

УДК 338.3:502.315

<https://doi.org/10.31713/vs120246>

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## **SUSTAINABLE WASTE MANAGEMENT INITIATIVES FOR A SAFE ENVIRONMENT**

The current issue regarding the implementation of environmental standards and requirements in Ukraine, including in terms of waste management, separate collection of the mixture, is not the only one. Three or four decades ago, almost all European countries had similar problems. The implementation and modern technologies, the implementation of innovative projects in individual countries and even at the level of individual regions today have successful results and significant experience in solving them. European countries have been following this path since the early 1990s and plan to achieve 65–75% recycling in 2030. Ukraine prescribed the same indicators in the Strategy. The «road map», which the country received after signing the Association Agreement and obtaining the status of a candidate for EU membership in June 2022, obliges Ukraine to implement the environmental standards of the European Union and to implement national environmental legislation to the European one.

Over the past five years, a number of legislative and by-laws have been adopted in Ukraine. This is the Law of Ukraine on Waste Management, developed in accordance with the EU Framework Directive on Waste Management, the National Waste Management Strategy until 2030, the goal of which is to reduce the share of household waste disposal from 95% to 30%, the National Waste Management Plan until 2030. The implementation of the majority of the main provisions of the Law was slowed down by a number of economic and political reasons, including the military invasion of the territory of Ukraine by Russian troops.

Given Ukraine's limited experience in waste management in terms of separate collection, it is important to find and implement sustainable initiatives in this area. The article examines the results of the implementation of such initiatives at the regional level in one of the most ecological countries – Switzerland.

**Keywords:** waste management; separate garbage collection; environmental standards; environmental protection legislation; sustainable environmental initiatives; innovative solutions (technologies).

**Problem statement.** The basis for a quality comfortable life is the implementation of environmental norms and standards for clean air, water resources, food quality and safety.

A few decades ago, environmental issues were not discussed in Ukraine due to the lack of environmental awareness and culture of civil society, and contradictions in government and business structures. However, the European integration vector of the country's development and the targeted and consistent work of civil society organizations have led to a comprehensive recognition of the importance of these issues by society.

This state of affairs is not unique to Ukraine – almost all European countries faced similar problems about 3–4 decades ago and, today, have successful experience in solving them.

The European Union's environmental standards, which are binding on its member states, should become a «roadmap» for Ukraine, which received EU candidate status in June 2022, to ensure a quality standard of living. Unlike Ukraine's environmental legislation, which has been declarative in many respects, EU law defines quantitative and qualitative results that each country must achieve within a certain period of time.

The signing of the Association Agreement between Ukraine, on the one hand, and the European Union and its Member States, on the other hand [1] (hereinafter – the Agreement), has created new opportunities for the adoption of standards, including in the field of environmental protection, and the adaptation of domestic waste management legislation to European norms.

The amendments to the Law of Ukraine «On Waste» in 2018 and the entry into force of the Law of Ukraine «On Waste Management» in

July 2023 [2] will allow us to build a modern waste management infrastructure and establish transparent rules for this activity.

The Law [2] has been developed taking into account the norms of the EU Directives on waste, waste disposal, industrial emissions and will facilitate compliance with the waste management hierarchy and the introduction of extended producer responsibility. This law is a real opportunity to introduce a European approach to waste management for the first time since Ukraine's independence and to get on a par with the EU member states. The law will be a good foundation for building a circular economy, which means the restoration and rational consumption of natural resources, and is part of the European Union's Green Deal. And the experience of implementing sustainable waste management initiatives in European countries will help to find acceptable ways to solve the problem of waste management at the national level.

**The aim and objectives of the study** are to analyze the solutions to waste management problems in Ukraine and the prospects for implementing sustainable initiatives in this area on the example of Switzerland.

**Summary of the main research material.** The enactment of the Law of Ukraine «On Waste Management» on 09 July 2023 has been one of the steps towards fulfilling the obligations undertaken by Ukraine when signing the Agreement, including the approximation of three EU directives that Ukraine must implement.

