

# Waste management in the transition to green economy leading to environmental sustainability

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**Abstract.** Kazakhstan is facing serious environmental challenges that affect the regional economy and shape new realities. Such challenges include the management of solid and industrial waste. At the same time, policies and investments in adaptation to sustainable waste management are insufficient and require more attention. This study provides an analysis of the challenges towards the transition to a green economy model in Kazakhstan affecting the management of municipal and industrial solid waste, reviewing the progress made, and highlighting opportunities and priority areas for policy steps to implement transformations in the field of good governance. This study identifies the key areas to promote the involvement of all stakeholders in the process of promoting the transformation of the waste management sector.

## 1 Introduction

The problem of domestic solid waste management in Kazakhstan is one of the priority tasks in the field of environmental policy. In Kazakhstan, there is a decrease in waste generation, while the volume of generation in the country per year is about 5 million tons of waste, and, in this regard, there is an economic interest in the processing and use of secondary raw materials. At the summit of the UN Conference on Sustainable Development "Rio + 20", Kazakhstan presented its regional initiatives "Green Bridge" and "Global Energy and Environment Strategy", which received support. The goal of the Green Bridge Initiative is to develop a practical cross-regional mechanism to promote the development of green enterprises that will promote environmentally sound technologies and their investments. Currently, small businesses are trying to set up recycling facilities for plastic, tires, cullet and other waste, raising questions about effective interaction with both authorities for support and the public to promote tools that should protect the environment.

Waste management should be a priority for Kazakhstan. The adopted concept of transition to a "green economy", new regulation of waste management in the new Environmental Code, certain tasks and target indicators for the management of solid waste and industrial waste in the national project "Green Kazakhstan" for 2021-2025, should contribute to sustainable development in the field of waste management. Waste management problems are also associated with the provision of landfills, almost all waste is taken to landfills for disposal, while most of the landfills do not meet the requirements of sanitary rules and environmental

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standards and require recultivation. The methodology for calculating the tariff for waste removal provides for the inclusion in the tariff of the costs of collection, removal, processing, disposal and disposal of solid waste, but in accordance with this methodology, the tariff was reappraised only in some cities. The remaining tariffs, approved without the costs of processing and disposal of solid waste, are inadequately low and are not even able to cover the costs of removal and disposal. Lack of incentives for the introduction of thermal waste disposal, lack of control over the formation of spontaneous landfills, violation of the hierarchy of waste management, non-compliance with environmental requirements, these and many other problems exist and need to be addressed [1].

Despite the measures taken by the state for waste management, the analysis shows that there is no systematically verified state policy to achieve national indicators in the waste industry [2]. Data on waste management from different state regulators do not converge, attention is paid only to recycling, and not to the application of preventive measures or an integrated approach, for example, the introduction of the concept of a circular economy (circular economy). Currently, there are many regulatory legal acts on waste management adopted by various departments. At the same time, measures to reduce waste generation are implemented only to a small extent. It is necessary to create a system (mechanism) of interdepartmental coordination and institutional interaction to intensify efforts to reduce waste and recycling in the secondary industry. This will lead to transformative change through the creation of a comprehensive modern waste management system that will provide a framework for the implementation of green economy principles at the national, regional and local levels.

## **2 Materials and methods**

The purpose of this study is to identify the challenges faced by Kazakhstan in the process of transition to a green economy in the field of waste management. To prepare the analytical part, the available reliable and accessible data from open sources were used. Interviews were also conducted with stakeholders. A bibliometric analysis was carried out, using statistical and mathematical methods that evaluate the results of research at various levels with the study of scientific research. The conclusions and recommendations given in the article are based on expert assessments of experts (representatives of universities, the scientific community, specialists from industrial companies, non-profit organizations).

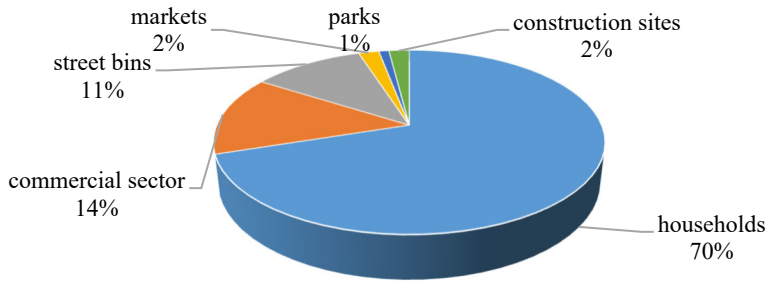
## **3 Results**

In Kazakhstan, at the government level, the Program for the modernization of the municipal solid waste management system for 2014-2050 was approved, based on the Green Economy concept. The main postulates of the program are to increase the efficiency, reliability, transportation, processing and disposal of municipal solid waste (MSW). The target indicators are to increase the share of waste recycling up to 50% by 2050, while the storage of residual volumes of waste in landfills by 2050 should increase to 100%. Funding for the implementation of the program for 2014-2050 is 128 billion tenge.

