

ENVIRONMENTAL SAFETY OF THE INDUSTRIAL SECTOR OF KAZAKHSTAN: REDUCTION, RECYCLING AND DISPOSAL OF WASTE IN THE COUNTRY

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Environmentálna bezpečnosť priemyselného sektora Kazachstanu: zníženie, recyklovanie a likvidácia odpadu v krajine

***Abstract:** The Republic of Kazakhstan is an economic leader in the region of Central Asia, and also belongs to the world leaders in the availability and production of natural resources. Oil, natural gas and black coal are the main export commodities of Kazakhstan. But in addition to economic growth, the mining and quarrying industry are significant sources of environmental pollution. The environmental safety of the Republic of Kazakhstan is also largely violated due to improper waste management. In this article, we analyzed the trend in the generation and waste management system in Kazakhstan for the period 2014 – 2019 and came to the conclusion that despite the increase in the cost of environmental protection and waste management, the ecological situation in the country needs careful monitoring and reform.*

***Keywords:** Environmental safety, Waste management, Republic of Kazakhstan.*

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1 Introduction

Economic growth, prosperity and well-being of the population are one of the main tasks and responsibilities of every state. The current task and duty of the state is to ensure economic growth without devastation of the environment. Nevertheless, today we can observe global ecological unsustainable growth with its tragic consequences for the ecology (Lipkova et al., 2011).

The Republic of Kazakhstan, as the economic leader of the Central Asia region, is a country with significant reserves of energy raw materials (oil, hard coal, natural gas, uranium) and a large amount of various minerals such as tungsten, chromium, iron ore, manganese, silver, lead, zinc, titanium, copper, gold, and others. These natural resources enable Kazakhstan to successfully develop industry (mining, metallurgical, chemical, petrochemical, and engineering) and subsequently ensure the economic prosperity of the state. On the other hand, these energy sources and mineral resources are non-renewable and require rational, pragmatic, and careful treatment. Reducing of the high consumption of raw materials, which entails the emission of exhaust fumes into the air, water pollution and the accumulation of large amounts of industrial waste as by-products, is a part of the strategic economic development plan of every developed country, including Kazakhstan (Lipkova et al., 2011, p.11).

The Government of the Republic of Kazakhstan places great emphasis on strategic infrastructure planning, and it has prepared a number of documents in which it defines its main tasks in the field of economy and state development in the context of sustainable economic growth. These initiatives are summarized in the main government infrastructure program “Nurly Zhol” (Light Road), which is focused on the usage of regional projects One Belt, One Road and CAREC (Central Asia Regional Economic Cooperation Program) and ultimately to achievement of the main goal– to become one of the first thirty most advanced economies in the world by 2050. The principles of sustainable economic growth are also included in the Kazakhstan. Development Strategy until 2030, the Strategic Development Plan of the Republic of Kazakhstan until 2020, the Ecological Code of the Republic of Kazakhstan, the Concept of the Transition of the Republic of Kazakhstan to the “green economy”, etc. The Government Council for Sustainable Development of the Republic of Kazakhstan has been established since 2005 to achieve the set goals more effectively and coordinate them, too (NESDCA, 2010, p.119).

Kazakhstan is also an active member and supporter of international climate conferences and agreements. Back in 1992, President of Kazakhstan Nursultan Nazarbayev signed the United Nations Framework Convention on Climate Change (UNFCCC) during the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro (United Nations, 2006). The Kyoto Protocol entered into force in 2005 and it was ratified by the Law of the Republic of Kazakhstan in 2009 (Forbes, 2019). *“At the 21st Conference of the Parties in Paris in 2015, the parties to the UNFCCC reached a major agreement to combat climate change and accelerate and intensify the activities and investments needed for a sustainable future with lower carbon emissions”* (National Committee, 2019). On Earth Day, April 22, 2016, Kazakhstan signed the Paris Convention at the UN headquarters in New York City (UNIS Vienna, n.d.).