As early as 1 January 2018, when the amendments to the Law on Waste came into force, Ukraine was supposed to switch to separate waste collection. Sorting and a new approach to waste management are generally among the commitments that Ukraine has made under the Agreement [1]. However, colorful bins have not yet appeared in the yards and streets of Ukrainian cities. Unfortunately, the main participants and implementers of most waste sorting projects were only volunteer projects.

Over the past five years, Ukraine has adopted the necessary legislation and regulations. These include the National Waste Management Strategy until 2030 [3], which aims to reduce the proportion of household waste disposal from 95% to 30%, and the National Waste Management Plan until 2030 [4]. As noted above, the

framework law «On Waste Management» was adopted in accordance with the EU Waste Management Framework Directive [5].

The Law [2] lays down the principle of extended producer responsibility, which creates a mechanism for financing separate waste collection and recycling. This also applies to the future development and adoption of sectoral laws on packaging, waste electrical and electronic equipment, batteries and accumulators, waste oil and tyres. This process was partially slowed down by the end of the previous Verkhovna Rada's term, the Covid-19 pandemic, and the full-scale military invasion of Ukraine by Russian troops. This also applies to the draft law on municipal waste, which includes household waste. That is why experts call the National Waste Management Plan an «umbrella» for the country as a whole, as the regions have to develop their own plans on their own [6].

The Ministry of Environmental Protection and Natural Resources of Ukraine has developed guidelines for regions to develop regional waste management plans. These plans should contain not only an assessment of the current waste situation in the region, but also plans and a strategic vision for action. This includes a detailed description of where landfills are located and how separate collection should be implemented, in what fractions, and how containers should be used (if necessary, according to the plans). Moreover, the conditions for such separate collection differ for each region. The plans should provide an analysis of waste flows from various sources at all stages of their existence - from information on their generation to the final stage of transportation. A forecast should be made of the waste streams generated in the future. Therefore, the household waste management system and the entire tariff policy should be formed exclusively at the local level. Thus, the state of implementation of separate waste collection directly depends on decisions made at the local level by local administrations.

According to experts, it is impossible to introduce sorting in a comprehensive manner, to provide funding through tariffs and people. The sorting infrastructure requires billions of dollars in investment, as it is supposed to use 250–260,000 containers at a time, as a minimum, a large number of sorting stations and an extensive network. However, local governments, which have been delegated all the powers, are unable to implement this, as they lack funding sources. The issue will be

resolved when the law on extended producer liability comes into force. It should stipulate that everything, starting with the infrastructure for collection, sorting and recycling, is funded by producers of packaged goods. Such a draft law has been submitted to the Verkhovna Rada of Ukraine for consideration on several occasions.

In the pre-war years, Ukraine had a fairly strong processing industry. There were 16 high-capacity glass plants, about 36 registered plastic recyclers, of which about 17 were operating. In 3 years, the volume of plastic processing increased from 15 to 50 thousand tonnes. Moreover, the fact that not all plants were operating or operating unstably was due to a lack of secondary raw materials. Therefore, many domestic companies purchased recycled materials, specifically plastic, in Europe. For example, in one year, the pulp and paper industry imported 355,000 tonnes of raw materials from other countries and paid about \$58–60 million for it. Thus, instead of investing in its own collection infrastructure, the money is spent on purchasing raw materials from other countries.

Before the adoption of the Law [2], without waiting for the necessary laws to be implemented, there was a good trend in Ukraine to introduce separate waste collection in many local communities. Since 2015, when separate waste collection was introduced in 398 settlements, their number has increased 3–4 times in five years (respectively, in 2016, there were 575 such settlements, in 2017 – 822, in 2018 – 1181) [6].

Local communities faced a number of problems when implementing the separate collection system. These included the lack of a transparent and perfect tariff system, and the absence of landfills that met all standards.

