

УДК 69.001:711.1

M.V. Savytskyi¹, Dr. Sci. (Tech.), Prof.,
 O.I. Bondarenko¹,
 M.M. Babenko¹, Cand. Sci. (Tech.),
 Yu.B. Benderskyi², Cand. Sci. (Tech.), Assoc. Prof.

1 – State Higher Educational Institution “Prvdniprovsk State Academy of Civil Engineering and Architecture”, Dnipropetrovsk, Ukraine, e-mail: sav15@ukr.net, bond.bagatel@gmail.com, babenko.marina@yahoo.com
 2 – Kryvyi Rih Technical University, Kryvyi Rih, Ukraine, e-mail: efim8808@gmail.com

OPTIONS OF SUSTAINABLE DEVELOPMENT OF REGION'S TERRITORY

М.В. Савицький¹, д-р техн. наук, проф.,
 О.І. Бондаренко¹,
 М.М. Бабенко¹, канд. техн. наук,
 Ю.Б. Бендерський², канд. техн. наук, доц.

1 – Державний вищий навчальний заклад „Придніпровська державна академія будівництва та архітектури“, м. Дніпропетровськ, Україна. e-mail: sav15@ukr.net; bond.bagatel@gmail.com; babenko.marina@yahoo.com
 2 – Криворізький технічний університет, м. Кривий Ріг, Україна, e-mail: efim8808@gmail.com

МОЖЛИВІ НАПРЯМИ СТАЛОГО РОЗВИТКУ ТЕРИТОРІЇ РЕГІОНУ

Purpose. To develop a scientifically founded model of strategic and spatial planning at the regional levels, which should be based on the main principles of sustainable development.

Methodology. The model was based on a review of scientific work on the problem, the analysis of statistical data, using the methods of field research to study the features of sustainable development in the region.

Findings. The research showed that sustainable spatial planning is a combination of economic strategic and spatial planning based on principles of sustainable development; sustainable spatial planning aimed to protect biodiversity and to safeguard the cultural heritage of man-made ecosystems. The results of this research confirmed the vulnerability of environmental and cultural resources in the Dnepropetrovsk region, due to the existing practice of urban encroachment and the absence of balanced territorial planning tools. The environmental adaptation of territorial planning and effective resource management share the goals of enhancing the sustainable development of each local community. A new approach to spatial planning of the region's territory development based on the conception of socio-economic complexes supporting the main principles of sustainable development was proposed. The ecological and economic balance of these complexes was characterized by the fact that the technology used in these communities is beneficial to the environment.

Originality. The model of spatial planning of region's development meets the basic criteria of sustainable development: economic and energy efficiency, social orientation, environmental friendliness, preservation of cultural heritage.

Practical value. The implementation of the proposed new planning model may contribute into promotion of balanced development of the industrial region.

Keywords: *sustainable development, spatial planning, socioecocomplex*

Problem statement. The village is the center of national traditions' preservation such as: honoring the family and established relations between generations, which have a significant influence on the formation of the Ukrainian mentality.

Ukraine is primarily an agricultural state. Its formation occurred under the influence of the processes that passed in the villages. Nowadays Ukrainian government has a difficult task to revive the village. The concept of a national project to build agrarian socioecocomplexes is developed on the basis of globalization trends' analysis and awareness of Ukraine's role in the global labor division. Other notions taken in to account are the principles of sustainable development, the features of modern post-industrial information society ('knowledge society'), the formation of "national idea", the modern technologies of natural farming, the study of international experience of ecovillages' existence, the innovative energy-efficient construction and information technology implementation. It is also very im-

portant to consider the historical relationship both to the ancient agricultural Tripoli culture that was present on the Ukrainian lands and existence of the Cossack 'Zimovniki' and the hamlet of farms.

The term 'socioecocomplexes' means established residential space in which the industrial, scientific, educational and recreational activities are integrated into the environment in a way that supports healthy and thorough development of the individual and helps to develop responsible attitude towards future generations.

Identification of an unsolved problem. Nowadays agricultural sector is one of the most important parts of Ukrainian economy. Today more than 14 million people are employed in the agricultural sector, and only 620,000 of them are working in the large farms – agro-holding companies. The core components of the government's policy are support for micro and small scale enterprises (MSEs) and integrated housing development. Extremely important factor for the agricultural sphere is not only increase in production rates but also the development of rural social infrastructure, thus we are faced with the necessity for a governmentally funded program to ensure affordable housing in the regions.