As the issue of sustainable economic growth is very comprehensive and topical for the Republic of Kazakhstan, for the analysis in this paper, we concentrate on the role of industry in the economy of the Republic of Kazakhstan in the context of its impact on the state environment. We will focus on the share of industry in the overall structure of Kazakhstan’s GDP, its main sectors, and its development trend. The aim of our contribution will be to determine how dangerous is the mentioned sector of the economy for the ecology of Kazakhstan in terms of the amount of waste produced due to its development. We will focus on the trend of production of industrial waste and municipal solid waste (hereinafter MSW) as well as their management system in the Republic of Kazakhstan.

2 Literature Review

According to the United Nations, *“waste is often produced as a result of human activity, for example, the processing and extraction of raw materials”* (United Nations, n.d.). Awuchi et al. (2020, p. 2) define industrial waste as *“waste produced by industrial activity which includes any material that is rendered useless during a manufacturing process, such as that of factories, industries, mills, and mining operations”*. *“The rapid growth of population, development of industries, and extension of urbanization and consumerism have caused a significant increase in the production of municipal, industrial and agricultural wastes”* (Farzadkia et al., 2020). The issue of waste regulation is a current topic on a global scale, but in less developed economies it is becoming chronic,

especially on the outskirts of cities (Nikulichev, 2017). The ecological security of the state also consists in ensuring effective waste management, which would reduce the adverse impact of waste of various kinds on the environment and the health of the population.

According to Mochalova, Gricenko and Yurak (2017), waste management represents a holistic complex for the collection, transportation, processing, recycling or disposal of waste, as well as control over these processes in order to reduce the impact of waste on public health and the state of the environment. The authors also set out the main principles of waste management in their contribution, which should be followed by individual states: prevention or reduction of waste generation, waste separation at the source of their generation, waste recycling by returning to the production process, recycling, waste disposal in order to reduce their danger to the natural environment, waste disposal.

Based on the analysis of foreign literature, we can state that the authors' view of waste management is twofold. One group of experts sees the large volume of accumulated waste in the state as an environmental disaster and a significant threat to the environmental security of the state and its citizens. However, an interesting, and in our view very progressive, point of view is the second group of authors, who represent the amount of accumulated waste as a potential energy source for the country's economy. They cite as an example the strategy of Switzerland, which buys waste from Norway to secure its own power generating waste processing plants (Pakova and Khasanov, 2017).

In their monograph *What and Waste 2.0*, World Bank experts divided countries into several categories according to waste treatment and incineration. Countries in which from 0% to 41% of waste is recycled or incinerated are considered "beginners", from 41% to 80% – "catching up", from 81% to 100% – "advanced". The states of Europe and Central Asia, which also include Kazakhstan, use incineration to treat 18% of their waste, although this practice is generally more accepted in Western Europe. In Europe and Central Asia, the focus is usually on improving waste collection systems, building central landfills and closing landfills. In Kazakhstan, 60% of waste is disposed of, so it fell into the category of "beginners" countries (Kaza et al., 2018, p. 7).

Also, many experts on the subject draw attention to the destructive impact of hazardous waste not only on the environment, but also on the person himself. The authors Fazzo et al. (2017) in the article Hazardous waste and health

impact: a systematic review of the scientific literature, note that *“ineffective, outdated and illegal methods of urban and hazardous waste disposal affect local communities in almost all countries; this includes illegal cross-border trade, mainly from industrialized countries. The burden of disease associated with waste exposure is growing in middle- and low-income countries and is underrecognized.”*

WHO experts in their report Waste and human health (2015): Evidence and needs, state that *“incorrectly disposed of or untreated waste can cause serious health problems for the population living in the disposal area”*. Although it is very complicated to perform an analysis that could directly determine the causal relationship between the amount and type of waste and human diseases, researchers have determined that waste has certain negative effects on cancer, the course of pregnancy and subsequently the child. In analyzing the ecological situation in the Republic of Kazakhstan, Omarova (2020) points out that *„along with wastes containing harmful chemical compounds, lands in the regions of Betpakdala, Balkhash, Mugodzhar, Irtysh, Mangistau, and Caspian Sea are heavily affected by radioactive substances. The level of radioactivity here exceeds all permissible standards. The rivers Syrdarya, Shu, Talas, Ural are contaminated with lead, fluorine, copper, pesticides and nitrates“*. The given hazardous waste has a negative impact on the health of the population located in its vicinity. We consider government measures in the form of specialized medical assistance and financial support to be insufficient. We consider the main role of the state to prevent and eliminate as much as possible the given negative consequences for the health status of the population. There is a need to more actively introduce new technologies that could eliminate the shortcomings of the waste management system in the Republic of Kazakhstan as effectively as possible.