But despite these challenges, the implementation of an innovative model of solid waste management has had positive results in local communities in Kyiv (Kyiv Without Waste volunteer initiative), Kyiv (Vyshhorod) and Mykolaiv (Bashtanka) regions. The State Fund for Regional Development and the city budget were used to purchase garbage trucks and containers, including those for separate waste collection. We also worked with the public to raise their environmental awareness and awareness of waste management.

Over time, there were so many people willing to sort waste that the project's stations could not cope with the load. But those who were

sorting had problems selling the raw materials: the volumes they collected were too small for profitable cooperation with processors who work with huge volumes. Moreover, at the collection stage, the raw materials need to be accumulated and properly packaged for export. And if this process takes a long time, it is not economically viable. In order to obtain large volumes, larger areas must be covered. But even this activity is not profitable enough, which is why extended producer responsibility is needed to compensate for processing costs.

According to the Ministry of Regional Development and Construction of Ukraine, the number of landfills in Ukraine has hardly changed in recent years, ranging from 5,800 to 6,000. However, there has been a steady increase in the number of unauthorized landfills. Over the past three years, about 2,500 have appeared.

The National Plan [4] provides for the preparation of a new draft law on waste disposal, in line with the European Landfill Directive. The main problem with the existing landfills is that most of them have long since reached the end of their useful life and are overloaded. Building new modern landfills requires large financial outlays. This issue can be resolved either by raising tariffs for waste management or by attracting investment and introducing sustainable initiatives (innovative technologies).

What is currently being done in Ukraine. Landfills are undergoing certification to decide whether the landfill will be closed, whether it will be rehabilitated, or whether there is a possibility to make it safer. Biogas plants are already being built at many landfills to use the gas produced to generate heat and electricity.

The construction of a modern incinerator is also very expensive (from \$200 million to \$600 million). It is cheaper to build a modern, environmentally friendly landfill. But, in any case, it will be difficult, almost impossible for Ukraine to solve these issues on its own, especially given the state of the national economy amid the war and its consequences, without external investment and the introduction of innovative technologies.

European countries have been following this path since the early 90s and plan to reach 65–75% recycling in 2030. Ukraine has set the same targets in its Strategy [3].

Given Ukraine's limited experience in waste management in terms of separate collection, it is important to note the need to find and

implement sustainable initiatives in this area. Including those that have already been implemented or are being implemented in European countries and have excellent implementation results.

The management of waste sorting is one of the most important tasks for the authorities of one of the most «environmentally friendly» countries in Europe – Switzerland. How it all started. A tax on garbage bags has been introduced throughout Switzerland. However, the authorities of the canton of Geneva decided not to introduce a tax on garbage bags in the near future, but decided to launch an information campaign aimed at teaching the population, and especially the younger generation, to sort kitchen waste better.

Each Swiss resident produces an average of more than 700 kg of garbage and municipal solid waste (MSW) per year.

The good news is that about half of this volume is utilized and recycled [7].

Swiss residents throw away twice as much waste as residents of the Czech Republic, Japan, Poland and Costa Rica. According to the Organization for Economic Co-operation and Development (OECD), in 2018, the average citizen of an average OECD country threw away 525 kg of waste.

It is not surprising that Switzerland had to create sophisticated waste recycling systems, and this step was inevitable and objectively necessary, as the amount of household waste produced in Switzerland has more than doubled over the past 50 years. At the same time, the amount of household waste separately collected for recycling has increased more than sevenfold, to 52% of total MSW in 2018. In 2000, Switzerland stopped taking waste to landfills altogether, which means that everything that is not recycled or disposed of is simply incinerated to generate energy. You won't find the scary and poisonous smells around landfills in Switzerland anymore.

