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TOWARDS ENVIRONMENTAL SECURITY VIA ENERGY EFFICIENCY: A CASE STUDY*

Laura Igaliyeva ¹, Shakizada Niyazbekova ², Madina Serikova ³, Zita Kenzhegaliyeva ⁴,
Galym Mussirov ⁵, Anna Zueva ⁶, Yuliya Tyurina ⁷, Leila Maisigova ⁸

¹ Atyrau State University named of Kh.Dosmukhamedova, 212 student avenue, 060001, Atyrau, Kazakhstan

² Moscow Witte University, 2 Kozhuhovski proezd 12 stroenie 1, 115432, Moscow, Russian Federation

³ L.N. Gumilyov Eurasian National University, 1 Satpaev street, 010000, Nur-Sultan, Kazakhstan

⁴ Atyrau State University named of Kh.Dosmukhamedova, 212 student avenue, 060001, Atyrau, Kazakhstan

⁵ Baishev University, st. Zhubanov Brothers 302A, 030000, Aktobe, Kazakhstan

⁶ Lomonosov Moscow State University, 1 Leninskie gory, 119991, Moscow, Russian Federation

⁷ Financial University under the Government of the Russian Federation, 49, Leningradsky Prospekt, 125167, Moscow, Russian Federation

⁸ Ingush State University, pr. Zyazikova, 7, 386001, Magas city, Russian Federation

E-mails: ¹ igaliyeva82@mail.ru; ² shakizada.niyazbekova@gmail.com; ³ madina2281@mail.ru; ⁴ kzita@mail.ru
⁵ mvsirov@mail.ru; ⁶ zueva@audit.msu.ru; ⁷ u_turina@mail.ru; ⁸ maisigova@yahoo.com

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Abstract. The article is devoted to the features and problems of the formation of economic mechanism for ensuring environmental safety via energy efficiency in the process sustainable development at the regional level. The focus on environmental risk, which is considered as one of the components of the environmental safety system. In modern conditions, close attention is paid to issues of finding economic mechanism in ensuring environmental safety via energy efficiency; development of directions for implementation of green strategy in the regions and countries. Features of the economic mechanism in ensuring environmental safety and energy efficiency held back in sufficient development of theoretical issues, methodological and regulatory framework. The relevance of the study lies in the fact that sustainable development analysis of the current situation, problem analysis optimization prospects play an important role in improving economic mechanisms for regulating the market for petroleum products, oil and gas industries, economic mechanisms of energy regulation, etc. There is a need, on the one hand, for quantitative assessment the probability of occurrence of processes and phenomena that reduce the quality environment, and on the other hand, quantification of possible damage from their manifestation at the regional level. The aim of the study is to elaborate the economic mechanism for ensuring environmental safety of the region. Authors conduct analysis using observations, reports and comparative official statistics; formulate original insights, which can have policy implications.

Keywords: economic mechanism; environmental safety; region; efficiency; development

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JEL Classification: H23, R11, Q56, Q57

1. Introduction

The presented study was conducted in a predetermined sequence. At the first stage, the articles are obtained by searching in the Scopus database, Web of Science. The following keywords and key combinations of words were used: environmental safety, mechanism, programs, environment, region, energy efficiency. Articles were limited to those published in English-language journals and on the basis of the International journal of energy Economics and policy. At the second stage, annotations and Discussion of materials on topics related to research on the economic mechanism for ensuring environmental regional security and energy efficiency in sustainable development were reviewed and studied. In the third stage, analyses were carried out using observations, reports and comparative official statistics.

Notable that sustainable development is the development of society on the basis of inexhaustible environmentally sound environmental management, providing a high quality of life for people of all generations, namely human health, high life expectancy, favorable habitat, environmental safety and others. Targets can be determined by indicators, characterizing the quality of life, the level of economic development and ecological well-being in the regions. Analysis of the search for materials on the research topic revealed that environmental impact include air pollution, noise pollution, water and soil pollution, agricultural degradation resources and loss of agricultural land and vegetation. Types mining, included as small-scale mining, sometimes called “Galamsi” (illegal mining of minerals by local residents), which is conducted on a small scale using a small quantities of tools and equipment, and large-scale mining (legal), mining, commonly exploited by foreign companies conducted on a large scale using heavy equipment. Most environmental and health risks, quantities of tools and equipment, and large-scale mining (legal), mining, commonly exploited by foreign companies conducted on a large scale using heavy equipment. Most environmental and health risks, associated with mining, widely distributed to all production sites from an economic point of view of environmental research security, in particular the economic mechanism.

