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Waste Management in Ukraine Opportunities for Dutch Companies

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Waste Management in Ukraine
Opportunities for Dutch Companies
Final Report

Engineering & Technologies

Bilfinger Tebodin Ukraine CFI
16-b, Stepana Bandery Ave.
04073 Kyiv
Ukraine

Authors: Oksana Cherinko, Andriy Balanyuk
Telephone: +38 044 481 2121/ +38 044 481 2122
E-mail: oksana.cherinko@bilfinger.com, andriy.balanyuk@bilfinger.com

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1 Introduction, Acknowledgements and Disclaimers

This market study 'Waste Management in Ukraine: Opportunities for Dutch Companies' is done by Bilfinger Tebodin Ukraine CFI on request by the Embassy of the Netherlands in Ukraine.

The results of the study were presented in the seminar on the opportunities for Dutch companies in the waste management sector of Ukraine on October 5, 2018, facilitated by the Netherlands Enterprise Agency (RVO) in the Hague (see **Annex 1** for the Presentation).

This study was prepared with the support of industry experts and based on interviews conducted with various market players such as advisors to governmental decision makers, industry and business associations, private companies and International Financial Institution (IFI) project teams. We are grateful for a constructive dialogue, fruitful cooperation and informative inputs provided.

We feel confident that this study gives a sensible executive view on the opportunities in the Ukrainian waste management market and will be happy if this will support Dutch market players in their decision-making, business initiatives development and implementation in waste management in Ukraine in the most effective way.

Waste management is a key environmental concern across Europe with many countries witnessing a significant increase of the amount of waste produced and accumulated. The situation in Ukraine has already proven to be critical in many cities and regions due to a lack of proper waste management infrastructure and adequate government policy, business approach and public response.

In 2014–2017, Ukraine took initial important steps to change the situation through commitment of compliance with the EU Directives as a part of the Association Agreement with the EU and adopting the National Waste Management Strategy until 2030.

The aim of this study is to identify opportunities and niches for Dutch companies on the national and regional levels in the Ukrainian waste management sector, in particular, but not limited to, in municipal solid waste (MSW) handling. The study also provides information on the potential areas and needed sources of financing in order to reach the targets outlined in the recently adopted National Waste Management Strategy.

The Executive Summary addressing the main conclusions under the study, with the focus on the opportunities for the Dutch institutions, business and R&D stakeholders, is presented in **Chapter 2**.

The overview of the waste management market in Ukraine, including key challenges and trends, indicators, institutional, private, NGO & CSO stakeholders, is given in **Chapter 3**.

This study focuses on the MSW market and its infrastructure (**Subchapter 3.2.7**), as well as frameworks of sector functioning and development (**Chapters 4, 5**). The status, trends, challenges and opportunities under other waste streams – *e.g.* industrial waste, construction and demolishing waste, hazardous waste, agricultural waste, specific types of waste (packaging, Waste Electrical and Electronic Equipment (WEEE)/ batteries/ accumulators, end-of-life vehicles, healthcare waste) – are commented on in **Subchapters 3.2.1–3.2.6** at a higher level to present the complete waste management market snapshot and provide ideas for potential more in-depth investigations, as further commented in **Chapter 8**.

Considering recent and expected changes in the legal and institutional framework of the market and the role of international donors and financial institutions in this process, special insights are elaborated on in **Chapters 4-6** for the policy targets related to the waste management sector and development goals, including the National Waste Management Strategy until 2030, current and upcoming projects to be carried out, the financing system and implementing bodies, insights into local tender procedures and the overview of IFI and foreign governments' initiatives in the market.

The SWOT analysis of the waste management market in Ukraine is presented in **Chapter 7**.

The capabilities of Dutch waste management approaches and the opportunities for Dutch companies in Ukraine are given in **Chapter 8** with the focus on areas where Dutch equipment, technologies and consultancy services could be applied in line with the objectives defined in the recently approved National Waste Management Strategy of Ukraine until 2030.

The overview of the Ukrainian legislation regulating waste management is detailed in **Annex 2**.

The overview of the current financing framework, waste management financing trends, state-end financing is given in **Annex 3.**

The overview of the IFI initiatives in waste management sector of Ukraine, including the related database, is given in **Annex 4.**

Modern waste management technologies and their applicability to the Ukrainian market are described in **Annex 5.**

Key exhibitions to attend are listed in **Annex 6**.

A special note has to be made about the quality and completeness of the available data on the Ukrainian waste management market, in particular about MSW indicators and related disclaimers by the Consultant.

The information contained in this study has been obtained from sources considered the most reliable by the Consultant and industry experts. While all reasonable care has been taken in preparing this study, no responsibility and liability are acceptable for errors or opinions provided.

Three main issues form the area of concern of the Consultant.

Discrepancy between the Ukrainian and EU definitions and classifications of waste:

- The Ukrainian classification of waste is based only on toxic indicators (I–IV hazardous grades of waste).
- Ukraine still uses a list of waste not corresponding to the EU list of waste; changes are expected shortly as one of the actions anticipated by commitments under the Association Agreement with the EU.
- The definitions of waste management operations mentioned in the actual Law on Waste of Ukraine are different from the EU definitions; changes are expected in the short term as one of the actions anticipated by the adopted National Waste Management Strategy. Formally, incineration of MSW is considered a recovery operation; it was not calculated with an index as set in the requirements of the Directive 2008/98/EC to clarify if incineration can be recovery or disposal.

Significant disadvantages of Ukrainian state accounting and statistics on waste and specifically on MSW:

Statistical information on waste is rather unreliable and varies according to different official sources. The State Statistics Service of Ukraine (Ukrstat) and the Ministry of Regional Development, Construction and Utility Service of Ukraine (Minregion) are considered the main official sources of information on MSW. However, their data vary since statistical reporting, normative legal acts related to MSW operate both volumetric and weight categories, and further conversion of units leads to significant errors during data processing, evaluation, and forecasts. *E.g.* initial information regarding the generation of MSW is collected in cubic meters (cub. m) and then data is manually recalculated by regions into tons. Sometimes, such a recalculation results in significant mistakes[1].

- The Ukrstat relies on statistical reporting data regularly submitted by companies through Form '1-Waste 'Generation and Management of Waste'. Meanwhile, the Minregion applies special Form '1-ТПВ' where data are generalized further at municipal-, regional- and oblast- levels.
- The Minregion also collects additional information on separate waste collection and the status of landfills using different questionnaire forms (data from such forms are not always comparable with Form '1-ТПВ' data). In the end, it is data from the Minregion that is usually considered the most complete official information.
- Besides the two mentioned official sources, some specific information can be extracted from the Minecology State Registry of waste disposal places, including landfills for MSW and others.
- MSW market data on the MSW composition is especially poor. Available official data on the MSW composition is provided using different methodologies and approaches with different levels of details. *E.g.* according to different sources, the share of recyclable waste can vary from 14.5% to 35% of the total amount of waste, which depends on whether this waste had been studied before capturing the recyclable fraction by the informal sector of the MSW market or not. Other general factors contribute to this discrepancy, such as a level of income of people living in the settlement, etc. A limited number of municipalities estimate composition of municipal waste. There are 'Methodological Recommendations for Determining the Morphological Composition of MSW' approved by the Minregion's Order No. 39 dated February 16, 2010, the enforcement of which is limited.
- Since 2010, the transition to a new form of statistical accounting in Ukraine has made it possible to introduce changes in the assessment of the situation with industrial and other types of waste[2]. However, experts still consider sectoral data rather incomplete and contradictory (*e.g.* see the comment on agricultural waste data in **Subchapter 4.2.5**).

[1] *E.g.* Dnipropetrovska Oblast reported about 5,199,385 cub. m or 610,928.5 tons of generated MSW (index applied 8.5); at the same time, Kyivska Oblast reported about 1,432,322 cub. m or 937,041.7 tons of generated MSW (index applied 1.5).
[2] The annual amount of industrial waste generation is 419.2 million tons, and the amount of accumulation in specially designated areas or facilities is 13.27 billion tons, which is considerably less than in the previous reports.

- There is no available integrated electronic system of information collection at the level of the Minregion (or any other national authority). The Minecology has introduced the electronic system of waste declarations by companies; however, the system functions neither at the national level nor at regional levels.

Presence of the unofficial waste market:

- There is no available statistical data regarding the size of the unofficial market[3] in the MSW sector, which significantly affects the reliability of the overall market statistics.

The status period of this Report:

- The main status period of the study was January–June 2018; subsequent events and data have not been accounted for in this Report.
- Since then, Ukraine has made further steps in waste management improvement: besides the other recent progress, new revisions of the sectoral framework 'Law on Waste' and accompanying laws on main waste streams were drafted and sent for approval by the Ukrainian Parliament and the draft of the National Waste Management Plan was prepared and passed public hearings.
- In October 2018, the main annual industry exhibition 'Waste Management 2018' took place in Kyiv with the key topics as follows:
    - Progress in obligatory sorting during waste collection;
    - EPR as a low-hanging solution for accumulation of funds for packaging waste recycling;
    - Decentralization and cascading of the tariff regulation to the municipal level as an economic instrument for more effective local waste management practices;
    - Initiation of project preparation activities such as allocation of land for future facilities anticipated according to the National Strategy;
    - Consideration of waste's status as the subject of property rights to overcome the unofficial market;
    - Continued support of regional initiatives in Lvivska, Vinnitska, Khmelnyska Oblasts by IFIs.

[3] Meaning unofficial management of some processes in the MSW field (shadow economy) including a layer of population that selects renewable fractions from the general waste stream

2 Executive Summary

Waste management is one of the areas where the Netherlands is recognized as the world leader and the provider of best available and innovative techniques as well as advanced governance and policies. In the late 1980s, the Netherlands suffered from a lack of landfill capacity to serve waste flows. In the 1990s, the country made a transition from its small-scale, inefficient and regionally organized activities toward the professional, internationally oriented and increasingly innovative sector.

According to the European Environmental Bureau, in 2016, with the recycling rate of 57%, the Netherlands, held the sixth place in the world. The Dutch Government's policy 'from waste to resources' is to eliminate landfilling of waste and give the private sector confidence to invest in more sustainable solutions. Elements of the Netherlands Waste Management policy include the order of preference based on the waste 'hierarchy' of prevention over reliance on the landfill, strict waste treatment standards, cooperative approach, EPR, various instruments to promote waste prevention and recycling.

Waste management is a key environmental concern across Europe with many countries witnessing a significant increase of the amount of wastes produced. Experience and capabilities of Dutch companies, institutional and R&D stakeholders in the sphere of waste management covering a complete value chain represent the best practice for emerging economies, including Ukraine.

Ukraine and the Netherlands share a number of common interests for collaboration in the fields of environmental and sustainable development. The intention to cooperate was formally expressed in the Letter of Intent signed between the Ministry of Infrastructure and Environment of the Kingdom of the Netherlands and the Ministry of Ecology and Natural Resources of Ukraine and the Ministry of Regional Development, Building and Housing and Communal Services of Ukraine in 2016.

The situation in the waste management sector of Ukraine is continuously defined as critical in recent market studies, official documents, reports and analytics by NGOs / CSOs in terms of the status and trends in waste generation, accumulation, storage, processing, recycling and disposal. The situation has already proven to be emergent in many cities and regions and in many waste subsectors due to the lack of proper waste management infrastructure and adequate government policy, a business approach and public response.

The issue of waste management in Ukraine is particularly significant because of the traditional dominance of resource-intensive and non-waste-use technologies in the national economy. Waste generated in the process of extraction, enrichment, chemical-metallurgical processing, transportation and storage of minerals is a secondary raw material reserve for the industrial, construction and energy sectors. Secondary raw materials from remnants of final consumption products (*e.g.* waste paper, polymers, glass, worn tires, *etc.*) also have considerable resource potential. Low tariffs on waste disposal services do not create incentives for businesses and local authorities to recycle waste.

Significant volumes of accumulated waste, absence of relevant infrastructure and lack of effective measures to prevent waste generation and introduce the integrated waste management approach deepen the ecological crisis and become a restraining factor in development of the Ukrainian national, regional and local economies.

Considering the context of the integrated MSW management concept, Ukraine is currently positioned at the lowest level of the waste hierarchy with the absent or limited preventing framework, prevailing mix waste collection in preparation for use, recycling in a limited scope, other recovery steps implemented just initially and disposal to landfills as the main waste management technique. New technologies' introduction is limited by the lack of integrated management decisions and by insufficient financial resources and economic incentives. A small number of innovative technologies, if any, are adopted.

According to the Ukrstat data, over 295.9 million tons of waste was generated in Ukraine in 2016, including 289.5 million tons (97.8%) of waste generated by the industry and 6.4 million tons (2.2%) of waste generated by households. At this, 218 million tons (almost 74% of the generated waste) was generated by the mining and quarrying industry. Only households and the power-, gas- and heat- supply sector demonstrated growth in waste generation; with the agricultural and construction indicators almost at the same level as in 2015.

The situation with municipal solid waste management in Ukraine is still at a very basic level, when waste management consists of collection of mixed waste and landfill disposal. According to the Ukrstat data, of 11.6 million tons of MSW and similar waste generated in Ukraine in 2016, only 0.09% was recovered, 3.73% was incinerated and the rest 87.67% was landfilled.

The high level of waste generation and the low rates of its use as a secondary raw material have led to the fact that in Ukraine in the industrial and municipal sector majority of solid waste accumulated each year is disposed of into landfills. According to the official data on 5 487 landfills and dumps in Ukraine, in 2016 almost 6% of them were overloaded and 30% did not meet national environmental safety standards. According to the official data, due to the insufficient level of control and lack of a proper MSW management system, over 27 thousand unauthorized dumps are formed each year.

Despite the fact that the nominal amount of capital and operational expenditures in the whole waste management sector from all sources of financing increased from UAH 1.67 billion (or € 263.49 million) in 2006 to UAH 8.93 billion (or € 315.58 million) in 2016, the MSW sector is greatly underfinanced.

In 2014–2017, Ukraine made initial important steps to change the situation through commitment to comply with the EU Directives as part of the Association Agreement with the EU and adoption of the National Waste Management Strategy until 2030.

The National Waste Management Strategy provides short-, mid- and long-term directions for addressing challenges for all main waste subsectors (industrial waste, construction and demolition waste, hazardous waste, agroindustrial waste and specific waste streams) as well as provides fulfillment of obligations of Ukraine according to the international agreements. The Strategy is developed with the support of international donors and is considered one of the main drivers of the waste management market development, compliant with the EU requirements and close to the innovative integrated concept.

Following the EU countries' move toward what is referred to as 'integrated solid waste management (ISWM), the National Waste Strategy 2030 signals going away from sole reliance on landfill disposal with an increased focus on recycling and recovery for certain waste streams while the residual waste is disposed of into EU-compliant landfills. It proposes a significant increase in the coverage of the population with organized MSW separate collection and a progressive movement toward increased levels of recycling and recovery.

