

ANALYSIS OF THE SYSTEM OF MUNICIPAL SOLID WASTE MANAGEMENT IN IVANO-FRANKIVSK REGION (UKRAINE)

¹KARPASH MAKSYM, ¹VORONYCH ARTUR, ¹YATSYSHYN TEODOZIJA, ¹ORFANOVA MARYNA
¹Ivano-Frankivsk National Technical University of Oil and Gas, 5 Karpatska Street, Ivano-Frankivsk, Ukraine, t.yatsyshyn@nung.edu.ua

Abstract: In the course of the implementation of the project funded by Hungary-Slovakia-Romania-Ukraine ENI Cross border Cooperation Program 2014-2020: Energy Recovery from Municipal Solid Waste by Thermal Conversion Technologies in Cross-border Region HUSKROUA / 1702 / 6.1 / 0015 the analysis of the system of MSW management in Ivano-Frankivsk region and the city of Ivano-Frankivsk was carried out. The volumes of formation and morphological composition of solid waste at the MSW landfill in the village of Rybne, which receives municipal solid waste from the settlements of Ivano-Frankivsk City Council, settlements of Tysmenytsia, Nadvirna, Kosiv, Kolomyia districts have been defined. The main directions of improving the current situation in the field of MSW management have been identified on the example of Ivano-Frankivsk region.

Keywords: municipal solid waste, waste management strategy, recycling waste management, separate waste collection.

Introduction.

According to the data of the Ministry of Development of Communities and Territories of Ukraine in 2019 (excluding data from the Autonomous Republic of Crimea and Sevastopol) almost 53 million m³ of solid waste (MSW or more than 10 million tons were generated, which are disposed of in 6,000 dumpsites and landfills with a total area of almost 9 thousand hectares (Fig. 1) [1]. About 78% of the population of Ukraine is covered by household waste disposal services. Due to the introduction of separate collection of household waste in 1462 settlements, the work of 34 waste sorting lines, 1 incinerator and 3 incinerators recycled and disposed of about 6.1% of household waste, of which: 2% incinerated and 4.1% of household waste procurement points for secondary raw materials and waste processing lines.

The average formation of solid waste in the world is from 1 to 3 kg per capita per day [2]. In Ukraine, this figure is lower and is 0.6 - 1 kg per day or 220-250 kg per capita per year, and in large cities - 330-380 kg [3, 4].

The volume of solid waste formation is constantly increasing, and the morphological composition is not constant and depends on the season of the year. Thus, solid waste is a source of significant environmental hazards. The problem of collection, sorting and processing of solid

waste is extremely relevant for Ukraine as a whole and for each settlement separately. With the development of scientific and technological progress, the amount of solid waste increases. In its turn, the accumulation of large amounts of waste has a negative impact on the environment and human health.

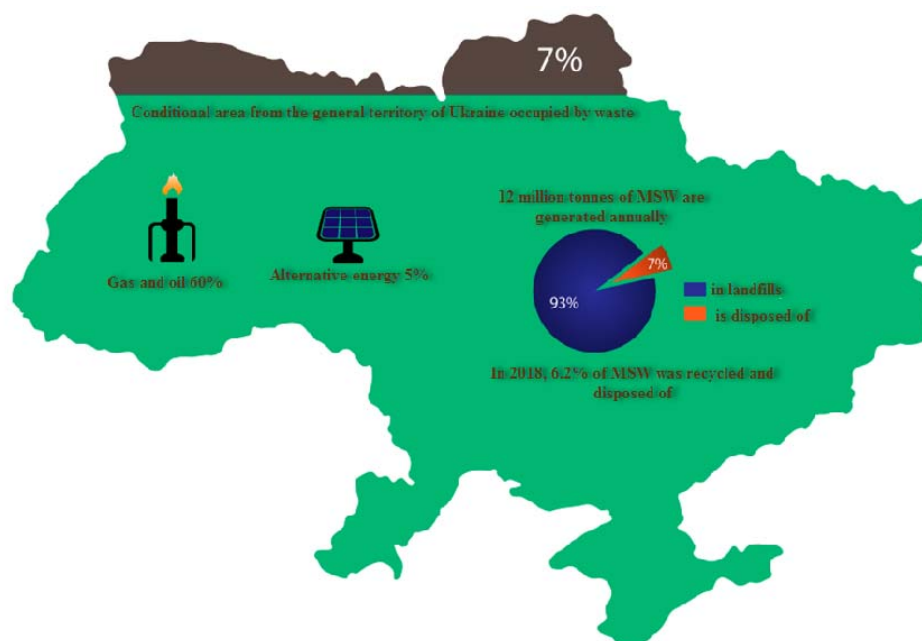


Fig. 1 - Current state of waste management in Ukraine

The situation is deteriorated by the catastrophic lack of places for their burial and storage. There is an increase in the height of waste storage facilities, which leads to an increase in the load per unit area of landfill and the degree of compaction of MSW. Therefore, the issue of waste disposal with the organization of their separate collection is becoming increasingly important, which requires addressing this issue at the state and regional levels [4].