2. Literature review

Many studies address issues regarding the effectiveness of policy towards economic mechanism in ensuring environmental safety (Aslanturk, Kiprizli, 2020; Ilyinova, 2018; Imangozhina et al., 2019). There is a point of view whose advocates point to significant benefits of developed policies and opportunities to accelerate development economies through the use of various economic mechanisms Support (Zonn et al., 2016; Tvaronavičienė, Razminienė, 2017, El Idrissi et al., 2020; Eddelani et al. 2019; Tvaronavičienė, Ślusarczyk, 2019).

The essence of the study is that the authors reflected a dynamic view of the features of the economic mechanism for ensuring environmental security of the region and energy efficiency in the process of sustainable development (Gagarina et al., 2019; Sarma et al., 2019; Chehabeddine, Tvaronavičienė, 2020).

The official statistical reporting for the 8-year period served as the informational basis for the study to ensure comparability, where the sample was taken for 2010-2017. In accordance with the methodology of comparative analysis (Smelser, 1976), data was grouped, which helped to conduct a comparison.

As it is mentioned above, questions of energy efficiency and environmental safety are thoroughly discussed in many works. Today, in the economic literature, the concept of “environmental security” is inextricably linked with the socio-economic development of society. Moreover, some scientists do not even distinguish it as a special

issue but define it as an integral part of environmental protection.

We aim to reveal additional subtleties of environmental efficiency and environmental safety via examining case of separate regions in Kazakhstan.

3. Methodology

The methodological basis of the study became fundamental provisions in the field of environmental safety. Scientific papers of scientists in areas of economics, environmental performance review results activities of the Republic of Kazakhstan. In science, certain development methods in the field of environmental safety in sustainable development. However, to identify directions of the country's regions need various integrated approaches. In the course of studying the issues of ensuring the economic mechanism in the field of environmental safety in the context of sustainable development, we analyzed data for a number of years "investments in environmental protection in the context of activities" and "Current expenditures for environmental protection in the regions of the Republic of Kazakhstan" (Energoprom, 2020).

It should be noted that the analysis focused on the disadvantages of observation methods inherent in many studies. Human perception is limited, so researchers may have missed or overlooked important manifestations of the topic. The limitation of the study is that a lot is determined by the measurement of influences such as lack of time, technical facilities, incomplete data for a thorough analysis, etc. Note that these restrictions may have influenced the results of the study. Therefore, we had to approach our conclusions more carefully.

4. Application functionality

Energy-saving is an integral part of resource-saving, involving the effective use of critical factors reduce energy intensity of production. Relevance of the direction due to the presence of symptoms of an energy crisis.

An intensive energy-saving policy is paramount in containing the growing deficit of fuel and energy resources and reliable provision of all sectors of the national economy of the regions. The impact of resource supply and resource conservation problems on social society's progress is intensifying in a number of ways. One of areas of impact of rational resource consumption is associated with ecology and public health.

Country experience indicates the need to create a mechanism for efficient resource consumption and resource saving in sustainable development, as well as their regulation. There are five regions in Kazakhstan: the Eastern region, Western region, Northern region, Central region and Southern region. We intend to present the regions and cities as part of the above regions (table 1).

Table 1. The regions and cities as part of the above regions

Regions																	
Region	Western Kazakhstan	Northern Kazakhstan				Central Kazakhstan				Southern Kazakhstan	Western Kazakhstan						
Eastern Kazakhstan		Aktyubinsk	Atyrau	Western Kazakhstan	Mangystau	Nur-Sultan (city of the Republican significance)	Akmolinsk	Pavlodar	Northern Kazakhstan	Kostanay	Karagandy	Almatinsk	Almaty city (city of the Republican significance)	Kyzylordinsk	Zhambyl	Turkestanakaya	Shymkent (city of the Republican significance)

Most regions lack domestic financial means to independently solve the problems of socio-economic development. Every year, the dependence of local on subventions increases from the republican budget. In Kazakhstan, each region seeks to improve its position in nationally and internationally.