The so-called «little green bin» project was proposed. According to representatives of the Geneva cantonal authorities, the problem is not that taxpayers do not sort their waste, but that they do it worse than in other cantons. First of all, several goals were pursued. For example, in the canton of Valais, in order not to fill the taxable garbage bag, waste was mixed with sorted materials, which reduced the quality of sorting. The first goal is to avoid this phenomenon. Secondly, the application of such taxation would be unfair to different segments of the population,

both rich and poor. Another reason is that it would encourage the emergence of «garbage tourism» to the neighboring canton. The problem of «garbage tourism» does exist. There have been cases of Swiss «tourists» taking garbage from the border areas of Vaud and Neuchâtel to France. For example, in 2017, 10 tonnes of waste were seized at customs, which the citizens of the Confederation tried to smuggle to waste collection points in neighboring French cities.

Paid garbage bags were first introduced in 1975 in St Gallen. The main purpose and reason were to improve the waste sorting process.

In the late 1990s and early 2000s, most German-speaking cantons followed suit. In French-speaking Switzerland, it was decided not to rush to introduce a similar measure.

In 2011, the Federal Court of Justice of Switzerland ruled that paid packages became mandatory almost throughout the country. However, some French-speaking cantons did not comply with this requirement until 2013, and the German-speaking canton of Nidwalden only gave in in 2014.

In the only Italian-speaking canton of Ticino, the issue of mandatory use of paid garbage bags was put to a popular referendum in 2017, which resulted in 66 municipalities out of 115 being «forced» to introduce a tax on garbage bags.

As a result, a special surcharge on garbage bags is now in place everywhere in Switzerland, except for Geneva.

What is the cost of the proposed initiative? For example, in Lausanne, where all residents are required to use paid garbage bags, a package of 10–35-litre bags costs 19.50 Swiss francs (20 garbage bags – 39 Swiss francs). In Geneva, in a Migros supermarket, one pack of 20–35-litre bags are sold for 2.50 Swiss francs. The cost of one bag including tax is therefore 1.95 Swiss francs compared to 0.12 Swiss francs in Geneva [7].

In Geneva, they want to solve the problem of waste sorting and recycling in a different way. The cantonal government plans to recycle up to 60% of all waste by 2030. Today, this figure is just over 50%, and the share of food waste is 30% [8, C. 8].

Geneva is trying to cope with the accumulated organic waste by launching a major new information campaign, the "little green bin", aimed at sorting food waste. One of the focuses of this campaign is new compostable bags.



To encourage people to sort their waste better, the authorities of the city and its suburbs offered tens of thousands of bags to residents of the canton free of charge at the start of the project. Later, they started selling them in shops. A similar campaign in Geneva in 2016 increased the recycling rate of organic waste by almost 50% in five years.

Another example of a sustainable waste management initiative implemented in the canton of Geneva (Switzerland) is the Eco21 program. It was developed by the public law institution SIG (Services Industriels de Geneve), which is governed by the Geneva Constitution and the law on their organization. As part of the Eco21 Program, SIG is developing ways and concrete steps to improve the overall balance of the canton. The first question that the program developers asked themselves was: How to reduce the amount of waste that goes to incineration plants every year?

Half of the waste that fills Geneva's bins is recyclable. This includes even a third of organic waste, or about 32,000 tonnes per year. Fruit and vegetable peels, expired food, wilted flowers, and food scraps. This organic waste, which is 90% water, is difficult to incinerate.

However, even in a country as highly regulated as Switzerland, there are still some shortcomings in terms of compliance. For example, due to a lack of proper sorting, half of the recyclable waste at the Cheneviers factory is incinerated. This means additional costs for society and an impact on the overall ecological state of the environment. Although it can be recycled as compost.

But, according to Florence Amoudry-Frazier, project leader of the *Waste and Circular Economy* project, which is part of the *SIG-eco21* program, there are ways to reduce the waste of local resources. Firstly, in order to contribute to solving industrial and environmental problems, it is necessary to promote the desire for more thoughtful consumption and to activate the implementation of the circular economy, avoiding the production of waste. Secondly, it is important to give preference to sorting at the source in order to maximize the use of the material. This requires serious educational efforts and awareness-raising along the entire value chain, from production to consumption.

