Eco-development and energy efficient technologies in Russia: prospects and reality

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Abstract. The article highlights the concept of eco-standards in Russia, and discusses new technologies that allow to build energy-efficient houses in the form of countryside real estate. Special attention is given to the principle of heat production based on the use of individual facilities, power centers mini thermal power plants, as well as to ways to reduce water consumption at home. Presents analysis of the advantages projects “built-to-suit” for the introduction of the energy efficient technologies. Justified idea and principles of "green construction" in Russia in the real estate market. Conclusion about the effectiveness of the use, opportunities and development of energy efficient technologies.

1. Introduction
Problems of green construction and efficient energy consumption are relevant. Many construction companies offer their innovative solutions aimed at improving energy efficiency and ecological compatibility of buildings. An important role in this process was played by the Law No. 261-FZ "About energy saving and about increase in energy efficiency and about modification of separate legal acts of the Russian Federation", law No. 111730-5-FZ "About energy saving and about increase in energy efficiency", law No. 384-FZ "Technical regulations for safety of buildings and structures", which established the ways of development of construction technologies in Russia and methods for Improving energy efficiency of the building. The direction of eco-development itself appeared about 40 years ago abroad, but in Russia this direction is quite young and very promising, and deserves special attention.

A great boost to the eco-development in Russia was the GREEN ZOOM standard. Main criteria of GREEN ZOOM:
1. Location of the built-up area;
2. Ecological compatibility of the built-up area;
3. Energy efficiency;
4. Water efficiency;
5. Ecological compatibility of construction and finishing materials;
6. Ecological compatibility of internal environment of buildings.

In 2015, 15 construction projects at Russia received a certificate of GREEN ZOOM, 30% of which falls within the commercial real estate sector. This standard is quite prestigious in the field of "green construction" and in addition to benefits of saving money, introduction of the GREEN ZOOM system is a public recognition of the company with a responsible approach to environmental protection and a
lean attitude to the country's resources, as well as an important factor improving the competitiveness of the construction project.

2. Methods
The purpose of eco-development is to reduce the level of consumption of energy and material resources while maintaining or improving the quality of buildings and the comfort of their internal environment.

One of the directions of eco-development is Eco-mainstream — European houses, where water and heat are usually saved (there is a parallel rain collection system), and waste heat exchanger is used. These are the low-cost houses of ultra-low consumption in Austria and Germany.

The definition of energy efficiency itself implies the rational use of energy resources. Science and technologies are constantly evolving and such solutions have emerged that allow generating electricity, heat and cold on the basis of one resource — natural gas. The problem of production and rational consumption of resources is solved by the combined production of electricity and heat, which is called cogeneration. Such a method allows producing electricity based on gas powered electrical generator, and using the heat energy generated by cogeneration plants for the production of hot water, steam, as well as in refrigeration units. Using this system with chiller, we get the cold supply system in summer. The cogeneration system was continued in the form of the possibility to dispose the excess heat produced by the plant itself, by connecting an absorption refrigerating machine to it. This system is called trigeneration. In Russia, this technology has been applied both for industrial purposes and for private individual houses. This type of energy production allows to significantly save the building heating and cooling costs (we get the cold for free). The use of a gas powered electrical generator is the most feasible, as a result of a comparative analysis of the cost of electricity produced from other resources, natural gas is the cheapest option and, in addition, is an environmentally friendly mineral raw material.

The ecological compatibility of this technology is determined by the fact that the excess heat that is generated as a result of the operation of the gas powered electrical generator is not released into the atmosphere, but goes through the absorption machine, turning it into a cold in summer. In winter, we use this heat to heat the building, and the losses are minimal and the efficiency of this plant is much higher than the efficiency at use of other energy sources, for example, electricity from the electric mains and heat from the central boiler house.

A significant plus of this generation of resources is payback of all equipment in a fairly short period, because besides the main gas, we may not consume other resources from the mains system. Such a system allows the construction and operation of completely independent facilities, having the possibility of connecting to the gas main in the territory. The ecological compatibility of this technology is determined by the fact that the excess heat that is generated as a result of the operation of the gas powered electrical generator is not released into the atmosphere, but goes through the absorption machine, turning it into a cold in summer. In winter, we use this heat to heat the building, and the losses are minimal and
the efficiency of this plant is much higher than the efficiency at use of other energy sources, for example, electricity from the electric mains and heat from the central boiler house [1].

![Figure 2. Trigeneration system in percentage](image2)

The energy recovery system with air filtration and humidification in the air handling units allows to save heat and maintain comfortable living conditions.

The system is designed in such a way that supply and exhaust air in the system is not mixed, but comes in contact via a special plate through which heat from the heated air is transferred to the colder one, which saves the heat consumed from the boiler room.

Parallel rain collection system is convenient to use in the individual country houses, in areas remote from industrial areas. Among the advantages of using rainwater in everyday life, it should be noted a significant reduction in the consumption of ordinary tap water, since its costs depend only on the number of residents and their habits. This also makes it possible to significantly reduce the intake of surface and groundwater and prevent subsidence of the soil.