A big role is played not only by the quality of services, the cost of products and services, but also the management of natural resources, environmental impact control at all stages production cycle and the range of services provided. All set goals are achieved through voluntary environmental certification, implementation of an environmental management system in compliance with international standards. The environmental management system plays an important role in enhancing environmental safety, energy efficiency and stability. System environmental management when transporting gas and oil in full brought in accordance with the new requirements.

The main areas of environmental protection Kazakhstani enterprises are: compliance with established environmental legislation requirements; environmental monitoring environment; planning and organization of environmental work; improvement and improvement of environmental measures; emergency prevention and containment; diagnostics environmental impact; providing conditions to reduce emissions of harmful substances into the atmosphere, water and energy consumption, reduce the amount of waste generated and other negative environmental impacts; development, acquisition and implementation technologies, materials used in pumping oil, the most safe for the environment and the public; mandatory environmental examination of projects of newly built and reconstructed objects, raw materials, used equipment; preparation and provision of conditions for repair and maintenance of trunk pipelines; increase employee culture and environmental literacy Kazakhstan enterprises in the regions. Improving the competitiveness of the enterprise, its reliability work dictates its conditions. It is the need to replace obsolete equipment; transition to a new level of pumping process control oil, expanding the tank farm, increasing through put the ability of the pipeline.

The Republic of Kazakhstan is developing strategic plans, environmental management programs; compliance measures are included environmental standards, reduce energy consumption, reduce pollutant emissions and waste generation, improving environmental education, system improvement environmental management, the implementation of which is absolute requirement for regional enterprises.

Energy efficiency, environmental and economic sustainability of the region is a sustainable balanced development and increase environmental image in an effective and efficient environment management aimed at minimizing negative economic and environmental consequences of its functioning as part of environmental and an economic system characterized by sustainable damage reduction environment. Improving pipeline energy efficiency through system approach to energy conservation of fuel and energy resources should be considered as an actual direction of development on enterprises. In order to achieve maximum fuel efficiency of energy resources, a system of energy management has been introduced in the regions and at Kazakhstani enterprises. The main advantages of the system implementation are the possibility of more efficient use of fuel and energy resources, a systematic approach to energy saving, which allows you to make more effective decisions based on the analysis of statistical and actual data. Held certification audit of the energy management system, after the audit certificate of conformity is issued, which confirms that implemented energy management system for oil transportation through oil pipelines. In the regions, akimats developed and implemented energy policies, reflective organization energy management strategy that Includes regulatory commitment requirements and continuous improvement in efficiency. Energy policy is implemented by achieving the set goals and objectives in the field of energy management.

In recent years, Kazakhstan has become one of the leaders in application green economy approaches. With the adoption in 2013 of the Concept for transition to a green economy, Kazakhstan defines a green economy as a clear strategic goal. At the same time, the expansion of scale mining and fossil fuel production is national priority. Kazakhstan is a country with rich oil reserves, coal and mineral resources - in search of opportunities to ensure long-term growth based on climate-friendly technologies, measures to increase energy efficiency and rational use natural resources, reflecting both ups and downs along the way (see table 2, figure 1).

Table 2. Investments in environmental protection by sector activities for 2010–2017, million KZT

Years	2010	2011	2012	2013	2014	2015	2016	2017
Total	90325	70539	75149	77500	103492	82883	43937	86962
Air pollution	44289	21991	28829	26815	27056	24936	18128	22764
Water resources	13509	18478	20119	18775	41812	15186	10129	5966
Wastes	13340	13464	10777	8026	16941	14131	8 464	6210
Soil, groundwater and surface water	10780	12658	7597	10612	13436	10448	4 278	8826
Noise	-	1	22	5	126	-	4	-
biodiversity	169	618	379	135	164	688	461	420
Radiation protection (with the exception of protecting the public from external exposure)	2985	429	451	197	71	192	90	81
NIOKR	1154	278	454	722	790	333	621	129
Other services on the environment protection	4099	2622	6522	12213	3096	16969	1762	42568

Source: developed by the authors according to the Ministry of National Economy of the Republic of Kazakhstan. Statistics committee, 2018.

