

Features of Design of Ecovillages in Depressed Areas in the City

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Abstract: In the conditions of post-industrial society the question of recycling of the land resources, restoration broken or development of inconvenient territories is particularly acute enough. The considerable city spaces which are taken away under development of industrial production or settled the reserves or morally became outdated. Adaptation of depressive city spaces and their return to active use can fill the existing shortage of functions of this or that part of the city. Similar ecological programs promote change of the principles of town-planning design and construction forming new architecture and therefore, qualitatively new habitat of the person. In study, the integrated city planning on the example of the region of Hammarby in Stockholm (Sweden) which has complete, integrated character is considered. Criteria and the principles of a sustainable development of territories are formulated.

Key words: Depressive city spaces, the integrated planning, sustainable development, resource conservation, ecovillage

INTRODUCTION

Many kinds of activity of the person are connected with direct invasion into environment, disruption and transformation of landscape structure and change processes occurring in them. To such kinds of activity the architecture and town-planning belongs. Interaction of architectural and town-planning activity and environment is shown at all hierarchical levels and needs anticipation of its results. However, till today there was no awareness fully of irreversibility of transformation of environment yet. The environment of activity of the person is a difficult natural-technical system in which work not anthropogenic again created processes but also natural continue the influence on the environment. The greatest scientist of the 20th century is V. Vladimirov defines the city as “a specific type of ecosystem anthropogenic origin” (Mikulina and Blagovidova, 2013). Returning to natural ecosystems should be noted that there are five main components of the landscape: earth, air, water, vegetation and fauna which are historically located in this order on influence force at each other (N.A. Solntsev). Thus, by changing the shape of the earth's surface, the person changes the state of all other components.

Today, in the cities there was a situation in which you need not save and restore the natural environment.

Artificially created ecosystems under the influence of natural processes lose stability and lead to unforeseen consequences. In the conditions of post-industrial society, there has to be other approach when determining planning restrictions at the stage of pre-analysis of the territory of the city. The considerable city spaces which are taken away under development of industrial production or has exhausted its reserves or are obsolete. This in turn requires the issue of secondary use of land resources, restoration or development of inconvenient areas, reconstruction of areas in the city structure. Adaptation of depressive city spaces and their return to active use can fill the existing shortage of functions of this or that part of the city. Similar ecological programs promote change of the principles of town-planning design and construction forming new architecture and therefore, qualitatively new habitat of the person.

MATERIALS AND METHODS

The main part: Consider integrated urban planning on the example of the District Hammarby in Stockholm (Sweden). The town-planning Hammarby model has become a tool of ecologically friendly development of cities around the world. The area in which Hammarby settles down was old, neglected and polluted industrial area. In the early 1990's, seeking to win the right to host



Fig. 1: The region of Hammarby in Stockholm (Sweden): last, real, future. Company presentation IVL in Stockholm; industrial area size since late 1800

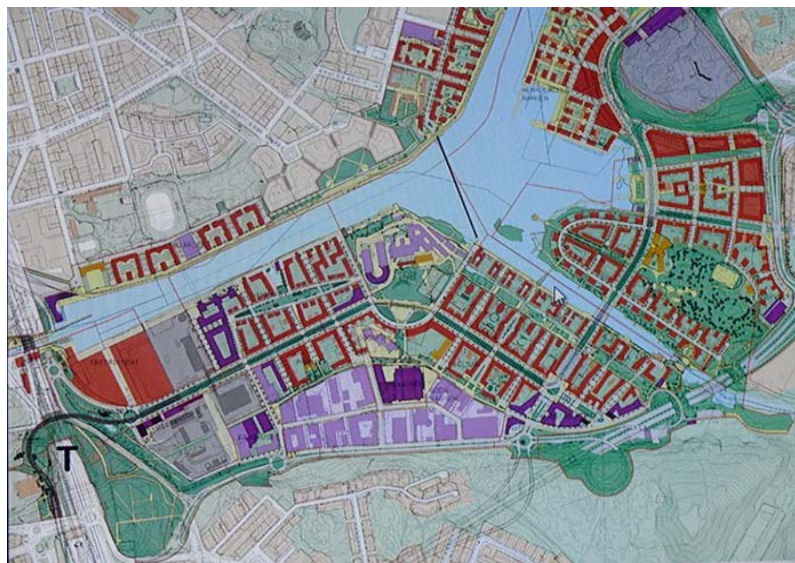


Fig. 2: The general plan of Hammarby. Company presentation IVL in Stockholm (Perkova, 2015a, b)

