

The Role of Modern Industrial Complexes in Ensuring Ecological and Economic Sustainability of Territories

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Abstract—The second half of the XX century is known worldwide not only for achievements in the field of science and technology, the development of various types of production, but also the emergence of serious problems. A special place here is occupied by the growth of environmental and economic crises, which have led to a number of negative consequences of different levels. Active economic activity of the company contributed to the deepening of contradictions in the functioning of economic and environmental systems. As a result, the expediency, importance and rationality of further development of science and technology are questioned. At the present stage of development of market relations, approaches to management of economic entities in all spheres are radically changing. Known scientific and practical approaches to ensuring ecological and economic sustainability of territories are not adapted to modern conditions of regional development. The new management concept requires innovative approaches to economic and environmental security. In this regard, the problem of effective environmental protection is currently relevant, especially for industrial regions.

Keywords—*ecological and economic stability, economic security, ecological safety, industrial complexes, sustainability of territories, ecological investment.*

I. INTRODUCTION

Modern economic systems require sustainable stable development. The purpose of managing these systems, therefore, should be to form an effective mechanism to maintain their stability. However, this does not mean the maintenance of economic stability, the emphasis is on a comprehensive indicator of environmental and economic stability, which is the ability of the system of an economic entity to maintain its internal relations and properties under the influence of internal and external factors for a long time.

The territorial production complex (TPC) is a good base for the introduction of various innovative approaches, including modern industrial and economic security management systems. Official data on the accident rate of TPC enterprises indicate that environmental safety is the determining indicator in ensuring the stability of economic entities [1-3]. However, the criteria reflecting the level of economic security are very vague and do not make it possible to clearly determine the state of the enterprise from the standpoint of the stability of its functioning, the direction of further development of economic entities and the territory. In this regard, new approaches and principles are

needed to ensure the effective functioning of the mechanism for ensuring the ecological and economic stability of the territory [4-5].

II. MATERIALS AND METHODS

Issues related to the formation of intraregional industrial complexes, their sectoral and territorial structure were considered in their works by the following scientists-economists: E. B. Alaev, M. K. Bandman, N. N. Baransky, A. G. Granberg, T. M. Kalashnikova, V. V. Kistanov, N. N. Kolosovskiy, T. G. Morozova, A. T. Khrushchev, etc.

L. I. Abalkin, I. A. Budanov, L. P. Bufetova, K. G. Hoffman, A. p. Zaitsev, M. Ya. Lemeshev, P. M. Nesterov and others were engaged in various aspects of development of ecological and economic systems and rational nature management.

The problems of sustainability of the ecological and economic system are reflected in the works of N. F. gazizullina, T. N. Gubaidullina, L. A. Dedov, L. I. Krutova, G. A. Reznik, E. Yu. Rodina, Yu. M. Fedorova and others.

The theoretical and methodological basis of the work was made up of scientific research of domestic and foreign scientists, conceptual provisions on the formation of TPC, their sectoral structure, ecological and economic consequences. When writing the work, the following methods were used: scientific generalization, system analysis, content analysis, methods of graphical methods of data visualization, logical method, abstraction, statistical methods, economic and mathematical methods. Also, the study was carried out through the use of cognitive means of systemic and reproductive approaches, which allowed to identify systemic problems of environmental safety and ecological and economic stability of the territory.

As a result of the study, the basic principles of ensuring the effective functioning of the mechanism of ecological and economic stability of the territory are formulated. The main directions of increase of efficiency of ecological and economic stability of territories taking into account modern tendencies of development of TPK and anthropogenous loading in the territory are defined.

The practical significance of the study lies in the possibility of use of results of work of the regional authorities in the formulation of development strategies, environmental policy, policy reforms interaction with TMV Chuvash Republic; to create an effective system of management of ecological-economic sustainability of the territory through

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the introduction of new technologies restructuring and development of related industries and structural links. Also the results of the work can be used in the activities of enterprises in various industries to optimize relations with the external environment.