The annual increase in MSW in Kazakhstan is 5-6 million tons and is projected to increase to 8 million tons per year by 2025 (World Bank, 2017), while the amount of accumulated waste is 104 million tons. Poorly developed regulatory framework, insufficient management, lack of economic incentives for waste conversion are the principles that contribute to the accumulation of waste [3].

Among the hazardous wastes in Kazakhstan: ash and ash and slag waste - 22.8 million tons, bird manure - 1.3 million tons, waste drill cuttings - 212 million tons, pork slurry - 143

million tons and oil sludge - 103 thousand tons. tons. From non-hazardous waste: construction waste - 398 thousand tons, packaging materials - 182 thousand tons and waste paper - 150.5 thousand tons. The structure of MSW by segments is shown in Figure 1.



**Fig.1.** Structure of MSW by segments in Kazakhstan.

Of the 3030 legal landfills, only 20% comply with the norms and requirements. According to the results of remote sensing in Kazakhstan, up to 10.000 unauthorized dumps and countless small garbage bins have been identified.

In 2021, 2.538.200 tons of waste were taken to landfills and landfills. The area of Kazakhstan is 2.725.000 km<sup>2</sup>, that is, Kazakhstanis have produced almost a ton of garbage for every square kilometer of the country's area in just a year [4].

World Bank data (2017) shows Kazakhstan's problems with waste management:

- 1) growth and low recycling of waste;
- 2) low level of waste collection and transportation;
- 3) open, unauthorized landfills and non-compliance with environmental regulations landfill management;
- 4) lack of separation of waste;
- 5) low level of municipal waste disposal.

Key World Bank findings on solid waste management are presented in Table 1.

**Table 1.** Key Findings from the World Bank on Solid Waste Management in Kazakhstan.

Category	Key Findings
Rates	- Low tariffs, does not cover full costs of solid waste management - Household pay far below international norms - The state raises tariffs but not often
Financing	- State funding is needed to eliminate landfills and illegal landfills - Requires landfills for waste disposal - To implement alternative waste management options, it is necessary to increase tariffs for garbage collection and maintenance of landfills
Private Sector Engagement	- More than 130 waste processing enterprises - Involvement in the management of state enterprises for waste management of partners under the public-private partnership program
Responsibility	- Collection and disposal of solid waste in Kazakhstan are carried out by municipal companies - As a non-municipal organization, the company will face increased costs as VAT and profit margins must be included in the company's tariff calculation

Waste management is the second most important area of concern after air pollution in Kazakhstan. Topical issues are the number of unauthorized solid waste dumps, disposal of various types of waste and other issues of state policy in this area. Waste incineration plants could act as a source of "green energy". The renewable energy sector is one of the most promising sectors of the economy [5]. The search for alternatives to fossil fuels is dictated not only by economic problems, but also by concern for the future of our planet. An extremely efficient and environmentally friendly way to obtain energy is its regeneration in modern waste incineration plants. During thermal waste disposal, energy is generated that can be used to heat homes or used in industry and agriculture. The intensive exploitation of coal and oil fields, the huge amount of garbage produced and the destructive smog for health are the problems that the whole world is currently facing. The construction of new incineration plants in Kazakhstan with improved equipment may be the next step in addressing the issue of reducing the number of landfills and active waste management in the country. The experience of some Western European countries shows that there is a technology that can dispose of most waste in an efficient and environmentally friendly way and at the same time recover a large amount of energy for heating or industrial purposes. We are talking about modern small waste incineration plants that use oscillating and rotary kilns in their activities [6].

In 2021, a new Environmental Code was developed, which provides for some measures to improve the situation in the field of solid waste. Thus, in Kazakhstan it is planned to introduce the European waste classification. The principle of waste management hierarchy has been introduced. The implementation of state regulation of the activities of waste management enterprises is prescribed. Waste management operations are clearly defined. Requirements for separate collection of waste (two-container system) are prescribed. Opportunity to implement public-private partnership in the field of municipal solid waste management [7].

Waste management is regulated by the Environmental Code. In December 2015, the government of Kazakhstan approved the list of products and goods recognized as objects of extended obligations of importers and producers, and in January 2016 adopted the Rules for the implementation of extended obligations of producers (importers).

Individuals and legal entities engaged in the production and / or import into the territory of Kazakhstan of products specified in the EPR list are obliged to collect, transport, process, neutralize, use and / or dispose of waste generated after the loss of consumer properties, in one of the ways:

- use of its own system of collection, processing and disposal of waste. At the same time, the system must meet the following requirements: utilization of at least 30% of the quarterly volume of sold or imported products;
- availability of own infrastructure facilities;
- conclusion of a contract with the EPR Operator for waste management and payment for its services.

The rules oblige manufacturers to conclude contracts with the EPR Operator in the absence of their own disposal system [8].