the Olympic games in Stockholm, all political parties represented in the city council, agreed to make this territory an example of environmentally sustainable urban development (Lavrik, 2006) (Fig.1).

In its building and creation of the master plan of the area participated some large Swedish architects: StellanFryxell with JanInge Hagstrom and Pierre Vig. Architectural Bureau Tengbom, Nyre'ns, CAN Arkitektkontor, Arkitekturkompaniet, Erse'us, Frenning

and Sjogren, Equator, AIX, Brunnberg and Forshed, White, Tengbom, Millimeter, Sweco, Reflex, AQ Arkitekter, Blomqvist landskapsarkitekter, Johanson Linnman, Fidjeland arkitektkontor, Ahlström Arkitektbyrå*, Carina Palmqvist and landscape architects Carl Bro landskapsarkitekter received prizes for their participation in the project (Aleksieva, 2014). Janinge Hagstrom was one of the main (if not the most main) strategists in design of Hammarby (Fig. 2).



Fig. 3: Multi-functional yard space ecovillage Hammarby. Children's playgrounds for various purposes (Perkova, 2015a, b)

The first stage of working on complex territory was recultivation of soils: a thorough treatment plots with removal of earth contaminated with harmful substances and cleaning water area. The construction of the Hammarby eco-district is to be fully completed by 2018. In it 11 thousand apartments, 35,000 inhabitants. About 45% of housing municipal (leased to residents), 55% private (residents are owners of apartments)(Alekseeva, 2014). Almost all new Swedish areas are eco-friendly and can be an example for many other countries. However, among them the ecovillage Hammarby reference and the most progressive area (Fig. 3).

The term "ecovillage" has received in recent decades widespread. However, its accurate definition in architecture and town planning isn't present so far. It is considered that environmental friendliness is based on full processing of liquid and solid waste, collecting rain water, cleaning and a reuse of "grey" drains there. The energy supply is focused on alternative sources photovoltaic installation in combination with a generator, powered by biomass. Also is supposed construction of small hydroelectric power stations on river dams. Houses are, as a rule, built from traditional natural materials. The ecovillage of the future sees as continuously changing system of interaction with natural processes, built on accurate charts such as those that in our time there are in ground and air transport, in certain types of production. To some extent it is realized in some modern buildings, their systems of insulation and ventilation which are directly reacting to change of a natural situation. We will consider features of integrated city planning ecovillage Hammarby in the structure of the City of Stockholm.

The first criterion of stability is the presence of the eco available high-speed transport connecting the village with other parts of the city. In the territory of the settlement as the main vehicle (80%) the bicycle is used. The government invested large sums in development of public transport. As a result, there were new bus routes and the line of the tram. Develops water ferry transport. Takes root the system of joint ownership of the car. At

the disposal of residents of the area and the staff of offices, there are 25-35 cars, 75% from them work at biofuel (Fig. 4 and 5). Organized system of walking and cycling paths in the settlement (Fig. 6).

In the reconstructed areas formed district building. Quarters are turned to picturesque reservoirs and parks. The average number of floors 4-7 floors. The maximum height of buildings 40 m. All buildings give economy of energy consumption due to perfection of a construction and thermal insulation and also orientation of rooms (Fig. 7).

The architectural appearance of buildings is rather various and traditional. Some construction companies and some architectural bureaus from the very beginning participated in planning and construction. So each architectural bureau worked on a quarter or several quarters (Sandelin, 2013) (Fig. 8).