While the dominant model for generations has been that of a linear economy (extract, produce, consume, discard), the circular economy represents a comprehensive or integrated approach. This involves rethinking the entire cycle, from raw materials to recycling, including

design, production, distribution and use, to ensure that the process continues as long as possible.

In light of the current challenges posed by climate change, the circular economy is the foundation for building the economy of the future.

According to the local authorities, various structures and institutions in Geneva are actively focusing on alternatives and opportunities to implement a circular economy, thus demonstrating their vision of combining the environment and the economy. This process builds on the capacities of the financial structure, within which several companies have already taken steps and are sharing best practices to make better use of natural resources. Changing the model requires a deep collective transformation.

The *SIG-eco21* program was launched in 2007 by SIG to support the canton's efforts to reduce energy consumption and CO<sub>2</sub> emissions. Since 2020, the SIG has been offering support on the topic of waste and the circular economy, guided by experts to identify opportunities, financial assistance and ready-made methods tailored to the needs of each individual. This support helps to create a strategy to reduce waste and optimize waste sorting.

The new waste management law, which was approved by the Confederation Council, aims to drastically reduce waste by introducing mandatory sorting, banning single-use plastic products in restaurants and public events, and disposing of waste on-site in the canton to limit the carbon footprint of transportation.

Implementation of the law's provisions should lead to a 25% reduction in municipal waste incineration. Moreover, the law is in line with the steps proposed by the *SIG-eco21* program, which emphasize the following: consume less and do better. Consuming local, sustainable, repairable and recyclable products is a guarantee of quality and value. This philosophy of life leads to a change in the way we produce and consume. This involves replacing imports, which have a significant environmental impact, with circular practices that link demand to available resources in the urban (cantonal) areas. In this way, environmental impacts are better controlled.

SIG has joined forces with Helvetia Environment to meet its ambitious environmental targets. Helvetia Environment is a Swiss industrial and municipal waste collection and recycling company

founded in 2005 and headquartered in Carouge, Canton of Geneva. The company was the result of the merger of several Swiss companies specializing in waste collection and recycling. The company has had 13 sites across Switzerland and is one of the main Swiss players in the waste treatment, recycling and disposal sector, processing more than 500,000 tonnes of waste per year [8, C. 9].

As part of the SIG-Helvetia Environment joint project, the PoleBio site has been created to process organic waste, which will process up to 48,000 tonnes of waste per year. The facility is being built to replace the Châtillon plant operated by SIG and will be commissioned in 2024. The facility will have a dual purpose: waste processing (recycling) and production of organic fertilizers (compost, liquid biofertilizers), which can replace imported mineral fertilizers. As a result, farmers and landscapers in the canton will have access to high-quality local resources for their crops.

The plant will also produce 25 GWh per year of energy in the form of biomethane, which will be injected into the SIG gas network and supply the equivalent of 4,000 Geneva households, while also meeting the needs of the hauliers. The solar power plant that will cover the roof will provide the equivalent of 300 households with electricity.

Saving energy and CO<sub>2</sub> and limiting waste are among the key elements of the canton of Geneva's environmental transition. They contribute to the conservation of natural resources and the climate, as well as the phase-out of nuclear power. In line with the objectives of the Confederation and the canton, the program aims to make Geneva an efficient region through partnerships with companies and local associations, as well as with Geneva's own professionals.

This program offers concrete solutions for individuals, businesses, companies, communities and owners. It enables results to be shared across the territory and facilitates networking to accelerate circular approaches.

In cooperation with the services of the Canton of Geneva, the program's main mission is to contribute to the reduction of incinerated waste.