Such water is used for household and practical needs. Outside the house, it is designed for irrigation of lawns and gardens, in the spring-autumn period - for washing cars and cleaning the area around the house [1].

Now, builders and large developers interested in applying "green technologies" are trying to introduce solutions to improve the energy efficiency of the project at the design stage, which is the most appropriate solution for the subsequent operation of the property, which is associated with a reduction in maintenance costs.

![Figure 3. Percentage of energy produced from different sources, overall efficiency (EFFICIENCY)](image3)

In the period of active development of the information society, the urgency of automating all processes is growing, and construction, as an industry, is no exception. Now, manufacturers of automation for engineering systems offer a wide range of different devices that allow you to
independently adjust the microclimate, automatically maintain the optimum air temperature, humidity and purity. Technologies used in the house, allow residents to save up to 70% on payment for utility services. The main problem of "green technologies" and the eco-development as a whole is the high cost of their implementation, since the equipment used is imported and not every developer or customer can afford the implementation of this technology at their site.

3. Results of the analysis
In Russia, in 2009, non-profit partnership "Green Building Council" (RuGBC) was established, the main purpose of which is the development and implementation of the green construction principles. RuGBC is a part of the World Green Building Council, an international organization uniting 20 full-fledged, 10 developing, 27 prospective and 25 associated councils under its aegis.

Since 2009, centers for green construction standards have begun to be established in Russia:
- Non-profit Partnership "Center for Environmental Certification — Green Standards" (NP "Center for Green Standards");
- Committee on Energy Efficiency and Real Estate Ecology under the Guild of Property Managers and Developers (CEEN GUD).

In December 2015, the Association of Organizations for the Promotion of the Development of Environmental Certification in the Building Sector "National Center for Green Construction" (NCGC Association), which developed the Voluntary Certification System VCS RUSO (the single interdepartmental voluntary certification system "Rating for Habitat Sustainability Assessment") for residential and public buildings, as well as VCS "RUSO. Football stadiums" (voluntary certification system "Football stadiums. Rating for Habitat Sustainability"). The assessment principle is similar to that of other systems. The facility is assessed in categories: 9 categories according to VCS "RUSO" and 12 categories according to VCS "RUSO. Football Stadiums". As a result, the system provides for 4 classes of certification (green construction, silver, gold, platinum). The maximum rating is 1000 points, the certificate is granted if the rating is over 400 points.

Creation of new schemes for implementation of eco-projects, or practical implementation in eco-development of existing schemes (such as built-to-suit) will help give impetus to the development of this area in Russia. Subsequently, this allows implementing eco-projects not only within the framework of private residential construction but also within the framework of mass construction of apartment houses.

Benefits, which the customer will receive by concluding the built-to-suit contract:
- Development of the project concept and its implementation in full, including the work supervision.
- Possibility to fix the cost of facility at the initial stages of construction.
- The requirements to the object are worked out – the optimum area, configuration, engineering and technical equipment are determined for the benefit of the customer.
- Possibility to forecast and fix payments, and also to structure them according to their own plans.
- All problems and issues with contractors are solved by the developer, the money and time costs are fully in their charge if the developer's financing scheme is used. The customer's involvement is necessary only for the solution of key strategic issues at the initial stage.

4. Conclusions
In order to "green" construction has become an integral part of the Russian construction market, it is necessary first to change the people’s attitudes towards this issue. In conditions of solvent demand, the issue of ecological cleanliness of the building is not relevant for the majority of Russians. The same applies to the efficiency of the use of natural resources – introduction of energy-saving technologies should begin with the reform of housing and public utilities [1].

In addressing the importance of promoting eco-projects to the real estate market and their popularization in Russia, special attention should be paid to the BTS format at this stage of development. Since the definition of BTS development for residential real estate is mostly attributed to exclusive
projects, and implementation of eco-projects is rather costly from a financial perspective. Not every customer will be willing to invest in such a project.

Different financing options are also possible.
1. Option - the developer covers all the costs,
2. Option - developers may receive advance payments for purchases,
3. Option - the customer is the investor of his project,
4. Option - the investor of the project is the third party.

The most favorable option is when the customer is an investor for the process of implementing its facility. This scheme reduces the risk of non-purchase of the facility for the contractor, and also, taking into account the specificity of the facility (usually the only possible development option on the available site) in the future, the low potential liquidity of such a facility.

But the main thing that Russia's eco-development should strive for is the availability of eco-technologies, since access to the economy is very important for the mass development of this sector. This requires the state support. State compensation to developers for part of the costs when constructing such projects is practiced abroad. The first such steps are observed in our country: City authorities are starting to build social facilities with "green" technologies, such as sports complexes and stadiums, kindergartens, etc. The strategy of Russian developers, as a rule, is aimed at the construction and sale of housing, and developers abroad are oriented to a longer-term perspective, involving not only construction, but also further operation and management of the project, involving its management company, which guarantees the long existence of a "green" project [2].

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