

WASTE MANAGEMENT PROBLEMS IN THE TERNOPIL REGION

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Abstract. The National Strategy and the National Waste Management Plan in Ukraine until 2030, the regional program for solid waste management in the Ternopil region for 2018–2020 on the reality of conducting key infrastructure measures and achieving the desired result for society are studied. An improved version of the solid waste management scheme in the Ternopil region and a suitable scheme for solid waste management in the city of Ternopil within the regional complexes for the municipal waste recovery are proposed and the sources of their financing are substantiated.

Key words: solid household waste, waste management, treatment, processing, sorting, utilization.

1. Introduction

The problem of waste management including solid household waste (SHW) in Ukraine remains unresolved. To ensure the solution of this problem the Cabinet of Ministers of Ukraine (CMU) by its order of 8.11.2017 No. 820-r approved the National Waste Management Strategy in Ukraine until 2030. In pursuance of this order the Ministry of Ecology and Environmental Protection together with other central executive bodies (hereinafter – CEB) has developed the National Waste Management Plan until 2030 (hereinafter – the plan), which was approved by the order of the CMU of 20.02.2019 No. 117-r. Based on the text of the National Strategy (hereinafter – the strategy) the term ‘waste management’ (regulation) involves the implementation of measures for the reuse of natural resources, waste processing, waste utilization. In this area of activity of all levels of executive bodies, the situation is characterized as critical. There has not been an adequate reaction to its challenges for a long time, which has led to an environmental crisis deepening, exacerbated the socio-economic situation in society, and necessitated reform and development, taking into account domestic and world experience in waste management.

2. Methodology and theoretical part

To conduct an analytical study of the main legislative and regulatory documents at the state, regional and local levels on the SHW management and treatment for the availability of key infrastructure measures and the reality of achieving the desired result for society. To propose an expedient scheme of SHW management in Ternopil within the regional complexes for the municipal waste recovery, and substantiate the sources of its financing.

The complexity of the situation with SHW in Ukraine compared to other developed countries is because of the large volume of SHW generation and the lack of infrastructure for their treatment, which is objectively due to the availability in Ukraine of the areas necessary for storage, time to make the decisions on the application of a more energy-efficient cost-effective scheme of SHW management. The consequences of these objective reasons were the SHW placement without taking into account the possible dangerous consequences of their impact on the environment and human health, inadequate level of waste use as a secondary raw material due to imperfect organizational and economic principles of their involvement in production, the lack of state financing for the creation of an SHW infrastructure network for processing and utilization as a separate sector of the national economy.

Therefore, the dominant way of SHW treatment in Ukraine is their removal and disposal at landfills (landfills disposal) and dumps. Ukraine currently ranks ninth in the world in the amount of waste generated per capita. They all go to landfills or dumps in 95 percent of cases [13]. Besides, due to the insufficient level of control or the lack of a proper SHW treatment system, every year, more than 27 thousand spontaneous dumps are formed [1].

In the Ternopil region, there are 740 dumps for the removal of SHW from 1.022 settlements, but only 93 (12.6 %) of them are certified [9]. However, due to the lack of funds in local budgets, the work on certification, recultivation, and sanitation of existing dumps, the construction of new SHW landfills is being carried out improperly.

The lack of an SHW processing system including food (communal) and excessive dependence on SHW disposal violates European standards in this area and the Association Agreement between Ukraine and the European Union, the European Atomic Energy Association and their member states signed by Ukraine in 2014.

3. Results and Discussion

Let's analyze the strategy and the plans for the reality of obtaining concrete results for the realization of the Ukraine population's right to a safe environment for life and health. The strategy identifies the main directions of state regulation in waste treatment for the coming decades taking into account European approaches to waste management. According to the strategy part "Purpose and Terms of Strategy Implementation" its implementation is carried out in three stages: the first – 2017–2018, the second – 2019–2023, the third – 2024–2030 [1]. Each stage respectively comprises 2, 5, and 7 years and altogether 14 years are devoted to the strategy implementation. Implementation is carried out by taking general and special (for certain waste types) measures [1].

The tools for implementing the strategy are the National Waste Management Plan approved by the CMU and the regional waste management plans approved and agreed with the Ministries of energy and environmental protection and development of communities and territories. Before approval, the National Plan was expertly discussed, but 5 of the 6 expert assessments were negative. Elaboration and approval of the National Plan were scheduled for May 8, 2018, and agreement and approval of regional plans – until November 8, 2019 [1]. However, only in February 2019, the plan was approved [2]. By February 2021 the regions of Ukraine should have plans that would serve as a basis for financing their activities from the state and local budgets, and the total term for their implementation is reduced to 9 years. Real financing of these plans will be possible only starting from 2021 if the relevant budgets provide funds for this.

