Concept of management of the technolandscapes through the creation of innovative coal-watercoal clusters

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Abstract. Innovation should be at the heart of sustainable urban development. Innovations should become the basis for sustainable development of industrial and urban areas. A significant improvement in the quality of the environment can only be achieved through innovative technologies that should not degrade the environment. Coal mining at coal mining enterprises and coal burning at thermal power plants and in utility boilers are associated with a negative impact of economic activity on all geospheres. Therefore, it is important to ensure the rational use of natural resources and geo-ecological sustainability of industrial and urban areas through the introduction of innovative "green" technologies. In this regard, the authors of the article propose the concept of managing man-made and urban landscapes by creating innovative coal-watercoal clusters. The development of the concept of technolandscape management through the creation of innovative coal-watercoal clusters allows to increase the geoeological stability of industrial territories by significantly reducing the anthropogenic impact on the geosphere during coal mining and transportation. Development of scientific foundations, concepts and models of innovative coal-watercoal cluster includes the possibility of automatic control of innovative coal-watercoal technology, the concept of preparation and combustion of coal-watercoal slurry in housing and utilities boilers for the purposes of environmental management, energy and resources and reduce the negative anthropogenic impact on urbolandscapes.

1. Introduction
Rational use of nature should be aimed primarily at the rational development of natural resources with the minimization of minerals extracted from nature and the prevention of possible negative consequences. However, the extraction, storage, processing, and burning of solid coal fuels at thermal power plants and in municipal boilers is associated with a negative impact of economic activity on all geospheres on a daily basis.

Modern technogenesis has features of an unmanageable process caused by almost unlimited exploitation of natural resources and increasing consumption. At the same time, technogenic processes are already comparable to geological processes that cause damage to the environment, change and create techno and urban landscapes commensurate with changes in the geological environment [1].

At the unmanaged stage of technogenesis, all geospheres and their functions undergo transformation under the influence of technology. V.T. Trofimov wrote about the technogenic transformation of ecological functions of abiotic spheres of the earth under the influence of economic and other human activities in the article [2].
The methodology for modeling biosphere compatibility, environmental and energy security of the "man – technology – environment" system was developed by V.A. Ilyichev – in General and in connection with the assessment of innovative technologies. In particular, in his articles, V.A. Ilyichev says that modern technologies should become the basis for the formation of an urban life support system compatible with the biosphere, and deduces the principles of reconstruction industrial and urban areas that ensure safety and comfortable living conditions [3, 4].

We believe that a significant improvement in the quality of the environment can only be achieved with the help of innovative "green" technologies, which should not worsen, but, if possible, improve the state of the existing environment [5].

Innovation should be at the heart of sustainable urban development, including in public utilities. According to the "Energy strategy of Russia for the period up to 2030", great attention should be paid to the development of innovative fuel technologies, including innovative water-coal technologies [6].

Therefore, the development of the concept of management of techno and urban landscapes through innovative coal-watercoal clusters in order to ensure rational use of natural resources and geoecological stability of territories is relevant [7].

Innovative water-coal fuel technologies have been developed around the world since the middle of the XX century. The principles and scientific and methodological foundations of rational nature management and the formation of a new technological order of sustainable development of mining enterprises and industrial territories were considered in a number of articles by academician K.N. Trubetskov.

In particular, the scientific and methodological foundations of the strategy of a new stage of Geotechnology development in the context of the ecological crisis of modern technocratic civilization, the energy and material basis of which is the substance extracted from the lithosphere, were formulated in the form of five principles, which are mainly reduced to the conclusion of new requirements for geotechnologies related to the extraction of minerals from the lithosphere [8, 9, 10].

However, even today, almost all but a few countries in the world still burn solid coal fuels, causing damage to the environment. Therefore, we offer a simulation of controlled geoeospheric technogenesis using innovative technologies as a means of protection and automatic control of techno and urban landscapes.

In the article, we will focus in more detail on the development of scientific foundations for rational nature management with reducing the impact of economic activity on geospheres, energy and resource conservation by modeling an innovative coal-watercoal cluster of public utilities using innovative watercoal technology as a means of protection and automatic management of urban landscapes.