Recent research analysis. Currently, there is a significant number of technical and technological proposals in the field of MSW management. The choice of the optimal directions of waste management depends on many factors. However, the main problem is the lack of a well-established waste collection system. The current state of the system of separate waste collection and disposal is characterized by imperfect structure of the management system in the field of MSW management, lack of proper infrastructure and funding directly for the collection of valuable solid waste or removal of resource components from them, as well as economic disinterest in practical implementation of waste disposal and recycling technologies. As a result, there is an increase in waste in dumpsites and the emergence of unauthorized dumpsites. In addition, the filtered water of dumpsites contains pollutants (Fe, Ba, Cr, P, Ti, Ni, Pb, Bi, Zn, Li,

Sr, etc.), which are a source of contamination of soils and surface waters. Biochemical decomposition and chemical oxidation of waste leads to the fact that the dumpsite is a source of air pollution, and the process itself is accompanied by the release of heat, which can lead to spontaneous combustion of waste.

Thus, all issues related to the collection and disposal of solid waste create environmental, economic and significant social problems that need to be addressed urgently. In Ukraine, there are currently three main ways of handling solid waste - landfilling, composting and incineration [4]. In addition, there is a tendency to continue to increase waste generation [3].

Therefore, the development of effective approaches to solid waste management in the conditions of overloaded MSW landfills to prevent negative impact on the environment is an extremely important issue for Ukraine.

Research results. The study of the MSW management system in Ukraine, and in particular in Ivano-Frankivsk region has been carried out within the framework of the project, funded by Hungary-Slovakia-Romania-Ukraine ENI Cross border Cooperation Programme 2014-2020: Energy Recovery from Municipal Solid Waste by Thermal Conversion Technologies in Cross-border Region HUSKROUA/1702/6.1/0015.

Since the 2000s, a number of laws and regulations have been adopted aimed at systematizing waste management policy and achieving two goals, which are to reduce the negative impact on the environment and increase the efficiency of resource and energy use. The Law of Ukraine "On Waste" with changes and additions and the approved Program for solid waste management are aimed at the development of processing technologies and minimization of waste generation. The new waste management strategy for 2030 was adopted by the Cabinet of Ministers of Ukraine in 2017 [5]. The draft National Waste Management Plan was submitted to the Cabinet of Ministers of Ukraine and approved in February 2019. A draft Law on Waste is currently being developed to implement the requirements of the EU Framework Directive 2008/98 / EC on waste [6]. The long-term goal of the development of this industry is to achieve the EU standards of waste recycling, which are already partially mandatory in accordance with the Association Agreement between Ukraine and the EU.

Municipal solid waste generated in Ivano-Frankivsk region is currently a major environmental problem. Imperfect system of solid waste management causes their constant accumulation and burial in landfills (Fig. 2). Accordingly, MSW landfills are currently overcrowded and cause a difficult environmental situation in the surrounding areas. Solving this problem is a multi-stage process: starting with producers of various products and creating the conditions for them to prevent waste generation, public awareness of the importance of reducing

waste flows, as well as consideration of already accumulated MSW as a resource.