The analysis of general measures of the strategy shows [11] that in the first and second stages (until 2023 inclusive), its realization will be carried out mainly by organizational, instructional, methodological,

management, and structural measures which will need significant funds from the state budget. Only in the third stage starting from 2024 (in 4 years), there is one specific infrastructural measure to modernize the material and technical base of economic objects for the natural resources reuse and waste processing and utilization with a possible implementation period until 2030.

Special measures in SHW treatment are also saturated with numerous organizational, structural, and economic, regulatory, and other measures. In particular, local governments plan to create specialized municipal collection points for all waste types in settlements with a population over 50 thousand people. Reducing the number of landfills and dumps by building a network of regional landfills for SHW disposal with a minimum capacity of 50 thousand tons per year for at least 150 thousand people each and to reduce the transport costs arrange a network of dust reloading stations (200 units).

In general, it is planned to ensure the 15 % SHW processing in 2023 and to cover 23 % of the population with SHW separate collection. In 2030, 50 % of SHW and 48 % of the population, respectively. In our opinion, it is impossible to achieve these indicators without building the infrastructure of SHW processing and utilization objects as a separate branch of the national economy. In particular, the strategy shows the need to build such objects without specifying the types, places, and the cost.

Paragraph 1 of the Forecast of the impact of the realization of the draft order of the CMU "On approval of the National Waste Management Plan until 2030" [2] on the key interests of stakeholders states that, the purpose of the draft order is to ensure the effective functioning of the waste management system in Ukraine. In paragraph 2, "realization of the right to a safe environment for life and health" is indicated as the key interest for the stakeholder "Population of Ukraine". The creation of the waste management objects infrastructure, which will help reduce the entry of hazardous chemicals into the environment, is determined as the main explanation why the realization of the draft order will lead to the expected positive impact.

Therefore, we will briefly conduct an analytical study of the plan on the reality of the infrastructure measures implementation, which is essentially the core of waste management in general and in particular SHW. The strategy uses the term "household waste" while paragraph 21 in part 2 "Household Waste" of the plan provides for the development and submission of the law project on municipal waste (hereinafter – MW) to the CMU within one year after the adoption of the law on waste management. Thus, there is an obvious hint at a

principle approach of the plan developers to the ways of solving the problem of its management.

In Part 2 “Household Waste” the implementation of 5 tasks and 22 measures is proposed. Only 5 of them contain infrastructure measures and the rest are rule-making, organizational and methodological in nature. The most significant is paragraph 31 “Construction and placement of regional complexes for the recovery of municipal waste, planned in the framework of regional waste management plans based on a cluster approach” and paragraph 42 “Creation of new and increase of existing objects capacities/installations of sewage sludge processing operators of municipal wastewater treatment objects with the capacity calculated on population equivalent over 50.000” where local authorities (hereinafter – LA) are determined as the responsible executors, the implementation period for all measures is from 2023 to 2030. Consequently, the sources of funding are also from local budgets.

The same tendency is observed in other important parts of the plan. Thus, in part 3 “Hazardous Waste” and 4 “Industrial Waste” measures 51 and 69 respectively bringing processing hazardous waste and industrial waste objects in line with the established requirements is also entrusted to the LA within two years after the approval of the relevant measures of the plan. In part 8 “Electrical and Electronic Waste”, 9 “Waste Batteries, Batteries and Accumulators”, 10 “Medical Waste”, and 11 “Decommissioned Vehicles” the creation of infrastructure for collection, storage, dismantling, reuse and recovery of relevant waste (accordingly measures 112, 119, 123, 128 of the plan) is again entrusted to the LA with a period of implementation in the last 7 years of the plan (2024–2030). Besides, LA still need to take measures to inventory the relevant waste from the collection and processing objects, acceptance and dismantling, and in some cases, even to conduct the necessary research.