Investments in environmental protection by sector activities for 2010–2017, million KZT (figure 1).

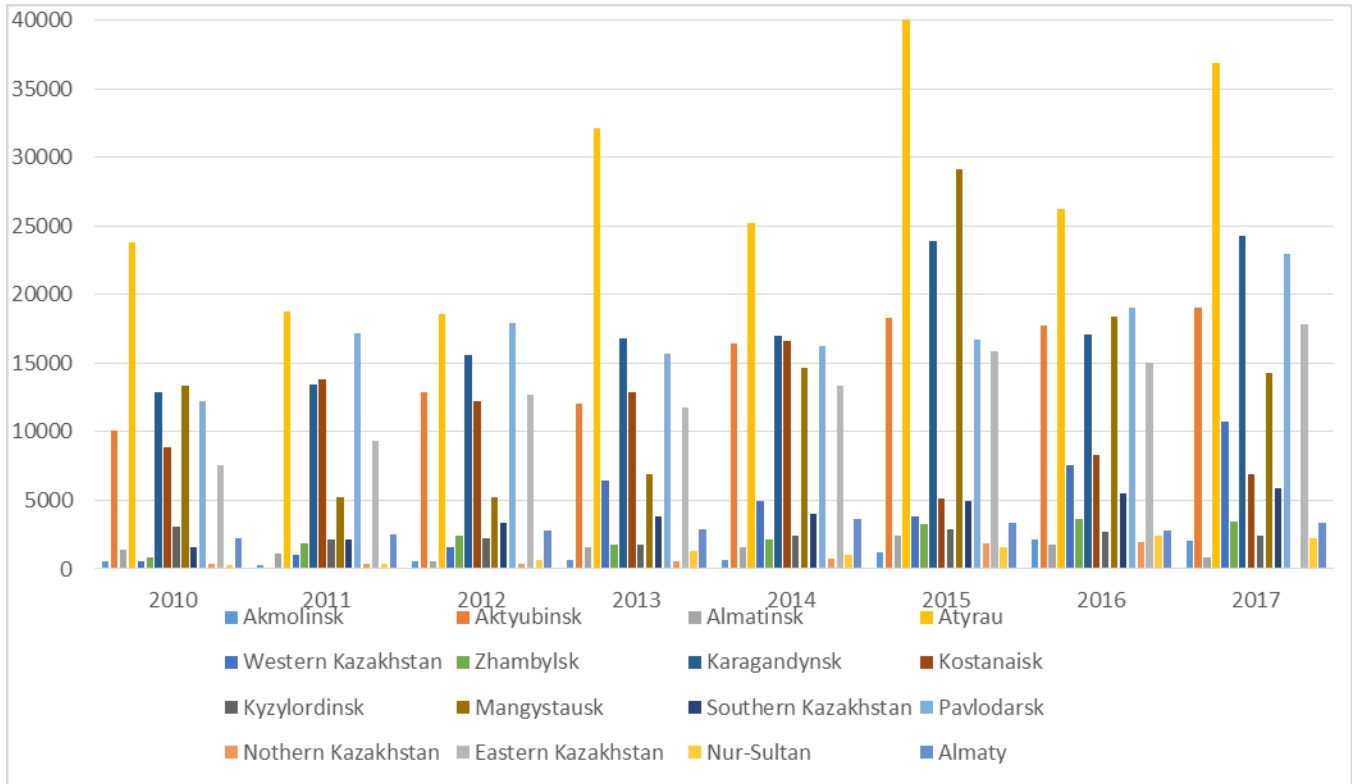


Figure 1. Investments in environmental protection by sector activities for 2010–2017, million KZT

Source: developed by the authors according to the Committee on Statistics Ministry of National Economy of the Republic of Kazakhstan, 2018.

For investments in measures to reduce air pollution throughout the last few years accounted for the largest share of investment in environmental activities (table 3,4, figure 2) - about 40% of the total investments in 2016 and 26% in 2017. The total cost of investments fluctuates from year to year: 50 billion tenge in 2008 (0.3% of the nominal GDP), 90 billion tenge in 2010 (0.3 % of nominal GDP), 103 billion tenge in 2014 (0.3 %) and 44 billion tenge in 2016 (0.1 %).