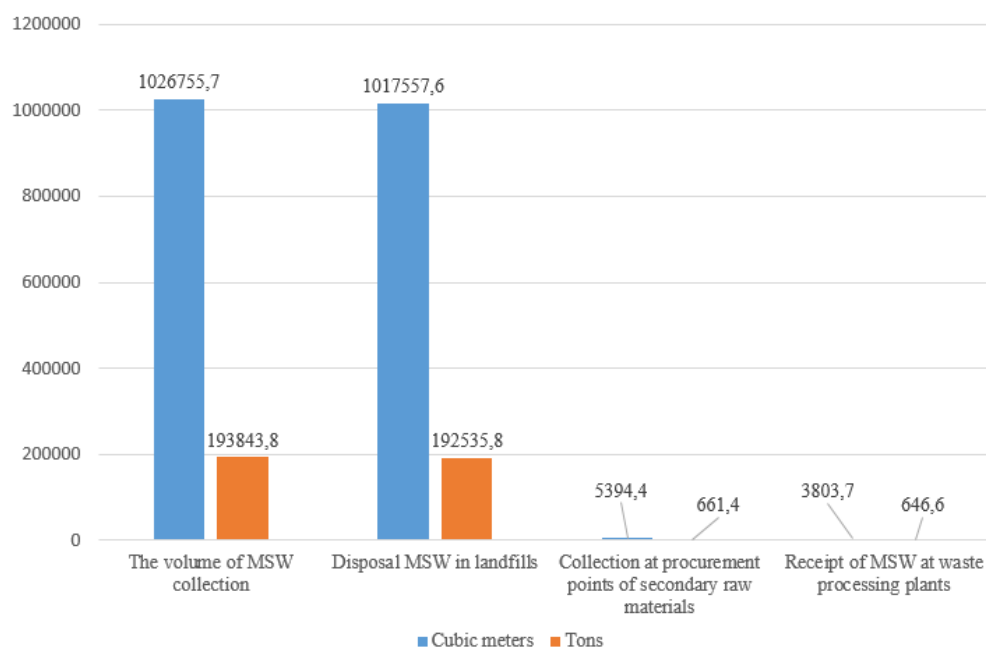


Fig. 2 - Handling MSW in Ivano-Frankivsk region in 2019 [1]

Ivano-Frankivsk is a city with significant industrial and economic potential. The volume of products sold by industrial enterprises in 2019 in Ivano-Frankivsk amounted to about 11768.7 million UAH over the past year, accounting for 86.2%. The share of the city in the total regional sales volume was 17.7%. In the volume of the products sold of the mining and processing industry by the main industrial groups, 51.3% were consumer goods of short-term and long-term use, 21.7% - investment goods, 27% - goods of intermediate consumption [7].

On the territory of Ivano-Frankivsk, about 390 thousand m³ or 100 thousand tons of municipal solid waste is generated annually, on average 1.6 m³ per inhabitant per year and there is a tendency to an increase in the amount of solid waste per year according to the documentation provided by the solid waste landfill (Fig. 3).

The morphological composition of municipal solid waste in Ivano-Frankivsk (Fig. 4) differs from the composition of waste in other regional centers mainly in percentage terms. Municipal solid waste, which is disposed at the landfill, is waste from residential buildings - food waste, room and yard waste, glass, leather, rubber, paper, metal, waste from apartment renovations, ash and slag, large household items, as well as household waste of trade enterprises and institutions of cultural and domestic purposes, waste of catering establishments, waste of markets, medical institutions, street waste, industrial and construction waste of IV hazard class. On the territory of the city there are 293 waste disposal sites with containers for waste collection,

the sanitary and hygienic condition of most of which is extremely unsatisfactory.