More precisely, the National Waste Management Strategy anticipates reaching the following targets in the short-, mid- and long-term perspective:

Table 2-1. Short-term, mid-term and long-term targets under National Waste Management Strategy 2030

Strategic Targets set in National Waste Strategy	2016 (Base)	Short-term (2017-2018)	Mid-term (2019-2025)	Long term (2026-2030)
Waste prevention				
Network of centers for the introduction of cleaner production (technology)	0	5	10	20
Decrease in the volumes of using primary raw materials	90%	85%	80%	70%
Preparation for second use				
Waste Collecting Points	0	25	100	250
Settlements with separated waste collection	575	800	2500	5000
Waste collection centers for repair for the purpose of reuse (primarily WEEE)	0	25	100	250
Increase in the volumes of MSW sent for reuse	5%	7%	8%	10%
Waste processing and recycling				
Waste for processing	3,0%	5%	10%	20%
Processing entities	65	100	250	800
Establishing of biowaste composting facilities	20	70	150	500
Waste sent for recycling	3%	5%	15%	50%
Other utilization				
Waste for incineration	2,4%	5%	7%	10%
Incineration units	1	3	15	20
Waste disposal				
Regional landfills compliant to EU Directives	0	5	25	50
Waste for landfilling	50,0%	45%	40%	35%
MSW for landfilling	95,0%	80%	50%	30%
Decrease in a number of landfills of MSW according to the EU Directives	6000	5000	1000	300

The main measures toward the Strategy implementation include, among others:

- Institutional and legislative changes
- Measures toward population awareness, improvements in waste management behavior, R&D
- Tax incentives, tariffs reform, introduction of EPR
- Investment in equipment, technology and infrastructure development: according to the expert estimates, the total CAPEX for the MSW strategy realization is about € 2.8 billion.

The implementation of this Strategy will contribute to:

- Introduction of a waste management system on an innovative basis that will ensure the effective consumption of natural resources (natural resources – useful products – waste – secondary resources – useful products – waste);
- Development of legislation in the field of waste management taking into account the requirements of the relevant European directives;

- Qualitative changes in the field of waste management in accordance with the best environmental practices;
- Improvement of the state of the environment as well as sanitary and epidemiological well-being of the population;
- Compliance with ecological safety requirements during the operation of waste management facilities and reduction of the social tension;
- Attraction of investments in the field of waste management and creation of modern waste management infrastructure;
- Introduction of the latest technologies of utilization and removal of solid household wastes, reduction of their burial at the landfills;
- Reduction of the number of objects of waste management that do not meet the requirements of the legislation, release of land after the closure of landfills;
- Increase in volumes of harvesting, processing and utilization of waste as a secondary raw material;
- Stimulation of business entities to conduct production activities using non-waste and environmentally sound technologies.

Strategy implementation opens up wide opportunities for Dutch institutional, R&D and private business stakeholders to benefit from knowledge sharing in organizational and legislative framework development, know-how transfer, services, equipment and technology supply.

Ukraine has access to and benefits from financing opportunities and initiatives of various international donors and financial institutions aimed at all stakeholders of the waste management sector: institutional and governmental, regional and municipal, private, R&D and NGO/ CSO. International donors and IFIs focus on institutional and legislative framework development in the waste management sector, including support for alignment of the national legislation with the EU requirements and best practice benchmarking. Another interesting aspect concerns the EU as the most active donor of local waste management projects in Ukraine. There have been dozens of MSW management project initiatives since 2009; some projects are still in progress or have been recently launched to capitalize on the opportunities opened by the recently adopted National Waste Management Strategy 2030. The international community also actively supports addressing the most urgent and critical issues of waste management such as regional cases or hazardous waste management. Despite massive international donor support on the institutional level and in pilot demonstration projects, the absence of microfinancing instruments from IFIs and high interest loan rates from local banks hamper the realization of small-scale (up to US $ 1-3 million) projects of local service providers. And here, there are also opportunities for mutually beneficial cooperation between Dutch and Ukrainian companies.

Please refer to **Annex 1** ‘Waste Management in Ukraine: Opportunities for the Dutch Companies, Institutional and R&D Stakeholders’, which is a visualization of the main findings of this Study.

3 Waste Management Market in Ukraine

3.1 Waste Management Market in Ukraine: Challenges and Trends

The situation in the waste management sector of Ukraine is continuously defined as critical in recent market studies, official documents, reports and analytics by NGOs / CSOs in terms of the status and trends in waste generation, accumulation, storage, processing, recycling and disposal. The current situation is characterized by increasing risks of environmental threats. The issue of waste management in Ukraine is particularly significant because of the traditional dominance of resource-intensive and non-waste-use technologies in the national economy. Waste generated in the process of extraction, enrichment, chemical-metallurgical processing, transportation and storage of minerals is a secondary raw material reserve for the industrial, construction and energy sectors. Secondary raw materials from remnants of final consumption products (*e.g.* waste paper, polymers, glass, worn tires, *etc.*) also have considerable resource potential.

The high level of waste generation and the low rates of its use as a secondary raw material have led to the fact that the major part of the industrial and municipal solid waste in Ukraine is disposed of into landfills.

Significant volumes of accumulated waste, absence of relevant infrastructure and lack of effective measures to prevent waste generation and introduce the integrated waste management approach deepen the ecological crisis and become a restraining factor in development of the Ukrainian national, regional and local economies.

In 2014–2017, Ukraine made initial important steps to change the situation through commitment to comply with the EU Directives as part of the Association Agreement with the EU and adoption of the National Waste Management Strategy until 2030. The National Waste Management Strategy provides short-, mid- and long-term directions for addressing challenges for all main waste streams. This document also provides fulfillment of obligations of Ukraine according to the international agreements.

In general, the waste management market in Ukraine is characterized by the following challenges and trends:

- Accumulation of waste both in the industrial and domestic sectors, which adversely affects the environment and human health. However, proper management of possible dangerous consequences is not in place;
- Inadequate disposal of hazardous waste;
- Poor use of waste as a secondary raw material due to imperfection of organizational and economic bases of its application in production;
- Inefficiency of introduced economic instruments in the field of waste management, such as low tariffs and no incentives for effective waste management, waste recycling and the circular economy both for the population and business;
- Lack of or limited responsibility of waste producers and authorities;
- The substantial unofficial market which is not taken into account by the official statistical data on waste generation and management;
- Non-transparent and unreliable statistical data from the official sources;
- The legislative and institutional environment is in the transition mode toward development and implementation of an integrated waste management approach and compliance with the EU standards including elimination of the current discrepancies in the Ukrainian and international/ EU definitions and classifications;
- Massive long-term, however rather uncoordinated, support through project initiatives from international donors, financial institutions and foreign governments for institutional, legislative and B-2-B waste management market development in Ukraine.

3.2 Waste Management Market in Ukraine: Key Data

In 2010–2016, the registered volume of generated waste decreased by over 30%, which is explained both by the continuous recession of the Ukrainian economy and by the difficult political situation including loss of control over part of the territory (*i.e.* the Autonomous Republic of Crimea and the Anti-Terrorist Operation zone). According to the estimated data for 2017, generated waste increased by 24% vs. 2016, which is considered as situational and caused by the increase in dredging and other mineral waste categories specific for the last year.

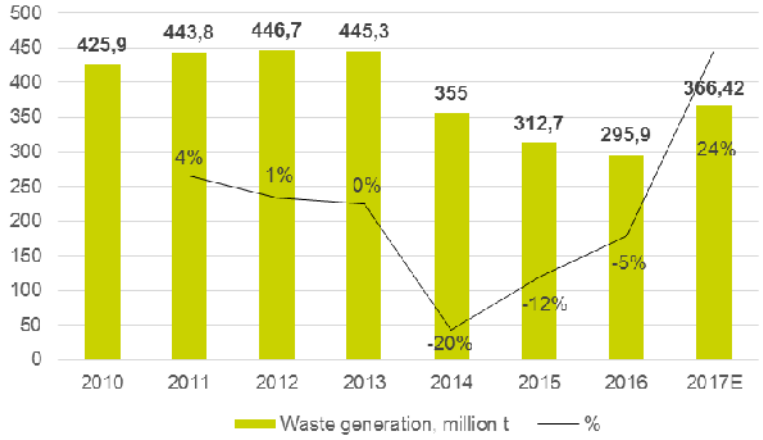

Figure 3-1. Waste generation in Ukraine, 2010–2017E

Source: Ukrstat 2017–2018[4]

According to the State Statistics Service of Ukraine (Ukrstat) data, over 295.9 million tons of waste was generated in Ukraine in 2016, including 289.5 million tons (97.8%) of waste generated by the industry and 6.4 million tons (2.2%) of waste generated by households.[5] At this, 218 million tons (almost 74% of the generated waste) was generated by the mining and quarrying industry. Only households and the power-, gas- and heat- supply sector demonstrated growth in waste generation; with the agriculture and construction indicators almost at the same level as in 2015. For more details, please refer to **Table 3-1** and **Table 3-2** below.

In 2016, 84.6 million tons of waste was utilized, which is 8.5% (7.8 million tons) less than in 2015 (for more details, please refer to **Table 3-3** below). In 2016, 28.9% of waste was recovered, 0.37% of waste was incinerated and the rest (53.2%) was disposed of. The volume of waste incineration decreased by 2.5%, due to the reduction of 4.7% (or 51 thousand tons) of waste incinerated for energy purposes; at the same time, there was an increase in incineration of waste for the purpose of thermal recovery by 46% (22.3 thousand tons).

The amount of waste disposal to specially designated places or facilities in 2016 equaled 157.4 million tons (5.1 million tons more compared with 2015). At the end of 2016, 12.4 billion tons of waste were accumulated in specially designated places or objects.

In terms of the regional aspect, oblasts with the largest volume of generated and accumulated waste (above the Ukrainian average) are the following ones: Dnipropetrovska, Kirovogradska, Donetska, Poltavska, Zaporizska, Lvivska, Luhanska, Mykolaivska, Kharkivska, Ivano-Frankivska, Vinnytska, Kyiv and Kyivska Oblast. For more details, please refer to **Table 3-4** below.

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[4] Sources: http://www.ukrstat.gov.ua/express/expr2017/expres_u.html, http://www.ukrstat.gov.ua/operativ/operativ2018/ns/upvl_IV/upvl_IV2017_u.html

[5] Based on the statistics of companies collecting waste from households. The indicator differs from the overall figure for MSW accounted for by the Minregion.

Table 3-1. Generation and utilization of waste in Ukraine by material category, '000 tons 2016–2017

Waste by material category	Generated waste		Structure of generated waste		Recovered		Incinerated		Disposed (landfilled) to the specially designed sites	
	2016	2017E	2016	2017E	2016	2017E	2016	2017E	2016	2017E
Total	**295 870,10**	**366 423,50**	**100,00%**	**100,00%**	**1 106,10**	**1 105,00**	**84 630,30**	**1 105,00**	**157 379,30**	**193 607,90**
Other mineral waste	225 883,50	265 739,80	76,35%	72,52%	3,40	0,10	57 016,10	0,10	134 464,40	138 932,80
Combustion waste	13 829,90	12 901,50	4,67%	3,52%			4 150,60		5 920,20	7 133,90
Dredging spoils	12 500,10	45 028,00	4,22%	12,29%			9 930,60		3 380,80	33 478,60
Mixed and undifferentiated materials	9 429,10	10 798,20	3,19%	2,95%	0,80	0,90	1 390,30	0,90	3 428,50	2 834,80
Vegetal waste	8 606,00	8 678,70	2,91%	2,37%	425,00	414,30	3 158,40	414,30	7,00	54,50
Municipal and similar waste	6 946,20	6 605,70	2,35%	1,80%	259,30	283,80	6,50	283,80	6 089,50	6 589,90
Animal faeces, urine and manure	4 288,70	3 651,60	1,45%	1,00%			3 146,90		58,90	52,70
Industrial wastewater (effluent) sludge	3 919,80	3 644,10	1,32%	0,99%	2,60	2,40	1 019,30	2,40	304,10	389,00
Metallic waste, ferrous	3 706,00	3 555,20	1,25%	0,97%		0,10	3 272,70	0,10	759,00	773,10
Animal and mixed food waste	990,60	589,40	0,33%	0,16%	2,30	4,10	315,10	4,10	12,90	8,10
Chemical waste	940,70	848,30	0,32%	0,23%	0,50	16,00	4,80	16,00	910,80	787,30
Wood waste	933,80	814,80	0,32%	0,22%	401,40	374,30	58,30	374,30	16,30	17,90
Sludge and liquid waste from wastewater treatment facilities	838,30	974,60	0,28%	0,27%	0,10	0,10	9,40	0,10	304,00	940,50
Mineral waste from construction and demolition, incl. mixed construction waste	822,50	975,50	0,28%	0,27%			222,50		882,30	1 109,90
Common sludge	693,60	513,10	0,23%	0,14%			406,20		313,10	209,80
Soils	501,70	367,30	0,17%	0,10%			87,10		158,50	156,80
Mineral waste from waste treatment and stabilized waste	311,20	49,10	0,11%	0,01%		0,10	1,50	0,10	182,00	10,30
Acid, alkaline or saline wastes	278,60	213,10	0,09%	0,06%	4,70	4,20	77,40	4,20	162,60	102,50
Paper and cardboard waste	184,50	185,00	0,06%	0,05%	0,20	0,30	47,80	0,30	2,10	2,90
Sorting residues	81,90	62,30	0,03%	0,02%	0,10		186,00		17,00	17,30
Plastic waste	51,90	64,40	0,02%	0,02%	0,60	1,00	51,40	1,00	2,60	2,40
Glass waste	25,80	34,40	0,01%	0,01%			1,80		1,00	0,30
Metallic waste, non-ferrous	23,50	29,20	0,01%	0,01%			4,80			
Rubber waste	20,30	26,50	0,01%	0,01%	0,10	0,20	5,60	0,20	0,90	1,10
Textile waste	18,80	21,00	0,01%	0,01%	0,60	0,30	1,10	0,30	0,40	0,30
Waste oils	14,00	18,00	0,00%	0,00%	3,20	1,00	22,10	1,00	-	0,20
Discarded equipment	10,80	16,00	0,00%	0,00%		0,10	0,90	0,10	0,10	0,10
Mixed metallic waste, ferrous and non-ferrous	10,40	9,10	0,00%	0,00%			1,40		0,30	0,90
Batteries and accumulators waste	4,00	5,70	0,00%	0,00%			33,40			
Discarded vehicles	2,00	1,70	0,00%	0,00%			0,10			
Used solvents	1,10	1,20	0,00%	0,00%	0,10	0,20	0,10	0,20		
Health care and biological waste	0,70	0,80	0,00%	0,00%	1,10	1,40	0,10	1,40		
Wastes containing polychlorinediphenyls	0,10	0,20	0,00%	0,00%		0,10	-	0,10		

Source: Ukrstat 2017-2018[6]

[6] Sources: http://www.ukrstat.gov.ua/express/expr2017/expres_u.html, http://www.ukrstat.gov.ua/operativ/operativ2018/ns/upvl_IV/upvl_IV2017_u.html

Table 3-2. Waste generation in Ukraine by economic activity and households, 2016

Economic activities and households	Generated waste		
	000 t	structure per economic activities and households	%to 2015
Total	**295 870,10**	**100,0%**	**94,7**
Mining and quarrying	217 907,80	73,6%	93,7
Processing industry	53 857,90	18,2%	95,3
Agriculture, forestry and fisheries	8 715,50	2,9%	99,8
Power-, gas-, heat- and conditioning supply	7 511,50	2,5%	113,9
Households	6 346,51	2,1%	104,8
Other activities	984,60	0,3%	94
Water supply, sewage, waste management	457,40	0,2%	77
collection, treatment and supply of water, sewage, wastewater treatment and treatment, other waste management activities	321,20	0,1%	77,5
collection, treatment and disposal of waste; material recovery	136,20	0,0%	75,7
Construction	88,90	0,0%	98,8

Source: Ukrstat, http://www.Ukrstat.gov.ua/express/expr2017/expres_u.html

Table 3-3. Waste indicators in Ukraine, 2016

Waste management aspects	Waste Indicators	
	000 tones	%to 2015
Generated	295870,1	94,7
Incinerated	1106,1	97,5
waste-to-energy	1035,3	95,3
heat recovery	70,8	146,1
Recovered	84630,3	91,5
Disposed (landfilled) to the specially designed sites	157379,3	103,3
equipped landfills	33871	108,8
Not registered landfills	12,4	86,4
Leakage, evaporation, fire, theft	19,8	306,3

