Basic principles of “green” architecture in foreign realization experience

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Abstract. Recent years the interest in the questions of “green” architecture is growing increasingly visible throughout the world. The “green” architecture has become one of the most demanded areas of modern architecture as well as providing an incentive for the most various and multi directional research. At the present time architects and engineers face a challenge to effectively implement this trend’s opportunities in creating the architectural objects, in accordance with the principles of sustainable development. Based on analysis of the overseas experiences the article articulated and illustrated the basic principles that should be guided in order to achieve the greatest effect in the development of design and construction “green” objects.

1. Introduction
The concept of “green” architecture is a part of the whole complex of the effective approaches to the solution of the latest architecture current problems formed nowadays and undergoing approbation. All of them are closely interconnected. At the same time features and a variety of the nature and climate of Russia require special attention to development of this direction from the points of forming the integrated approach strategy to the solution of eco-architectural problems. The ecological architecture in general is a product of a harmonious technological chain. It begins with application of production rational methods and technologies and transportation raw materials for construction works, the effective choice of planning solutions and engineering systems for resource-saving, comfortable and ecologically safe functioning of architectural objects and comes to an end with utilization and recycling materials and construction issues which served the term of buildings, constructions and complexes.

2. Relevance of a subject
Reduce the impact on the ecosystems and all kinds resource saving as well as the conditions for efficient cooperation between the natural forms and man-made environment objects. As a result of that interaction the parameters of microclimate are improved and stabilized both inside created objects and inner and remote environment. It reduces energy consumption for relevant engineering system work, used for this purpose. At the same time, the ecosystem sustainability, including man-made objects, remains steady or increases. The most significant in this row is the fact that the conditions which sustain the human population and all kinds of friendly bioforms are established (including psychological aspects). It is possible due to reducing of replacement size and rates of bioforms by the
artificial objects. The inner world, the logic of development and improvement of eco-architecture, like a flagship of the newest architecture are determined by certain law or principles. We consider it appropriate to formulate and to reveal the content and meaning of such principles set. The many examples analysis of the «green» projects and constructions helps to identity and formulate, first of all, the basic principles that guide architects in order to ensure the most effective realization of this trend’s opportunities in a modern architecture.

3. Principles of creation of eco architectural concepts and their practical importance
One of the leading principles, we have emphasized, should be considered the principle of the commonwealth with nature. It assumes clearly integrated the natural, mainly vegetation forms into the structure of architectural object. The effect of such integration we have already described [1-3]. Experience with this principle in a resident architecture appears to be the most important and interesting to study. This work focused on developing and implementing this principle build on idea about approaching the basic parameters of living units in multi-flat house to parameters of living unit in a single-family house. As a result, the middle-rise housing is considered to be the most favourable and perspective housing for creating the bulk of living blocks. Meanwhile, in foreign architectural practice particular attention is paid to the house where the ground-floor apartments are equipped with the small «green» yards; the apartments located on the upper floors made by type of penthouse using the perimeter terraces; the apartments of medium levels are equipped with the terraces or the huge loggias or with the balconies. In this, the proportions and areas such summer rooms allow organizing comfortable recreational environment where the container plants [4] (Figure 1) may be placed.

![Figure 1. Principle of the commonwealth with nature.](image)

The basic model in Figure 1 is regarded the certain standard, getting a lot of interpretation in real architectural practice. Such approaches could be spread to multi-rise buildings, in limits up to 18, at most – up to 24 floors. Other leading principle, realizing an originality and potential of «green» architecture is the principle of nature similarity. For many cities of Russia which are especially among large and the largest everything more becomes relevant a problem of preservation, rational use and improvement of city landscape complexes. In this regard it is expedient to address the examples from foreign experience illustrating possibilities of formation of a city landscape on the basis of use of the principle of nature similarity.
Figure 2. Principle of nature similarity.

To make the city recreational spaces, such as floodplains, coastal city ponds zones, city parks, more attractive and demanded inclusion in their structure the public buildings with the different kinds of entertainment facilities. Expediently to organically include these buildings in structures of the developed landscapes without destroying their integrity and supplementing and reasonably adjusting. Here and appropriate application, so-called «buried to the earth» and «surrounded with earth shaft» of buildings which call also buildings hills [5]. Such buildings are quite widely presented in foreign practice. They can not only supplement a natural landscape but also create expressive artificial landscapes [5-8] (Figure 2) on the basis of use of nature similar forms.