Analysis of the recent research. Over the last decade eco-blocs that evolved into eco-cities has appeared in Europe. Vauban district in Freiburg (Germany) is considered the most famous European eco-village. It is here that the concept of “passive houses” was developed. The main idea behind that concept is construction of buildings with minimal energy consumption. Their purpose is to produce heat and electricity by burning natural material collected during cleaning of Freiburg parks. A typical energy-efficient house through cogenerates and solar cells produces one and a half times more energy than it consumes [1].

The construction of the first ecoblocs in Malmo (Swedish city) began in 2001. It is the first part of the 20-year plan for creating a “city of the future” with a population of 300,000. The creation of energy efficient houses is restricted by the known framework of engineering knowledge, such as triple-glazed windows, the use of heat exchangers for air ventilation, use of ground heat accumulators. Heat is generated by a heating plant for a district. This plant operates thanks to the energy generated by wind turbines located in the open sea [2]. Finland also observes a growing popularity of eco-blocs that use autonomous and environmentally friendly energy sources [3].

Identification of the unsolved part of the general problem. The principles that comprise a foundation for agricultural socioecocomplexes are: environmental friendliness, innovation, business and social activity of inhabitants, comprehensive development of an individual. The environmental friendliness of socioecocomplexes is characterized by the fact that the technology used in these communities is beneficial to the environment. Natural environment mechanism is studied and incorporated into the complexes in order to secure its safe integration to existing surroundings. A trademark of socioecocomplex is reuse of material resources.

The formulation of the research aim and objectives. To develop a scientifically sound model of strategic and spatial planning at the regional levels, which should be based on the main principles of sustainable development: improving economic performance and energy efficiency, social orientation, environmental friendliness, preservation of cultural heritage

Presentation of the research results. Features of development of civil construction in Ukraine in the context of globalization mainly coincide with the global trends. The agricultural stage of society development (wave) is characterized by the development of settlements in rural areas and traditional type of dwelling. As for industrial stage, it can be characterized by urbanization, the development of big and small towns. Moreover, as for the post-industrial stage it can be characterized by suburbanization, de-urbanization, ruralisation.

Prerequisites for ruralisation are as following: there is no need to live in super dense urban settlements; environmental awareness; problem of traffic jams in megacities; increased risk of accidents, emergencies, viral epidemics in urban areas; growing cost of land, and housing in cities. The best solution for this problem is the creation of a widespread network of agricultural socioecocomplexes.

When it is creating socioecocomplexes, the priority should be given to the following technologies:

- a) energy saving technologies;
- b) improving energy efficiency on the basis of renewable energy sources usage
- c) introduction of technologies of bio decomposition of waste products of an organic origin;
- g) introduction of technologies of reprocessing inorganic waste that can be located on the residential complex premises;
- d) usage of materials, structures, devices and engineering equipment in the facility reprocessing of which will cause minimal impact on the environment.

In broad terms, integration of adaptation planning approaches could be achieved through implementation of the model for agricultural production based on an entirely different relationship with nature.

The application of such approach means the orientation to the creating open economic system with the focus on enhancing the eco-friendly status of the territory, without prejudice to provide the population with quality food and other organic materials.

For such facility to succeed alternative systems of farming and agriculture has to be used. Examples of such approaches are: a) biodynamic agriculture; b) organic agriculture; c) agriculture that profits from usage of energy-information components; d) agriculture that find use of microbiological components and fungus spores; e) the agro-technology based on worm-compost, humic substances and green manure; e) other technologies that eliminate the use of chemical fertilizers. We suppose that the during the design process that predates construction of socioecocomplex it is necessary to consider facility entire life cycle (production of building materials, construction, maintenance, demolition).

The scale of ecocomplex and the optimal number of residents must provide the conditions under which all residents are familiar with each other and with each can have the influence on the development of ecocomplex. According to the results of social research, the upper limit of the group of about 500 people, and the optimal number is 300 people. It is given, that if the average composition of the family is 3–4 people, then the optimal number of individual residential buildings in socioecocomplexes can be 70–100 houses.