III. RESULTS

The Chuvash Republic is an industrial region, the basis of its economy are enterprises of mechanical engineering and Metalworking (over 40%). Mechanical engineering is engaged in the production of industrial tractors of high power, electrical equipment, measuring equipment, trailers, cable products and other products. The chemical industry is represented by the production of caustic soda, dyes, pesticides for agriculture, plastics, household chemicals. The light industry is engaged in cotton, sewing and knitting production. The main industrial centers are Cheboksary, Novocheboksarsk, Kanash, etc. Specialization of agriculture: meat and dairy farming, grain production, cultivation of industrial crops.

For a long time, these industrial enterprises had a negative impact on the ecosystems of the region. The environment was polluted by industrial waste, emissions of pollutants into the atmosphere, discharges of wastewater to the terrain and into water bodies. Recently, in connection with the implementation of an active environmental policy in the Chuvash Republic, there has been an increase in social responsibility not only of the population, but also of business. For the purpose of greening of own production and increase of competitiveness of production economic subjects dynamically invest researches on studying of influence of large industrial complexes on ecological stability of the territory.

For the Chuvash Republic, these studies are very important, since the functioning economic complex has a significant impact on the ecosystems of the region and its socio-economic development.

Changes in environmental indicators are not always possible under existing management models, therefore, it is impossible to increase the ecological and economic stability of the region. This situation is due to the fact that the positive dynamics of environmental indicators is primarily associated with economic growth in certain sectors of the economy [6-9]. It should be noted that the main production industries are under-operating, production processes in them are associated with the formation of large volumes of solid, liquid and gaseous waste. The costs of economic entities for environmental protection include about 70% of their own funds, which indicates their significant role in environmental protection.

Industrial production is the leading sector of the region's economy, accounting for more than 60% of emissions from stationary sources of the Chuvash Republic. The volume of emissions of pollutants in 2017 increased by 12.7% compared to the previous year and amounted to 129.8 thousand tons. the volume of emissions from stationary sources increased by 36.3%, from road transport-by 7.5% (Fig. 1).

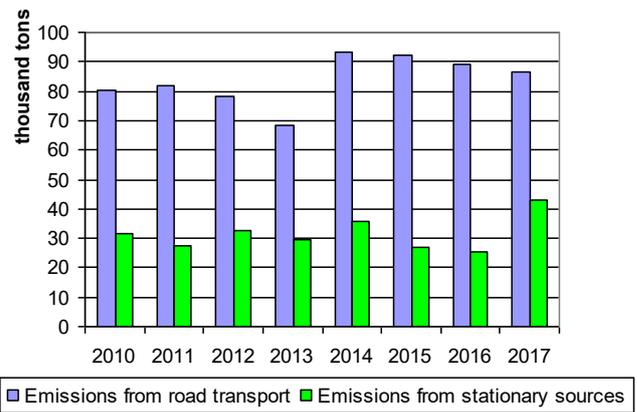


Fig. 1. Dynamics of emissions of major pollutants into the atmosphere

Nitrogen oxide (5.5%), carbon monoxide (4.5%), LTF (3.4%) occupy the largest share in the structure of pollutant emissions, which is due to the peculiarities of production technologies. It is also necessary to note the growth of emissions of solids (6.3%), sulfur dioxide (25%), LTF emissions (1.8 times). There are also positive trends: a significant reduction in emissions of CO (43%) and NOx (14.1%) (table I).

TABLE I. THE STRUCTURE OF EMISSIONS OF POLLUTING SUBSTANCES FROM STATIONARY SOURCES

Emissions, thousand tons	2010	2011	2012	2013	2014	2015	2016	2017
Total	31.4	27.6	32.7	29.4	35.9	26.9	25.3	42.8
solid	1.6	1.7	1.6	1.8	1.8	1.8	1.6	1.7
CO	7.9	7.7	7.2	7.3	6.4	5.9	4.6	4.5
SO2	0.8	0.9	0.7	0.6	0.6	0.6	1.3	1
NOx	6.4	7.1	7.2	6.9	5.6	4.8	4.9	5.5
LTF	1.9	2.4	2.9	2.8	2.8	2.9	2.5	3.4

As the main stationary sources of air pollution of the Chuvash Republic it is necessary to allocate the enterprises on transportation of gas by the pipeline way, on providing with energy, including electric, air conditioning, on animal husbandry, production of chemicals and chemical products.