Nevertheless, special measures for optimization of the volume decision on the principles of stability it wasn't applied. The correct orientation had impact from the point of view of specific points. A visual variety is formed thanks to various solutions of facades with use of contrast colors, invoices, materials, different images of windows, forms of balconies. The glazed loggias located on the southern facades of buildings. In buildings ventilation is decentralized and organized recirculation of heat. The educational sector wasn't rather considered at a construction stage (Fig. 9).

In this regard, it was necessary after settling of the area families with children to convert the first floors of buildings into kindergartens and schools (Fig. 10).

It should be noted that architectural methods of design of ecovillages are almost not developed, all attention is devoted to rationalization of engineering support. Eisenman and Rizzoli (2008), characterizing outstanding buildings of the second half of the XX century, noticed that "for the building function, structure and type, its instrumentality, not criteria for understanding of its value in the field of architecture".

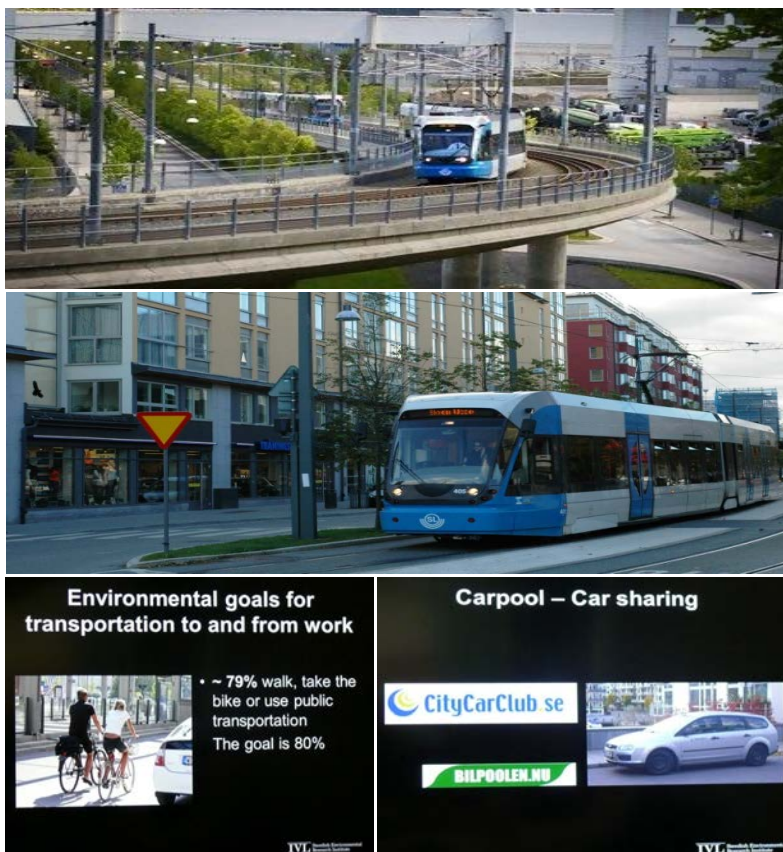


Fig. 4: Modes of transport, connecting Hammarby with other parts of the city. Presentation of the IVL company in Stockholm (Perkova, 2015a, b)



Fig. 5: The scheme of a transport and pedestrian network in Hammarby (Blagovidova and Mikulina, 2014a, b)



Fig. 6: The scheme foot and cycle paths in the settlement (Blagovidova and Mikulina, 2014a, b)



Fig. 7: Quarter building ecovillage Hammarby (Perkova, 2015a, b)



Fig. 8: The architectural appearance of buildings ecovillage Hammarby (Perkova, 2015a, b)



Fig. 9: Various solutions of facades with use of contrast colors, invoices, materials, various drawings of windows and forms of balconies ecovillage Hammarby (Perkova, 2015a, b)