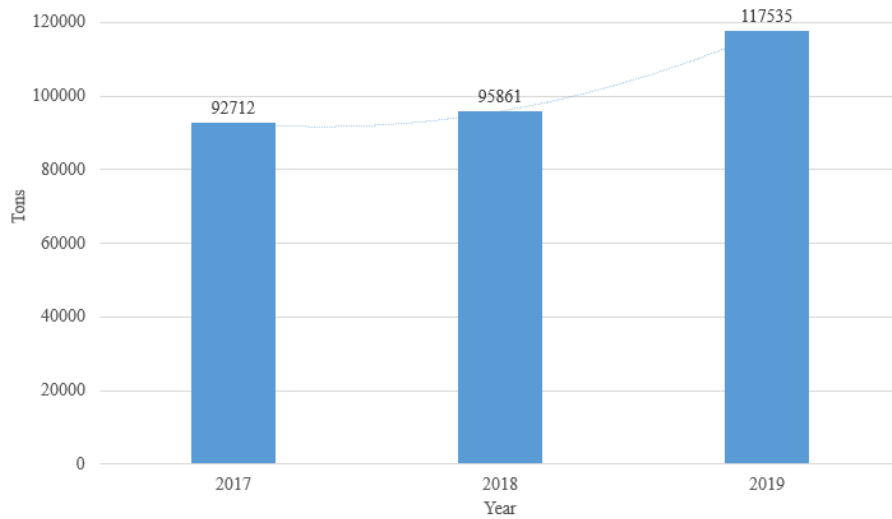
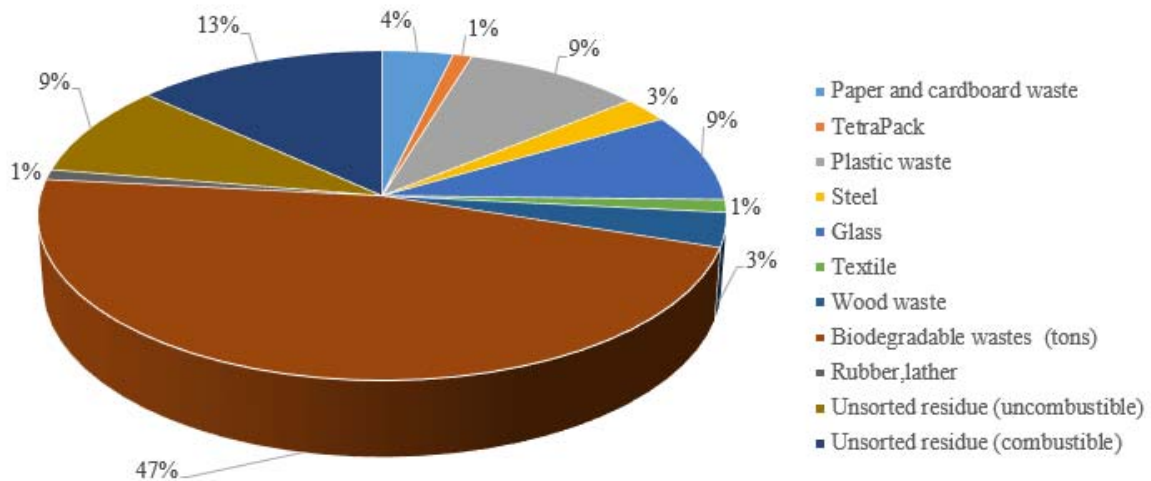


Fig. 3 - Number of solid waste disposed at the landfill of Ivano-Frankivsk in 2017 – 2019 years

The disposal of solid household waste in Ivano-Frankovsk is carried out by OJSC "ATP 0928", Avtokolona 2222. Part of household waste, about 7%, is exported by economic entities independently. Disposal of solid waste is carried out at the landfill, which is located at a distance of 12 km from the city in Rybny village and commissioned in 1992. The area of the landfill according to the project is 22.4 hectares. For the period from 1992 to 2020 the landfill has accumulated about 10,700,000 m³ of household waste, which is about 2,330,000 tons of waste. The average daily volume of waste disposal is about 320 tons/day. The landfill has a height of about 15 meters and is classified as highly loaded. [8].



Picture 4 -Morphological composition of MSW in Ivano-Frankivsk

In Ivano-Frankivsk region, there are no other facilities for receiving household waste, in large quantities, except for solid waste landfills. There are practically no competitors. Other solid waste landfills for storing municipal household waste from the Ivano-Frankivsk are as follows [8]:

- a solid waste landfill in the area of Tysmenytsya is currently overloaded and closed for receiving household waste;

- a solid waste landfill in the area of Skobyshivka does not comply with State Building Standards, accepts a limited amount of solid waste, only from the Bohorodchany;

- a solid waste landfill in Nadvirna is overloaded, and it accepts only a limited amount of solid waste from Nadvirna;

- the landfill in Kalush is overloaded, but at present a new site of 3 hectares has been prepared for storing solid waste.

The solid waste landfill is the only facility that accepts household waste from settlements of the Ivano-Frankivsk city council, settlements of Tysmenytsya, Nadvirna, Kosiv and Kolomya districts. In 2020, the enterprise plans to accept 110 thousand tons of household waste for burial, of which 1.0 thousand tons of recyclables will be sorted, and the rest will be buried in Ivano-Frankivsk [8].

Collection, procurement and use of valuable raw components of solid waste in Ivano-Frankivsk is at the beginning stage. At the solid waste landfill in Rybne village in 2018, a sorting line began operating with a maximum capacity of 50 tons. When 50 tons of solid waste passes through the sorting line, the resource-valuable component is selected in approximately the following quantities: glass - 310-340 kg; PET bottle (transparent 350-380kg; brown 260-280kg; green 220-240kg, oil-filled 120-140kg); plastic (unsorted by type) 60-65 kg; metal objects 8-10 kg.

