;

$Qcs$ – the volume of expenses on collecting and storage of the waste caused by introduction of actions for environmental protection;

$Qt$ – the volume of the transport expenses caused by introduction of actions for environmental protection;

$Qep$ – volume of expenses of construction company on environmental protection.

4. Conclusions

Formation of strategic priorities of development of housing branch assumes the accounting of modern calls of national economy. However the modern housing policy pursued by the Government of the Russian Federation actually doesn't consider the increased requirements to quality and environmental friendliness of OHC. Besides, the state represented by Ministry of Construction of Russia pays not enough attention to creation of conditions of fair competition among developer and construction companies. Therefore favorable conditions for emergence and development of the green washing exerting negative impact on development of housing branch are created.

Theoretical provisions have shown prospects of a further research which are in improvement of the directions of improvement of quality and environmental friendliness of the environment of activity that will allow to increase social ecological and economic efficiency of the studied segment of national economy and to provide worthy level of quality of life of the population.
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