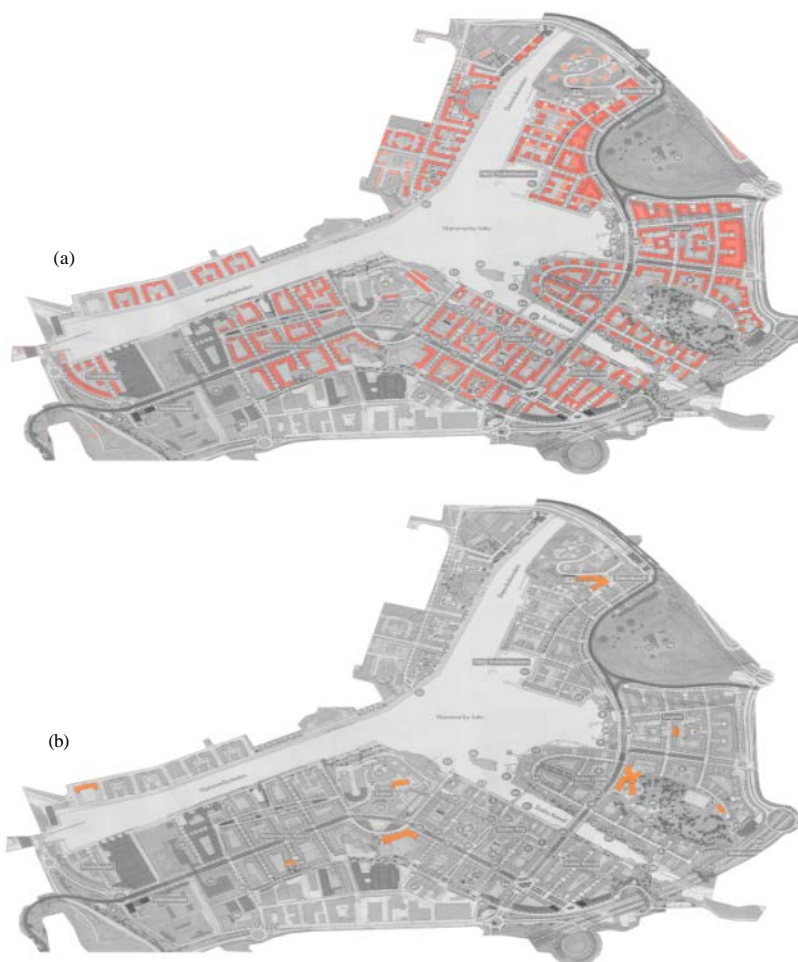


Fig. 10: Quarter housing development: a) Educational institutions; b) In the settlement of Hammarby (Blagovidova and Mikulina, 2014a, b)



Fig. 11: The placement of the offices in the structure of the ecovillage (at the left) and green areas (Blagovidova and Mikulina, 2014a, b)

When planning the area provided for the establishment of a large number of well-planned public spaces in quarters, parks on embankments was provided. The special nature of the formed public spaces gives the mentality of the Swedes. Interpenetration of an interior and exterior their “merger” due to lack of elements of a decor at windows characterizes a single, accessible open and safe environment of the settlement. Lighting of streets with the help not only external but also internal lighting can be considered also as an important element of control over public spaces. Offices in the bulk are concentrated on perimeter of a housing estate from South side of an ecovillages. In Hammarby created the special information center devoted both the theme of the functioning of the district and the general aspects of steady architecture. In conference rooms of scientific center pass public meetings and discussions of the vital issues of functioning of the city. They are also used as

classrooms in which to hold training seminars on sustainable architecture (Fig. 11). Thus, realized the second criterion of a sustainable development preservation of health and improvement of quality of life of the population.

