Elements of Innovative Scenario's Development of Waste Management System in Russia

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***Abstract*—The research paper considers changes in Russian legislation concerning the use of new elements and technologies for waste processing; the results of the Russian-Swiss environmental forum "Clean City"; an analysis is carried out of the "Strategy for the Development of the Industry for the Processing, Utilization and Disposal of Production and Consumption Wastes for the Period to 2030"; an innovative element of eco-technical parks is analyzed; the level of useful waste generation for 2017 - early 2018 is estimated; the definition of manufacture equipment's localization for processing, recycling and neutralization of a waste is resulted.**

Keywords—ecological forum "Clean City"; processing, development strategies, recycling and neutralizing production and consumption wastes; waste fractions; equipment

I. INTRODUCTION

The experience of Europe has shown that recycling of garbage can be a profitable business that benefits not only the environment, but also business.

The issue of environmental safety has long worried foreign experts. Back in 2012, Eric Antman's joint work on optimizing solid waste utilization and processing programs became available to Russian readers [1]. Yusuhiko Hotta, who wrote about the experience of Yokohama and Kamakura [2], the Australian University named after James Cook [3], the Indian University of Malaya [4], John Abrashkin from the Columbia University (USA) [5], and many others are also involved in waste processing. The analysis of publications shows that environmental safety and problems of waste processing is a global problem worldwide. Citizens of Europe disciplinedly sort the garbage into categories and put it in separate containers. A good example is the experience of Switzerland.

II. PRACTICE OF WASTE MANAGEMENT IN RUSSIA

A. Legal regulation

In 2015, within the framework of the "Russian Cultural Seasons" festival, the Russian-Swiss ecological forum "Clean City" was held, the task of which was to explore the possibility of promoting the experience of foreign experts in the field of clean technologies in Russia and CIS countries. The Russian delegation could clearly see the new environmental technologies and resource-saving technologies, visit enterprises for processing domestic and industrial waste. Together with Swiss colleagues, Russian specialists have identified areas in which foreign experience could be applied most rationally from an economic and environmental point of view [6].

In December 2014, the State Duma of the Russian Federation adopted the Federal Law on Industrial Policy of the Russian Federation [7]. In accordance with the changes introduced by the Government of the Russian Federation to the Draft Federal Law "On Amendments to the Federal Law" On Industrial Policy in the Russian Federation "(regarding the application of incentive measures to business entities using industrial infrastructure facilities and equipment in the composition eco-technical park) "in the Russian legislation a new term" eco-technical park "has appeared, which will be understood as" the aggregate of those in functional dependence and placed objects of industrial infrastructure and equipment that are intended for the production of industrial products by the subjects of activity in the sphere of industrial production with the use of production and consumption wastes in the process of processing, utilization and neutralization of such wastes "[8]. Based on the explanatory note to the draft law, municipal waste will be given special attention, since the official data of the Federal State Statistics Service state that according to the data for May 2018, in the whole volume of production and consumption waste, the indicators of water supply, water disposal, organization of waste collection and disposal, the activities to eliminate pollution from 7181.3 tons in 2016 increased to 9937.6 tons. The total increase in the volume of waste from 2016-2017 amounted to 779329.9 tons. [9]. Such a growth clearly demonstrates the growing burden on the environment and the need for an urgent and rational solution of the problem.

B. Development of environmental management strategy in Russia

In Russia, the main method of waste disposal is the creation of landfills, where recovery of secondary raw materials is only 10% of the total volume of solid municipal waste (TCO). The high concentration of settlements causes a shortage of vacant areas to create new landfills. Such polygons belong to a considerable distance from cities, which, in the opinion of the Government, will increase the transportation costs for garbage by 1.5 times. In this connection, the Russian Federation Government Order adopted in January 2018 the

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"Strategy for the Development of the Industry for the Processing, Utilization and Disposal of Production and Consumption Wastes for the Period until 2030" [10]. In accordance with paragraph 2 of the Strategy - "Current state and problems of waste management, development of the industry for treatment, utilization and disposal of waste" - "the share of solid municipal waste, directed at processing, in the total volume of exported from the places of education is extremely low, tends to minor changes and, according to statistical reporting, amounted to 7.5 percent in 2014, 7.8 percent in 2015, and 8.9 percent in 2016 (table 1). At the same time, according to the Ministry of Natural Resources and Ecology of the Russian Federation, the share of neutralized waste from their formation over the past five years varies between 46.9% and 59.6% "[10].

Consider the structure of the fractions included in the TCR.