3 Industry and its Role in the Structure of the Economy of the Republic of Kazakhstan

The economy of the Republic of Kazakhstan during the period from 2013 to the present, as the official statistical data of the Ministry of National Economy of the Republic of Kazakhstan allow us to claim, has had a constantly growing tendency. As shown in Table 1, Kazakhstan's GDP, denominated in the national currency – tenge, has indeed been on an upward trend since 2013, and by 2019 the indicator had doubled. Kazakhstan's GDP in 2019 is 68,956 billion tenge.

According to the World Bank, which provides information in dollars, the trend in Kazakhstan's GDP is less linear. From 2013 to 2016, we can observe a large decline in the indicator, which in the following period began to stabilize and then grew. In 2019, Kazakhstan's GDP in dollars reached 180 billion. The current growth rate of the Kazakh economy maintains relatively high numbers. In 2019, GDP growth reached 4.5%. The favourable dynamics have been maintained since 2017 due to high investment and consumer demand (MZV SR, 2019). GDP per capita in 2019 (according to a preliminary estimate) was 3,725,582 tenge or 9,731 dollars (Agency for Strategic Planning and Reforms, 2020).

Table 1: The trend of GDP development of Kazakhstan in 2013 – 2019

	2013	2014	2015	2016	2017	2018	2019
GDP (bil. KZT)	35 999	39 676	40 884	46 971	54 379	61 820	68 956
GDP (bil. USD)	237	221	184	137	167	179	180
Annual growth in %	6	4,2	1,2	1,1	4,1	4,1	4,5

Source: Ministry of National Economy of Kazakhstan, 2020; The World Bank (2020)

The main component in the GDP structure of the Republic of Kazakhstan is the services sector. Its share during the entire monitored period exceeded 50% and in 2019 it represented 56%. Nevertheless, the value does not reach the level of developed economies.² The greatest importance for the economy of Kazakhstan in the field of services is wholesale and retail, transport and storage, and real estate services. Sixty-six percent of Kazakhstan's population work in services (MZV SR, 2019).

Industry is the second most important sector of the economy of the Republic of Kazakhstan. The share of industry in GDP in 2019 was 27.5%. The tendency of the development of the given indicator during the whole monitored period has a permanently stable high level – above 25%. The volume of production of industrial production (goods and services) in 2019 reached more than 29 billion tenge. The index of the volume of industrial production in 2019 compared to the previous year represented 104%. The most important sectors of Kazakhstan's industry are the mining and quarrying industry (14.5%) and industrial production (11.4%). Thirteen percent of the state's population is employed in this sector.

² The share of services in GDP in economically developed countries reaches (and in some exceeds) 70%. The largest producers and exporters of services are currently the USA (79% of GDP).

Agriculture is not very important for the economy of Kazakhstan and accounts for 4.5% of its production. The given development trend is observed during the whole monitored period. Nevertheless, it creates up to 15% of the total number of jobs, which is of great importance in the field of employment. Cereals, sunflowers, rape, flax, cotton, rice, and others are mainly grown in Kazakhstan.

Table 2: Structure of Kazakhstan's GDP in 2013–2019 in %.