The key CEB which should be the first executors, the Ministries of Infrastructure, Development of Communities and Territories, Energy and Environmental Protection, Economic Development, Trade and Agriculture of Ukraine and others are to be executors only after LA and regional state administrations (hereinafter – RSA) in the third and further places. These CEB with rare exceptions are in the first place of the main executors in measures for the elaboration of numerous legislative, rule-making, methodological, institutional and structural documents, which are usually important, but not crucial in the realization of key infrastructure measures of the plan and therefore these CEB will carry out only methodological, expert and control functions.

From the above analytical research of the plan, it is clear that with such an approach to solving the problem of SHW management by 2030 and further it will not be solved. It is obvious that no real sources of funding have been determined as there are not so many funds in local budgets for the realization of the above measures. This is especially true of regions such as Ternopil which are depressed areas that exist solely through subsidies from the state budget.

To carry out the strategy, in the Ternopil region a regional program for SHW treatment for 2018–2020 was approved with total funding of 50330.0 thousand hryvnias [12]. 46650 thousand hryvnias, which is 93 % of the total program funding, are provided to carry out 5 infrastructural measures for the construction of four regional waste processing enterprises, a thermal and electric energy generation object from SHW, an organic SHW bio-fermentation object for the organic fertilizers production, a network of recycling points (66 points), grounds, pavilions for SHW separate collection and purchase of containers for separate collection (1030 grounds and 4120 containers). The analysis of financing sources of the specified measures shows that 3000.0 thousand hryvnias will be allocated from the regional budget (6 %), 22750.0 thousand hryvnias (45 %) should be allocated by the LA and 20900.0 thousand hryvnias (42 %) at the expense investors, which still need to be found by the LA. It is obvious that the financing of key infrastructure measures of the regional program for 43650.0 thousand hryvnias (87 % of the total funding) is entrusted to the LA and finding such funds is a tough task for them.

The lack of funds in local budgets is evidenced by the failure to carry out the work on the construction and installation of new and 740 existing dumps in the Ternopil region, non-compliance with technological processes in SHW utilization [5].

The reform of LA decentralization also doesn't contribute to solving the problem. Today, there are already 886 united territorial communities in Ukraine, but they cover only 37.6 % of the Ukraine territory, where about 70 % of the population lives [7].

In our opinion, the choice of an appropriate inexpensive scheme of SHW treatment in regional centres, cities of regional importance, in particular the city of Ternopil, is one of the key ways to further solution to the problem of SHW treatment.

Concerning the choice of SHW treatment scheme, it should be taken into account that unlike the countries such as Japan, Austria, Italy, France, Germany, Belgium, Denmark, Sweden, where there is no free area and time for conceptual solutions, but there is a publicly

available and effective health care system, thermal methods of SHW utilization at $T = 800\text{ }^{\circ}\text{C}$ (from 20 to 80 % of SHW) have been developed [3]. Ukraine has the necessary area, time to decide on the application of a more energy-efficient, cost-effective scheme for SHW treatment. We offer the following more improved variant of the SHW management scheme in the Ternopil region (Fig. 1) than the one developed by the authors of the research [6]:

Fig. 1 shows that the key point of the scheme is the close cooperation at the same level of LA (united territorial communities, hereinafter – UTC) and the Ministries of economic development, trade and agriculture, energy and environmental protection, development of communities and territories of Ukraine, providing financing for the construction of SHW processing infrastructure, adjustment of their work and further transfer of their LA (UTC) for exploitation.

Within the framework of regional complexes for MW recovery for the city of Ternopil, it is proposed to choose a two-stage scheme for such an SHW treatment

scheme during the realization of which the SHW sorting is carried out with separate utilization and storage of residues at certified SHW landfills and subsequent utilization by extraction of methane gas from SHW after storage at landfills and recultivation of the latter after gas depletion (Fig. 2).

For other cities of Ukraine, a three-stage SHW management scheme is possible where after garbage sorting, the stage of production of alternative solid RDF-fuel (Refuse Derived Fuel) from waste and garbage is introduced as proposed by Zhuk G.V., Nikitin E.E., etc. [4] for the Ivano-Frankivsk city. But this is possible providing there are coal-fired HPPs or coal-fired cement plants in or near the city where RDF fuel is used as an additive to the main coal fuel and where there are flue gas purification systems. However, when using this alternative fuel the significant limitations of its use should be taken into account, namely the high cost of modern flue gas purification systems and analysis of flue emissions for their safety and the low share of RDF-fuel in the total mass of combustible fuel which reaches only about 5–7 %.