Source: Ukrstat, http://www.Ukrstat.gov.ua/express/expr2017/expres_u.html

Table 3-4. Waste management by oblast in Ukraine, '000 tons 2016

Regions (Oblasts) of Ukraine	Generated	% to 2015	% to total generated	Incinerated	Recovered	Disposed (landfilled) to the specially designed sites	Total amount of waste accumulated during operation in specially designated places or objects	% to total accumulated
Ukraine	**295 870,10**	**94,70**	**100,0%**	**1 106,10**	**84 630,30**	**157 379,30**	**12 393 923,10**	**100,0%**
Dnipropetrovska	205 850,10	90,70	69,6%	33	66745,7	103161,9	10 238 254,50	82,6%
Kirovogradska	34 408,10	103,20	11,6%	31,6	3049,9	31016,5	375 580,40	3,0%
Donetska	20 205,70	119,70	6,8%	27,2	3758	8775,3	864 761,10	7,0%
Poltavska	5 421,20	122,30	1,8%	34,4	3615,2	344,5	26 311,50	0,2%
Zaporizska	5 040,80	92,30	1,7%	79,2	2887,8	1790,9	162 288,70	1,3%
Lvivska	2 773,80	93,90	0,9%	58,6	482,7	1642,5	231 799,80	1,9%
Luhanska	2 456,40	96,40	0,8%	34,2	562,2	2117,5	155 913,50	1,3%
Mykolaivska	2 366,40	102,60	0,8%	25,5	81	1819,3	50 926,00	0,4%
Kharkivska	1 952,60	114,10	0,7%	58,8	422	859	41 803,20	0,3%
Ivano-Frankivska	1 935,40	91,10	0,7%	114,1	681,8	774,7	43 559,70	0,4%
Vinnytska	1 927,50	98,80	0,7%	53,6	343,4	105,3	29 042,20	0,2%
Kyiv City	1 668,70	103,60	0,6%	258,6	1,9	286,6	11 623,10	0,1%
Kyivska	1 561,30	94,00	0,5%	19,9	53,9	1393,2	45 429,30	0,4%
Khmelnytska	1 299,60	135,30	0,4%	10,7	450,1	292,7	8 500,00	0,1%
Cherkaska	1 219,20	103,40	0,4%	5,6	697,7	252,7	6 220,40	0,1%
Ternopilska	862,20	106,60	0,3%	5,7	83,1	28,7	500,20	0,0%
Chernihivska	720,60	83,10	0,2%	15,6	104,3	418,4	10 930,80	0,1%
Rivnenska	713,20	84,60	0,2%	73,9	65,2	155,4	24 509,90	0,2%
Volynska	684,00	107,10	0,2%	39,5	118,7	496,2	8 875,30	0,1%
Sumska	672,60	80,10	0,2%	18,3	194	410,8	34 293,20	0,3%
Odeska	647,50	107,50	0,2%	14	10,3	679,5	11 621,80	0,1%
Zhytomyrska	550,40	106,20	0,2%	42,2	76,5	140,9	5 049,70	0,0%
Khersonska	388,70	93,10	0,1%	24,9	23,5	64,7	1 175,00	0,0%
Chernivetska	388,50	97,60	0,1%	20	121,1	209,6	2 985,90	0,0%
Zakarpatska	155,60	116,30	0,1%	7	0,3	142,5	1 967,90	0,0%

Source: Ukrstat, http://www.Ukrstat.gov.ua/express/expr2017/expres_u.html

3.2.1 Main Waste Management Subsectors in Ukraine

The main Waste Management subsectors in Ukraine are typically categorized in the following way:

- Industrial waste,
- Construction and demolition waste,
- Hazardous waste,
- Agricultural waste,
- Specific waste streams (packaging waste; WEEE, exhausted batteries and accumulators; end-of-life vehicles, healthcare waste),
- Municipal solid waste (MSW).

This study focuses on the MSW market and its infrastructure (**Subchapter 6.2.7**). The status, trends, challenges and opportunities for other waste management subsectors are commented on below in **Subchapters 4.2.2–4.2.6** at a higher level[7] to present the complete waste management market snapshot and provide ideas for potential more in-depth investigations.

3.2.2 Industrial Waste

Of over 60 million hectares of the territory of Ukraine, 160 thousand hectares (*i.e.* approximately 2,7%) are covered with 36 billion t of solid industrial waste, recycled or partially processed natural resources.

In 2016, according to the Ukrstat data, 218 million tons of industrial waste was generated by the mining and quarrying industries and the other 41.3 million tons of waste also had industrial origin[8]. The main amount of industrial waste is generated by the following industries:

- Mining and Chemical Industry,
- Ferrous and Nonferrous Metallurgy,
- Machine Building and Metalworking Industry,
- Forestry and Woodworking Industry,
- Power Engineering,
- Petrochemical and Related Industries,
- Food Industry,
- Consumer industry.

In 2015, the amount of industrial waste generation reduced from 448 million tons to 312 million tons (the amount of waste from the mining industry reduced by 32%, industrial waste – by 24%, and that of the energy production – by 29%). There is a particularly sharp decline from 1994 to 1995, from 2008 to 2009, and from 2012 onward. This clearly is not a result of improved waste management approaches within the industry but rather one of the complex impact of economic crises in 2008/ 2009 and deteriorating economic relations with Russia and the Donbass conflict from 2013 onward.

Apart from the social and environmental issues related to industrial waste generation and disposal, there is the economic aspect of poor waste utilization, meaning losses from waste not being applied as a secondary raw material, fuel, fertilizer or building materials in new technological processes.

The major share of waste (over 70%) is generated by the mining sector and, typically, it is disposed of into landfills. Almost in all cases these are unequipped landfills, as landfills constructed according to all requirements represent less than 20% of the total number of landfills in Ukraine. The amount of used waste rock constitutes only 5%, while its potential to be utilized in road construction processes is 70%. For processes in the cement production industry, this figure reaches 24%, for rubble – 30%, for ceramics – 16%, for silicate bricks – 10%. Over 20% of iron is lost at the stage of ore enrichment. About 70% of waste generated at the stage of ore enrichment can be further used for production of construction materials. Nevertheless, according to current industrial practices, almost all waste is disposed of in dumps.

Ash slag waste generated by power stations represents another example of poor waste management: the industry generates annually 8 million tons of ash slag and its accumulated volume reaches 300 million tons covering large territories and affecting the environment and health. Only 10% of ash slag is utilized in Ukraine, mainly for cement production.

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[7] As the main sources of the overview of waste streams other than MSW, the National Waste Management Strategy and a Preliminary Draft of the National Waste Management Strategy developed under GIZ's 'Program to Support the Green Modernization of the Ukrainian Economy' by RWA and COWI were used.

[8] Since 2010, the transition to a new form of statistical accounting in Ukraine has made it possible to introduce changes in assessment of the situation with industrial waste: according to the established system, the annual volume of industrial waste generation is 419.2 million tons and the accumulation of industrial waste in specially designated areas or facilities is 13.27 billion tons, which is considerably less than in previous reports.

Industrial waste landfills can be considered technogenic deposits; however, such recognition requires additional investigations and some legislative amendments. Only 12 out of 630 perspective technogenic deposits that originated from activities of the mining and iron industries have been investigated in detail to be registered as deposits. There is a need for development of a regional and national inventory, as well as environmental and geological investigations of the existing technogenic objects of secondary mineral resources with further assigning of the special status to allow private operators' involvement in utilization.

3.2.3 Construction and Demolition Waste (C&DW)

The amount of C&DW recorded and included in official statistics is not high compared with the registered amount of C&DW generated in many EU countries. For Ukraine, which has a population of approximately 42.5 million inhabitants, this amount corresponds to approximately 33 kg of C&DW generated per capita per year. Nevertheless, according to the expert estimates, the actual amount of C&DW in Ukraine is much higher than the recorded figures and can be about 100 – 200 kg/per capita per year.

Construction waste consists of products such as concrete and reinforced concrete (52%), 32% is bulk of stone wall materials (*i.e.* bricks, wall blocks, foam and aerated concrete), 8% – waste of asphalt and the like, 4% – metal waste, 2% –wood and plastics waste, 1% – ceramic products (sanitary ceramics, ceramic tiles), 1% – plasterboard, glass and other types of waste.

The formation of C&DW depends on development of human settlements, transport and utilities infrastructure, as well as on the maintenance and demolition strategies. Recently, construction waste in Ukraine has been generated mainly by construction of new commercial and residential buildings and infrastructure objects, reconstruction and demolition of industrial and infrastructure buildings or facilities the lifespan of which is about to expire. In former industrial zones and military units, there are a significant number of buildings that require reconstruction or demolition to free the territory for new developments. A significant source of C&DW is construction of new residential buildings: *e.g.* construction of a 100-apartment house leads to accumulation of 15–20 tons of C&DW, the major part of which are broken bricks, remains of the hardened concrete, of wall blocks made of expanded clay concrete, cellular concrete, gypsum board, foam plastic, mineral wool, *etc.* The issue of construction waste management in Ukraine is expected to become crucial in the nearest future, as the obsolete material in many residential houses is being exhausted and their reconstruction is considered inexpedient; thus, demolishing will generate a substantial construction waste volume to manage (e.g. demolishing an obsolete five-story building of 1950–60s will generate approximately 3 000 cub. m of C&DW).

In comparison with many EU member states where the level of recycling of construction waste is more than 80% and where private companies handle C&DW, construction waste in Ukraine has a substantial environmental impact as an unused resource with significant growth potential. According to the current practice, the major part of construction waste is disposed of into landfills, in limited cases it is used for backfilling or land reclamation; steel structures and large lumber are more often re-used or recycled.

3.2.4 Hazardous Waste

The total amount of hazardous waste accumulation is estimated at 5 billion t with the costs for its disposal and storage being approximately UAH 600 million (€ 20 million).

The difference of the situation with hazardous waste in Ukraine in comparison with that in developed countries is the larger volume of generation of such waste in the absence of relevant infrastructure that should be an integral part of the economy.

In Ukraine, there are about 300 hazardous waste storage facilities built without proper technical protection, having become a source of environmental hazards of regional importance. There are only a few undertakings with equipped storage facilities for storing, disposing of and regenerating hazardous waste. At present, there are several new modern capacities for automatic processing of used batteries; other installations need modernization and introduction of new technologies.

This impact has increased in the last years due to the spreading of hazardous waste over the country and the uncontrollable entering of the natural environment: if earlier the nomenclature of hazardous waste in rural areas was limited to prohibited agricultural chemicals for plant protection, now the variety and volumes of generation of hazardous waste have increased significantly due to the higher use of WEEE, batteries and accumulators, chlorine-containing polymers, steroid and biological plant protection chemicals, growth promoters, preservatives, food additives, *etc.*

The main problems related to hazardous waste management are:

- Absence of complete information on education and further operations for management of hazardous consumption wastes in the current accounting and reporting systems, which is related to practical lack of collection/ reception systems for these wastes from the public;
- Lack of real incentives and a low level of waste disposal costs hinder the introduction of systems for separate collection and processing of hazardous waste;

- For industries (metallurgical, chemical, *etc.*) in connection with the use of obsolete technologies and large volumes of hazardous waste generation, a sharp increase in the cost of handling can cause significant financial and technological difficulties;
- Lack of technical facilities for processing certain categories of hazardous waste leading to their uncontrolled disposal;
- A significant part of existing production facilities and facilities for disposal of hazardous waste does not comply with environmental requirements and modern technical standards providing immediate danger to the environment.
- Introduction of modern requirements to handling certain types of hazardous waste may entail growth of the necessary financial costs or the need for technological re-equipment for economic entities. In case of inefficient implementation of state (environmental) control in the field of hazardous waste management, this may lead to an increase in the number of violations of environmental legislation;
- Lack of systems for proper planning of hazardous waste management at the level of business entities;
- The difficult financial situation and small-scale production in some industries hinder the construction of necessary facilities to eliminate the impact of hazardous waste on the environment;
- An insufficient level of costs for environmentally sound management of hazardous waste at all levels to protect the environment and human health;
- The total amount of investments related to waste management is limited; low investor awareness of the potential for production of new products from wastes potentially suitable for re-use;
- A low level of public awareness and awareness of business entities about the possibility of processing or re-using hazardous waste.

3.2.5 Agricultural Waste

Ukraine is a leading global agri-industrial player. Intensification of agricultural production and expansion of the agricultural areas have led to an increase in the amount of agricultural waste and its impact on the environment. Agricultural waste covers organic crop waste; organic waste of livestock and poultry; biological waste (carcasses of animals), residual quantity of fertilizers, chemical and biological substances of plant protection, veterinary drugs.

The share of agricultural waste generation is a relatively small fraction of the total volume of generated waste (less than 4%). Agricultural waste in Ukraine is divided into livestock waste, crop waste and agrochemical waste. According to statistical observations, in 2016, over 13.9 million tons of agricultural waste was generated, including:

- Waste of vegetable origin (8.6 million tons; 62%);
- Animal feces, urea and manure (4.3 million tons, 31%);
- Animal waste and mixed food waste (991 thousand tons, 7%).

However, the official statistical data does not reliably reflect the actual status and forecast volumes, *e.g.*:

- With grain harvest of 50 million tons, up to 25 million tons of straw can be generated annually (and in case of the expected increase in gross collection to 80 million tons, the straw generation will amount to 40 million tons);
- For the livestock and poultry categories, the main type of agricultural waste is manure. As livestock in Ukraine is about 13 million heads and one animal gives 10 kg of manure per day in average, up to 50 million t of manure can be generated annually. Chicken livestock is 1.5 million heads, which gives more than 100 t of bird droppings per day or about 500 thousand t annually.
- In addition, waste is formed from slaughtering or death of birds and, if calculated according to the standards (3.5% of the total number per year with the average bird weight of 500 grams), about 3 570 t of bio-waste is generated excluding bio-waste generated by slaughtering.

A specific critical issue is handling chemical plant protection products, which include pesticides, herbicides, fungicides, chemical and biological plant growth stimulants. A separate specific group here is waste chemical plant protection products formed by obsolete and forbidden-for-use pesticides manufactured and accumulated at the times of the USSR. The Order on comprehensive inventory implementation of places of accumulation of chemical plant protection products that are prohibited and unfit for use in agriculture is approved by the joint Order of the Ministry of Agrarian Policy, Ministry of Ecology and Natural Resources and the Ministry of Health No. 315/376/412 dated October 18, 2001. It provides for a comprehensive inventory of accumulation of chemical plant protection products that are prohibited and unfit for use in agriculture and is carried out in enterprises, institutions, organizations of all forms of ownership with facilities relevant for

storage of chemical plant protection products. At the same time, data of the inventory of waste chemical plant protection products do not allow making accurate estimates of their quantity. According to preliminary results, the amount of accumulation of unsuitable chemical plant protection products can be 8.5 thousand tons.

The utilization of agricultural waste is not widely practiced in Ukraine. According to the experts[9], waste disposal is the predominant management type for animal feces waste and incineration is the most popular management type for vegetable waste.

Defining a national policy toward use of sewage sludge in agriculture is an important unresolved issue.

3.2.6 Specific Waste Streams

3.2.6.1 Packaging Waste

Statistics for generation, processing and recycling of packaging waste as a secondary raw material are not fully available and reliable. The situation in the field of handling packaging waste in Ukraine is unsatisfactory, especially considering insufficient separate waste collection, preparation for re-use and recycling. The absence of an effective system for collecting packaging waste annually leads to the loss of significant resource potential for the processing industry in the form of waste paper and paperboard from 0.5 to 0.6 million t, glass – 1 million t, polymers – 0.6 million t as well as a consequence, the deterioration of the ecological situation.