	2013	2014	2015	2016	2017	2018	2019
Total GDP	100	100	100	100	100	100	100
Industries producing goods	38.3	37.6	35.5	36.6	36.5	38.3	37.5
Agriculture, forestry, fishing	4.5	4.4	4.8	4.6	4.4	4.2	4.5
Industry	27.8	27.3	24.7	26.1	26.5	28.7	27.5
• Mining industry	15.2	15.2	12.7	12.9	13.3	15.2	14.5
• Manufacturing	10.7	10.2	10.1	11.3	11.2	11.6	11.4
• Electricity, gas, steam	1.6	1.6	1.7	1.7	1.7	1.6	1.4
Construction	6	5.9	6	5.9	5.6	5.4	5.5
Sectors producing services	53.1	54.8	59.4	57.8	57	54.4	55.5
Gross value added	91.4	92.4	94.9	94.4	93.5	92.7	93
Net taxes on products	8.6	7.6	5.1	5.6	6.5	7.3	7

Source: Ministry of National Economy of Kazakhstan (2020)

The mining and quarrying industry accounts for more than half of the production volume in industry. According to the latest published data, in 2019, its value reached about 16 billion tenge, which is 54.4% of the total volume. The key is oil extraction, which accounts for 42%. Industrial production in that year accounted for 11.5 billion tenge or 39.4% of Kazakhstan's total industry. The main component of industrial production is the metallurgical industry (17%).

Smaller shares are provided by food production (6%), repair of machinery and equipment (5%) and production of coke and refined petroleum products (3%).

“Kazakhstan has proven oil reserves of 30 billion barrels (3.9 billion tonnes), with Tengiz, Karachaganak and Kashaganas the main production areas” (MZV SR, 2019). In 2018, according to British Petroleum (2019), the volume of oil extracted in Kazakhstan reached 91.2 million tonnes (Ministry of Industry and Infrastructural Development of the Republic of Kazakhstan. n.d.). This indicator is the largest for the whole period of independence of the republic after the collapse of the USSR. Kazakhstan is also rich in minerals such as copper, lead, zinc, titanium, magnesium and precious metals (gold and silver). According to iron ore reserves, Kazakhstan is ranked 8th in the world. The value of iron ore reserves is 8.7 billion tonnes, which represents about 6% of world reserves (MZV SR, 2019).

Table 3: Volumes and indices of industrial production by type of activity in 2019

	2019 (mill. KZT)	Index 2019/2018	Rate of 2019 in %
Total industry	29 380	104,1	100
Mining and quarrying industry	15 978	103,1	54.4
• Oil extraction	12 257	100,2	41.7
• Mining of non-ferrous metals 1 492	113,1	5	
• Iron ore mining 416	109,3	1.4	
• Extraction of natural gas 397	101,7	1.4	
Industrial production	11 573	105,8	39.4
• Metallurgical industry	4 965	105,5	16.9
• Food production	1 708	103	5.8
• Manufacture of coke and refined petroleum products 840	105,7	2.9	
• Repair of machinery and equipment	1 472	124,1	5

• Products of the chemical industry	475	102	1.6
• Other non – metallic mineral products	632	102,3	2.2
Electricity, gas and steam	1 561	100,6	5.3
• Electricity generation/ distribution	1 121	104,5	3.8

Source: Ministry of National Economy of Kazakhstan, 2020

Despite the current economic situation, which is largely affected by the COVID-19 pandemic, over the period of four months of this year, the volume of industrial production in Kazakhstan increased by 5.9%. According to the Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan (n.d.), the increase was recorded in the automotive, textile, pharmaceutical and metallurgical industries. At the same time, there are 13 special economic zones and 23 industrial zones in Kazakhstan.

4 Impact of Industry on the Environment of Kazakhstan. Waste Management System

The important role of industry for the economy of Kazakhstan and the growing tendency of its development brings to the state not only economic growth and prosperity, but also a number of environmental threats. Due to industrial growth, millions of tonnes of sulfur dioxide, hydrogen sulfide, nitrogen dioxide, hydrocarbons, ozone, ammonia, carbon monoxide, and dust fall into the air every year. Extraction and processing industry in addition to large amounts of water consumption, also entails the formation of waste water, hazardous to the environment. As a result of industrial production, surface water is contaminated by oil products, compounds of copper, iron, zinc, surfactants, phosphorus, phenol, ammonium and nitrite nitrogen, which often end up in the composition of groundwater. Mining also leads to destruction of natural landscapes, destruction of soil cover and disruption in the hydrological balance of groundwater.

In the second chapter of the paper, we will focus on the impact of industry on ecology and especially on the issue of industrial and municipal waste in the Republic of Kazakhstan and measures taken to improve the current situation.