2. Materials and methods
In the article, the authors used systematization and analysis of data obtained from open sources, theoretical generalization used to identify shortcomings.

These methods allowed the authors to generate new ideas in the field of geoecological sustainability of industrial and urbanized territories in the development of scientific foundations, concepts and models of controlled technogenesis in the field of coal mining, processing it into a water-coal mixture with subsequent combustion in innovative clusters of public utilities.

3. Results
The main objectives of introducing new environmentally friendly innovative technologies in the energy sector should be to reduce the emission of pollutants into the atmosphere and improve energy efficiency when burning fuel.

The direction of the project under development corresponds to the priority strategy of scientific and technological development of the Russian Federation, which includes the transition to environmentally friendly and resource-saving energy, increasing the efficiency of production and deep processing of hydrocarbons, and the formation of new ways of processing hydrocarbons within the municipal economy.
Scientific and practical development of the model of an innovative coal-watercoal cluster of public utilities allows increasing the geocological stability of urbanized territories by significantly reducing the anthropogenic impact on the Earth's geospheres during the production and combustion of innovative environmentally friendly coalwater fuel mixture in boilers instead of solid coal.

The project we are developing includes fundamental scientific research aimed at reducing the anthropogenic impact on the environment and improving the geocological stability of urbanized territories based on the development of a model of a coal-watercoal cluster of public utilities, followed by its implementation at the pilot site.

The study identified the main objectives of the project, which includes developing the scientific basis, concepts and models of innovative coal-coalwater utility cluster based on existing and under construction boiler.

The tasks also include the search for the possibility of automatic control of innovative coal and watercoal technology, a schematic diagram of the preparation of watercoal fuel suspension using the principles of rational nature management, energy and resource conservation, and reducing the negative technogenic impact on geospheres.

At the moment, we are developing the scientific basis, concept and model of an innovative coal-watercoal cluster of housing and communal services based on existing and under construction boilers, including a comparative geocological assessment of coal and innovative coalwater technologies taking into account their impact on geospheres, automatic management of innovative coalwater technology, a schematic diagram of the preparation of coalwater fuel suspension using energy and resource saving, reducing the negative technogenic impact on techno and urban landscapes.

As a result of our research, we have identified the main provisions of the concept in terms of coal-watercoal technogenesis (figure 1).

1. Spontaneous technogenesis should be transferred to the category of controlled technogenesis at this stage of development of society and technologies.

2. Management urbolandcape and protection of the environment should be yourself innovative technologies.

3. Innovative technologies should be biosphere compatible – to improve, not worsen, the environment.

4. Innovative thinking should be reoriented to geocospheric innovative thinking.

Figure 1. The main provisions of the concept in terms of coal-watercoal technogenesis.
Even earlier, in the article, we proposed to consider innovative "green" technologies as the basis for rational use of natural resources and management of technolandscape on the example of the development and implementation of innovative coalwater technology [5].

Many people perceive innovative state policy only as a means of directing investments in high-tech production and high-tech innovative technologies, and as a result – in uncontrolled technogenesis as a product of technologies.

This approach to innovation needs to change. Taking this into account, we can conclude that new fuel technologies are needed at the moment, aimed not only at achieving an innovative effect, but also at reducing the man-made impact on all geospheres. In other words, we need innovative technologies that are aimed not only at technological progress, but also at improving the earth's ecology as a whole.

With the existing coal fuel technology, incomplete combustion of solid coal occurs, leading to mass emissions of dust, pollutants, which causes acid rain, thermal pollution of the atmosphere, and self-exaggeration of the greenhouse effect.

In the course of the work, a comparative geoecological assessment of coal and innovative coalwater technologies will be given, taking into account their impact on the Geosphere, based on a specially developed geoecological methodology.

The completion of the project includes the development of a schematic diagram for the implementation of an innovative coal and water coal cluster of public utilities (road map) with a set of measures.

