

# Innovative geotechnologies is the key to geoenvironmental sustainability of urban areas by reducing the load and control technolandsapes on the example of innovative water-coal technologies

Tatyana Zommer<sup>1,\*</sup> and Sergey Chernyshov<sup>1</sup>

<sup>1</sup>Moscow State University of Civil Engineering, 129337, 26, Yaroslavskoye Shosse, Moscow, Russia

**Abstract.** The relevance of the article lies in the necessity of development of innovative geotechnologies in order to establish the geo-ecological stability of the territories while reducing the negative anthropogenic impact of economic activities on the environment. Therefore, at the present stage innovation policy needs to be fundamentally reoriented in the direction of coordinated development of new technologies aimed at restoring the supply of their biosphere. The authors come to the conclusion that modern innovative geotechnology can not only promote the improvement of ecological state of urban ecosystems, but also to facilitate automatic control techno landscapes on the example of innovative water-coal technology. In this case, technogenesis not the last, apocalyptic, evolutionary phase of human activity characterized by the disturbance of the biotic turnover and balance «biosphere – technosphere» in the direction of the technosphere. Reasonable parity of the biosphere and technosphere marks the transition of innovative thinking to an innovative geo-environmental, geocosphere thinking, and of the technosphere – to geocosphere.

## 1 Introduction

The role of technogenesis in the transformation of the planet as a result of human activities is linked to the development of mining industry, intensive agriculture, urban development, construction of power plants and other types of construction. The concept of technogenesis, in terms of science and technology is man-made changes to natural landscapes as a result of human industrial activity.

At a certain stage the results of the human activities become comparable to geological processes [1].

Technogenesis at comparable geological processes to human activities is becoming a source of anthropogenic hazards. The result of the irrational nature of contemporary technogenesis is characterized by the intensification of human impact on the geosphere of

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\*Corresponding author: [ZommerTV@mgsu.ru](mailto:ZommerTV@mgsu.ru)

the Earth: the lithosphere, soil, hydrosphere, atmosphere, resulting in randomly created and modified techno-landscapes.

The level of technogenesis is due to the applied technologies and equipment. In our opinion, modern and innovative Geotechnology can and should contribute to the improvement of the ecological state of urban ecosystems. At the same time innovative technologies can be a key to automatic control when you create a techno-landscapes. Example of control action with the projected reduction of the negative anthropogenic impact on geosphere shells of the Earth is the massive introduction of innovative water-coal technologies. According to «Energy strategy of Russia for the period till 2030» the main part of electric and thermal energy to be generated from thermal power plants. At the same time coal mining remains associated with the impact of human activities on the Geosphere of the Earth, comparable to geological processes, and the daily burning of solid coal fuel in thermal power plants and boiler housing is detrimental to the environment and habitats of the ecosystems in urbanized areas.

In the decree of the RF Government also notes that the energy policy is focused on reducing internal gas consumption in the structure of fuel and energy resources. Coal should become the main energy source of thermal and electric power stations. Respectively should be paid great attention to the development of innovative technologies, including innovative coal-water fuel technology.

Innovative public policy is perceived by many only as a means of investment in high-tech manufacturing and knowledge-intensive innovative technologies, and as a consequence – in technogenesis as a product of technology.

In the paper [2] devoted to the study of technogenesis, it is noted that in a global context contemporary technogenesis acquires the features of an unmanaged process is not subordinate to the will and mind of people, is almost chaotic, with unlimited growth of consumption and exploitation of natural resources.

Therefore, at the present stage innovation policy needs to be fundamentally reoriented in the direction of coordinated development of new technologies of production and of the man himself, aimed at restoring the supply of the biosphere.

In the process of conventional coal technology, involving a mass withdrawal from the earth and burning non-renewable coal fuel, is comparable to geological processes of technogenic impact on the Geosphere shells of the Earth. In the structure of the crust changes occur. Coal piles, having the potency to spontaneous combustion, towering like an artificial mountain with a latent flowing volcanic processes. Artificially created voids become a cause of technogenic failures on the undermined territories. In the emptiness in mine workings, rushing underground and surface mine waters.

In the emptiness in mine workings, rushing underground and surface mine water, forming artificial lakes and rivers. Extensive production in open territories provoke dust storms. Emissions of pollutants from coal combustion at thermal power plants and municipal boilers cause acid rain. Emissions of pollutants from coal combustion at thermal power plants and municipal boilers cause acid rain leads to acidification of soils and oceans, promote the self-reproduction of the greenhouse effect and global warming.

In particular for these reasons, according to some pessimistic minded authors [2], technogenesis «is the last stage of the evolutionary human activity», characterized by the disturbance of biotic turnover and balance «biosphere – technosphere» with a clear superiority in the technosphere. In this predictive in its essence, the definition of the word «last» is addressed to humanity as a whole and makes you think about finding a reasonable compromise between the technosphere and biosphere that feeds her. In order to really stage technogenesis was not «the last stage of the evolutionary human activity», it is necessary to develop a new paradigm ecosphere compatible to geo-ecological sustainability of urban areas with decreasing impacts on the Geosphere of the Earth.