Existing recycling facilities are underloaded due to the low efficiency of the system for collection of secondary resources and the activity of the unofficial sector: only for paper and cardboard processing capacities, the deficit of secondary raw materials amounts to 300 thousand t per year and is covered with imports. Glass-recycling facilities operate at 40% capacity and plastic-recycling facilities – at 50%.

The European principle of the extended producer responsibility (EPR) is not implemented and enterprises are not responsible for further utilization of used packaging. However, leading international producers, such as Carlsberg, PepsiCo and others, are launching own campaigns to promote introduction of EPR in Ukraine.

3.2.6.2 WEEE, Used Batteries and Accumulators

WEEE is one of the fastest growing waste streams in Ukraine. There is no reliable data about actual volumes of WEEE generated in Ukraine. Also, there are no legal requirements for municipal authorities or waste management companies regarding WEEE data reporting. This waste flow is hidden among solid and hazardous wastes and currently is not available for assessment.

A separate collection system for WEEE is not currently established. There are no legislative requirements for private households to collect WEEE separately and to provide it for treatment. However, legal entities are obliged to depreciate their electronic and electrical equipment and, after retirement, provide it for recycling to licensed waste management companies.

WEEE management in Ukraine is institutionally fragmented, which means that different governmental bodies, regional, environmental and health authorities, private business have taken independently some of the responsibilities for WEEE. The coverage and quality of WEEE service provision differ depending on the region. Information about production capacity of waste management companies is unknown.

WEEE is considered extremely dangerous as it contains toxic metals (lead, mercury, cadmium, chromium and beryllium) as well as brominated flame retardants, fluorocarbon carbohydrates, polychlorinated biphenyls, polyvinyl chloride. About 70% of substances hazardous to the environment and human health in MSW are contained in WEEE. In terms of generation volumes, prevailing hazardous wastes are those containing heavy metals (chrome, lead, nickel, cadmium, mercury) as a result of operation of the ferrous and non-ferrous metallurgy, chemical industry, machine building (galvanic production) industries.

Changes in functions and design of new technologies lead to reduction of the life cycle of products, acceleration of the withdrawal of obsolete electrical and electronic appliances and a sharp increase in waste. The investment activity in the field of waste management of electrical and electronic equipment is low due to the lack of the necessary legislative framework and clearly defined areas of responsibility for all market participants.

[9] A preliminary draft of the National Waste Management Strategy developed under GIZ's " Program to Support The Green Modernization of the Ukrainian Economy"

Prohibition of the use of certain hazardous substances in electrical and electronic equipment is regulated by the Resolution of the Cabinet of Ministers of Ukraine No. 139 'On Approval of the Technical Regulation for the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment' dated March 10, 2017, which includes the requirements of the Directive 2002/95/ EC of the European Parliament and of the Council on the prohibition of the use of certain hazardous substances in electrical and electronic equipment. Another regulatory document on management of waste electrical and electronic equipment is the Order of the Ministry of Regional Development, Construction and Housing and Communal Services No. 15 'On Approval of Methodological Recommendations on the Collection of Waste Electrical and Electronic Equipment Included in Household Waste' dated January 22, 2013.

Processing of used batteries and accumulators is necessary to meet the requirements of the environmental protection measures for recovery of precious metals, for energy saving measures by reducing the need for secondary raw materials and for preventing batteries from entering landfills, where during the destruction stage heavy metals can enter the soil contaminating the water and the soil.

In Ukraine, collection and processing of used batteries and accumulators of more than 7 ampere-hours is regulated by the Law of Ukraine 'On Chemical Sources of Current' and the Joint Order of the Ministry of Industry, Ministry of Economy, Ministry of Environmental Protection and Nuclear Safety No. 223/154/165 'On Approval of the Regulations on the Collection and Processing of Used Lead-Acid Batteries' dated December 31, 1996. However, these regulations contain outdated provisions that actually remain unimplemented and do not cover the handling of all types of batteries and accumulators. At present, chemical sources of current are withdrawn from the sphere of regulation of the Law of Ukraine 'On Waste'.

The issue of organizing the collection and processing of used batteries in Ukraine remains unresolved. Collection of such batteries is carried out on a voluntary basis by public organizations and citizen associations, but due to the lack of proper infrastructure for their processing, they remain stored for further processing.

Given the high level of profitability of lead processing, many business entities have licenses for hazardous waste operations and collect lead-acid batteries. At present, there are several new modern capacities for automatic processing of used batteries, other installations need modernization and introduction of new technologies.

3.2.6.3 End-of-Life Vehicles

The average age of passenger vehicles in Ukraine is about 20 years (twice as much as the EU average). Out of 9.1 million registered cars, 50% originated from the USSR or the CIS and one in five cars is used for over 30 years. According to the expert assessments, about 50% of the cars are subject to utilization.

In 2013, the Law on Utilization was adopted with the introduction of an environmental tax on imported cars to establish a framework for use of collected funds for old car utilization; it was an attempt to introduce a system of processing of old cars with the anticipated establishment of the utilization network. However, the mentioned tax was canceled in 2014 and the Law was disabled in this respect. Also, the stimuli or obligatory criteria for utilization are not set under the Law that makes it ineffective.

3.2.6.4 Healthcare Waste

According to the statistics, healthcare and biological waste in 2016 amounted to 0.7 million t. From 75% to 80% of waste generated by health facilities without contact with biological fluids of infectious patients, and is similar in composition to MSW waste, namely: waste (bottles, phials, cans, *etc.*), paper, stationery, packaging, furniture, decommissioned soft equipment (bathrobes, bed linen), diagnostic equipment that has lost consumer properties. The remaining medical waste (10–25%) can be classified as hazardous with a high risk for the environment and human health. Hazardous medical waste is:

- Sharp waste (used/ unused needles, syringes, scalpels, pipettes, knives);
- Infectious waste with a risk of containing pathogens and transmission of diseases (tissues contaminated with blood, laboratory cultures and microbiological stocks);
- Pathological waste (tissues, organs or liquids of the human body, body parts, embryos, unused blood products);
- Pharmaceutical waste (expired/ partially used drugs);
- Cytotoxic waste containing substances with genotoxic properties (wastes containing cytotoxic drugs, genotoxic chemicals);
- Chemical waste (*e.g.* laboratory reagents, films, disinfectants, heavy metal waste such as batteries, broken mercury thermometers and blood pressure measuring devices).

The main problems in the field of healthcare waste management in Ukraine are:

- A low level of medical waste treatment is carried out in healthcare institutions;

- Lack of facilities necessary for collection, internal logistics and safe temporary storage of infectious wastes within health care institutions;
- Absence of refrigeration equipment for storing substances at low temperatures, as well as appropriate containers and packaging for waste;
- Limited abilities of healthcare institutions to purchase high-quality medical waste treatment equipment.

Currently, a significant part of medical waste is transported to landfills and unauthorized landfills because of the irresponsible approach of medical workers in healthcare institutions, inadequacy and inaccessibility of processing and disposal capacities for medical waste and the non-awareness of households.

Extremely limited financial resources are an important deterrent that impedes the improvement of the medical waste management system. The state of the national economy in the recent years has significantly affected the financial provision of the healthcare industry and, obviously, the attraction of financial resources necessary to introduce a proper system for handling medical waste.

3.2.7 Municipal Solid Waste (MSW)

3.2.7.1 Key Indicators

According to the Ukrstat data, of 11.6 million tons of MSW and similar waste generated in Ukraine in 2016, only 0.09% was recovered, 3.73% was incinerated and the remaining 87.67% was landfilled.

According to the Minregion data for the same year, 49 308 053 cub. m (or 10 795 million t) of MSW was generated by 33 083 thousand people (78% of population of Ukraine) covered with MSW collection services. Only 5.76% of MSW was recycled and recovered: 2.72% (1.3 million cub. m) was incinerated and 3.04% (1.5 million cub. m) was received by secondary raw material collection points and waste recycling facilities. Other 46.58 million cub. m of MSW was landfilled at 5 487 landfills covering the area of about 9 160 ha.

The prevailing method of MSW management is its collection and disposal in landfills and dumping grounds. According to the official data on 5 487 landfills and dumps in Ukraine, in 2016 almost 6% of them were overloaded and 30% did not meet national environmental safety standards. The work on certification, reclamation and rehabilitation of landfills is improperly carried out. Of 1 551 dumps requiring certification in 2016, only 380 were officially certified (21%). Of 509 dumps in need of reclamation, only 86 or 7.7% received reclamation required.

According to the official data, due to the insufficient level of control and the lack of a proper MSW management system, over 27 000 unauthorized dumps are formed and require elimination each year.

According to the expert estimates, over 99% of the operating landfills do not comply with the European standards[10]. The comparison of key MSW market indicators in the EU-28 and in Ukraine is given in **Table 3-5** below.

Table 3-5. Comparison of key MSW market indicators in EU-28 and Ukraine, 2015

Waste Management aspects	EU – 28		Ukraine	
	mln tones	%	mln tones	%
Total	**235,40**	**100,00**	**10,80**	**100,00**
Disposal to landfills	61,90	26,30	10,28	95,26
Incineration	64,40	26,70	0,26	2,38
as recovery operation	54,90	23,30	0,07	0,70
as disposal operation	9,50	4,00	1,04	10,00
Processing and recycling	109,10	29,50	0,26	2,44
composting	39,70	16,90	-	-

Despite the fact that the population of Ukraine has been steadily declining over the last 20 years, the volume of MSW generation has been increasing. Assuming the annual GDP growth of 4.5% and the annual waste generation growth rate of 0.9%, the following estimate was made in the EBRD Project 'Supporting Investments in Sustainable Municipal Solid Waste Management and Recycling in Ukraine' in the frame of drafting the National MSW Management Strategy[11]: the total

[10] Directive 1999/31/EC dated 26 April 1999 'On the Landfill of Waste'
[11] https://menr.gov.ua/content/tehnichna-redakciya-proektu-nacionalnoi-strategii-povodzhennya-z-vidhodami-dlya-podalshogo-gromadskogo-obgovorennya.html

MSW volume generated in 2030 will be 13.53 million tons, the total MSW collected in 2030 (at 90% collection coverage) will reach 12.25 million tons.

There are 460 cities, about 500 districts, 885 urban-type settlements and 28 388 villages in Ukraine. According to the legislation, local self-government bodies are fully responsible for providing solid waste management services. According to the expert estimates shared by the Minregion, the market of MSW collection services amounted to UAH 2.0 billion (approximately € 70.7 million) in 2016.

In the regional aspect of MSW services (see **Table 3-6** below), Kyiv City and Kyivska Oblast, Odeska Oblast, Lvivska Oblast, Kharkivska Oblast, Dnipropetrovska Oblast, Zaporizhska Oblast and Donetskska Oblast led in terms of collected MSW in 2016, with the share of over 5% in cub. m (and Kyiv City and Kyivska Oblast, Lvivska Oblast, Kharkivska Oblast and Dnipropetrovska Oblast, Zaporizhska Oblast and Donetskska Oblast in terms of collected solid waste in tons).

In terms of coverage of the population with MSW collection services, the annual average in 2016 was 78%, with the regional leaders as follows: Kyiv City (100%) and Kyivska Oblast (84%), Mykolaivska Oblast (95%), Chernihivska Oblast (93%), Lvivska Oblast (91%), Chernivetska Oblast (88%), Ivano-Frankivska Oblast (85%), Ternopilska Oblast (85%), Vinnytska Oblast (84%), Dnipropetrovska Oblast (84%), Donetska Oblast (83%) and Zaporizhska Oblast (80%).

As to the annual indicator of waste generation for covered population per person, the average value for Ukraine in 2016 was 325 kg, with Kyiv City and Kyivska Oblast as the absolute leaders (1 852 kg and 482 kg) followed by Odeska Oblast (1 100 kg), Kharkivska Oblast (931 kg), Dnipropetrovska Oblast (622 kg), Donetska Oblast (395 kg) and Zaporizhska Oblast (344 kg).

As to the number of settlements where separate MSW collection is introduced, the overall number of such settlements in 2016 was 822, of that over 75% were in Kharkivska Oblast, Zakarpatska Oblast, Lvivska Oblast, Ivano-Frankivska Oblast, Ternopilska Oblast and Dnipropetrovska Oblast.

Table 3-6. MSW services (preparing for use) in Oblasts in Ukraine, 2016

Administrative units	Collected municipal solid waste, 2016				Population, '000 persons	% of coverage by waste collection services	Population covered by waste collection service, persons	Population uncovered by waste collection services, persons	Generation of waste for covered population, tpa per person	Number of settlements where the separate waste collection is introduced	% from overall settlements where the separate waste collection is introduced
	cub. m	% from overall	tones	% from overall							
Total/ Average for Ukraine	**49 573 034,6**	**100%**	**10 888 655,4**	**100%**	**42 584 500**	**78%**	**33 467 933**	**9 116 567**	**0,325**	**822**	**100%**
Donetska	2 455 287,5	5,0%	527 097,1	4,8%	4 244 000	80%	1 335 936	254 464	0,395	4	0,5%
Kyiv city	6 030 686,4	12,2%	1 176 289,2	10,8%	2 925 800	100%	635 010	405 990	1,852	1	0,1%
Kyivska	1 697 303,0	3,4%	1 030 357,0	9,5%	1 734 500	84%	2 138 525	1 091 875	0,482	32	3,9%
Lvivska	4 189 899,2	8,5%	1 047 672,4	9,6%	2 534 000	91%	3 395 200	848 800	0,309	82	10,0%
Kharkivska	3 619 507,8	7,3%	747 039,5	6,9%	2 701 200	83%	802 604	437 897	0,931	191	23,2%
Dnipropetrovska	5 199 385,1	10,5%	610 928,5	5,6%	3 230 400	66%	981 864	276 936	0,622	46	5,6%
Odeska	6 121 816,0	12,3%	1 530 454,0	14,1%	2 386 500	70%	1 391 600	347 900	1,100	4	0,5%
Zaporizska	2 649 455,0	5,3%	405 816,5	3,7%	1 739 500	80%	1 178 435	201 465	0,344	13	1,6%
Vinnytska	1 386 374,0	2,8%	277 269,0	2,5%	1 590 400	84%	1 456 980	277 520	0,190	32	3,9%
Luhanska	588 174,0	1,2%	130 349,5	1,2%	2 195 300	60%	621 975	343 825	0,210	7	0,9%
Ivano-Frankivska	895 406,0	1,8%	183 433,7	1,7%	1 379 900	85%	1 325 961	869 339	0,138	70	8,5%
Mykolaivska	1 597 500,0	3,2%	339 900,0	3,1%	1 150 100	95%	2 311 768	222 232	0,147	14	1,7%
Poltavska	1 580 944,7	3,2%	276 798,6	2,5%	1 426 800	75%	1 092 595	57 505	0,253	4	0,5%
Zakarpatska	741 811,3	1,5%	197 806,5	1,8%	1 258 800	78%	1 670 550	715 950	0,118	165	20,1%
Khmelnytska	1 357 959,2	2,7%	278 334,9	2,6%	1 285 300	76%	1 070 100	356 700	0,260	6	0,7%
Chernihivska	939 005,2	1,9%	199 986,1	1,8%	1 033 400	93%	869 700	293 000	0,230	21	2,6%
Ternopilska	774 650,0	1,6%	169 770,0	1,6%	1 059 200	85%	795 240	309 260	0,213	65	7,9%
Rivnenska	1 021 189,1	2,1%	176 410,2	1,6%	1 162 700	75%	900 320	158 880	0,196	6	0,7%
Zhytomyrska	1 165 844,3	2,4%	263 512,4	2,4%	1 240 500	65%	2 248 479	452 721	0,117	16	1,9%
Chernivetska	644 478,0	1,3%	151 546,6	1,4%	908 100	88%	791 700	263 900	0,191	18	2,2%
Sumska	744 796,7	1,5%	189 057,0	1,7%	1 104 500	72%	974 643	310 657	0,194	6	0,7%
Khersonska	898 680,1	1,8%	201 136,0	1,8%	1 055 600	75%	787 968	443 232	0,255	3	0,4%
Cherkaska	1 002 900,0	2,0%	188 554,0	1,7%	1 231 200	64%	801 852	106 248	0,235	6	0,7%
Volynska	997 322,0	2,0%	292 607,0	2,7%	1 041 000	61%	963 129	70 271	0,304	6	0,7%
Kirovogradska	1 272 660,0	2,6%	296 529,8	2,7%	965 800	64%	2 925 800		0,101	4	0,5%

Source: Ukrstat

Highlighted numbers exceed the country's average.