Table 3. Current expenditures for environmental protection in the context regions of the Republic of Kazakhstan for 2010–2017, million KZT

Years	2010	2011	2012	2013	2014	2015	2016	2017
Total	99653	99213	109438	129094	140579	174650	152206	175445
Akmolinsk	550	255	566	694	604	1201	2129	2049
Aktyubinsk	10075	9 709	12865	12063	16382	18309	17711	19018
Almatinsk	1371	1152	526	1623	1608	2432	1793	844
Atyrau	23756	18777	18551	32071	25159	40254	26218	36828
Western Kazakhstan	552	998	1553	6450	4964	3794	7533	10744
Zhambylsk	816	1880	2388	1780	2182	3245	3599	3424
Karagandynsk	12848	13448	15560	16798	16969	23881	17040	24231
Kostanaisk	8893	13823	12263	12878	16573	5171	8303	6946
Kyzylordinsk	3074	2138	2222	1754	2429	2905	2709	2402
Mangystausk	13363	5209	5184	6870	14651	29093	18427	14266

Southern Kazakhstan	1619	2138	3329	3860	4046	4988	5462	5912
Pavlodarsk	12251	17152	17927	15690	16266	16696	19016	22983
Nothern Kazakhstan	397	387	330	570	772	1865	1 995	2 488
Eastern Kazakhstan	7548	9285	12720	11771	13317	15838	15063	17783
Nur-Sultan	267	382	688	1302	992	1585	2425	2211
Almaty	2273	2479	2766	2918	3664	3393	2781	3315

Source: developed by the authors according to the Ministry of National Economy of the Republic of Kazakhstan. Statistics committee, 2018.

Current expenditures for environmental protection in the context regions of the Republic of Kazakhstan for 2010–2017, million KZT (figure 2).

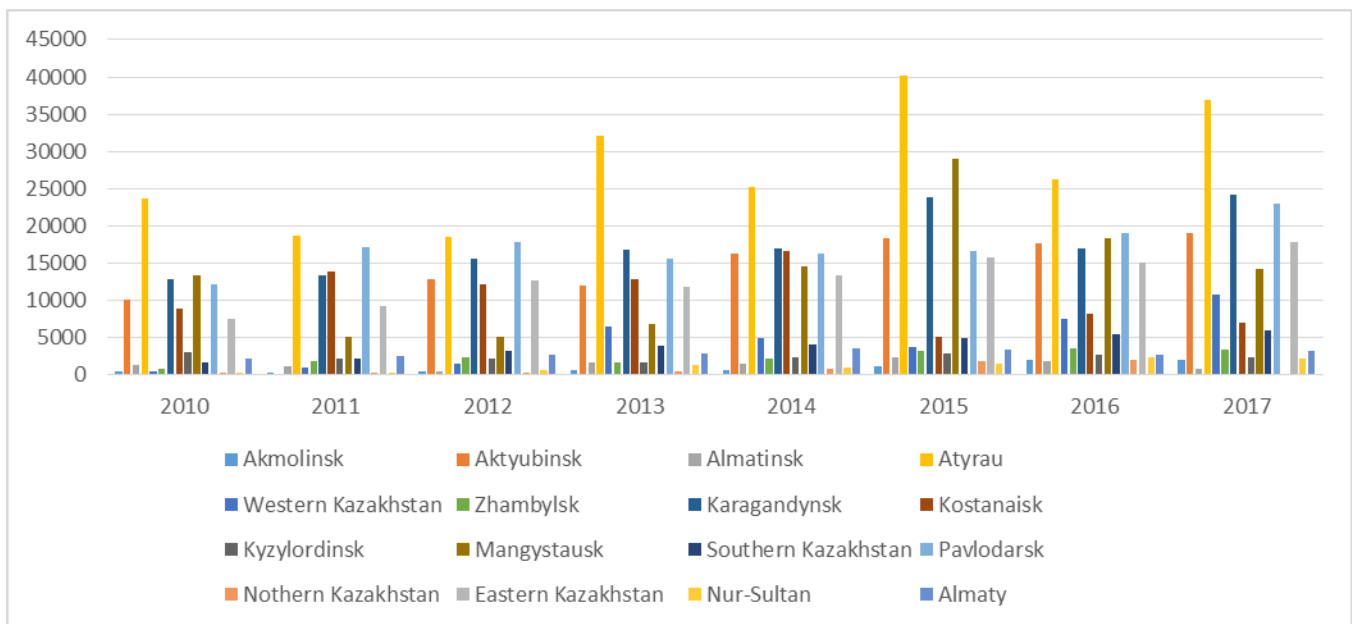


Figure 2. Current expenditures for environmental protection in the context regions of the Republic of Kazakhstan for 2010–2017, million KZT.