Although the topic is very current and actively addressed at the highest level of the state, it dates back to the past. *“There is historical industrial waste in Kazakhstan, including man-made mineral formations. During the period of the Soviet industrial five-year plans, significant volumes of waste from heavy industry, the agrarian complex and the development of mineral resources have been accumulated. At the same time, a significant part of this waste is very toxic and has a high level of radioactive contamination”* (Ministry of Ecology, Geology and Natural Resources, n.d.). Minister of Ecology, Geology and Natural Resources Magzum Mirzagaliyev said that as of 2018, the country accumulated a colossal volume of POP-containing waste since Soviet times, 40.3 thousand pieces of PCB-containing oil transformers and capacitors, 82.6 tonnes and 4 100 litres obsolete banned, unusable pesticides, 3.7 thousand tonnes of buried pesticides, and 13.5 thousand pesticide containers, despite the fact that there is no production of POPs in Kazakhstan (KURSIV, 2019).

After the collapse of the Soviet Union, former President of the Republic of Kazakhstan, Nursultan Nazarbayev, in 1992 in his book *“The strategy of resource conservation and transition to the market”* emphasized the importance of creating a system for waste disposal and recycling: *“full and effective use of secondary raw materials in the form of waste and their transformation into a new consumer value is an important direction for improving the environment”*.

The volume of industrial waste generated in Kazakhstan even after the collapse of the Soviet Union has a growing tendency, which only aggravated the situation. More than 900 million tonnes of industrial waste are generated every year.³ During the period under review, in 2014, more than 980 million tonnes of waste were generated as a result of industrial production in the state. Only 23% or 226 million tonnes of the waste of the volume of industrial waste generated in 2015 was slightly higher and reached 982 million tonnes. Only 23% were also utilized. A comparatively small proportion of waste in Kazakhstan is MSW. In 2014 and 2015, more than 5 million tonnes were produced. Disposal of the waste is also very small and represents only 2%. The share of utilized waste products is slightly higher and represents about 30% of the total volume.

³ In 2010 – 786 mill. tonnes, in 2011 – 1 101 mill. tonnes, in 2012 – 961 mill. tonnes, in 2013 – 978 mill. tonnes.

Table 4: Volumes of planned waste for 2014 and 2015, million tonnes

Type of waste	2014	2015
Generated industrial waste	979.6	982.2
Disposal of industrial waste	225.5	227
The share of production waste utilization to their formation	23	23.12
Generated municipal solid waste	5.3	5.5
Disposal of municipal solid waste	0.1	0.09
The share of utilization of municipal solid waste to their generation	2.21	1.8
Generated hazardous waste	337.4	251.6
Disposal of hazardous waste	110	74
Share of hazardous waste disposal	32.6	29.5

Source: Ministry of Ecology, Geology and Natural Resources (n.d. a, b)

Since 2016, the statistical information provided by Ministry of Ecology, Geology and Natural has changed. The waste was categorized into four groups: hazardous, non-hazardous, radioactive and municipal solid waste. From Table 5 we can see that the volume of waste discharges and MSW has a slightly decreasing tendency, and the volume of non-waste discharges is gradually increasing. Also, the statistics give us the opportunity to see that there are produced about 0.13 million tonnes of radioactive waste in Kazakhstan every year.

Table 5: Waste generated in 2016 – 2018, million tonnes

Type of waste	2016	2017	2018
Generated hazardous waste	151.4	126.9	149.96
Generated non-hazardous waste	169.6	278.2	295.5
Generated radioactive waste	0.13	0.16	0.13
Generated municipal solid waste	5.4	4.8	4.3

Source: Ministry of Ecology, Geology and Natural Resources (n.d. a, b)

The main types of industry producing industrial waste are mining, metallurgical, oil and gas production, and heat and power industries. *“About 99% of hazardous waste from the manufacturing industry and more than 90% of all*

waste from the mining industry is generated precisely in the metallurgical industry and the production of finished metal products. This fact characterizes this industry as the most environmentally unsafe among other industries” (NESDCA, 2010, p.119).