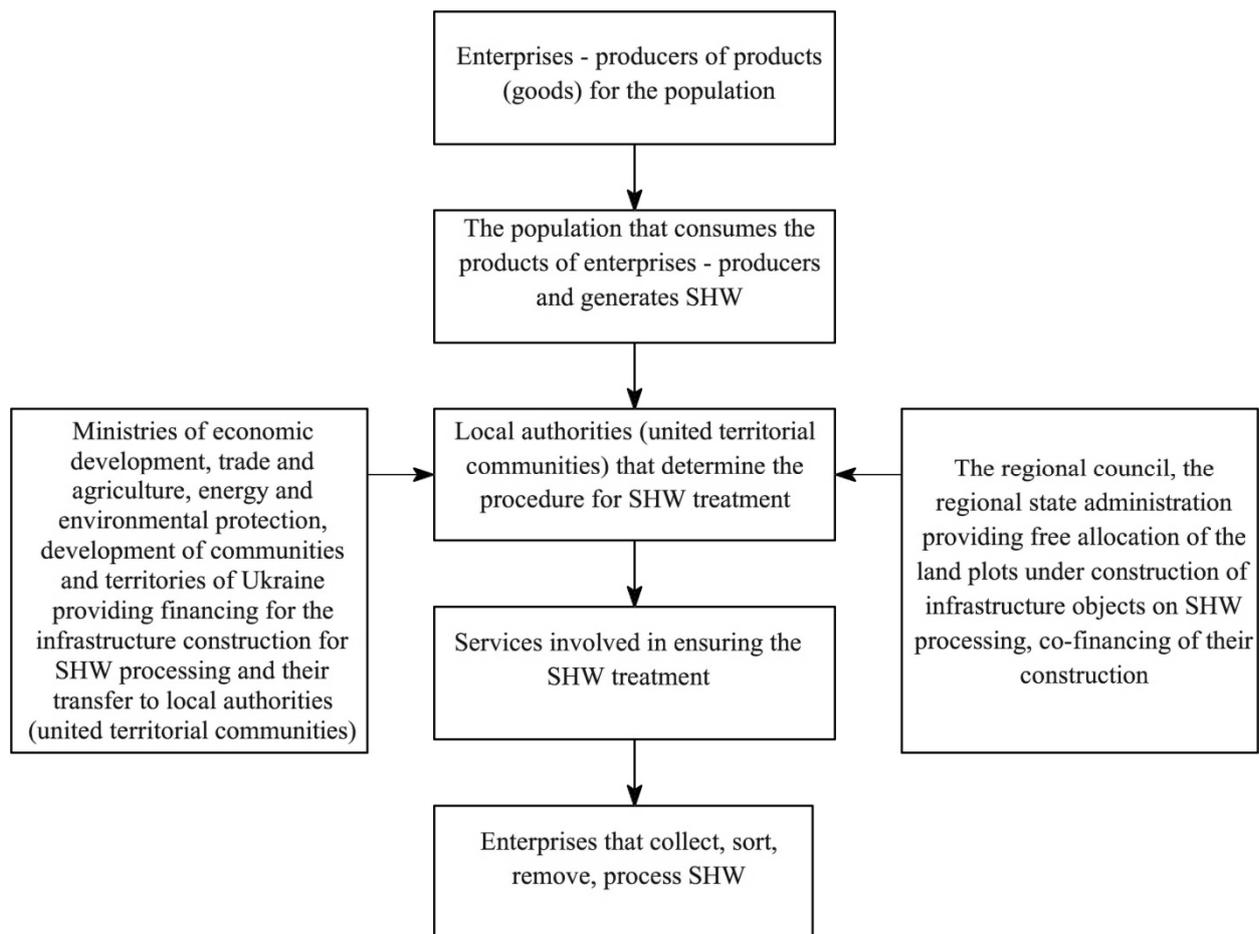


Fig. 1. Scheme of SHW management in the Ternopil region

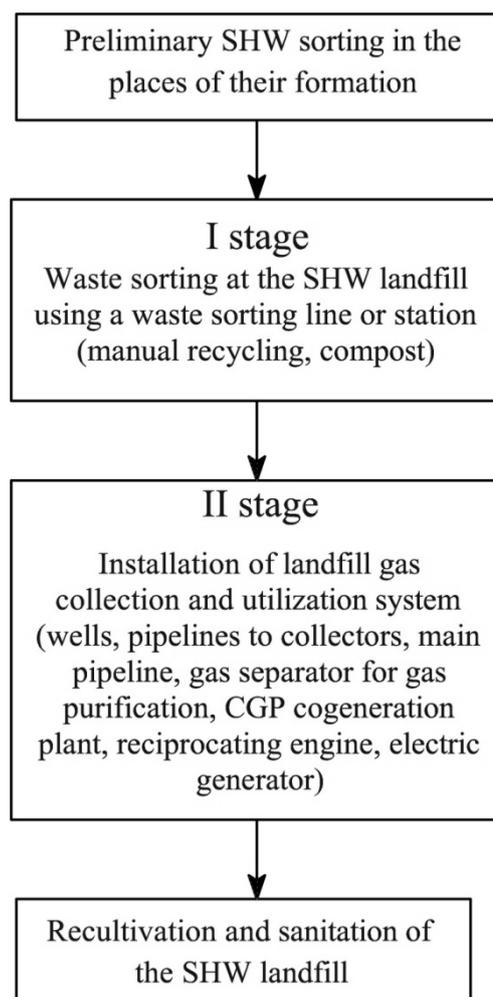


Fig. 2. The proposed scheme of SHW management for the Ternopil city

SHW from the city of Ternopil and villages that are part of the Ternopil United Territorial Community is taken to a dump near the Malashivtsi village Zboriv district. The volume of imported SHW is about 490 thousand m^3 per year (121.2 thousand tons) [8], the area allocated for the dump is 17.5 hectares. About 14.6 million m^3 of SHW or 3.5 million tons have been accumulated over the years of the dump's operation [5, 9]. The specific density of stored SHW is $0.24 \text{ t} / \text{m}^3$. On average, about 330 tons of SHW are disposed per day.

However, this dump is located in the third zone of Ternopil water intake sanitary protection, which creates preconditions for water horizons pollution and an actual danger to the health of the Ternopil inhabitants. Besides, it has a major negative impact on the environment due to the release of large amounts of dump gases that are explosive and spread over long distances.

At the first stage of SHW sorting, it is proposed to use a low-capital waste sorting line or station. Considering the high energy consumption and danger of landfill gas, it is advisable to use the collection and

utilization of this biogas in the second stage of SHW treatment. To do this, the authors of the research [4] propose to use a system of biogas collection and purification and its combustion in a modular cogeneration plant to recover electricity and heat. In our opinion, it is important that in comparison with the SHW landfill of Ivano-Frankivsk at the Ternopil dump near the Malashivtsi village Zboriv district, with approximately the same area (20.8 and 17.5 hectares respectively) much as twice SHW was stored: 7.5 and 14.6 million m^3 of SHW, respectively, which will be 1.8 and 3.5 million tons at an SHW specific density of $0.24 \text{ t} / \text{m}^3$. This approximately doubles both the projected term of gas productivity at the Malashovets dump and its projected gas productivity, which can be about $1800 \text{ m}^3 / \text{h}$. If at least 60 % of the emitted gas is collected, purified, and transported under the available technical capabilities, the amount of utilized gas will be about $1080 \text{ m}^3 / \text{h}$.