Analysis of table 3 showed that environmental protection costs differ significantly by region. Aktobe, Atyrau, Karaganda, Mangistau and Pavlodar regions have relatively high levels of environmental expenditure, especially in the Atyrau region, where current environmental expenditure in 2015 exceeded the level of 2012.

This is due to the relatively large scale and structure of these economic zones. If we talk about the structure of the economy, then in the gross regional product (GRP) of the Atyrau and Mangistau regions, a relatively large share belongs to industrial, mining and extractive industries. Manufacturing and energy industries account for a relatively large share of the GRP in the Karaganda and Pavlodar regions. The GRP of Aktobe region is characterized by a relatively large share of mining and energy industries.

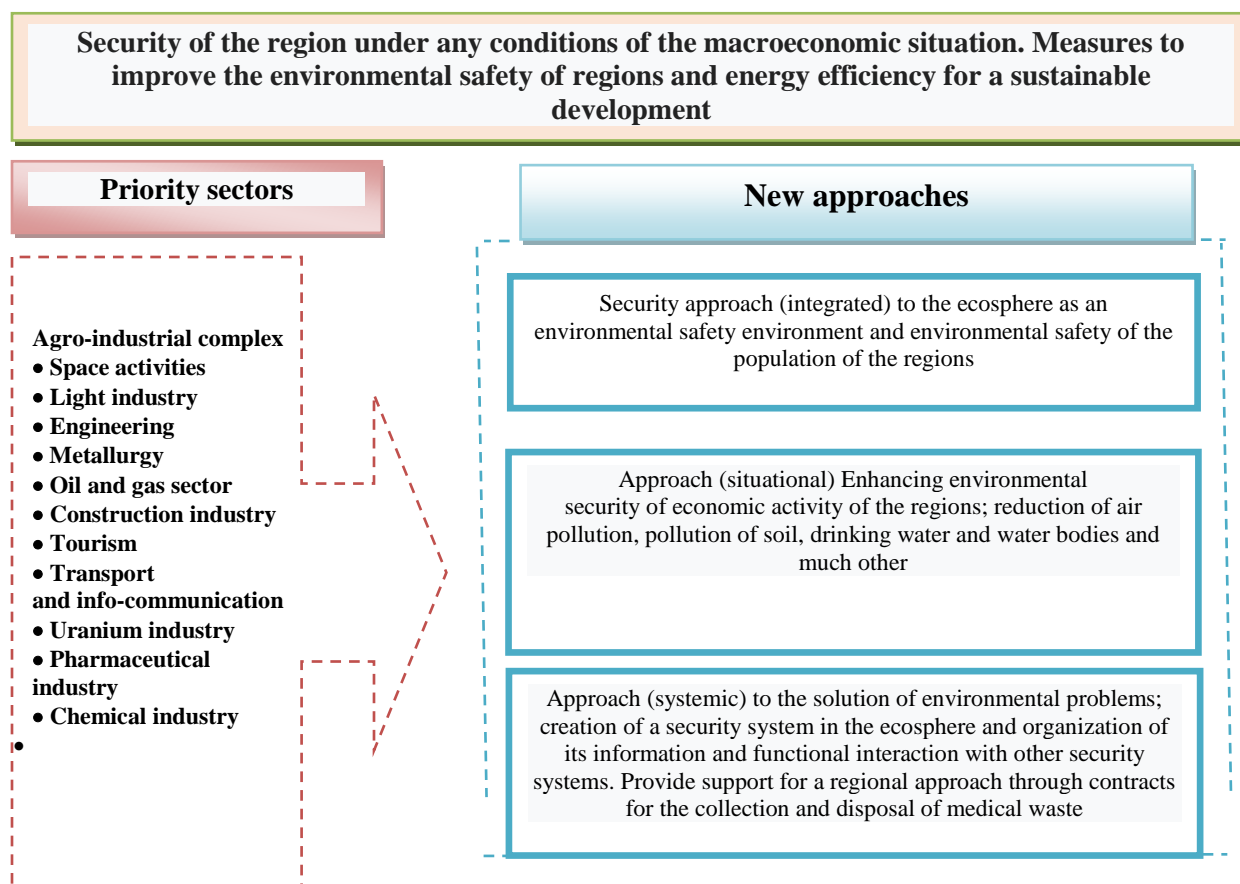


Figure 3. Measures to improve environmental safety regions and energy efficiency in sustainable development

Source: developed by the authors

Figure 3 shows that the proposed improvement measures environmental safety of regions and energy efficiency in sustainable development may be different. The largest contaminated sites and territories are located in Almaty, Eastern Kazakhstan and Karaganda regions. These territories are characterized by high salinity, water hardness and high concentration of sulfates and chlorides in excess of the MPC.

Groundwater pollution is observed in the Western Kazakhstan, in the Northern Kazakhstan, i.e. in oil producing and mining regions where water pollution is observed by iron, manganese and hexavalent chromium. Separate sources of water supply in rural areas (rural wells) are often polluted and unsuitable for due to over-application agricultural fertilizers in such waters have high levels nitrates despite strict rules that require organization sanitary protection zones around water intakes. In general, according to available data, bacteriological pollution of water in wells in rural areas found in 40% of cases, and chemical pollution - in 16 % cases.

Kazakhstan seeks to increase the share of processed resources. Solid waste sorting facilities with a total design capacity of 1 million tons of solid waste per year have been established in eight regions, including Almaty and the capital of the state. However, the return of such waste sorting complexes to processed raw materials is extremely low. The waste disposal fee does not cover the operating costs of sorting facilities. Investment in this infrastructure is almost not wasted. East Kazakhstan, as well as its Eastern and South-Eastern mountains, is subject to natural disasters: landslides, mudslides, avalanches, floods, hurricane-force winds, hail, precipitation,

