Management of the Ecological-Economic System of the Russian Arctic Zone

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Abstract. It is shown that the relevance of the problems of managing the ecological-economic system of the Russian Arctic regions is caused by a number of aspects, including increased costs for production and life support, the uncertainty of the economic situation and the need to minimize the man-made impact on the vulnerable Arctic environment.

The study showed the negative trends in the ecological-economic system management of the Russian Arctic regions. Atmospheric pollutant emissions have increased by an average of 2.7% in the Arctic regions, share of captured and neutralized air pollutants have not changed, discharge of polluted wastewater have decreased by 3%. These small changes in the sphere of the ecological-economic system management are achieved within the framework of close attention to the environment and the adoption of a large number of regulatory and strategic documents aimed at environmental planning and of the territorial development management.

Following proposals to improve the ecological-economic system management of the Russian Arctic regions was developed.

1. Introduction
Management of the ecological-economic system has an impact on industrial development. Industrial activities in the Arctic related mainly to the mineral resources exploitation directly influence the ecological-economic system of the territories. Unsustainable consumption of non-renewable natural resources results in depletion, negative environmental impact, and additional environmental costs.

The relevance of ecological-economic system management problems of the Russian Arctic regions is caused by a number of aspects including increased production costs and life support, uncertainty of the economy and the need to minimize man-made impact on the vulnerable Arctic environment.

It should be noted that the leading countries implement the concept of transition to environmentally efficient economic development, which is considered as socio-economic growth with meeting the needs of the current generation provided the livelihood provision of future generations [1].

2. Materials and methods
Problems associated with the management of ecological-economic system including climate change, pollution of air, surface and groundwater as well as the marine environment, damage from natural and man-made disasters recently have been significantly increased. These and other causes determine the need to ensure the management of ecological-economic system under modernization and innovative development of the economy of the Arctic and the Russian Federation.
Management of ecological-economic system is carried out in accordance with the Constitution, federal and regional laws and other governmental documents [2, 3].

Ecological-economic system of the Russian Arctic regions is characterized by a high level of man-made impact on the environment and significant negative consequences of economic activities [4, 5]. In this regard development of objective indicators and evaluation methods of environmental economy for making science-based management decisions and ensuring sustainable development in the long term becomes relevant. In Russia the scientific community and public organizations pay much attention to ecological-economic system management issues [6-12]. However, scientists and specialists pay insufficient attention to the objective assessment of the ecological-economic system.

3. Results

Studies of the impact of economic and industrial activities on the efficiency of the ecological-economic system management of the regions completely related to the Arctic zone of the Russian Federation were carried out [13]. Correlation analysis was used for an objective assessment (table 1).

| Correlation coefficient of the gross regional product and the pollutant emissions volume | 2010 | 2012 | 2014 | 2015 | 2016 | 2017 |
|----------------------------------------------------------------------------------------|------|------|------|------|------|------|
| Correlation coefficient of the gross regional product and the pollutant emissions volume | 0.99 | 0.99 | 0.94 | 0.96 | 0.97 | 0.99 |

Correlation coefficient for Arctic regions ranges from 0.95 to 0.99 that characterizes the presence of the close relationship between industrial development and ecological-economic system.

A study to determine the specific environmental load that shows the impact of industrial activity on the ecological-economic system was carried out (figure 1).

**Figure 1.** Specific environmental load of the Arctic regions.

It should be noted that environmental load of the Arctic regions is higher than in the Russian Federation that also determines the increased negative impact of economic activities on the environment.

The analysis showed the ecological-economic system management level of the Arctic regions stipulated by the basic state documents. It can be stated that not all target indicators are fully implemented on time (table 2).
Table 2. Air emissions in the Arctic regions in relation to 2007 [14, 15].

|                      | 2013 plan | 2013 fact | 2015 plan | 2015 fact | 2017 plan | 2017 fact |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Nenets Autonomous District | 50.3      | 50.2      | 70.2      | 70.2      | 60.0      | 69.1      |
| Murmansk region       | 91.4      | 91.3      | 93.4      | 93.4      | 89.1      | 82.3      |
| Yamalo-Nenets Autonomous District | 68.6      | 68.6      | 57.8      | 57.8      | 76.2      | 71.8      |
| Chukotka Autonomous District | 77.2      | 77.2      | 80.0      | 80.0      | 82.1      | 75.2      |

In the Nenets Autonomous District and the Yamalo-Nenets Autonomous District target indicators are not fulfilled. In the Murmansk Region and Chukotka Autonomous District air emissions have reduced what allows fulfilling the target indicators of the state program on environmental protection.

At the same time the level of the specific weight of captured and neutralized air pollutants in the total amount of pollutants from stationary sources was investigated (table 3).

Table 3. Share of captured and neutralized air pollutants in the total amount of outgoing pollutants from stationary sources, percent [14].

|                      | 2013 | 2014 | 2015 | 2016 | 2017 |
|----------------------|------|------|------|------|------|
| Nenets Autonomous District | 6.8  | 8.7  | 10.6 | 9.4  | 11.0 |
| Murmansk region       | 85.5 | 86.7 | 86.6 | 88.8 | 84.8 |
| Yamalo-Nenets Autonomous District | 0.0  | 0.1  | 0.1  | 0.0  | 0.0  |
| Chukotka Autonomous District | 59.5 | 60.2 | 58.8 | 55.1 | 56.3 |

The planned target indicators of the state program on environmental protection are not fulfilled in the Murmansk Region, the Yamalo-Nenets Autonomous District and the Chukotka Autonomous District.

It is shown that the Arctic regions are characterized by multidirectional dynamics in the discharge of polluted wastewater to surface water bodies (table 4).

Table 4. Discharge of polluted wastewater to surface water bodies, million cubic meters [14].

|                      | 2013 | 2014 | 2015 | 2016 | 2017 |
|----------------------|------|------|------|------|------|
| Nenets Autonomous District | 0.1  | 0.0  | 0.0  | 0.4  | 0.3  |
| Murmansk region       | 334.0| 331.0| 328.0| 312.0| 318.0|
| Yamalo-Nenets Autonomous District | 25.0 | 22.0 | 23.0 | 32.0 | 31.0 |
| Chukotka Autonomous District | 5.0  | 5.0  | 4.0  | 3.0  | 3.0  |

In the Nenets Autonomous District and the Yamalo-Nenets Autonomous District volume of polluted wastewater discharge to surface water bodies for the period of 2013-2017 increased. For the Nenets Autonomous District there was a 2 times increase.

In the Murmansk Region and the Chukotka Autonomous District volume of wastewater discharges decreased.

4. Conclusions

The study showed the negative trends in the ecological-economic system management of the Russian Arctic regions. Atmospheric pollutant emissions have increased by an average of 2.7% in the Arctic regions, share of captured and neutralized air pollutants have not changed, discharge of polluted wastewater have decreased by 3%. These small changes in the sphere of the ecological-economic system management are achieved within the framework of close attention to the environment and the
adoption of a large number of regulatory and strategic documents aimed at environmental planning and of the territorial development management.

Following proposals to improve the ecological-economic system management of the Russian Arctic regions was developed:

– the need to improve the methodology for an objective assessment of the state of the environment;
– further research aimed at increase of management efficiency of the ecological-economic system of the regions;
– improvement of the regulatory framework;
– ensuring the monitoring of the ratio of financial costs for environmental protection and environmental policy results.

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