The woods which was ruined during commercial operation were restored, there was a natural balanced ecological environment attractive to insects and birds reflecting criterion of a biodiversity. We formulated it as the criterion reflecting providing a biodiversity in the territory. In the construction process are realized standards for public green spaces: at least 25-30 m² of park have to be in limits of 300 m from each apartment. Also, a minimum of 15% of this area shall be illuminated by direct sunlight during the autumn-spring period. Numerous embankments of the region of Hammarby turned into the parks and biotopes promoting maintenance of natural ecological environment. Such

green spaces adapt for foot and cyclings become a place of active pastime of residents of the area. They help inhabitants to communicate more actively among themselves, forming social communications characteristic for single community. According to Lars Frenne, the project manager of Hammarby Shystad from municipality of Stockholm, “for the last few years to this area was run over by a large number of the population”. And his colleague Freudental, especially distinguishes one of categories from those who here lodged recently: “In the area, there are many families with children he says. Total 10% of its inhabitants are children under 5 year and in the district ten kindergartens and two elementary schools” (Sandelin, 2013). There is an interrelation of spatial and social characteristics of the environment.

RESULTS AND DISCUSSION

Let's formulate the main principles of sustainable territorial development of ecovillages on depressed areas of the city on the basis of the studied experience? The relationship of criteria of a sustainable development with spatial and social characteristics opens the principle connected with social characteristics of the territory of the city, the principle of social stability. It is necessary to consider interests of the social groups relating to this or that type of activity and to find balance between multidirectional interests of groups (Table 1).

The next important principle is energy sustainability. The used model of functioning of this settlement allows to reduce energy consumption by 50% in comparison with other projects of similar scale. Within the project harmoniously and logically coordinated systems of waste recycling, development of alternative types of energy, multi-cycle use of water. The industrial sector represents two blocks of the enterprises connected with processing of waste of the settlement. For collecting garbage is thought over the three-level system: at the level of the building (combustible garbage, food waste, paper waste, packings, etc.), the inhabited block (old furniture, electric devices, etc.) and the area (batteries, paint, glue). To facilitate process of transportation of garbage developed, the system of an automatic refuse chute to stations of processing (Fig. 12 and 13).

Resource-saving; use of energy of the sun. In solar collectors, there is a heating of water due to energy of the sun. Established about 400 m² of collectors on a roof of one of inhabited blocks. They provide more than a half of the hot water which is required for needs of residents. Another type of use of solar energy, the solar batteries transforming energy of beams to electricity. The energy from 1 m² of the coating of the solar cell is about

Table 1: Elements of social stability of territories

Social stability			
Settling	Space	Social ininteraction	Configuration properties of territory
Demographic structure	City	Standards of behavior	Transport networks
Ethnographic structure	Residential area	Carrying out actions of different function	Landscape
Cultural traditions	Microdistrict	Different types of “Consumer”	Spatial regularities of temporary and constant properties of the territory
Continuity	Quarter (housing estate)	Information and communication technologies	
Social potential		Yard space	Social crowd sourcing*

*Crowdsourcing is the mobilization of people through information technologies to solve problems facing business, government and society in general

100 kWh year⁻¹. It provides about 3 m² of the area of housing. Thought and water system, on the basis of a new canal crossing the construction zone and associated with a system of drainage and wastewater treatment. Water consumption reduced by 50%. Provides for the separation of domestic waste water, storm sewer, drainage system and industrial drains. Built an experimental sewage treatment plant. Process of cleaning includes chemical, mechanical and biological stages. All storm drains are cleared directly on a site in separate systems. They are absorbed to the soil or dumped to the special output canals merging to the main canal passing in the central park. After completion of construction, 50% of the energy necessary for Hammarby, will be produced in the area (biofuel from food and sewer waste, a reuse of hot water, renewable types of fuel plus energy efficiency and energy saving in houses) (Fig. 14). The silt received as a result of sewage treatment is loaded into big tanks where fermentation process begins. Released biogas which is the most environmentally friendly type of fuel for today. Produced gas is used as fuel for public transport and also in gas stoves in city kitchens (Fig. 14). After process of fermentation from silt there is a dense nutritious substrate rich with nitrogen and phosphorus which is ideally suited as fertilizer.