Interregional and intermunicipal cooperation on MSW management issues in Ukraine is quite limited. However, the critical situation in some regions (*e.g.* in Lviv City and Lvivska Oblast, Ivano-Franskivska Oblast) and the attention to it from the central government and the international community accelerate some progress. Some examples of the recent intermunicipal/ regional cooperation initiatives on waste management are given below:

- On April 21, 2017, the Lvivska Oblast State Administration, the Lvivska Oblast Council, the Lviv Municipal Council and local authorities of the Lvivska Oblast, in the territory of which landfills of solid waste are situated, under the mediation of the Cabinet of Ministers of Ukraine signed a special two-year Memorandum on MSW treatment

elaborating the resolution of the month-long problem with accumulation and inability to dispose of MSW in the region. The document inked in Lviv in the presence of Vice Prime Minister of Ukraine Volodymyr Kistion ensures the disposal of waste at landfills and dumps in Lviv Oblast and guarantees financial support for enterprises and cities that will stockpile waste at landfills. The Memorandum, in particular, provides for the following:

  - The Lvivska Oblast State Administration is to establish a public council to control garbage removal from the city; to choose on the competitive basis investors for the construction and maintenance of complexes of utilization (recycling) of solid waste in Lvivska Oblast, as well as for building of utilization systems and for coordinating work on removal and disposal of waste from Lviv City.
  - In 2017 and 2018, the Lvivska Oblast Council is obliged to allocate funding from the regional environmental protection fund for the improvement of the logistics base and the remediation of landfills stockpiled with waste.
  - Among other, in 2017 and in 2018, the Lviv Municipal Council shall allocate funds from the local budget in the amount of UAH 70 million annually to the improvement of the logistics base and the remediation of landfills stockpiled with waste, and to the conclusion of agreements with local governments and enterprises that deal with solid waste landfills for a period of 24 months to ensure proper disposal of solid waste accumulated in Lviv City.

- The Memorandum on partnership and cooperation in the field of solid household and industrial waste management was signed between the Ivano-Frankivsk Oblast State Administration, Ivano-Frankivsk City, Nadvirna, Kolomyia and Kalush Municipal Councils, which will promote the issues of rational, environmentally sound management of waste as well as capacity building for its processing in the territory of the oblast.

There have been no systematic statistics and studies on the MSW structure in Ukraine. Expert assessments were done under some recent projects funded by IFIs, *e.g.*:

- According to the assessment made under the EBRD Project 'Supporting Investments in Sustainable Municipal Solid Waste Management and Recycling in Ukraine' in the frame of drafting the National MSW Strategy, the MSW composition in 2015 was defined as follows: organic waste – 30%, paper and cardboard – 17%, polymers – 11%, glass – 6%, metals – 3%, hazardous waste – 1%, other – 32%.
- According to the assessment made under the IFC Report 'Municipal Solid Waste in Ukraine: Development Potential. Scenarios for Developing the Municipal Solid Waste Management Sector (IFC Ukraine Resource Efficiency Program)[12], findings of the available small studies performed by MSW operators and associations for specific regions at different times differ significantly. For instance, the studies completed by the national project 'Clean City' assign the most significant shares in the MSW structure to food (more than 30% of the total volume) and packaging waste (mainly cardboard and paper). According to the Sixth National Communication of Ukraine on Climate Change, the MSW structure is composed of food waste — 35–50%, paper and cardboard — 10–15%, secondary polymers — 9–13%, glass — 8–10%, metals — 2%, textiles — 4–6%, construction waste — 5%, wood — 1%, and other waste — 10–14%. Besides, a part of organic waste was possibly not included.

According to IFC, in comparison of the MSW generation structure in Ukraine to that in the EU countries, experts conclude it is closer to Eastern European countries (Poland, Czech Republic, Slovakia, Baltic States, *etc.*). The organic fraction in Ukraine is greater than that in other European countries, while the shares of glass and plastic are relatively low.

3.2.7.2 Existing MSW Value Chain and Infrastructure

The situation with municipal waste management in Ukraine is at a very basic level, when MSW management mainly consists of collection of mixed waste with a low level of separate collection and disposal in landfills and/ or natural landfills, most of which do not meet the environmental safety requirements and are underdeveloped technologically. New technologies' introduction[13] is limited by the lack of integrated management decisions and by insufficient financial resources and economic incentives. A small number of innovative technologies, if any, are adopted.

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[12] http://www.ifc.org/wps/wcm/connect/b9df9eb3-ee87-4442-b831-677515529609/21.+Municipal+Solid+Waste+in+Ukraine+DEVELOPMENT+POTENTIAL+Scenarios+for+developing+the+municipal+solid+waste+management+sector+.pdf?MOD=AJPERES

[13] http://www.minregion.gov.ua/napryamki-diyalnosti/zhkh/terretory/informatsiya-shhodo-vprovadzhennya-suchasnih-metodiv-ta-tehnologiy-u-sferi-povodzhennya-z-pobutovimi-vidhodami-stanom-na-04-09-2017-roku/

Figure 3-2. Typical examples of waste collection and disposal in Ukraine

Table 3-7. MSW value chain/ infrastructure in Ukraine

Chain element	Current situation
Collection & Transportation	• 1 143 companies providing MSW collection and transportation services, 74% are in municipal or partial municipal ownership • 78% of population covered with MSW services • Mostly one-container-mixed-waste, no waste collecting points • Separate collection is introduced in 822 settlements (23% of population, 6% of total MSW collected volume) • Waste collection vehicles park includes over 3 496 units with the estimated depreciation rate of 67% • Separate collection is mainly supported by processing companies and international producers • Existing recyclables collecting points in cities are inefficient and in majority cases are part of the unofficial sector
Sorting	• Mixed waste => Low efficiency and quality of secondary material • Only 31 waste sorting lines (Kyiv City and 14 Oblasts) • Unofficial sector controlling flows of waste for recycling and re-use
Waste processing and recycling	• Share of waste for processing – 3%, share of waste for recycling – 3% • 65 waste processing facilities working under designed capacity due to unstable and insufficient supply of resource-containing materials including imported raw materials
Composting	• Insignificant amount of MSW has been composted
Solid Recovered Fuel (SRF)	• Single installation available
Incineration	• Share of waste for incineration – 2.4% • 1 operational (however, 100% deteriorated) incineration plant (in Kyiv)
Landfill Gas Extraction	• At 13 landfills, there is a system of landfill gas collection
Landfilling / Disposal	• 50% of waste is for landfilling • > 10 million tons of MSW is disposed into landfills annually, 95% of collected MSW • Landfills cover 9 160 ha or >5% of the country territory • Out of 5 487 landfills in 2016: ▪ 1 551 dumps required certification; only 380 have been officially certified (21%)

Chain element	Current situation
	▪ Only 100 (2%) landfills were compliant with local norms, 99% were not compliant with EU norms ▪ 1 339 (25%) landfills were noncompliant with local environmental and safety requirements ▪ 327 (6%) landfills were overloaded ▪ 516 (9%) landfills were to be rehabilitated ▪ Only 57 landfills had leachate collection system • >27 000 unofficial dumpsites are generated annually (1 284 ha) and require closure • 2 000 ha are required for new landfills

Each of the elements is commented on below in greater detail. The CAPEX data in this Subchapter are taken from the Draft MSW Strategy developed in March 2017 under the EBRD Project 'Supporting Investments in Sustainable Municipal Management and Recycling in Ukraine'.

Collection and Transportation

The main option currently implemented in Ukraine is mixed waste collection. All waste including resource-intensive components is collected in containers for mixed solid waste.

As usual, the following types of containers are used for MSW collection:

- Euro-containers (1.1 cub. m) produced from metal or plastic used for mixed waste;
- Simple containers (1.1 cub. m) produced from metal or plastic used for mixed waste;
- Underground containers (3–5 cub. m) usually for mixed waste, applied mainly in Kyiv City (limited availability of locally produced equipment);
- Grid containers (1.1 cub. m) for recyclables;
- Bells (3–5 cub. m) for recyclables;
- Private bins (120 l) for collection of waste from private households.

Normally, 2–3 containers are installed near the multi-story buildings. If separate collection is introduced, one from available containers is for separate collection. The practice for individual containers per each household is not applied widely yet and is used mainly in some rural areas in Western Ukraine. As an experiment in some villages, MSW is collected in bags according to the timeline defined by the companies providing MSW collection service. At the same time, large part of rural areas is not covered with MSW collection service and households dispose and incinerate waste on their own.

Resource-valuable components are manually selected from mixed waste (about 6% of the total waste volume).

From the organizational point of view, only companies that won tenders of municipalities are allowed to provide MSW collection services based on agreements with the municipalities and consumers of the service. According to the Ukrainian legislation, a company that won the tender competition should provide services for at least 5 years. If only one company participated in the tender, it should provide services only for one year. Usually in Ukraine, a municipal transportation entity and a landfill are owned by the same municipal company.

Municipal companies have limited financing and most vehicles owned by small settlements are significantly deteriorated. Only the biggest players (e.g. such companies as AVE Umwelt, Veolia, Umwelt Ukraine) and a limited number of small private companies possess advanced vehicles. For collection of recyclables, normal vehicles are re-equipped.

In relation to the collection and transportation aspects, the Strategy 2030 considers increasing coverage of the population with organized MSW collection services from 77 to 84% in the mid-term (which implies purchasing of about 9 500 additional containers and about 150 vehicles) and up to 90% in the long-term (with extra 8 500 containers and 150 vehicles). The estimated CAPEX is € 15.4 million and € 23.2 million, respectively.

Separate Collection

Among the immediate steps in the MSW sector, the National Waste Strategy of Ukraine up to 2030 sets increasing the recycling rate, including, by extension of separate collection system.

As of September 2017, separate MSW collection has been introduced in 822 settlements of Ukraine (23% of population[14]). This allows collecting about 6% of recyclables from the general stream of MSW. However, separate collection fragmentarily covers a limited share of population settlements or includes containers for PET bottles only, sometimes for mixed recyclables with poor quality. As a part of the system for recyclables collection, there are points for procurement of secondary materials from the population. This activity does not require licensing, private companies or individuals can be owners of such points or their chains.

There are recycling processing facilities for at least 100 secondary raw materials (paper, cardboard, glass, plastics, lead) in Ukraine. According to the experts, recycling facilities work under designed capacity due to the unstable and insufficient supply of resource-containing materials. The best situation is in the field of paper/ cardboard recycling, but stable supply of secondary raw materials is ensured by imports (up to 300 000 tons or 30% of the recycled quantity).

Figure 3-3. The main 'dry' resource valuable components to be separated (cardboard, paper, glass, aluminum and iron cans, plastics)

Currently in Ukraine, the main source of 'recyclables' are points which the population now brings individual resource-valuable components (in particular, glass bottles) to and receives a certain fee in cash in exchange (*e.g.,* VTORMA recyclables collection centers[15]). A significant volume of resource-valuable components is delivered by the 'informal sector' after extraction from containers for mixed waste.

a B c d e

Figure 3-4. Containers for separate waste collection near apartment blocks (a–b) and recyclables collection point (c–e) with 'bell' type containers by VTORMA association companies (owned by private market operators)

To raise the level of recycling in Ukraine, the coverage of separate collection of MSW should to be significantly increased. Increasing the separate collection coverage will require procurement of new containers and collection vehicles. In the first instance, the focus should be on the introduction of separate collection of dry recyclables. However, to allow subsequent production of the high-quality compost, separate collection of organic material should also be considered.

To achieve a 50% coverage of the population with services of separate collection of solid waste (the recycling rate set is 15%) in accordance with the indicative calculations, the following items are additionally required:

- Collection vehicles: in the mid-term– about 230 units; in the long-term – about 400 additional units;
- Containers: in the mid-term – 35–40 thousand units; in the long-term – additional 60 thousand units;
- Estimated CAPEX: in the mid-term – € 15 million, in the long-term - extra € 23 million.

Sorting

The system of preparation for re-use in Ukraine includes waste sorting lines (WSLs) and potentially can include composting facilities as well (according to the official Minregion information, the insignificant amount of MSW has been composted).

[14] http://www.minregion.gov.ua/napryamki-diyalnosti/zhkh/terretory/informatsiya-shhodo-vprovadzhennya-suchasnih-metodiv-ta-tehnologiy-u-sferi-povodzhennya-z-pobutovimi-vidhodami/
[15] http://www.vtorma.ua/punkty-priema-vtorsyrya.html?lang=en

As of 2017, 31 waste sorting lines operated in over 20 settlements, including 6 in Kyiv City. Some of them are owned by providers of MSW collection service companies, some are installed at landfills. Data regarding capacity of the existing waste sorting lines are mentioned as the average capacity in tones or cub. m per shift per separate line, which makes it difficult to estimate the overall capacity or compare installations – in general, the full capacity of the existing waste sorting lines can achieve 1 million tpa. Usually, quite simple waste sorting lines with a capacity of 10,000 – 25,000 tpa are used (including a trommel, conveyor, sorting cabin, baler, in some cases also a magnetic separator). There is no optical sorting in the existing facilities. The sorting line in Rivne City produces RDF at a first stage and then performs simple sorting line operation.

Most of the existing sorting lines in Ukraine, which are quite basic in their nature, process both commingled dry recyclables and residual waste, and rely mainly on manual sorting. The recycling levels are relatively low (typically less than 10% of the throughput) in cases when the sorting lines are used to capture recyclables from the residual waste stream (*i.e.* mixed waste). Significantly higher capture rates can only be achieved where the incoming waste stream consists of a single waste stream/fraction or of 'dry' types of recyclables.

Intake conveyor | Trommel screen | Overband magnet | Baler

Figure 3-5. Main components of sorting line used in Ukraine

Facilities for post-collection sorting, compaction and/ or shredding for supply of secondary materials to end users shall be further developed.

It is considered that a minimum capacity of 10 000 tons of 'dry' recyclables should apply to new WSLs in Ukraine. For larger catchment areas in Ukraine (*e.g.* cities with population greater than 640 000), WSLs with a capacity of 50 000 tons per year may be appropriate, while facilities with a capacity about 30 000 tons per year may be appropriate for catchments/ regions with a population between 250 000 and 640 000. For settlements with a population less than 25 000, a capacity of about 20 000 tons per year may be more appropriate.

Table 3-8. Indicative estimate of CAPEX for WSLs

Population served	WSL capacity, tons per year	CAPEX
Less than 200,000	10,000	€ 5,000,000
200,000 – 250,000	20,000	€ 3,000,000
250,000 - 600,000	30,000	€ 2,500,000
More than 640,000	50,000	€ 2,000,000

The estimates of the need for WSL and the associated CAPEX are as follows:

- Waste sorting lines: in the mid-term – 40 aggregates (depending on capacity and coverage area), in the long-term – some 50 lines more;
- CAPEX estimated: in the mid-term – € 115 million, in the long-term – extra € 140 million.