According to the latest published statistics, in 2019, the country accumulated about 31.1 billion tonnes of industrial waste. These are mainly man-made mineral formations (MMF), including overburden and ash (70% of the total), waste from the manufacturing industry (10% of the total) and other activities (20%) (Ministry of Ecology, Geology and National Resources of the Republic of Kazakhstan, n.d. b.). As the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan (N.ND, B) informs us, the level of industrial waste processing is also growing. In 2019, 34% of production waste was recycled, which is 10.9% more than in 2015. The remaining volume of industrial waste, which is about 680 million tonnes annually, is sent to tailings and landfills throughout the country. As of today, 1.5 thousand of such objects are registered in the State Cadastre of MMF.

The authorities' particular concern and the danger to the country's ecology and the health of the population of Kazakhstan are 170 million m³ of radioactive waste. Minister Mazgum Mirzagaliyev also said that the Koshkar-Ata uranium-containing waste storage facility is a serious environmental problem in the Caspian region. The total area of the disposed waste is 66 km². A total of 105 million tonnes of toxic and radioactive waste have been disposed there (KURSIV, 2019).

We consider the alarming amount of hazardous waste per capita in Kazakhstan. According to the latest available United Nations statistics for 2017, Kazakhstan was ranked first in the world. The amount of hazardous waste per capita in a given year reached the level of 7,017 kilograms. For comparison, we also presented data from other post-Soviet countries, which, despite their common past, a large population (Russia, Ukraine, Uzbekistan), the level of industry show incomparably lower indicators hazardous waste per capita.

Table 6: Hazardous waste generated per capita, in kilograms, in 2017

Country	Value
Kazakhstan	7017.4
Kyrgyzstan	2043.4

Russian Federation	736.6
Armenia	184.5
Belarus	176.5
Azerbaijan	27
Ukraine	13.6
Uzbekistan	2.6
Republic of Moldova	2.1

Source: United Nations (2017)

About 4.5 – 5 million tonnes of municipal solid waste is generated in the Republic of Kazakhstan annually. In 2019, the volume of solid waste amounted to 4.7 million tonnes.⁴ The share of recycled and disposed MSW is also growing annually, and in 2019 this indicator reached 15%.⁵ Sorting and processing of solid waste is carried out in factories in the cities of Nur-Sultan, Shymkent and Zhanaozen, as well as at enterprises, mainly small and medium-sized businesses. By today, 3,292 facilities for the disposal of solid waste have been created in Kazakhstan, of which only 601 (18%) comply with environmental and sanitary standards. Also, the government is fighting unauthorized landfills. By the end of 2019, 2,590 (28%) were disposed of from 9,229 illegal dumps (Ministry of Industry and Infrastructural Development of the Republic of Kazakhstan, n.d.).

Table 7: Municipal waste generated in 2014 – 2019.

	2014	2015	2016	2017	2018	2019
The volume of collected municipal waste (1000 t / year)	3 446	3 236	2 814	3 415	3 692	3 674
Population of the country (million people)	17.3	17.5	17.8	18	18.3	18.5
Collected municipal waste per capita (kg / person)	199	185	158	190	202	199

Source: Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2020)

⁴ In 2017, the volume of SHW amounted to 4.9 million tonnes, in 2018 – 4.3 million tonnes.

⁵ In 2017, the share of recycled and disposed solid waste was 9%, and in 2018 – 11.5%.

According to the National Committee Statistics data (National Committee, 2019), the collected municipal waste in 2019 amounted to about 3.7 million tons. A similar trend has been observed throughout the entire study period, and only in 2016 we can see a slight decrease in the volume of municipal waste. Also in table 6, we see that despite the growth in the population of one million people in 2019 compared to 2014, the volume of collected municipal waste per capita remained at 199 kg per person. This is due to the growth in sorting and recycling. The main categories for sorting and recycling municipal waste are food and plastic waste, as well as waste paper.