frost, and droughts. The rapid development of other manufacturing industries, such as the oil and gas and metallurgical industries, creates favorable conditions for the growth of the chemical industry. They are located in Aktobe, Atyrau, South Kazakhstan and Zhambyl regions. Approach (situational) to improving the environmental safety of economic activities of regions; reducing air pollution, soil pollution, drinking water and water bodies, and much more by various chemical plants that produce nitrogen, phosphorous, potash and complex mineral fertilizers.

Enterprises are located near industrial areas and regions where qualified labor resources and scientific research centers, for example, manufacturing enterprises household chemicals in East Kazakhstan, Karaganda and Pavlodar regions and the city of Almaty, caustic soda in Pavlodar region, sulfuric acids in Akmola, Kyzylorda and Zhambyl regions and rubber products in the Karaganda region.

In connection with the above, the following solutions are recommended:

1. Strict adherence to international and national norms and rules, reasonable consumer requirements in the areas of production.
2. Customer focus - continuous study of requirements and customer satisfaction with the quality of services provided regional level.
3. The consumer is an important figure. Improvement planning and enterprises of all production processes for minimize negative impact on workers and the environment.
4. Ensuring the safety and health of workers and people, living in areas of activity of enterprises in the regions.
5. Minimizing risks and preventing production risks injuries and occupational diseases.
6. Ensuring the functioning of monitoring and control systems quality of service. Occupational health and safety.
7. Improving competitiveness in the market for services transporting oil and gas by achieving recognition in regional, national and international levels as competent and reliable partner.
8. Personal participation and responsibility of regional leaders enterprises in quality assurance activities. Clear distribution duties and powers of staff.
9. Improving the training of each employee; aspiration constantly reduce the negative impact of the enterprise on environment and natural resource management.
10. Compliance with environmental obligations. Introducing environmentally friendly effective energy-saving technologies and modern technologies, rational use of material, labor and financial resources.
11. Continuous improvement of the quality management system, occupational safety management systems, environmental management systems in compliance with the requirements of standards.
12. Maintaining contacts with government bodies and the public, as well as the desire for a constructive dialogue with all stakeholders on issues related to politics and eleven activities of regional enterprises in the field of quality, health and the environment.