While the estimates are indicative only, it is clear that economy-of-scale factors are significant and, for that reason, it is considered that WSLs should generally be installed on the basis of intermunicipal cooperation arrangements serving a catchment with the appropriate critical mass, except in case of larger cities.

Incineration

At the beginning of the 1980s, four MSW incineration plants were built in the cities of Kharkiv, Dnipropetrovsk, Kyiv and Sevastopil (ARC). The total designed capacity of these plants was about 1.2 million tons per year. These plants have never worked at their designed capacity and have not used generated energy in the efficient way (which, according to Annex I of the Directive 2008/98/EC, is classified as a disposal operation). Three of these incineration plants were closed as a result

of noncompliance with the Ukrainian environmental standards. Currently, only one incineration plant 'Energia' in Kyiv City with the capacity of 250 000 tons per year and 3 incineration installations in Kharkiv City and Kharkivska Oblast with the capacity of about 10 000 tons per year are in operation.

Given their very high investment costs, incinerating facilities with energy recovery are generally not considered to be economically feasible unless their minimum intake is above 150 000 tons per year (*i.e.* relevant for the population stratum of more than 500 000). In this regard, thermal treatment/ waste-to-energy recovery facilities can be considered in respect of the largest cities in Ukraine. Also, they can be considered as the additional treatment option after the mechanical-biological treatment stage and before the disposing stage. Until Mechanical Biological Treatment (MBT) is be widely spread in Ukraine, incineration cannot be considered feasible.

Disposal

There are 5 487 MSW landfills in Ukraine covering the area of about 9 160 ha, including 327 (6%) overloaded landfills and 1 339 landfills (24.4%) noncompliant with the environment safety requirements. About 516 landfills should be rehabilitated. According to the data published by the Minregion[16] on November 2016, only 100 landfills complied with the official State Building Norms for landfills. According to the data published by the Minregion on January 16, 2018, only 57 landfills had a leachate collection system, including 40 landfills which had leachate disinfection systems, meanwhile other landfills had lagoons/ tanks for leachate storage with further transportation of leachate to wastewater treatment facilities.

In Ukraine, the major part of landfills are owned by municipalities. The vast majority of landfills with a capacity of more than 50 000 tons (200 000 cub. m) need a special license. There are no successful examples when one company manages several landfills.

About 29 000 dumpsites are generated annually in Ukraine (in the area of about 1 284 ha). Usually, more than 99% of generated dumpsites are eliminated in the same year.

According to the estimates of local authorities, in 2016, there was a demand for construction of 433 (+8%) additional landfill units[17]. This number differs from the most recent target mentioned in the National Waste Management Strategy. According to the latter, Ukraine needs fewer landfills. This number will be defined based on the intermunicipal cooperation approach taking into account economy of scale.

It is an objective of the National Waste Management Strategy to provide an appropriate network of landfill disposal facilities that will comply with the EU Landfill Directive, 1999/31/EC. It is proposed to develop new landfill facilities at the regional level, contrary to the current development of landfills at a municipal level. Economy-of-scale considerations are not very important in case of poor standard, low-cost landfill facilities. However, where landfill facilities are developed and operated in accordance with the requirements of the EU Landfill Directive, economy-of-scale considerations clearly show strong advantages of regional facilities. Development and operation of EU-compliant landfill facilities will result in a significant increase in costs per ton of landfilled material. This, in turn, will mean that smaller facilities will not be economically sustainable.

Development of regional landfill facilities will require intermunicipal cooperation arrangements (IMCAs) for MSW management. This, in turn, may require facilities to be configured on a pragmatic basis, having regard to topography/ transport considerations, rather than on a strict regional ('oblast' or 'rayon') basis. Regional landfills and a network of transfer stations would typically be operated by a regional body or company and MSW tariffs should ideally be consistent within each region.

It is expected that in the mid-term, construction of the first stage of the overall network of regional landfills (EU-standards compliant, minimum capacity of about 50,000 tons per year and covering an agglomeration with a population of not less than about 150 000) will commence across Ukraine.

Long-term expectations relate to construction of state-of-the-art landfill facilities across all the area of Ukraine, which would be worth approximately € 0.73 billion:

- 3 landfills with a capacity of 400 000 tons per year;
- 7 landfills with a capacity of 200 000 tons per year;
- 82 landfills with a capacity of 100 000 tons per year

[16] http://www.minregion.gov.ua/napryamki-diyalnosti/zhkh/terretory/informatsiya-shhodo-vprovadzhennya-suchasnih-metodiv-ta-tehnologiy-u-sferi-povodzhennya-z-pobutovimi-vidhodami-stanom-na-04-09-2017-roku/
[17] http://www.minregion.gov.ua/napryamki-diyalnosti/zhkh/terretory/stan-sferi-povodzhennya-z-pobutovimi-vidhodami-v-ukrayini-za-2016-rik/

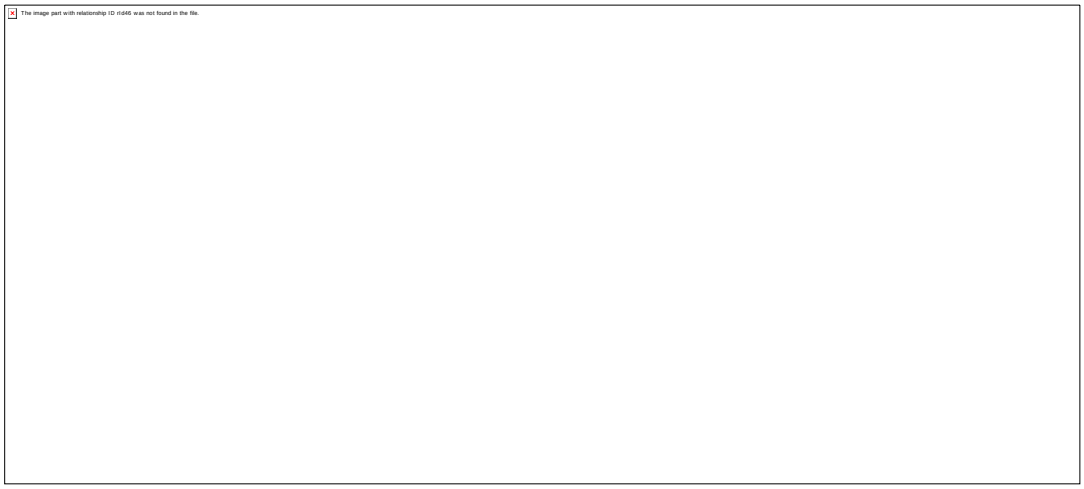
Also, in the long-term, reclamation and closure of existing landfills/dumpsites in Ukraine should be accomplished (the estimated investment of about € 1.4–1.7 billion overall[18]).

Landfill Gas Extraction

There is a system of landfill gas collection at 13 landfills in Ukraine. At 6 landfills, landfill gas is incinerated (Vinnitsa City, Zaporizhzhia City, Rivne City, Village Nova Dolyna in Ovidiopolsky Region of Odeska Oblast, Village Communist and Settlement Slobozhanskie of Zmiiv Rayon of Kharkivska Oblast). Some landfills have cogeneration installations with landfill gas recovery benefitting from the 'green tariff' for produced electricity[19], *e.g.* Vinnitsa City, Kovel City of Volynska Oblast, Uzhgorod City (v. Barvinok), Ivano-Frankivsk City, v. Glyboke of Boryspil Rayon of Kyivska Oblast, v. Rozhivka of Brovary Rayon of Kyivska Oblast, v. Pidgirtsi of Obukhivsky Rayon of Kyivska Oblast, Zhytomyr City, Mykolaiv City and Cherkassy City. The overview of existing waste sorting, recycling and incineration facilities as of September 2017 is given in **Table 3-9.**

According to the Minregion, as of September 2017, there were 52 registered projects on development of waste management infrastructure (MSW landfills, collection and recycling, incineration stations) with approximately 1/3 being at the finalization stage. Their overview is presented in **Table 3-10.**

Table 3-9. Existing waste sorting, recycling and incineration facilities, status as of September 04, 2017



[18] This estimate is based on the following assumptions: the total number of landfills in Ukraine is about 6 064, with the average area of approximately 1.5 hectares per landfill. Closure and rehabilitation of old and noncompliant landfills will be in parallel with construction of new regional landfills. The provided estimate is based on reclamation of the average of 467 closed landfills per year beginning from 2020 with the average cost per landfill of about €280 000.

[19] According to the National legislation, the "green" tariff is available for electricity produced from landfill gas, which provides incentives for development of cogeneration installation at landfills.

Table 3-10. Running projects for MSW landfills, collection and recycling, incineration stations as of September 04, 2017 (excluding projects with high completion status)

Source: http://www.minregion.gov.ua/napryamki-diyalnosti/zhkh/terretory/informatsiya-shhodo-vprovadzhennya-suchasnih-metodiv-ta-tehnologiy-u-sferi-povodzhennya-z-pobutovimi-vidhodami-stanom-na-04-09-2017-roku/

3.2.7.3 Tariffs on MSW Services

Tariffs on MSW services are defined by the Resolution of the Cabinet of Ministers of Ukraine No. 1010 'On Approval of the Order of the Forming of MSW Collection Service Tariffs' dated July 26, 2006. This document establishes categories of MSW collection service consumers and a level of profitability for MSW collection service providers (which should not exceed 12%, and for certain categories of customers such as budget institutions and other customers – 15% and 50% respectively). The mentioned Resolution allows including investment costs in the tariff in case of a proven investment program for the next 5 years, which should not exceed a 20% share in the tariff structure. In practice, this mechanism does not work and the tariff formation is rather a political issue than an economic one – which results in low and unattractive tariffs for potential investors. Besides, there is a long annual review procedure for tariffs depending on the inflation rate, which usually takes from 3 to 5 months.

The tariff on MSW collection services includes landfill tariffs (subject to a separate approval): thus, MSW collection companies receive MSW service fees and then pay for landfill services to a landfill operator.

Tariffs on MSW services vary from municipality to municipality. In 2016, the average tariff on MSW services (including the landfill component) in Ukraine was about UAH 64.83/ cub. m (approximately € 2.29/ cub. m) and for landfill services the average tariff was UAH 19.65/ cub. m (approximately € 0.69/ cub. m). The minimum tariff was noticed in Zhytomyrska Oblast, the maximum was applied in Zakarpatska Oblast.

The average tariff on MSW collection services has increased by almost 6 times in the last decade. However, taking into account the tariff's low base and the high inflation rate in Ukraine in that period, the tariff's increase has been insignificant. The same situation applies to the MSW landfill tariffs (the nominal increase by almost 5 times, nonetheless, resulting even in a real decrease of the tariff rate considering the inflation growth).

The landfill tariff in Ukraine is very low. In 2017, the decision-making power to set tariffs for landfills with big capacities was transferred to the National Commission on the State Regulation in the Field of Energy and Utility Services, which according to the market experts should improve the situation. In Ukraine, there is no mechanism of setting tariffs on waste landfilling compliant with the Directive 1999/31/EC that would allow the full cost recovery including financial guarantees, costs for the closure, reclamation, aftercare and monitoring.

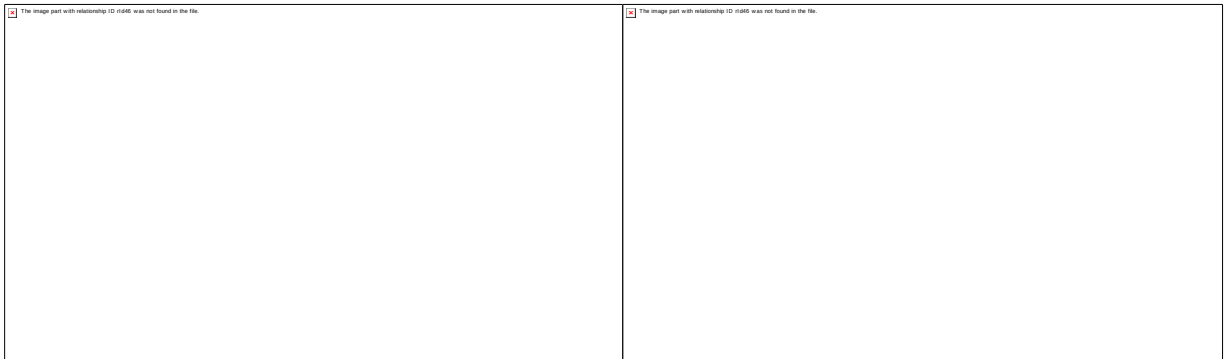


Figure 3-6. Average MSW collection* and landfilling tariffs in Ukraine per cub. m of waste in 2004–2016

** Tariff on MSW collection including costs of collection, transportation and landfilling services*

Source: Minregion

The key factor hindering the increase of tariffs and the introduction of new technologies is the affordability issue. In 2016, the average income indicator per one household (2.58 persons) was about UAH 5 200 (approx. € 184). Taking into account the mentioned level of income, a significant increase in tariffs is hardly possible in the short-term. However, the National Waste Management Strategy 2030 envisages the strategic goal of making MSW collection and landfilling services tariffs economically feasible to secure investments and proper management.

3.2.7.4 Market Landscape, Main Players, Institutional and Private Stakeholders

The overview of the main groups of stakeholders of the Ukrainian waste management sector (with a focus on MSW) and their roles are given below. Please also refer to the Executive Presentation to see the player landscape (Slide 9, **Annex 1).**

- **Law and Policy Makers, Central Executive and Coordinating Bodies:**
  - **The Parliament Committee on Environmental Policy, Nature Management and Liquidation of the Consequences of the Chernobyl Disaster** (http://komekolog.rada.gov.ua/) has a direct relation to the legislative activities with regard to waste management issues. The area of competence of the Committee is the state policy in the field of waste management, including radioactive and toxic wastes. It is active in waste legislation on issues of EPR, penalties, the framework law "On Waste ..."
  - **The Parliament Committee on Construction, Urban Development, Housing and Utility Services** (http://kombud.rada.gov.ua/) is another direct stakeholder relevant to utility services and MSW management services as their part. The area of competence of the Committee is planning and building of territories; land relations (within the territories of development); the utility sector. The Committee supports a new Law on Utility Services, as well as a law on EPR for packaging.
  - Strong lobbying for 'green tariffs' on energy produced from waste is provided by **the Parliament Committee on Fuel and Energy Complex, Nuclear Policy and Nuclear Safety** (http://kompek.rada.gov.ua/). The area of competence of the Committee is development of the fuel and energy complex, coal, gas, oil, oil refining and electricity; development of nuclear energy and nuclear safety; functioning of energy and energy markets; transportation of energy and energy saving; alternative and renewable energy sources. The Committee considers MSW management an issue within its competence and sees a key solution in introduction of a green tariff on energy produced from MSW as an alternative source of energy. The Committee pushed amendments regarding the introduction of the tariff by National Commission on the State Regulation in the field of Energy and Utility Services for landfills with a big capacity and recovery units.
  - **The Parliament Committee on Industrial Policy and Entrepreneurship** (http://komprompol.rada.gov.ua/). The area of competence of the Committee is industrial policy and development of industries; foreign economic activity, investment activity, special (free) economic zones and territories of priority development, technological parks; standardization, confirmation of conformity, accreditation and metrological activity; PPP; space activities; development of SME; development of entrepreneurial activity and guaranteeing rights and legitimate interests of business entities. The Committee is not directly involved in registration or initiation of waste legislation, however draft laws are coordinated with the Committee if required (*e.g.* for industrial waste).
  - **The National Security and Defense Council of Ukraine** (http://www.rnbo.gov.ua/content/aparat.html). The Council has a working group related to waste management.
  - **The National Commission on the State Regulation in the Field of Energy and Utility Services** (http://www.nerc.gov.ua/). The Commission is responsible for licensing of landfills and recovery facilities with a big capacity as well as for approval of tariffs on landfilling and recovery. Its functions are under revision.
  - Development of the national policy on waste management falls under the competence of the Minecology. The same competence related to MSW only is with the Minregion.