Thus, the implementation of the concept of creating the socioecocomplex provides for the withdrawal of a large portion of the population of cities and resettlement of people in ecocomplex integrated into the environment, and that will satisfy all human needs. In ecocomplex will be maintained the lifestyle, that will bring balance to the inner world of man, make it harmonious with respect to each other and to the environment.

One of the most important issues is the formation of eco-villages and their integration into the existing system of settlement. Ecovillages are formed in the structure of national and natural parks, on the territory of natural systems, in the system of rural settlement. Of the above areas, the integration of eco-villages in rural settlement is necessary for the implementation of the principles of sustainable development of the area. This is especially sound problem for the industrialized regions characterized by a dense network

of large cities, high rates of urbanization, environmental problem [4].

The main prerequisites for the formation of eco-villages in the Dnipropetrovsk region is getting worse day by day the environmental situation in towns and cities, social factors (stress, poor diet, sedentary lifestyle, etc.), which leads to an increase in disease level of population and to the decrease of quality of life. Essential for the development of eco-villages Dnepropetrovsk region is a "Program of the formation and development of the national network of eco-villages of Dnipropetrovsk region for 2006–2015".

The main objective of the program is the formation of territorial and functional ecosystem, which should ensure the preservation and reconstruction of landscape and biological diversity within the boundaries of the area, and increase the 'percentage of wilderness protection' up to 11% of the total area under the current 1.1%. For comparison, the average figure for Ukraine is 4.5%, and in some European countries – up to 15–17%. In areas within the boundaries of the national ecological network area, the economy should be formed in the future, with priority development of protected areas, eco-tourism, eco-friendly cultivation of agricultural products, the creation of agricultural ecocomplexes and ecovillages.

In the Dnepropetrovsk region, there are 1504 settlements, including rural – 1438. The villages with a population from 1 to 500 people make up 1079 (75%). Within the boundaries of the ecological network area, 340 small villages are located. A small village means the village with a population up to 100 people. Small villages are characterized by the absence or underdevelopment of material – industrial base, social and service facilities. At the same time, they are attractive by its originality, history, rhythm of life, unique interaction with the natural environment.

Ukrainian national center for sustainable architecture building (of SHEI "Prydniprovsk State Academy of Civil Engineering and Architecture") has already developed number potential socioecocomplex projects in the Dnipropetrovsk region. In the project "Integration of ecovillages in countryside settlement Tsarichanska region of Dnipropetrovsk region", a concept is developed by network of transformation sat of Tsybulkovska village council in the group system of ecovillages. The territory of the village council is located within the boundaries of the emerging Orelsky National Park [5].

It is proposed the formation of two types of ecovillages: high-end ecovillage "Smart – Village" (Greenhouse, greenhouse farming, science and research, agricultural products processing, management, maintenance of recreation and tourism) and eco-village "Eco Village" (agricultural activities, maintenance of recreation and tourism). The principle aims of such transformations in spatial planning are the economic development with the preservation of biodiversity and comprehensive management of natural resources; and cultural heritage of indigenous people.

Ecovillage concept of "Zubkovskaya Farm" based on the current planning of village's space. It is proposed to create a community of five farms with a closed-cycle of economic activity due to the natural environment: agriculture, livestock, fishery, fishing, cultivation of medicinal plants

and herbs, and a wellness vacation and eco-tourism [5]. The territory of the community is a landscape park (park, meadows, Agropark, waterfront park), where organically interact with all members of the community activities: economic, recreation, research, environmental and others. Primary residential unit-farm community is a family estate, residential group, where it can live a family of 2–3 generations.

Planning structure and development of farms – communities integrated into the structure of the landscape and formed with the geomorphological features of the area of farms: in the "Riverside" and "island" – linear and modular construction scheme in "Lesnm" and "Lugovoi" – dispersion, dispersed in 'agricultural farm' – linear group.

Eco-housing is integrated into the natural environment: shaping, planning, construction materials, scale and image are dictated by the type of the surrounding landscape. So the "Green House" is located in the forest, "Terra-house" and "Hill House" – pasture landscape, "Eco-Module" – on the water, "the very hut" – in the area and agroparks area etc. Ecohouse is a self-contained complex of life support, the composition of which is being developed for each of planning levels. Eco-village is a pedestrian space. The ecovillage area covers 600 hectares, including 180 hectares of fo-rest. The population of the eco-village is 500 people. The density of settlement is 1.2 persons / ha. The ecovillage's infrastructure is designed for serving 200 tourists.