Conclusion

Thus, in the course of studying the research topic, the following conclusions and recommendations

1. Close attention in the Concept for the transition to "green economy" focuses on social and regional development and investment needs. Particular importance is attached to sustainable use of water resources, development of sustainable and high-productivity agriculture, energy conservation and improving energy efficiency, developing the energy sector, improving waste management, reducing pollution atmospheric air, as well as conservation and effective management ecosystems.

2. In various regions of the Republic of Kazakhstan, Aarhus centers whose mission is to promote the three fundamental principles of the Aarhus Convention. Their activity decreases due to a lack of financing.

3. Kazakhstan has significant fossil fuel resources. According to proven reserves of oil, coal and uranium, the country is among twelve leading countries, and in terms of natural gas reserves - in the first twenty. Kazakhstan is the world leader in annual volumes uranium mining, ranks tenth among the countries of the world in coal mining and Twentieth in terms of oil production. Fuel and energy reserves resources are unevenly distributed across the country: large coal deposits are located in the northern and central regions, Uranium reserves are concentrated mainly in the southern and central regions countries, oil and gas fields are located in the western region, and insignificant gas and coal resources are available in the southern region. Kazakhstan poses enormous primary energy resources. It belongs to a group of countries, which are capable not only to satisfy domestic demand for energy resources, but also export them in significant volumes. Ensuring the environmental safety of the region and energy efficiency in sustainable development requires implementation of prudent energy management, requires the adoption of environmental standards safety, assessment and analysis of various learned economists and managerial decision making.

In the study, an attempt was made to develop activities created as part of the study, in terms of directions, contexts, paradigms, etc., which would identify inconsistencies in existing areas of analysis of environmental safety. This, in turn, contributed to a more objective picture of reality. This study has developed a neutral and reasonable tool that is equally useful to any economic factors, regardless of their scientific views and positions. All of this allowed us to get convincing and objective results.

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Laura IGALIYEVA is PhD student of Atyrau State University named of Kh.Dosmukhamedova, Atyrau, Kazakhstan. Research interests: finance, economics, ecology, management.

ORCID ID: <https://orcid.org/0000-0002-8625-5973>

Shakizada NIYAZBEKOVA is Candidate of Economic Sciences PhD, Moscow Witte University, Moscow, Russian Federation. Research interests: economic, finance, management.

ORCID ID: <https://orcid.org/0000-0002-3433-9841>

Madina SERIKOVA is Senior Lecturer, PhD, L.N. Gumilyov Eurasian National University, Nur-Sultan (Astana), Kazakhstan. Research interests: finance, audit, economic, management.

ORCID ID: <https://orcid.org/0000-0002-9832-8885>

Zita KENZHEGALIYEVA is PhD of Atyrau State University named of Kh.Dosmukhamedova, Atyrau, Kazakhstan. Research interests: finance, economics, ecology, management.

ORCID ID: <https://orcid.org/0000-0002-3172-2597>

Galym MUSSIROV, Ph.D. is Senior Lecturer, Baishev University, Aktobe, Kazakhstan. Research interests: economic, finance, management.

ORCID ID: <https://orcid.org/0000-0003-2853-6504>

Anna ZUEVA, is Candidate of Economic Sciences Department of computer law and information safety, Lomonisiv Moscow State University, Moscow, Russian Federation, Research interests: economic, finance, management, computer law.

ORCID ID: <https://orcid.org/0000-0003-4703-6679>

Yuliya Gabdrashitovna TYURINA is Doctor of economic sciences, associate professor, Professor of the Financial University under the Government of the Russian Federation, Moscow, Russian Federation. Research interests: economic, finance, management.

ORCID ID: <https://orcid.org/0000-0002-5279-4901>

Leila A. MAISIGOVA is Candidate of Economic Sciences, Ingush State University, Magas, Russian Federation. Research interests: economic, finance, management

ORCID ID: <https://orcid.org/0000-0003-2148-4924>

Register for an ORCID ID:

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