    The Ministry of Ecology and Natural Resources of Ukraine (Minecology) (https://menr.gov.ua/) is responsible for the waste policy and plays a leading role in the implementation of the National Waste Management Strategy and donor involvement to support separate strategic tasks. Working groups on waste issues function on the platform of the Ministry, including one related to the development of the National Waste Management Plan. The Reform Support Team (RST) of the Minecology (http://fsr.org.ua/page/komandy-pidtrymky-reform/) is responsible for support for the Ministry in the reformation process and for coordination of donors, organization of working groups and meetings.

    The Ministry for Regional Development, Construction, Housing and Communal Services (Minregion) (http://www.minregion.gov.ua) is responsible for the municipal waste policy. The Reform Support Team (RST) of the Minregion (https://fsr.org.ua/page/komandy-pidtrymky-reform) is responsible for support for the

Ministry in the reformation process and for coordination of donors, organization of working groups and meetings.

- **The Ministry of Economic Development and Trade of Ukraine** (Mineconomy) (http://me.gov.ua) is mainly involved in metal scrap management, which is regulated separately.
- **The State Ecological Inspection of Ukraine** (http://www.dei.gov.ua/) is responsible for control and enforcement of companies to comply with the Ukrainian environmental requirements. The Inspection is under transformation now.
- **The State Statistics Service of Ukraine** (Ukrstat) (http://www.ukrstat.gov.ua/) is responsible for collection of environmental information (including waste management) from companies through the regional Statistical bodies.
- **The State Agency of Energy Efficiency and Energy Saving of Ukraine** (http://saee.gov.ua/) supports the introduction of a green tariff on energy produced from waste as an alternative source, including MSW. One of the targets is to improve the existing draft legislation pushing implementation projects on producing energy from waste. The Agency actively cooperates with IFIs.

- **Local and regional authorities (oblast state administrations, local governments, municipalities)** are responsible for the following issues related to waste management[20]:
  - Development of regional programs on waste management and their implementation[21];
  - Coordination and promotion of development of entrepreneurial activities on waste management;
  - Control over the use of waste taking into account the resource value and safety requirements for human health and the environment;
  - Control over activities of waste management facilities;
  - Interaction with local self-government bodies;
  - Development and approval of schemes of sanitary cleaning of settlements;
  - Organization and promotion of establishment of specialized enterprises of all forms of ownership for collection, treatment, recovery and disposal of waste, as well as for manufacturing, installation and maintenance of appropriate equipment;
  - Involvement and unification (on a contractual basis) of funds of enterprises, institutions, organizations and citizens, local budgets and extra-budgetary funds for financing the construction of new waste management facilities and the expansion and reconstruction of existing ones, as well as for studying the possibilities of waste recovery, marketing, *etc.*;
  - Compilation and maintenance of registries of generation, treatment and recovery waste facilities and a registry of waste disposal sites;
  - Organization of keeping records of generation, treatment, recovery and disposal waste operations, their inventory;
  - Organization of collection and disposal of municipal and other waste, including waste from small producers, to landfills, as well as separate collection of recyclables;
  - Issuance of permits for waste management operations for a period of three years;
  - Ensuring the elimination of unauthorized and uncontrolled waste dumps with own efforts or at the discretion of authorized bodies;

[20] As defined in Article 20 of the Law on Waste of Ukraine
[21] The overview of the regional environmental programs is available on the Minecology website, however, it is quite outdated. It is possible to compare and update this information with data from the oblast state administration websites for: separate programs on municipal waste management, a separate program on waste management or dedicated chapters in the environmental program. Some information on local regional ecology plans can be found at http://old.menr.gov.ua/index.php/ecopolit and may include some measures on waste management.

- Assistance in clarification of the waste legislation to public, creating the incentives for involvement of the population in collection and procurement of certain types of waste as a secondary raw material;
- Control over compliance of legal entities and public with the requirements for treatment of industrial and municipal waste in accordance with the law including interaction with other authorities in case of violation of the waste legislation.

- **Local and International Industrial and Business Associations:**
  - Several sectoral Associations with a relatively small number of members are active in the Ukrainian waste market:
    - The biggest association is 'Ukrvtorma' (http://ukrvtorma.com.ua/). The Ukrainian Production and Environmental Association (Ukrvtorma) is the largest group of companies in the field of waste management. Ukrvtorma is a member of the Ukrainian Association of Pulp and Paper Industry (UkrPapir), the Ukrainian Association of Secondary Metals (Ukrvtormet), and the Public Council under the Ministry of Ecology and Natural Resources of Ukraine. The association comprises about 100 specialized waste collecting and processing enterprises of large, medium and small business located in all regions of Ukraine. Activities of the enterprises of the association cover collection and procurement of waste as a secondary raw material (*e.g.* in 2017 members of the association collected 1mln t of secondary raw materials trough specialized procurement), in particular:
      - 70 enterprises are engaged in collection of waste paper;
      - 10 enterprises collect glass waste;
      - 22 enterprises collect secondary polymer materials;
      - 15 enterprises are engaged in collection of used PETF bottles;
      - 6 enterprises collect ferrous and non-ferrous metal waste and scrap.

      Processing companies united by the Association recycle waste as a secondary raw material and produce cardboard, toilet paper, plastic tubes, xes, a wide range of products from secondary polymer materials, flakes of PET bottles and others. In particular:
      - 2 enterprises deal with waste recycling;
      - 7 enterprises process secondary polymer materials;
      - 4 enterprises process PETF bottles;
      - 2 companies process ferrous and non-ferrous metal waste and scrap.

      A number of companies of the Association provide services for MSW disposal and separate waste collection and sorting.
    - Another influential Association, which unites companies providing MSW collection service and includes about 10–15 members, is **'Ukrecoalliance'** (https://bit.ly/2G7TCka).
    - Members of **The Association of Ukrainian Enterprises of Pulp and Paper Industry** (UkrPapir) (http://www.ukrpapir.org) and **The Association of Enterprises of Glass Industry** (Glass of Ukraine) (http://www.sklo.kiev.ua/) use secondary raw materials (paper and glass waste) in the manufacturing process. These associations are interconnected with 'Ukrvtorma'.
    - **The Association for Hazardous Waste** (http://ecoteam.org.ua/) unites 6 companies providing services for hazardous waste recovery.
    - **The Public Community "Environmental Recycling Association of Ukraine"** (ERA) is a small association of companies providing waste management services in Ukraine (about 5 members).
    - **The UKRPEC-Ukrainian Packaging & Ecological Coalition** (https://www.facebook.com/ukrpec/) is a non-profit association of producers of packaging and packaged products.
  - There are other business associations related to waste management in some aspects:
    - The Public Association **'Bioenergy Association of Ukraine'** (http://www.uabio.org/) is involved in biomass project development and management and can potentially be involved in agricultural waste and composting projects for bio-waste. The association's activities cover the use of biomass as an alternative source of energy. It offers consultancy, project management, FS, maintenance projects. The association can potentially be interested in equipment for AG and composting technologies from the Netherlands. It is an active participant of IFI projects.
    - **The Association of Bioenergy Entities** (http://abc.in.ua/) is founded with the goal of uniting players of the alternative energy and bioenergy market to create a strong and influential professional community. The association is potentially interested in RDF production project implementation.

- **The Association of Cement Producers of Ukraine** (UkrCement) (www.ukrcement.com.ua) is potentially interested in using high-quality RDF/ RSF produced in Ukraine.

  The Ukrainian Towns Association (http://ammu.com.ua/) is open to pilot projects in waste management as there is a significant issue with financing of such projects. The association maintains a database of investment proposals from small towns, searches for investors for small towns, develops investment projects, business plans, strategic plans for economic development, provides consultations under preparation of investment proposals and projects, searches for sources of financing and establishes contacts between Ukrainian cities and foreign partners, does event marketing and develops quality management systems (training, consulting).

- **The American Chamber of Commerce** (AmCham) (http://www.chamber.ua/uk) in Ukraine, together with **The UKRPEC-Ukrainian Packaging & Ecological Coalition,** promotes a draft Law of Ukraine on EPR for packaging waste[22].

- **The European Business Association in Ukraine** (EBA) (https://eba.com.ua/) is the biggest association of international and local businesses in Ukraine. The EBA is active in discussions of the draft legislation on waste supporting the fulfillment of requirements set under the Association Agreement with the EU.

- **Service Providers and Equipment Producers:**

  - In 2016, about 1 143 companies provided MSW management services in Ukraine[23], only 24% of that number were private companies. Most of the companies are owned by municipalities, typically being small companies at the settlement where collection services are provided. There are several companies representing European brands in Ukraine and its regions:

    - **AVE Group** (https://bit.ly/2pBPp21, www.ave.ua) entered the Ukrainian market of waste management by organizing collection of domestic waste in Zakarpatska Oblast in 2006 and in Ivano-Frankivska Oblast in 2008, respectively. At the beginning of 2010, AVE started to work in two cities of Western Ukraine having established AVE Mukachevo (Zakarpattia) and having bought the majority stake (70%) in the Lviv waste management company ECO-Lviv Service. The company ECO-Lviv Service has worked in the field of waste management for over 15 years and was first to introduce Western European standards in waste management. After the agreement was signed, the company began operating under the name of AVE Lviv. AVE UMWELT Ukraine (http://www.umwelt.com.ua/services/) seeks to start building a Waste Recycling Complex in Zakarpatska Oblast.

    - **Veolia Ukraine** (https://www.veolia.ua/en/about-us/about-us/veolia-ukraine/subsidiary-companies) belongs to the Veolia Group, a global leader providing waste management solutions, water and energy services with over 160 years of history. Veolia has been operating in Ukraine since 1995. This is the first global company with waste management operations in the Ukrainian market. Veolia is represented by 4 subsidiaries[24] operating in the waste management area and located in Kyiv, Ternopil, Chernivtsi and Yalta (ARC). Veolia Ukraine employs around 400 people. The company's running park consists of more than 100 specialized vehicles with investments in state-of-the-art equipment. Veolia also provides services for industrial and commercial clients as well as container business. Veolia Ukraine is one of the founders and a member of the Association 'Ukrecoalliance'.

  - Many companies have several directions of activities and are active members of industry associations, *e.g.* the private company 'Rada' specializing in MSW separate collection services, sorting and procurement of secondary raw materials at collection points, purchasing and production of containers as well as sorting lines. The company heads the Ukrainian Production and Environmental Association 'Ukrvtorma'.

  - Ukrainian MSW collecting companies use vehicles with side or back loading mechanisms produced/ assembled in Ukraine (JSC 'AutoKraz', JSC 'ATECO', JSC 'Spetsbudmash', 'Communtechnika' Ltd, 'VLIV' Ltd, Autoassembling Enterprise 'COBALT'(https://kobalt-foton.com.ua/about/kobalt/) or second-hand/ foreign vehicles (*e.g.* from Germany). Some of MSW vehicle sales companies known in Ukraine are 'Kyivspetstech' Ltd (http://kievspecteh.com.ua/), JSC 'Trade House 'Communal Technika', JSC 'AutoKraz', 'Corral' Ltd, 'DAP' Ltd.

[22] Draft Law No.4028
[23] http://www.minregion.gov.ua/napryamki-diyalnosti/zhkh/terretory/stan-sferi-povodzhennya-z-pobutovimi-vidhodami-v-ukrayini-za-2016-rik/
[24] https://www.veolia.ua/en/about-us/about-us/veolia-ukraine/subsidiary-companies

- There are also some producers of containers in Ukraine. Usually, they produce the simplest euro-containers. Only 'Energo-Invest' company (http://www.energo-invest.com.ua/)[25] produces underground containers (5 cub. m). Some pilot ideas on production of underground containers are currently being implemented at the local level (*e.g.* by SPE 'Rada'). The market of euro-container production in Ukraine is more developed – there are representatives of German companies (*e.g.* Schäfer GmbH) as well as Ukrainian producers (*e.g.* SPE 'Rada', dealers 'Kyivspetstech', 'Eco-Lviv').
- The leading company for recyclables collection in Kyiv City is 'KyivMiskvtorresourcy' (Kyiv Municipal Secondary Resources) (http://kgvr.kiev.ua/); similar systems (of municipal secondary raw materials collection) operate in other settlements of Ukraine.
- Local producers and suppliers of sorting lines, sorting stations and mobile sorting installations include, but are not limited to, SPE 'Rada', PE 'ZakhidVtorResursy', 'Recycling Line' Ltd, SPF 'Sota-Stal'', 'Storehouses Modernization Systems' Ltd (http://sms-skladtehnika.com/en/news/exhibition-waste-management-2017/), 'Ecological Systems No. 1' Ltd (https://9902-ua.all.biz/). There are no local producers of turnersand optical separators. 'Hammel' LLC (http://www.hammel.com.ua/) produces and supplies sorting lines and waste recycling equipment as a representative of Hammel Recyclingtechnik GmbH.
- According to the 'Ukrpack' data[26], there are about 15 glass recycling facilities (companies manufacturing glass products using secondary glass); 15 paper and cardboard recycling facilities (*e.g.* paper mills, *etc.*); 39 secondary polymer recycling facilities; 19 PET recycling facilities and 16 metal recycling facilities. In addition, there is one company that recycles Tetra Pack packaging in Kharkivska Oblast (Zmiyev Paper Factory 'Kroneks-Kharkov' LLC) (https://zpf.company/). Only one company – 'Utilita' (http://souzenergo.com/proizvodstvo/utilita.html) – collects and sorts glass waste by color to send glass recyclables to other glass production companies in Ukraine or other countries. Recycling companies rely on the 40% import of raw materials to keep facilities at feasible capacity.
- The incineration plant 'Energia' is managed by Kyivenergo and produces heat for district supply purposes. Despite there are no calculations to exactly define this process as a recovery or disposal operation, incineration is formally considered a recovery operation because of the production of heat used by two residential districts of Kyiv City. The capacity of the enterprise allows burning more than 20% of MSW generated in Kyiv. Nevertheless, its actual load is 15% of the generated MSW volumes (240 thousand tpa based on the calculation of the continuous annual work of the plant). A plan of modernization of 'Energia' has been under development from 2012. However, the plan has not been finalized yet. After the formalization of the Japanese government support (based on the expression of interest signed by the Minecology regarding installation of an incineration line considered as a green investment project), Kyivenergo developed the company's modernization program in 2013. The amount of investments at the first stage of the program reached UAH 28 million (or € 2.4 million). With the support of the Kyiv Investment Agency, 'Energia' has been looking for funds to finance a system of chemical treatment of emissions (after the feasibility study, the tender for equipment supply was expected in 2018) and installation of a new incineration line to increase the capacity of the plant to 320 thousand tpa. In November 2017, the Kyiv Municipality Council approved the Waste Management Plan for 2017–2025, which included technical reconstruction of the plant with gas treatment and energy generation capacities (2018–2021).
- There are 5 487 landfills for MSW in Ukraine[8]. Cogeneration installations were implemented only at 6 landfills by LNK LLC (http://www.lnkenergy.com/eng/; TIS-Eco LLC (http://tiseco.com.ua/) developed two projects for the landfills of Mariupol and Ordzhonokidze cities.