A theory, not backed up by concrete technology, may be ephemeral in practice. Therefore, the desired qualitative improvement of the geocological condition of the urbanized territories as a whole must have an innovative technology with which this improvement can be achieved through scientific and technical progress, based on geosphere compatibility. The word technology we understand the hierarchical structure of some actions, ways and means, which is a production process with the aim of achieving a certain result in the form of products, goods or services that have consumer properties. Innovative technology is inherently carries the notion of critical technology, meaning technological breakthrough in any field of science and technology, requiring the amount of intellectual, material and financial resources.

The system of geo-ecological stability of the urbanized territories as a whole relies on the theory of: philosophical (the laws of development of nature and society) and economic (laws of development of relations of production, theory of automatic control). The purpose of the logistics system principles of geocological sustainability of urbanized areas is the increase of efficiency of management of innovation technology.

The word innovation implies the introduction of something new. Innovation as a process means investing in the knowledge-based economy in order to change of generations of technologies and technological structures. As the object of the innovation is a new technology arising from scientific and technological achievements.

In scientific development displays a paradigm, or conceptual basis of biosphere compatibility of man and nature, the principles of which is linking «the withdrawal of resources from the natural environment – back to nature waste – the state of health of the population».

Thus, in our opinion, innovative geotechnology as a critical technology should be focused on innovative thinking to ensure optimal use of intellectual, material and financial resources and geoenvironmental built on the principles of biospheric compatibility of man and nature. And in this case, technogenesis becomes not «the last stage of the evolutionary human activity», characterizing the violation of the biotic turnover and balance «biosphere – technosphere» in the direction of the technosphere [2]. Stage a reasonable parity of the biosphere and technosphere marks the transition of innovative thinking to an innovative geoenvironmental, geocosphere thinking, and the transition of the technosphere – to geocosphere. Thus, the term geocosphere we understand as the evolutionary state of the environment and man, which precedes the stage of the noosphere. Accordingly, the term geocosphere thinking will mean an innovative geo-environmental thinking, which precedes the noospheric thinking.

An integrated approach to geoenvironmental, feasibility, geotechnical and civil engineering issues allows synthesis of exact science with fundamental philosophical and geocological and ecological approach in studying the effects of the technosphere on the geosphere in connection with engineering structures and the applied technologies.

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At the same time, technology, and engineering structures, perfectly inscribed in the natural environment by minimizing the environmental damage, must be viewed as integrated natural-technical systems in which natural «geo» and «bio» components combined into a single geotechnical and geoenvironmental complex. In this regard, philosophical problems of geocology, engineering geology and construction as science and engineering can be formulated as the problem of increasing the level of self-organization of natural-technical systems with the steady merging of the natural and technical component in the construction and housing [3].

And in this case before us the example of biosphere compatible innovative coal-water fuel technology is directly associated with nanotechnologies, which are inherently technologies of control structure formation materials at molecular and atomic level.

Especially important is the question of the need for mass introduction of innovative coal-water fuel technology in response to the growing global environmental requirements of the state of the atmosphere, including the reduction of anthropogenic emissions that take into account the global organization.

The solution to the problem of reduction of impact on the Geosphere shells of the Earth in order geoenvironmental sustainability of urban areas through a gradual transition from coal technology to innovative water-coal technologies is important for developed countries.

For mass introduction of innovative coal-water fuel technology in order to ensure long-term energy and environmental modeling geo-ecological resilience in urbanized areas must be agreed upon and subordinate hierarchical geo-ecological and technological problems.

In the modern established practice of the construction of natural-technical systems, the relationship between nature and technology can often be regarded as antagonistic. In order to reconcile nature and technology in urban areas and developed innovative practices for the implementation of innovative technologies.

## Conclusions

Therefore, according to the principles of biospheric compatibility [1], under the innovative geotechnologies, we mean only those innovations and technologies that increase rather than reduce the viable capacity of the Geosphere shells.

While in the innovative practice is also necessary to logically link the seizure of natural resources, the throw-in the nature of pollutants, the state of the environment.

The use of innovative coal-water fuel technology allows you to increase the profitability of fossil fuel (coal) by 30-40%. Almost one hundred percent combustion of coal (98 % and above) in the mass implementation of innovative coal-water fuel technology will contribute to a radical improvement in the environment of the urbanized territories.

A corresponding decrease in the number of mines will lead to the predicted reduction of the negative impact on the lithosphere, pedosphere, hydrosphere, including the reduction of disturbed areas, man-made voids, the coal heaps and inflow of mine water.

It is important that the mass introduction of innovative coal-water fuel technology will also contribute to decrease in quotations of anthropogenic carbon dioxide emissions, the elimination of the mechanism of auto-escalation of the greenhouse effect. Including the interruption of this mechanism is provided through the planning of forest plantations - the so-called «carbon trees», depositing carbon from the atmosphere into the pedosphere and lithosphere. That in principle allows us to consider coal as a renewable source of energy.

As a result, we were shown the principle possibility on the example of mass implementation geoeosphere compatible innovative technology of water coal fuel of the transition from the current stage of the uncontrolled phase of technogenesis in the direction of the geo-ecological oriented technogenesis, or geoeosphere of technogenesis.

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