In general, the modern system of sanitary cleaning of the city and the management of solid household waste is ineffective and requires reforming as a system of collection and disposal of solid waste [2, 4]. The amount of solid waste accumulation depends mainly on the degree of improvement of residential buildings and the season of the year, and the ratio of the components of solid waste is a conventional value. A biogas plant, a filtration pipeline and a waste sorting line will temporarily postpone a garbage disaster at the solid waste landfill in the village of Rybne. Without the construction of a waste processing or incineration plant, the problem with waste in Ivano-Frankivsk and in the region as a whole is difficult to solve.

In Ivano-Frankivsk, in order to improve the system of reducing the volume of waste generation and disposal at the landfill, increasing the use of resource components of solid waste, a comprehensive Program of sanitary cleaning of the city and the management of solid

household waste "Clean City for 2009-2013" was proposed [9]. The main directions of reforming the sphere of solid waste management are the coordination of the activities of enterprises engaged in the collection, transportation and processing of waste, as well as the elimination of unauthorized and uncontrolled waste dumps and informing the population in accordance with the legislation and the implementation of local programs in the field of solid waste management. In 2012, a regional target program for the management of solid household waste in the region until 2016 was approved (Decision No. 620-17/2012 of 07.09.2012) [10]. According to this program, the task was set to organize container sites that meet sanitary and hygienic standards, modernize the fleet of smuggling machines, expand the system of separate waste collection by type (PET bottles, cullet, waste paper, polyethylene). Currently, a regional waste management plan is being developed in accordance with the National Waste Management Strategy in Ukraine until 2030, the National Waste Management Plan until 2030 and the provisions of the 2008/98/EU Framework Directive on waste, taking into account the indicators of the current state of waste generation and the forecast level.

In Ivano-Frankivsk, there is a system for collecting glass containers, waste paper, scrap of ferrous and non-ferrous metals in specialized points by private enterprises and entrepreneurs. The system of separate collection and partially recycling of used waste paper, cullet, plastic film, hard plastics, PET bottles of containers in the city was introduced by the Ecological company "Viza-Vtorma". At present, euro containers for collecting plastic waste have already been installed in the central part of the city. Within the framework of a joint project with Romania, which has been carried out since 2013 by the City Council of Ivano-Frankivsk within the framework of the Hungary-Slovakia-Romania-Ukraine ENPI Cross-border Cooperation Programme, the management of biological waste (grass, leaves, wood) is introduced for the purpose of their further composting. The city organizes the collection of solid waste in two types of containers: for wet waste (mainly food waste) and for dry. The question of the construction of waste processing facilities remains open. The issue of increasing the level of environmental awareness of various strata of the population for the separate collection of waste in everyday life is urgent [11].

The main direction of reducing the volume of waste accumulation is their separate collection with subsequent processing through the introduction of modern waste processing complexes. By sorting waste, you can get up to 40% of secondary raw materials. To improve the system of solid waste management, it is necessary to be guided by the principles of integrated waste management [2, 9, 10]:

1) waste consists of different components, in accordance with it, different approaches should be applied;

2) technologies and measures for processing, utilization, composting, burial should be developed in a complex and complement each other;

3) the solid waste disposal system should be developed taking into account specific local problems and based on local resources.

Therefore, it is important to develop integrated waste management, which has its own hierarchy of levels: minimizing the formation of solid waste, sorting, processing and disposal, and each of these stages of the waste life cycle is subject to management [11]. The combination of technologies and measures will contribute to solving the ecological and economic problems of solid waste. These provisions are fully consistent with the principles of EU regulatory policy. According to Waste Framework Directive [6], it is necessary to regulate all operations related to waste management, while the problem of handling each type of waste is solved separately. This approach is based on conducting activities within a regulatory framework, assigned responsibilities and regulatory control of all local authorities.

Conclusions. Thus, the main reasons for the difficult situation related to the collection, use, disposal of waste are: insufficiently developed system of collection and procurement of secondary resources; in most cases, economic inefficiency in the use of solid waste processing and disposal; lack of a system of management and control over the generation, transportation, disposal and utilization of waste.

The issues of organization of waste processing complexes and increase of the number of sorting lines remain relevant for Ivano-Frankivsk (currently there is one operating sorting line). However, there is currently a problem with unsorted solid waste that is placed in crowded landfills for solid waste storage. Therefore, further research in the framework of the project HUSKROUA/1702/6.1/0015 will be aimed at determining the energy potential of solid waste generated at the landfill of Ivano-Frankivsk by thermal conversion.

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