According to Rosstat, the largest contribution to the pollution of the Chuvash Republic provide the following economic agents: a branch of "Zavolzhsy linear production Department of main gas pipelines of LLC "Gazprom transgaz Nizhniy Novgorod" branch "Cheboksary linear production Department of main gas pipelines of LLC "Gazprom transgaz Nizhniy Novgorod", PJSC "Khimprom", JSC "Cheboksary plant named after V. I. Chapaev", JSC "Cheboksary ceramics", JSC "Promtractor-Wagon", LLC "Kommunalschik", LLC SUOR, LLC "Municipal technologies".

Water sources have also been adversely affected. A large share in the structure of water use is taken by water intake for drinking and household needs. In General, in Chuvashia there is a reduction in water consumption for industrial (34%) and agricultural (26.5%). In 2017, this figure was 47.14 million m³ (down 35%) (Fig. 2).

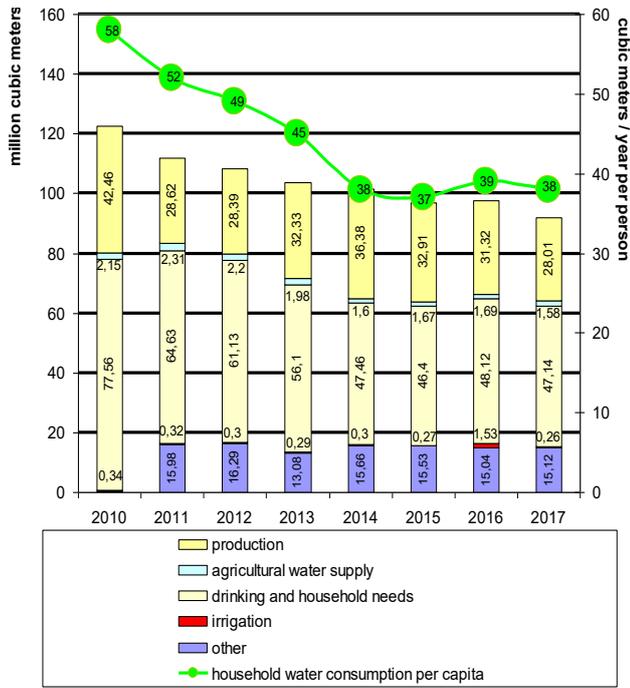


Fig. 2. Structure of water use in the Chuvash Republic

Discharge of contaminated wastewater in 2017 decreased compared to the previous period, but remains at a high level (33.12 million m³). Discharge of contaminated water without treatment in 2015 amounted to 24.08 million m³, and in 2017 already 5.85 million m³. Accordingly, the discharge of contaminated water insufficiently treated increased from 13.41 to 27.27 million m³ (Fig. 3.).

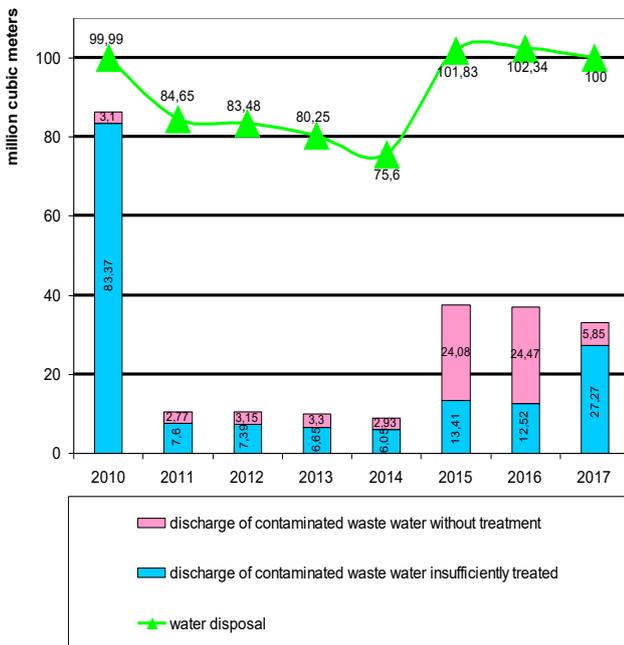


Fig. 3. Wastewater disposal and discharge of contaminated wastewater

The decrease in the volume of wastewater discharge by economic entities is associated with a high percentage of the use of waste water (table II). Water is used as a cooler, is part of the finished product, for example in the food industry. Machine-building and machine-tool enterprises, in turn, are equipped with circulating water supply systems.