This support includes diagnostics, action proposals, advice and financial incentives. This can take several forms: raising awareness of waste prevention and sorting among the public and employees, supporting the creation of resource centers, developing digital platforms

for the exchange of material resources between companies, piloting projects to reintroduce food container guidelines, developing a waste guide for new neighborhoods, etc. Occupations related to the circular economy, such as repair specialists, second-hand workers, and local know-how, are becoming more and more common and this trend is not changing.

Thus, very ambitious goals have been set – to be sustainable; the material footprint of Greater Geneva must be reduced from 19 tonnes to 6 tonnes, or even 3 tonnes per inhabitant per year. Such goals are worthy of emulation [8, C. 9].

**Conclusions.** Thus, the implementation of waste management in terms of waste sorting and household waste has a number of positive consequences.

Anything eventually becomes waste. However, materials from old products can be partially or fully used in the production of new items, reducing the total amount of waste. This will reduce the environmental impact, as less new raw materials will need to be used.

Addressing waste management issues significantly eliminates hazards to humans and the environment. Toxic waste can pollute air, soil, surface and groundwater. Hazardous waste management therefore requires stricter environmental protection measures.

The majority of household waste is made up of recyclable packaging, which makes it possible to reuse waste.

Timely waste sorting eliminates the need for additional payments by consumers for waste removal and storage, thereby saving some money.

Public health depends on many factors, including economic and genetic ones. The deterioration of the economic situation in the country and the growth of environmental pollution leads to an increase in the incidence of diseases such as allergies, upper respiratory tract diseases, and other pathologies, as well as a growing number of children with congenital diseases, as well as a high proportion of chronic disease exacerbations and malignant tumors associated with exposure to chemical carcinogens. Reducing the accumulated waste that spoils our health.

1. Угода про Асоціацію між Україною, з однієї сторони, та Європейським Союзом, Європейським співтовариством з атомної енергії і їхніми державами-членами, з іншої сторони : ратифіковано Законом України від

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## СТІЙКІ ІНІЦІАТИВИ УПРАВЛІННЯ ВІДХОДАМИ ДЛЯ БЕЗПЕЧНОГО ДОВКІЛЛЯ

Нагальне питання щодо впровадження екологічних норм та вимог в Україні, в тому числі в частині управління відходами, роздільного збирання сміття, не є унікальним. Тричотири десятиліття назад майже всі європейські країни мали подібні проблеми. Впровадження сучасних технологій, реалізація інноваційних проєктів в окремих країнах та навіть на рівні окремих регіонів мають на сьогодні успішні результати та значний досвід щодо їх вирішення. Європейські країни рухаються цим шляхом з початку 90-х років і планують вийти на 65–75% переробки у 2030 році. Україна прописала такі ж показники у Стратегії. «Дорожня карта», яку отримала країна після підписання Угоди про асоціацію та набуття статусу кандидата члена-країни ЄС у червні 2022 року, зобов'язує Україну впроваджувати екологічні стандарти

**Європейського Союзу та імплементувати національне природоохоронне законодавство до європейського.**

**За останні п'ять років в Україні прийнято низку законодавчих та підзаконних актів. Це Закон України Про управління відходами», розроблений згідно з рамковою Директивою ЄС про управління відходами, Національна стратегія поводження з відходами до 2030 року, метою якою є зниження частки захоронення побутових відходів з 95% до 30%, Національний план управління відходами до 2030 року. Впровадження більшості на виконання основних положень Закону уповільнювалось низкою економічних та політичних причин, у тому числі воєнного вторгнення на територію України російських військ.**

**Враховуючи незначний досвід України щодо управління відходами в частині роздільного збору важливим є пошук та впровадження стійких ініціатив в цій сфері. В статті розглянуто результати впровадження таких ініціатив на регіональному рівні в одній з найбільш екологічній країні – Швейцарії.**

***Ключові слова:* управління відходами; роздільне збирання сміття; екологічні стандарти; природоохоронне законодавство; стійкі екологічні ініціативи; інноваційні рішення (технології).**