However, according to the authors of the research Zhuk G. V., Nikitin E. E., etc. [4], capital expenditures for implementing the above two-stage scheme of SHW treatment for the city of Ivano-Frankivsk can reach 110

million hryvnias with a 3.3 years payback period. It is obvious that the Ternopil City Council does not have such funds, and it is not able to provide SHW treatment properly without the help of the state.

There are also technical difficulties in the innovative technologies implementation that exist at the regional and local levels. According to the list of environmental measures, which were financed by the Ternopil regional fund for environmental protection in 2016–2018, and in 2018, the development of projects for installations for the generation of heat and electricity from SHW and for the SHW processing by bio-fermentation was not carried out [10].

Conclusions

Thus, in our opinion, successful SHW management within the framework of regional MW recovery complexes is possible with creating a separate branch of the national economy in Ukraine, which provides such treatment. The same is confirmed by the research of Shchuryk M. V., Nadraga R. R. [6], where it is determined that the proper SHW treatment should become a full component of the social reproduction process. The construction and functioning of SHW processing infrastructure enterprises cannot be ensured only on a business basis and with the assistance of local executive bodies and LA. Neither LA, RSA, nor the population can allocate sufficient funds for this purpose. It is possible to hope for the financing of necessary

infrastructural measures first of all only from the state budget or co-financing in which the share of allocated means from the state budget should be at least 80–90 %.

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