TABLE II. THE ABSTRACTION AND USE OF FRESH WATER, MLN M³

Year	Water withdrawal		Use of fresh water	Turnaround and repeatedly-consecutive water supply
	from underground sources	from surface sources		
2010	18.52	106.83	121.72	281.34
2011	16.37	99.99	111.86	483.9
2012	16.13	96.39	108.31	549.96
2013	15.94	90.82	103.78	475.06
2014	14.37	90.11	101.4	577.26
2015	13.73	85.34	96.78	475.92
2016	13.31	87.24	97.7	437.95
2017	12.86	82.65	92.11	436.51

Thus, the anthropogenic load on the water resources of the Chuvash Republic is carried out through the discharge of wastewater into them, the main part of which is normative-clean and their source is the Cheboksary HPP. A significant load is created by discharges of such economic entities as PJSC "Khimprom", JSC "Cheboksary plant named after V. I. Chapaev", JSC "Cheboksary ceramics", JSC "Promtractor-Wagon".

Positive tendencies of greening of the industry are connected with development and introduction of modern closed systems of water supply at the industrial enterprises. However, due to limited funding for the maintenance and reconstruction of treatment facilities, water sources are still highly polluted.

It can also be noted that the main problem source of pollution of water sources in the territory of the Chuvash Republic are organizations of housing and communal services.

In 2017, there was also an increase in the indicators of waste generated (by 50%), recycled waste (by 3.8 times) and waste disposal (by 3.8 times) (table III).

TABLE III. WASTE GENERATION, DISPOSAL AND DISPOSAL, MLN T.

Year	Indicator			
	formation	utilization	storage	burial
2010	0.302	0.199	1.968	0.267
2011	0.368	0.192	1.994	0.232
2012	0.4	0.123	0.027	0.27
2013	0.412	0.176	0.002	0.276
2014	0.404	0.208	0.013	0.271
2015	0.598	0.214	0.03	0.277
2016	0.313	0.099	0.002	0.057
2017	0.471	0.379	0	0.217

The indicator of solid municipal waste export in 2017 decreased by 56.7% compared to 2010 if in 2010 the volume of export was 2.3 m³ per 1 person, in 2017 this indicator decreased to 1.0 m³ (Fig. 4). It should also be noted that the volume of export of solid municipal waste to enterprises for their processing in 2016 increased sharply and amounted to 3307 thousand m³. In 2017, this figure amounted to 3428 thousand m³. Until 2013, this indicator was 0, and in 2013 began systematic work on the processing of municipal solid waste, and the volume of export amounted to 0.9 thousand m³.

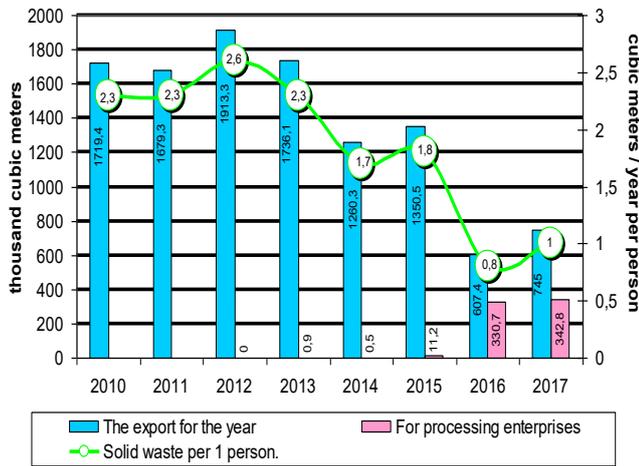


Fig. 4. Removal of municipal solid waste

The main contribution to the formation of waste and consumption was made by the following enterprises: SUE CR "BOS "of the Ministry of construction of Chuvashia, JSC "Bouquet of Chuvashia", JSC "Cheboksary aggregate plant", LLC "Promlit", LLC "Ceramics", LLC "ZHBK No. 2", JSC "AKKOND", JSC "Cheboksary plant named after V. I. Chapaev", PJSC "Khimprom".

It should be noted that the anthropogenic load in the Chuvash Republic is created mainly by enterprises of two large cities: Cheboksary and Novocheboksarsk. Therefore, a large part of the territory of the region the level of environmental security is quite high and more stable.