In addition to the EPR Operator, there are other companies that deal with waste processing. And they have to buy solid household waste from abroad, because people have not yet learned how to properly sort it. In Kazakhstan, the share of processing in 2021 was about 12%. 90% of waste in Kazakhstan is placed in landfills. From January 1, 2019, it is also forbidden to store plastic, paper, cardboard, paper and glass in the country. There are 3.417 municipal solid waste facilities in the republic, of which only 585 (17%) comply with the standards [9].

The trade trends in the waste sector show that the country's external turnover of municipal solid waste mainly consists of municipal waste, with recycled paper or cardboard occupying a leading position in exports. In 2019, a ban on the export of recovered paper came into force,

which increases the share of recycling of this type of waste within the country, which gives impetus to the development of local production.

The lack of a unified system for monitoring and transporting waste does not allow to effectively address the issues of illegal waste disposal and the formation of unauthorized dumps. Within the framework of the legislation, waste must be sorted before disposal at landfills, but there are problems: the lack of a waste collection system in the yards, low motivation of the population, lack of communication with the population. Almost all of these companies do not have Kazakhstani waste as a raw material for processing, and they buy it abroad. There are many opportunities for waste recycling in Kazakhstan, but an effective sorting system has not been established. In Kazakhstan, the average depth of sorting and processing is still at a low level. It is important to note that the most effective way to increase the share of recycling is to involve the population in recycling waste at the source of generation. This approach is justified both in terms of time and financial costs.

According to ecologists, the sorting system at the source of waste generation should create financial interest among the population. Each Kazakh citizen generates approximately 250-360 kg of household waste per year. However, the composition of garbage in each region is different: in the south - more food waste that cannot be recycled, in the north - packaging, that is, secondary raw materials.

Also in the country there is another issue of disposal of the so-called historical waste. This is waste left from the Soviet period after the collapse of the USSR. Many enterprises of that time went bankrupt in the 90s and closed. However, industrial waste, the location of which is most often unknown, still poses a threat to the environment and humans. In 2021, the country generated 709 million tons of hazardous industrial waste, of which only 32.2% was recycled. In accordance with the Rules, hazardous waste is transferred to the republican property for further processing, while non-hazardous waste remains under the jurisdiction of local authorities [10].

For Kazakhstan, the issues of handling chemicals are relevant, as well as the problems of historical pollution (persistent organic pollutants - POPs, mercury), according to the initial inventory, the total amount of these wastes is 250 thousand tons. Despite the fact that there is no production of hazardous substances in Kazakhstan, this problem is very relevant for the country.

Given the importance of addressing issues of reducing the impact of POPs on the environment in 2007, Kazakhstan acceded to the Stockholm Convention, undertaking the obligation to destroy historical stocks of POPs in an environmentally friendly way; take action to reduce unintentional POPs; and maintain a monitoring system. To date, the country is taking measures to fulfill these obligations in terms of inventory and creation of a database on POPs [11].

Responsible ministries and departments in their future work set the following goals in the field of waste management and development of the green economy: holding auction selections of projects for energy waste disposal (Waste to Energy); implementation of Roadmaps for the introduction of separate collection of solid waste in cities; implementation of the Green Kazakhstan project until 2025. However, as practice shows, there are still difficulties in achieving the target indicators defined in the Green Economy Concept in terms of waste. It is necessary to take further measures in strengthening the waste management system and capacity building in this area. In further work in this direction, it is important to take into account the experience and recommendations of previously implemented projects and programs. For example, UNDP in Kazakhstan has implemented a number of projects aimed at improving the management of various types of waste. Expertise, in terms of waste management, can be a valuable resource for integrating existing developments, as well as for attracting modern international experience and knowledge.

## 4 Conclusions

In order to effectively manage waste, which causes great harm by pollution from waste, as well as the development of the principles of a green economy, the following measures should be taken:

1. State subsidies for waste processors;
2. Consideration and use of such an instrument as payments for ecosystem services, as well as the development and promotion of a geographic information system;
3. Taking into account the regional specifics and historical features of the territories, development and implementation of a waste management approach from separate collection at the source to waste disposal at landfills;
4. Changing the methodology for calculating tariffs, which includes points for the collection and disposal of waste;
5. Involving independent, public experts in the landfill management assessment process to systematically check waste disposal;
6. Introduce tax measures for the reuse of resources;
7. Introduce an exemption for the payment of a number of taxes for entrepreneurs who are engaged in the full range of work on the collection and disposal of waste; apply reduction factors to profits from the sale of products made from recycled materials; granting tax holidays;
8. Carrying out joint activities in the field of waste management, with the United Nations Environment Program (UNEP), the United Nations Industrial Development Program (UNIDO), the United Nations Development Program (UNDP):
  - consult with UNEP on the development of key solutions for the sound management of chemicals and wastes;
  - UNIDO - expertise on industrial waste issues, advice on industrial development for environmental sustainability;
  - consultations with UNDP on the management of hazardous medical waste that is harmful to health and nature; development of a waste management system, including agricultural waste; support in the development of issues related to the management of historical, agricultural and medical waste.

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