TABLE I. STRUCTURE OF TCR FRACTIONS AT THE BEGINNING OF 2018

Type of waste	Share, %
Paper and cardboard	36-42
Food waste	24-35
Wood waste	1-5
Black metals	2-4
Non-ferrous metals	1-2
Textile	3-6
Bones	1-2
Glass	3-6
Leather and Rubber	1,5-3
Stones	1,5-3
Polymers	5-6

Source: (compiled by the author according to [10])

According to official statistics, the availability of valuable scrap fractions in TCR is an indisputable fact, however, up to 9 million tons of waste paper, 2 million tons of polymer materials and 0.5 million tons of glass are lost annually on landfills.

The Higher School of Economics of National Research University collected its own statistics on key market indicators for selected waste types in 2017 (table 2).

TABLE II. KEY MARKET INDICATORS OF SELECTED TYPES OF WASTE IN 2017 (THOUSAND TONNES)

Type of raw material	Waste paper	Glass	Plastics	Rubber-containing wastes
Resource base	Paper waste	Packaging, sheet and other glass	All kinds of plastics, including packaging	Tires, chambers
Formation of a suitable raw material for processing *	12000	4000	3600	729
Collection	3230	1130	450	95
Coefficient of extraction	27%	28%	12%	13%
Market indicators of basic processed products	Sorted waste paper	Glass (including untreated)	Crushed stone, flakes, granules, etc.	Rubber crumb
Volume of secondary raw materials production	3230	1130	450	66
Export	349	0,2	12	0,5
Import	34	62,7	23	10,4
Estimated consumption in the domestic market	2915	1193	461	76,2

*Waste consumption of commercial enterprises and housing stock; production wastes received on the market (recycling at the manufacturer's own capacities is not taken into account).

Source: [11]

As can be seen from the table, the main types of waste used for recycling in Russia are paper wastes with a recovery factor of 27% of useful raw materials and a calculated level of domestic consumption of 2,915 thousand tons. On the second place there is a glass with corresponding parameters of extraction factor in 28% and level of settlement consumption - 1193 thousand tons. All other categories of waste significantly lag behind in their indicators, which mean less involvement of these types of processed raw materials in total production.

III. DEVELOPMENT OF RUSSIAN TECHNOLOGIES FOR WASTE TREATMENT

In accordance with the amendments to the Federal Law "On Industrial Policy in the Russian Federation," the creation of eco-technical parks will allow the disposal of various waste groups, while reducing the total number of landfill waste and increasing the level of recycling of secondary processed raw materials in industry and production. The innovative component of eco-technical parks is aimed at the development of the domestic technological base, the eco-friendly elimination of polygon burials and the transformation of new vacant areas into suitable for industrial use. As part of the creation of eco-technical parks, it is planned to reduce the social and environmental tensions in the areas where polygons are located and in places where unauthorized dumps are located. Complex waste processing according to RosStat data will allow raising the useful return from TCR processing from 10 to 80 percent [11].

Within the framework of the Strategy mentioned earlier, achievement of the results on education and further development of Russian technologies for waste processing is possible through the target "level of localization of production of equipment for processing, utilization and disposal of waste." The introduction of this indicator coincides with the state import-substitution strategy and provides for the targeted localization of eco-technical parks and industries used for disinfection and waste processing in the territory of the Russian Federation. This also implies the creation of Russian production facilities and equipping them with domestic components.

Now the necessary number of equipment and other equipment is determined by the formula:

$$M_n = \frac{П_ч^П}{П_n} \times K \quad (1)$$

where: M_n - the number of apparatuses to be installed;

$П_ч^П$ - the required hourly capacity for this technological transfer;

$П_n$ - Passport or estimated hourly capacity of the device of the chosen standard size;

K - the nominal coefficient of equipment use by time (assumed to be 0.92).

The productivity of machines and devices is determined in accordance with the data of reference materials and passport data.

When calculating the demand for energy resources, the technical characteristics of the main and transport equipment and the capacity utilization factor are used:

$$K_{З.М} = \frac{П_Ф}{П_Т} \times \alpha \quad (2)$$

where $K_{З.М}$ is the engine load factor;

$П_Ф$, $П_Т$ - actual and technical equipment performance;

α - coefficient, depending on the degree of utilization of the equipment performance.

If the engine is running at full capacity and the equipment is loaded to the maximum, the coefficient will be equal to 1, if the equipment is not fully used and not at full capacity, the coefficient will be less than one.

IV. CONCLUSION

In conclusion, it should be noted that the innovation strategy for the formation of eco-technical parks and the strategy for the modernization of processing equipment requires a gradual phased implementation, a consequent increase in the volume of waste to be treated and an increase in the share of useful raw materials produced as a result of production, and as well as adjusting the existing production facilities for the use of recycled materials in their production cycle. The guarantor of this strategy is the President of the Russian Federation, the Government and local government bodies. The implementation of the new Project will not require additional allocations from the state budget, which means that all activities will be implemented within the framework of the implementation of the Federal Law on Industrial Policy of the Russian Federation.

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