All this shows attempts to connect in new ecovillages age-old construction traditions to the latest technologies (Blagovidova and Mikulina, 2014). Thus, the energy sustainability includes a number of elements (Anonymous, 2013) (Fig. 15) settling:

- Energy saving
- Renewable energy source
- Water supply and water disposal
- Garbage disposal



Fig. 12: a) Placement of the industry; b) the scheme of waste disposal in ecovillage (Blagovidova and Mikulina, 2014a, b)



Fig. 13: The scheme of vacuum waste disposal, characteristic for Sweden and Finland



Fig. 14: Ecovillage Hammarby (Perkova, 2015a, b)

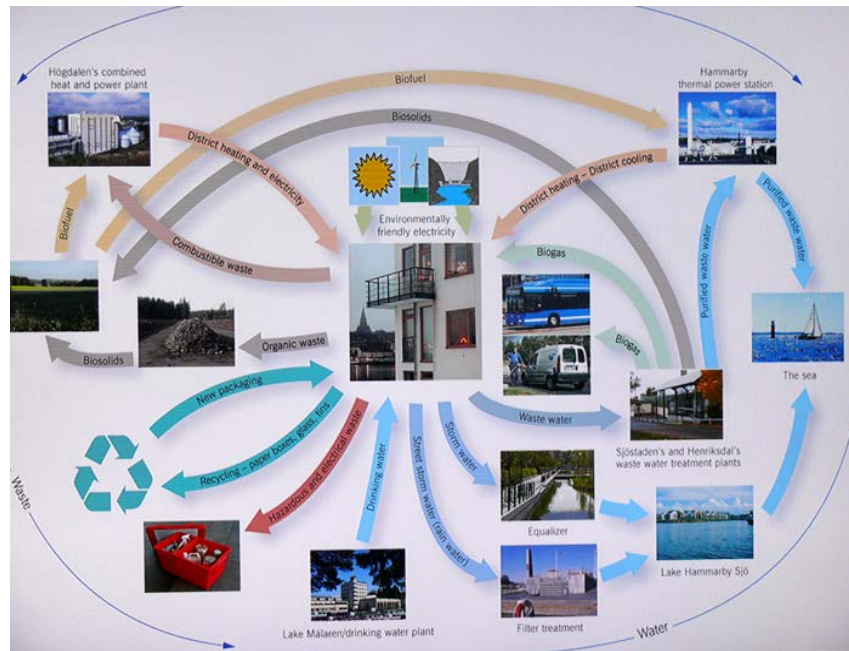


Fig. 15: The closed cycle resources consumption. Presentation of the IVL company in Stockholm (Perkova, 2015a, b)

Methods of power supply of ecovillages are various, experiments with biofuel, with solar or wind energy so far yield only partial result and power supply of production isn't considered at all. In principle, solar energy is considered as the main renewable source, however forecasts of rather possible consequences of the mass absorption of sunshine reducing their reflection didn't become yet (Blagovidova and Mikulina, 2014a, b). Meanwhile, change of the environment of the Arctic where the melting of ice

reduces the reflection of the sun, fills ecologists with misgivings. However, experience of design of small settlements while most often reduced to restriction of transport and the device of treatment facilities and also attempts of rationalization of energy consumption (Fig. 16).

The next principle is ecological stability. The sustainable development of economy and society is impossible in the conditions of degradation of nature. In this regard it is necessary:



Fig. 16: Methods of power supply of an ecovillage (Blagovidova and Mikulina, 2014a, b)

- Prevention of negative ecological consequences as a result of human activity
- Priority of life-supporting functions of the biosphere in relation to direct use of its resources
- Obligatory preservation and restoration of the existing natural systems
- Adoption of administrative decisions at the regional and local levels in the sphere of nature use and environmental protection on the basis of the developed innovative projects of basin natural resources management

Thus, the ecological sustainability includes a number of elements settling:

- Introduction of eco-friendly, waste-free productions
- Preservation of the biodiversity
- Continuous system landscaping