The project Socioecocomplex "Bogdanovka" is one of the first projects in Ukraine ecovillages based on a scientific approach to their design. Projected socioecocomplex total area is 7.0 hectares (the number of residents is 250–300 people. The density of settlement is 35–40 persons / ha). It is located in the Dnipropetrovsk region, organically integrated into the structure of Novoaleksandrovka.

To generate electricity and heat are applied solar cells, solar panels, electric photocells, power generating glass, heat pumps, wind turbines. There are ventilation, air conditioning and recovery air. The architectural diversity of living spaces is achieved by using different types of houses, landscaping and beautification techniques.

Residential homes are energy-efficient, eco-friendly local natural renewable construction materials buried row house "Green Ribbon"; row house "Green Hills", where technology is used Solar Window; round straw house under a thatched roof; "House-wave" and "House-Hut" fit perfectly into the environment by the methods of intensive greening roofs [5].

Constructive solution of houses: wood frame, with the filling of the internal space frame lightweight concrete based on renewable organic material (straw, grain crops, hemp fire, et al.). Presented a constructive solution has been developed on the basis of laboratory studies of thermal insulation characteristics of local renewable building materials of organic origin, carried out in SHEI "Prydniprovsk State Academy of Civil Engineering and Architecture" (table 1–2).

Projected socioecocomplex is regarded as an experimental platform for testing the developed architectural design, engineering and technology and urban solutions to their subsequent mass adoption in the implementation of the program of construction of agricultural ecocomplex.

Table 1

Characteristics of thermal insulation materials

Material	Volume weight, kg/m ³	Thermal conductivity coefficient, Watt/(m*K)
Chop of jonk	400	0.12
	300	0.09
	260	0.078
	220	0.06
Pressed paille	150–250	0.09
	90–110	0.045
	73–85	0.04–0.05
	100	0.054–0.065
Boon of hemp	70–90	0.048–0.06
Adobe	1500	0.5
Lightweight adobe	1000	0.13
	900	0.114
	580	0.073
	420	0.071
Lightweight concrete on the base of boon of hemp	260	0.075
	360	0.079
	400	0.084

Table 2

Economic indicators of the buildings of eco-complex

Heat insulation material	Construction	Liquidation	Rehabilitation	Heating
	grn/m ²		grn/(m ² year)	
Paille	2835	368	38	35
Light-weight adobe	3645			36
Lightweight hemp concrete	4050			39

Research conclusions and outlook. The present study clearly shows the following:

1. Ukraine was aiming at modernizing its spatial planning through the development of economic activities, and the use of environmentally friendly construction technologies to the creation of a national network of socioecocomplexes.
2. The basic principles of development of socioecocomplexes are business and social activity of the inhabitants, ecological, technological, the comprehensive development of individual.
3. Ukraine has no experience in creating a network of socioecocomplexes. Pilot projects by Ukrainian National Center for Ecological architecture and green building SHEI “Prydniprovska State Academy of Civil Engineering and Architecture” can push forward the implementation of projects and implementation of standards of sustainable development.
4. Strengthen sustainable economic development and lead to job creation, particularly in agriculture regions. In this context, the resettlement of much of the urban population into social ecological complexes (socioecocomplexes) is an effective solution.

References / Список літератури

1. Vauban – eco-region, available at: [http://www. Ecology.md/section.php?section=tech&id=57](http://www.Ecology.md/section.php?section=tech&id=57), (accessed June 15, 2015).
2. Eco-district in the city of Malmö (Sweden), available at: <http://gisap.eu/ru/node/1272>, (accessed June 15, 2015).
3. Eco-district Eco-Viikki, Helsinki (Finland), available at: http://www.ugra-ned.ru/new/tendency/city_garden/, (accessed June 15, 2015).
4. Энергоэффективные здания: мировой опыт: Энергоэффективные здания в Германии, Финляндии, России // Энергоинформ. – 2005. – № 47 – 14 с.
“Energy efficient buildings: A Global Perspective: Energy-efficient buildings in Germany, Finland, Russia” (2005), *Energoinform*, no. 47, pp. 14.
5. Savitskyi, M.V. (2010), “Environmental energy efficient low-rise construction”, *Stroitelstvo. Materialovedenie. Mashinostroenie*, Dnepropetrovsk, no. 55, pp. 26–30.
Екологічне енергоефективне малоповерхове будівництво / М.В. Савицький [та ін.] // Строительство. Материаловедение. Машиностроение. – Дніпропетровськ: ПДАБА, 2010. – Вип. 55.– С. 26–30.