Figure 3. Principle of compensation.
Thus, it is possible to solve rather effectively and correctly a set of problems: preservation and addition of natural landscapes, return of the sites used under construction to recreational resource base, equipment of city recreational areas with necessary public infrastructure, ensuring necessary parameters of a microclimate in rooms with the minimum expenses of energy resources.

Problems of resource-saving are successfully solved in complexes of this sort also due to reducing costs of usually expensive front and roofing materials. Besides, successfully remain, and sometimes ecological characteristics of city space – microclimatic parameters of the urban environment are improved [9,10]. And, at last, the palette of the architect forming public spaces considerably extends. Following to the principle of compensation in «green» architecture to some extent pursues the same aims. Architecture in this case more clearly, and sometimes traditionally, declares itself. The main objective at the same time is to compensate losses of city space which, as a rule, it is irrevocably withdrawn from category of spaces of recreational appointment (Figure 3). For this purpose the main resource for realization of a problem of compensation – operated roofs, most often planted trees and shrubs, is attracted [10-13].

Thus, the architecture partially returns to the city its invaluable square meters and hectares and at the same time solves the problems of the organization of open spaces provided by standards and functional requirements imposed to objects.

The «green» architecture is the one of the most demanded direction of modern architecture, provides an incentive for the most various and multidirectional research. Let's stop on one perspective direction of its development through realization of the principle of the buffer. Use of the principle of the buffer allows to create within a multipurpose complex several specialized zones with various microclimatic parameters which part can serve as a peculiar buffer between the main volume of the building and the hostile external environment [14-19]. Thus, the problem of protection of the main volume against adverse influence of climate with the minimum resource expenses is provided. Besides, organization issues of the spaces with the set microclimatic parameters are rationally resolving (Figure 4).

![Figure 4. Principle of the buffer.](image_url)

Examples of development of this sort of a perspective in foreign practice attract considerable interest of the architects and engineers because traditionally there are many questions in design of
housing, public and mixed-use estates for adverse climatic conditions, including complexes for conditions of Far North.

The following principle which foreign designers are guided by ecologically perfect solutions, is the principle of vertical transfer, settled and proved as ecologically justified typological structures (the principle of transfer). Use of this principle allows to unite separate elements of the typological structures recognized as the most comfortable for accommodation, not habitual horizontal (streets, drives, walking paths), and mainly vertical communications (ladders, elevators). Such structures are the farmstead, blocked and middle-storey dwelling (Figure 5). As a result the ladders and the elevators can connect down, for example, several inhabited modules platforms with the farmstead houses and homestead sites gardens placed on them. These modules are placed one above the other (Figure 5), thus it is possible to optimize the placement of inhabited blocks of high level of comfort in rather limited territory, having increased building density. Of course, such decision is possible, first of all, in the conditions of favourable climate. Meanwhile in the same manner possibly to organize the several inhabited modules which are the inhabited yards created by middle-storey houses (4–5 floors) and for more rigid climate. Middle-storey building is recognized as the European practice as the most comfortable option of configuration of rather large number of apartments in terms of harmony of parameters of open space to the person, approximations to an inhabited cell of the large vegetable forms placed in the yard, the organization places for walks with children. At the same time the inhabited yards in design decisions of this sort already have an artificial microclimate, the developed improvement and gardening, the necessary infrastructure placed in the first level of each module. Application of this sort of decisions is expedient when there is a need of formation of the high-class multi-storey structures of comfort placed on the sites [16, 18-20] limited on the area. The model and an illustrative row are presented on Figure 5 provides a concept of one of the most widespread reception of organization this type of structures.

4. Conclusions
In conclusion it should be noted that the width and versatility of statement of a problem of improvement of qualitative characteristics of modern architecture on the basis of identification and following to certain principles is not exhausted by the mentioned provisions, and their review is limited to article framework. At the same time it is important to emphasize that, being guided by the
basic installations considered in this article taken separately or applied in total designers have an opportunity fully and most effectively to solve problems of environmental safety and resource saving as the main problems of «green» architecture.

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