Despite the large volume of investments in environmental protection and current environmental costs, the processes of greening production are slow, which affects the pollution of the environment in some municipalities. The volume of investments of the Chuvash Republic for environmental protection in 2017 amounted to 205.4 million rubles (Fig. 5), current environmental measures - 1 057.2 million rubles. (Fig. 6).

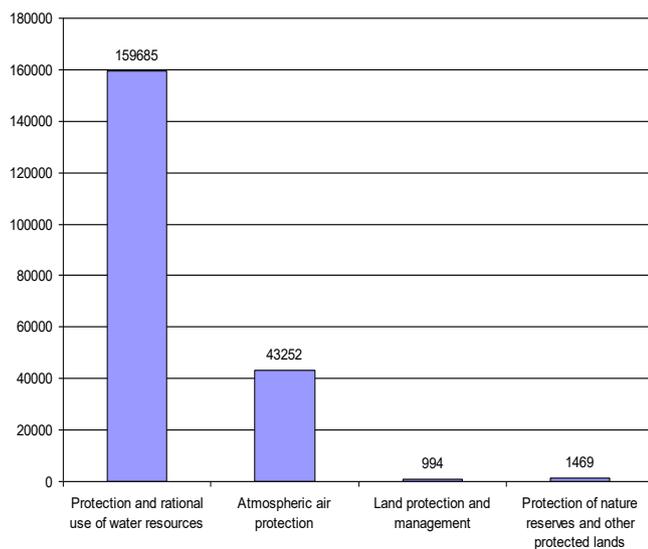


Fig. 5. Investments in environmental activities, thousand rubles

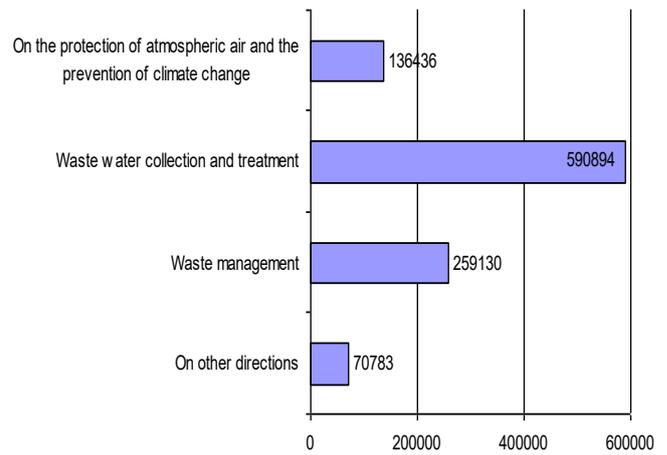


Fig. 6. Current (operational) environmental costs, thousand rubles

In modern ecological and economic conditions, there is a need for the formation of the environmental sector for the production of environmentally friendly products, cleaning agents, waste production and environmental protection, since such economic factors as: the decline in industrial production, the decline in capacity utilization in industry, the decline in the share of machinery, depreciation of fixed assets, loss of domestic markets, high inflation, etc., have a negative impact on the level of economic security [10-12]. The emergence of such a sector should become one of the most important areas of structural adjustment of the region's economy.

IV. CONCLUSION

According Thus, it is possible to formulate the basic principles of ensuring the effective functioning of the mechanism of ecological and economic stability of the territory:

- economic entities in achieving the strategic goals of stable sustainable development should focus on ensuring their environmental and economic sustainability;
- the state of TPC is largely determined by the specifics of the interaction of external and internal factors of stability, as well as such properties of the system as: vulnerability, variability, sensitivity, stability margin, plasticity, elasticity, buffering, so these properties need to pay special attention;
- one of the most important target criteria of ecological and economic sustainability is environmental safety and environmental efficiency;
- in General, the formation of the strategy for the development of TPC and the territory should be based on a comprehensive analysis of both economic and environmental aspects of the activities of TPC organizations.

Production complexes should be considered as the main elements of the ecological and economic system. And indicators of ecological and economic stability of economic entities should be determined on the basis of indicators that reflect the interaction of the environmental and economic environment [13-14]. The study of these indicators will form an adequate management system and increase the overall stability of both regional systems and production complexes.

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