Мета. Створення науково обґрунтованої моделі просторово-територіального планування на основі базових принципів сталого розвитку.

Методика. Модель розроблена на основі аналізу наукових праць у галузі проблеми, аналізу статистичних даних з використанням методів польових досліджень для вивчення напрямів сталого розвитку території регіону.

Результати. Показано, що стале просторове планування – це поєднання стратегічного економічного й територіального планування, що засноване на принципах сталого розвитку; стале просторове планування спрямоване на захист біорізноманіття та збереження культурної спадщини техногенних екосистем. Результати цього дослідження підтвердили вразливість екологічних та культурних ресурсів у Дніпропетровській області, що зумовлено існуючою практикою розширення міського будівництва та відсутністю збалансованих інструментів територіального планування. Показано, що екологічна адаптація територіального планування та ефективне управління ресурсами – усі вони мають ті ж цілі підвищення сталого розвитку кожної місцевої громади. Пропонується новий підхід до просторового планування розвитку території регіонів в Україні, що заснований на концепції соціально-економічних комплексів, що підтримують основні принципи сталого розвитку. Еколого-економічний баланс характеризується тим, що технології, які використовуються в цих комплексах, є дружніми для довкілля.

Наукова новизна. Модель просторово-територіального планування розвитку регіону відповідає основним критеріям сталого розвитку: економічність, енергоефективність, соціальна спрямованість, екологічна дружність, збереження культурної спадщини.

Практична значимість. Реалізація запропонованої моделі сприятиме поступовому нарощуванню збалансованого розвитку промислового регіону.

Ключові слова: *сталій розвиток, просторове планування, соціоекокомплекс*

Цель. Создание научно обоснованной модели пространственно-территориального планирования развития региона на основе базовых принципов устойчивого развития.

Методика. Модель разработана на основе анализа научных работ по проблеме, анализа статистических данных, использования методов полевых исследований для изучения направлений устойчивого развития территории региона.

Результаты. Показано, что устойчивое пространственное планирование – это сочетание стратегического экономического и территориального планирования, которое основано на принципах устойчивого развития; устойчивое пространственное планирование направлено на защиту биоразнообразия и сохранения культурного наследия техногенных экосистем. Результаты этого исследования подтвердили уязвимость экологических и культурных ресурсов в Днепропетровской области, что обусловлено существующей практикой расширения городского строительства и отсутствием сбалансированных инструментов территориального планирования. Показано, что экологическая адаптация территориального планирования и эффективное управление ресурсами – все они имеют те же цели повышения устойчивого развития каждой местной общины. Предлагается новый подход к пространственному планированию развития территории регионов в Украине, который основан на концепции социально-экономических комплексов, поддерживающих основные принципы устойчивого развития. Эколого-экономический баланс характеризуется тем, что технологии, которые используются в этих комплексах, являются дружественными для окружающей среды.

Научная новизна. Модель пространственно-территориального планирования развития региона отвечает основным критериям устойчивого развития: экономичность, энергоэффективность, социальная направленность, экологическая дружелюбность, сохранение культурного наследия.

Практическая значимость. Реализация предложенной модели будет способствовать постепенному наращиванию сбалансированного развития промышленного региона.

Ключевые слова: *устойчивое развитие, пространственное планирование, соціоекокомплекс*

Рекомендовано до публікації докт. техн. наук П.І. Пономаренком. Дата надходження рукопису 25.04.14.

Редакція повідомляє про те, що у випуску журналу «Науковий вісник Національного гірничого університету» №1 за 2015 рік назва статті Гонтаревої Ірини Вячеславівни та місце роботи англійською мовою були надруковані з помилками. Оригінальна назва статті має такий вигляд:

«Syllabus structure in the formation of complex competences», назва університету – Simon Kuznets Kharkiv National University of Economics.

Редакція журналу приносить свої вибачення за спричинені незручності.