Summary: In this direction in Hammarby implemented several activities. Collecting and water purification. Water consumption reduced by 50%. Provided division of household drains, the storm sewerage, drainage system and industrial drains. Built an experimental sewage treatment plant. Process of cleaning includes chemical, mechanical and biological stages. All storm drains are cleared directly on a site in separate systems. They are absorbed to the soil or dumped to the special output canals merging to the main canal passing in the central

park. Developed landscape design with system of drains for the thawed and rain water getting via filters to the lake. Water supply includes:

- Ecologically rational intake of fresh water
- Department of slightly contaminated waste water from highly contaminated
- Actions for sewage treatment, storm sewerage
- Elimination of surplus of water at floods
- Recovery of level of ground waters

Garbage disposal includes:

- Separate garbage disposal
- Utilization of landfill gas

The last principle is the economic stability which opening character of modern information society and formation of types of the productions connected in development of renewable energy.

CONCLUSION

Thus, it is the holistic, integrated nature of the planning process is a unique feature of the project Hammarby. "All divisions involved in the project were given installation on environment still before there draw though one line. It is a holistic concept" (Sandelin, 2013).

We will note that the concepts “holism” and “holistic” come from the greek word “holon” meaning “wholeness”, “integrity”. It is known that the principle of integrity is one of the general system principles demoecosystems. Accordingly, the whole world and all living things from the point of view of holism is a single unit. The concept of this movement consists that the person is indivisible and represents a whole in the space-time continuum. According to this theory, every individual is part of the Universe and fully reflects its structure. Material carrier “integrity” is the holographic structure of DNA in which is embodied the algorithm of integrity. It was formulated still by the ancient greek scientist Heraclitus in the V century BC: “From one everything from everything one”.

“The Hammarby model” has gone on exports, particularly to Russia, Great Britain and China. Today, after more than ten years, the index of ecological stability of the new area is estimated 30-40% higher than for standard housing estates. Progress, thus, is confirmed but it is necessary to make much. According to Freudenthal stability indicators on Hammarby Sjostad 75% are provided with a design of buildings and infrastructure; the remained 25% should be in the hands of the residents themselves (Sandelin, 2013).

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REFERENCES

- Blagovidova N.G. and E.M. Mikulina, 2014a. Energy effective Buildings and Concept of a Sustainable Development. *J. of Academia*, pp: 1.
- Blagovidova, N.G. and E.M. Mikulina, 2014b. “Methods of Design of Ecovillages”. *J. of Acade.*, 3: 90-97.
- Eisenman, P. and Rizzoli. N.Y., 2008. *Ten Canonical Buildings, 1950-2000*.
- Lavrik, G.I., 2006. *Methodological bases of Regional Planning. Introduction to a Demoeology*. G.I. Lavrik (Eds.), Belgorod. BGTU, pp: 116 p.
- Mikulina, E.M. and N.G. Blagovidova, 2013. *Architectural Ecology: Textbook*. E.M. Mikulina (Eds.), N.G. Blagovidova. Moscow: Academy, pp: 248.
- Perkova, M.V., 2015a. Social Stability as Principle of Development of Territories of the City: Collection of Scientific works. *Bulletin of BSTU Named after V.G. Shukhov*. Release, pp: 3.
- Perkova M.V., 2015b. Energetic Stability as the basis for Security Management of the City. *Municipal J.*, 1(16): 63-69.
- Anonymous, 2013. *Strategy of Social and Economic Development of the Belgorod Region for the Period till 2025*. Approved as the Resolution of the Government of the Belgorod Reg.
- Sandelin, A., 2013. World experience of energy saving. Hammarby Sjöstad to live “in a green way” in the centre of Stockholm. “Energosvet”, information electronic journal on energy saving Noordination Council Presidium of the General Council of all-Russian political party “UNITED RUSSIA”, 6(31): 53-55. <http://www.energ.osovet.ru/bul.php>.
- Alekseeva, T. , 2014. The Eco-district of Stockholm, Hammarby Sjöstad Hammarby Sjöstad. Lakecity Hammarby. Electronic popular scientific and educational journal “Ecology and life”. Electronic access <http://www.ecolife.ru/gorod/12451>.