Certainly, the ecological situation with both industrial and municipal waste in Kazakhstan is poor. The concept of the Republic of Kazakhstan's transition to a “green economy”, adopted by Presidential Decree in 2013, also regulates the state policy concerning the problem of waste in the state. Targets are set for 2030 to create the infrastructure for recycling/disposal of hazardous and toxic waste for 100% waste and also to process 50% MSW by 2050 (Coalition for a Green Economy and Development of G-Global, 2013). These plans are very ambitious, which will not be so easy to achieve, and the achievement of the set goals will require rather large financial resources.⁶

Table 8: Waste management costs in the Republic of Kazakhstan in 2014 – 2019.

	2014	2015	2016	2017	2018	2019
Environmental protection costs, KZT bln	243	257.5	196.1	262.4	302.2	420.4
Share of waste management costs, in%	23	26	26	25.8	23	18

Source: Ministry of National Economy of Kazakhstan (2020)

Analysis of statistical data on environmental costs in the Republic of Kazakhstan shows an upward trend from 2014 to 2019. As of 2019, the level of government spending on environmental protection of the country amounted to 420.4 billion tenge. This significantly exceeds the level of expenses of the previous year by 118.2 billion tenge or 39%. Despite the increase in the overall level, the share of waste management costs decreased slightly and in 2019 amounted to 18%. Most of the environmental costs (90%) are carried out by

⁶ The total investment requirement by 2050 for the Waste Management Program is 4 billion dollars.

industrial enterprises. The priority areas in 2019 were activities in the field of renewable energy sources – 38.8% and air protection – 20.3%.

To achieve the set goals and move the economy of Kazakhstan towards “green economy”, the government has developed the project Waste of Energy. The main idea of the project is to incinerate waste to generate electricity by analogy with renewable energy sources. Also, this project will give an impetus for the introduction of technologies and attracting investments in the field of recycling and disposal of waste. According to the Minister of Ecology, Geology and Natural Resources of the Republic of Kazakhstan: *“in general, the introduction of this mechanism will allow attracting at least 500 million dollars to the incineration industry in the next few years. It is planned to increase the share of thermal utilization from the total volume to 30% by 2025”* (Forbes, 2019).

Today we can see that the government and those who are directly responsible for this area of environmental protection as ministries and their subordinate bodies, industrial companies, and the people of Kazakhstan itself have to build a comprehensive and effective waste management system.

5 Conclusion

The industry of the Republic of Kazakhstan plays an important role in the economy of the state. Despite efforts of the state officials to diversify the economy, the mining and mining industries have historically been one of the main drivers of Kazakhstan’s economic growth. At the same time, industry, and especially the mining and metallurgical industries, produce the largest amount of hazardous industrial waste.

As part of the strategy and concept, the state leadership set goals for the storage and treatment of industrial waste and MSW by 2050, however, we can see that the current situation of waste management systems is insufficient and inefficient.

The main problems and shortcomings of the waste management system in Kazakhstan are:

- 1) the legacy of historical industrial waste from the times of the Soviet Union;
- 2) an annual increase in the volume of new industrial waste by at least 900

million tonnes and their accumulation (currently more than 31 billion tonnes of industrial waste);

- 3) an annual increase in the volume of household waste by 4.5 – 5 million tonnes;
- 4) *“the organization of public services does not meet the standards. Outside large cities, on average, only a quarter of the population has access to services for the removal of solid waste. There are also significant regional differences in service coverage”* (Coalition for a Green Economy and Development of G-Global, 2013);
- 5) the volume of processing of industrial waste in 2019 is 34%, and municipal solid waste is about 15%;
- 6) undeveloped infrastructure of the collection, processing and disposal of industrial waste and municipal solid waste;
- 7) a lack of economic incentives and a low level of control of the adopted norms by the state;
- 8) a large number of illegal dumps and landfills;
- 9) a lack of a clear mechanism of interaction between various ministries, departments for policy development and supervision over industrial waste and municipal solid waste;
- 10) insufficient regulatory framework and statistical data in the waste management system.

These and many other obstacles will have to be addressed by the government of Kazakhstan on the way to achieving the goals of the Concept of Transition to a “green economy”. However, we can see a positive trend in the development of utilization and processing of industrial waste and solid waste, specific projects, and plans for the formation of an integrated waste management system.

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