Therefore, in comparison with existing boilers, the innovative coal-watercoal cluster of housing and communal services can be considered as a comprehensive solution to intersectoral problems of science and technology.

Tests of innovative coal fuel at the experimental site of municipal services have shown that the production and combustion of coal in the form of innovative watercoal suspension reduces nitrogen oxide emissions compared to coal combustion by 20-40%; mechanical underburning of coal in the composition of VUT is no more than 1%, which eliminates slag emissions into the atmosphere, environmentally safe fuel at all stages of production and use, even with accidental spills does not cause damage to the environment; ash from WUT incineration contains no more than 3% of unburned carbon and can be used as a concrete filler.

A fairly simple modernization of conventional coal-fired boilers in housing and utilities boiler houses with their transformation into special installations for burning innovative water-coal fuel leads to a reduction in fuel costs by 30%...60% compared to fuel oil and by 20...40% compared to burning solid coal, which is very significant [6, 7].

The formation of an innovative housing and utilities cluster can take place with the participation of existing sections of storm sewers and snowmaking plants. Currently, snow and storm water is discharged after treatment into the storm sewer, although it can be used in principle to prepare a water-coal suspension in a coal-watercoal cluster.

In this case, the solution to the oncoming problems leads to higher profitability of coal-watercoal suspension and coal-watercoal cluster housing in General, helps to achieve rational use of natural resources, energy and resource conservation and geoecological sustainability of industrial and urban territories.

In addition, it is important that in an innovative coal-water coal cluster, the raw material for self-prepared watercoal fuel can be coal screenings, as well as slurries, which are usually disposed of as waste. That is, a coal-watercoal cluster can work on coal fines and waste from the coal industry (figure 2).
Figure 2. Schematic diagram of a coal-watercoal cluster housing and utilities.

The decrease in the number of mines will lead to the predicted reduction of the negative impact on the lithosphere, and the hydrosphere of techno-landscapes, including the reduction of disturbed areas, man-made cavities, heaps of inflow of mine waters, etc.

At the same time, almost one hundred percent combustion of coal with the mass introduction of innovative water-coal fuel technology will predictably contribute to a drastic improvement of the atmosphere of urbanized territories.

In our opinion, the geoeconomic stability of industrial and urbanized territories can be achieved only in the conditions of coal-watercoal geocospheric technogenesis.

4. Conclusions

The development of scientific bases, concepts and models of controlled technogenesis in terms of coal technogenesis with rational use of strategic coal fuel reserves allows us to turn innovative technologies into means of protection and automatic management of techno and urban landscapes with a reduction in the impact of economic activities on geospheres.

In particular, the simulated innovative coal-water-coal cluster of housing and communal services makes it possible to use innovative coal-water-coal technology in economic activity as a means of protection and automatic control of urban landscapes with a reduction in the impact of economic activity on geospheres.

Scientific and practical development of a model of innovative coal-water-coal cluster housing allows to increase the geoeconomic sustainability of urban areas by significantly reducing the human impact on the Geosphere in the production and combustion in the boiler housing of the innovative clean coal-water fuel mixture, instead of hard coal.

In comparison with existing boilers, the innovative coal and water coal cluster of housing and communal services can be considered as a comprehensive solution to intersectoral problems of science and technology.

A fairly simple modernization of conventional coal-fired boilers in housing and utilities boiler houses with their transformation into special installations for burning innovative water-coal fuel leads to a reduction in fuel costs by 30%...60% compared to fuel oil and by 20...40% compared to burning solid coal, which is very significant.

The solution to the associated problems of Geocology leads to higher profitability of coal-water slurry and coal-watercoal clusters in general, helps to achieve rational use of natural
resources, energy and resource conservation and geocological sustainability of industrial and urban territories.

The concept of management of techno and urbo landscape through the creation of innovative coal-coalwater clusters allows the transition from unmanaged technogenesis stage to the managed stage in the field of coal technogenesis, geocological to improve the sustainability of industrial and urban areas by significantly reducing human impact on the geosphere.

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