- **R&D Institutes** specializing in different aspects of waste management:
  - Economic and policy issues: the Institute of Environmental Economics and Sustainable Development under the National Academy of Sciences (NAS) of Ukraine (http://www.ecos.kiev.ua/news/list/;
  - Technical issues of thermal treatment: the Institute of Gas of the NAS of Ukraine (http://www.ingas.org.ua/;

[25] The company 'Waste Management Systems' used to produce underground containers as well, but after changes in the ownership structure it provides only MSW collection and sorting services and imports underground containers.
[26] https://www.youtube.com/watch?v=jXvP8a3_9zs
[8] http://www.minregion.gov.ua/napryamki-diyalnosti/zhkh/terretory/informatsiya-shhodo-vprovadzhennya-suchasnih-metodiv-ta-tehnologiy-u-sferi-povodzhennya-z-pobutovimi-vidhodami-stanom-na-04-09-2017-roku/

  - Methodological and project development issues: the Ukrainian Scientific Research Institute of Development and Introduction of Municipal Programs and Projects (UkrNDI KomunProekt) (http://waste.kharkov.ua/activities.htm).

- **NGO & CSO.** The most relevant NGOs and CSOs related to the waste management area are Mama-86 (https://mama-86.org), the Ukrainian Ecological League (http://ecoleague.net/), Environment-People-Law (EPL) (http://epl.org.ua/). All of them have their regional representative offices. There are some successful projects initiated by NGO & CSO, such as the Volunteer Organization 'Batteries, get collected!' (double meaning in the Ukrainian language: 'Batteries, give up!') (http://batareiky.in.ua/), and the NGO Project 'Ukraina bez smittya' ('No-Waste Ukraine') (http://nowaste.com.ua/).
- **International Financial Institutions** (**IFI**), as well as other **international donors** and **international companies,** are very active in supporting development of the waste management sector in Ukraine including implementation of pilot MSW projects. See the overview of the projects and initiatives of international donors in **Chapter 7** and **Annex 4.**

4 Waste Management Policy Targets of the Ukrainian Government

This Chapter provides brief information regarding the policy framework and the targets of the Ukrainian Government related to the Waste Management area. Details of the legislative and policy framework are given in **Annex 2.**

The Ukrainian policy framework is quite wide; however, it contains a number of key gaps in the environment area including, but not limited to, the lack of a clear baseline and realistic target indicators and goal prioritization, the lack of clear time frames in the national planning of necessary measures; and the weak integration of environment into sectoral strategies, programs and activities.

In 2014–2017, Ukraine made initial important steps to change the situation through commitment to comply with the EU Directives as part of the Association Agreement with the EU and adoption of the National Waste Management Strategy until 2030. In addition to the national policy framework, according to the Association Agreement with the European Union, Ukraine's national environmental legislation should be aligned with certain EU directives and Regulations. In the waste management sector, the requirements cover implementation of the following EU Directives:

- Waste Framework Directive 2008/98/EC 'On Waste';
- Directive 1999/31/EC as amended by Regulation (EC) 1882/2003 'On the Landfill of Waste'; and
- Directive 2006/21/EC amending Directive 2004/35/EC 'On the Management of Waste from Extractive Industries'.

In addition, Directive 2010/75/EC (with recent amendments) 'On Industrial Emissions (Integrated Pollution Prevention and Control)' should be implemented and some provisions of the Directive are applicable to the waste sector as well.

The most recent and actual document defining the waste management policy of Ukraine is 'The National Waste Management Strategy of Ukraine until 2030' approved by the Order of the Cabinet of Ministers of Ukraine No. 820-p dated November 8, 2017. The National Strategy is developed with the support of international donors and is considered one of the main drivers of waste management market development, compliant with the EU requirements and close to the innovative integrated concept.

4.1 Implementation of Requirements Set in the Association Agreement with the EU

The overview of the main provisions of the EU Directives that should be implemented by Ukraine in the waste management sector according to the Association Agreement are given in **Table 4-1** below.

Table 4-1. Main provisions of the EU Directives that should be implemented by Ukraine in the waste management sector according to the Association Agreement[27]

Provisions of the Directives	Years for implementation	Initial Deadline
Directive 2008/98/EC		
Adoption of national legislation and designation of competent authority	3	November 2017

[27] http://eeas.europa.eu/archives/docs/ukraine/pdf/10_ua_annexes_to_title_v_economic_and_sector_cooperation_en.pdf

Provisions of the Directives	Years for implementation	Initial Deadline
Preparation of waste management plans in line with the five-step waste hierarchy and of waste prevention programs	3	November 2017
Establishment of a full cost recovery mechanism in accordance with the polluter pays principle and extended producer responsibility principle	5	November 2019
Establishment of a permitting system for carrying out disposal or recovery operations, with specific obligations for management of hazardous waste	5	November 2019
Establishment of a register of waste collection and transport establishments and undertakings	5	November 2019
Directive 1999/31/EC		
Adoption of national legislation and designation of a competent authority	6	November 2020
Classification of landfill sites (art. 4)	6	November 2020
Preparation of a national strategy reducing the amount of biodegradable municipal waste going to landfills (art. 5)	6	November 2020
Establishment of an application and permit system and of waste acceptance procedures (art. 5- 7, 11, 12 and 14)	6	November 2020
Establishment of control and monitoring procedures at the operation phase of landfills and of closure and after-care procedures for landfills to be disaffected (art. 12 and 13)	6	November 2020
Establishment of conditioning plans for existing landfill sites (art. 14)	6	November 2020
Establishment of a costing mechanism (art. 10)	6	November 2020
Ensuring relevant waste is subject to treatment before landfilling (art. 6)	6	November 2020
Directive 2006/21/EC		
Adoption of national legislation and designation of a competent authority	5	November 2019
Establishment of a system to ensure that operators draw up waste management plans (identification and classification of waste facilities; characterization of waste) (art. 4 and 9)	5	November 2019
Establishment of a permit system, of financial guarantees and of an inspection system (art. 7, 14 and 17)	5	November 2019
Establishment of procedures for management and monitoring of excavation voids (art. 10)	5	November 2019
Establishment of closure and after-closure procedures for mining waste facilities (art. 12)	5	November 2019
Drawing up an inventory of closed mining waste facilities (art. 20)	5	November 2019
Directive 2010/75/EC		
Adoption of national legislation and designation of a competent authority	2	November 2016
Identification of installations that require a permit (Annex I)	5	November 2019
Implementation of BAT taking into account the conclusions of the BREFs (art. 14(3-6) and 15(2-4)	Upon the AA's entry into force , the Council shall define the timetable: for existing installations.	-
▪ Establishment of an integrated permit system (art. 6 – 9 and 13) ▪ Establishment of a compliance monitoring mechanism (art. 8,14 (1d) and 23(1)) ▪ Establishment of emission limit values for combustion plants (art. 30 and Annex V) ▪ Preparation of programs to reduce total annual emissions from existing plants (optional to setting emission limit values for existing plants) (art. 32)	Separate timetable in the AA Annex)[28]	-

[28] Association Agreement with the European Union

For the step-by-step implementation of these tasks, the Minecology and other responsible ministries have developed and approved implementation plans with the following main measures:

1. **Measurers on the development/ drafting of the legislation and other regulatory acts:**
    - New Law 'On Waste' implementing provisions of the Directive 2008/98/EC
    - List of waste
    - Act to regulate the order to define waste as hazardous
    - New forms of statistics reporting by companies
    - Law on amendments to the Tax Code of Ukraine regarding changes on environmental tax on waste disposal
    - Regulation of the end of waste status and sub-products
    - Order on development of waste management plans
    - Rules for calculation methods for recycling targets (taking into account the Decision 2011/753/EC)
    - Waste prevention program
    - Technical regulation on waste landfilling according to the Directive 1999/31/EC and the Decision 2003/33/EC
    - Order on implementation and introduction of the financial guarantee mechanism for landfills, forming the tariffs for landfilling of waste
    - Development the National Strategy on reduction of biodegradable waste going to landfills
    - Lists of waste which can be accepted at different types of landfills
    - Law on waste from extractive industries
    - Order on development extractive waste management plans
    - Resolution of the Cabinet of Ministers of Ukraine on order to define extractive waste facilities category.
2. **Institutional and organizational measures:**
    - Establishment of the Minecology's department responsible for keeping registries
    - Development of waste management plans
    - Creation of a database of waste transportation companies
    - Revision of local construction norms DBN V.2.4-4: 2010 'Landfills for the disposal of toxic waste' and DBN V.2.4-2: 2005 'Design. Landfills for municipal solid waste. Basic design concepts'
    - Inventory of existing landfills
    - Classification of landfills
    - Definition of the status and expediency of landfills
    - Development of conditioning plans
    - Definition of the order on closure of landfills
    - Development of detailed regional-level measures for step-by-step implementation of requirements for waste pre-treatment before landfilling
    - Reformation of the permitting system for extractive waste facilities
    - Definition of responsible divisions for implementation of provisions of the Law on waste from extractive industries
    - Classification of extractive waste facilities
    - Introduction of waste management plans at the level of companies
    - Introduction of closure and aftercare procedures for extractive waste facilities
    - Introduction of a financial guarantee mechanism for extractive waste facilities
    - Introduction of a monitoring system for closed extractive waste facilities
    - Translation and adaptation of the methodology, guidance documents on inventory of extractive waste facilities (including closed and abandoned ones).

As of the beginning of 2018, only one measure from the entire list has been implemented (drafting of the List of Waste).

According to the RST[29] at the Minecology, the above presented plans are terminated since the majority of the mentioned actions have been transformed in measures and targets in the adopted National Waste Management Strategy 2030 and are to be further translated into the National and Regional Waste Management Plans. The obligations of Ukraine under the Association Agreement requirements for the waste management sector are to be updated accordingly.

The Ukrainian government's activities related to the development of strategic documents regulating short-, mid- and long-term goals for the waste management sector in the context of the requirements set in the Association Agreement with the EU are carried out with the support of international financial institutions and donors, such as the European Bank for

[29] Reform Support Team (RST) – task-force expert teams at the Minecology and the Minregion funded by the EU and EBRD

Reconstruction and Development (EBRD), the German implementing agency GIZ, other international donors (see **Chapter 8**).

4.2 National Waste Management Strategy 2030 Approved in November 2017

The goal of the National Waste Management Strategy 2030 is to create conditions for raising living standards by introducing a systematic approach to waste management at the state and regional levels, reducing waste generation and increasing the volume of its recycling and re-use.

The objectives of the National Waste Management Strategy are as follows:

- Identification and solution of key problems of waste management development in Ukraine on an innovative basis;
- Determination of the priority areas for operation of central and local executive governmental authorities, local self-government authorities, organizations, institutions, enterprises, public organizations and society as a whole in the transition of the waste management system to an innovation model;
- Determination of the ways and methods for improvement of the existing waste management infrastructure that do not contradict the innovation model;
- Assurance of sustainable development of Ukraine through the implementation of tasks aimed at environmental and resource security.

The National Waste Management Strategy defines the general tasks on waste management in Ukraine as well as the specific tasks for the specified six streams of waste:

- Municipal solid waste
- Industrial waste
- Construction and demolition waste
- Hazardous waste
- Agricultural production waste
- Specific types of waste: packaging waste, waste of electrical and electronic equipment (WEEE), waste cells, batteries and accumulators, medical waste.

The National Waste Management Strategy defines three stages of its implementation:

- Stage I (short-term) for the period 2017–2018
- Stage II (mid-term) for the period 2019–2023
- Stage III (long-term) for the period 2024–2030.

The summary of measures planned for the short-, mid- and long-term, as set in the National Waste Management Strategy 2030, is given below:

- **Stage I (2017–2018): Institutional and implementation development** (formation of the Coordination Council for Strategy implementation, formation of task teams for local-level development for inputs to the National Waste Management Plan; formation of an interdepartmental coordinating council for R&D works; defining terms of creation of a central executive governmental authority for waste management; creation of a center for implementation of international conventions governing management of hazardous waste and substances); drafting the waste legislative package and development of the necessary technical regulations for waste management (including the regulatory and legal framework for organization of separate collection, recycling and recovery of waste); R&D and awareness (draft educational plan for re-use of natural resources and waste recycling and disposal; scientific research to determine the needs for professionals in environmental safety and life safety by 2030; action plan for conducting a nationwide campaign on waste management).
- **Stage II (2019–2023): Development of standards, regulatory and methodology documents on waste management, measures related to the introduction of a new information system and development of information and educational programs.**
- **Stage III (2024–2030): Assurance of the functioning of the informational system, modernization of the material and technical base of business entities for waste management; digitalization of industries with regard to waste management and natural resources.**

The short-term measures (Stage I), with the indication of the current progress on their implementation and the possible niches for support by donors, are described in **Table 4-2**.

Table 4-2. General measures defined in the National Waste Management Strategy of Ukraine until 2030, Stage I (2017–2018)

Measures	Status of implementation as of March 2018	Possible on cooperation with Donors
Formation of the Coordination Council for implementation of this Strategy	Done	
Formation of a task team at the Ministry of Ecology and Natural Resources of Ukraine for development of a draft National Waste Management Plan	Done	
Formation of task teams at local executive governmental authorities, local self-government authorities, the key assignments of which are to elaborate the proposals for the National Waste Management Plan	Status unclear	
Drafting laws to be part of the 'waste management package':		
Draft Framework Law 'On Waste and Secondary Resources'	Drafting process started and supported by EU APENA project	Support in drafting laws and regulations, sharing the best practices.
Draft Law on Landfilling of Waste	Not initiated yet	
Draft Law on Incineration of Waste	Not initiated yet	
Draft Law on Management of Waste from Extractive Industries	Not initiated yet	
Draft Law on Municipal Solid Waste	Organizational process has started (DESPRO, Minregion)	
Draft Law on Packaging Waste	Initiated, supported by AmCham in Ukraine	
Draft Law on Waste Oil	Draft law is submitted to the Parliament (No.4028) but further amendments/ revisions are expected	
Draft Law on Decommissioned Vehicles Waste	Initiated, development is supported by UNIDO	
Draft Law on Batteries and Accumulators Waste	Draft Law has been developed under EU-funded Twinning project	
Draft Law on Electrical and Electronic Equipment Waste	Draft Law has been developed under EU-funded Twinning project	
Development of the necessary technical regulations for waste management	Not started yet	
Improvement of the regulatory and legal framework for organization of separate collection of all waste and its recycling and recovery	Not started yet	Support in concept and implementation of the regulatory and legal framework for organization of separate collection of all waste and its recycling and recovery

Measures	Status of implementation as of March 2018	Possible on cooperation with Donors
Elaboration of proposals on improving the institutional structure of waste management on an innovative basis, including the creation of a central executive governmental authority for waste management, the activities of which must be coordinated by the Cabinet of Ministers of Ukraine through the Minister of Ecology and Natural Resources of Ukraine	The base for these issues is planned under the draft Law on Waste. Institutional proposals have not been developed yet.	Technical assistance to support establishment and implementation
Adoption of the necessary decisions on the creation of a center to procure implementation of international conventions governing the management of hazardous waste and substances by creating conditions for the effective fulfillment of obligations arising from Ukraine's membership in the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, the Stockholm Convention On Persistent Organic Pollutants and the Minamata Convention on Mercury	Status to be defined	Technical assistance to support establishment and implementation
Formation of an interdepartmental coordinating council for research and development works on the re-use of natural resources and waste recycling and disposal under the National Academy of Sciences of Ukraine	Not started yet	Opportunity for donors and R&D stakeholders in a separate initiative or part of integrated Technical Assistance project
Development of a typical draft on educational plan on the re-use of natural resources and waste recycling and disposal focused on the introduction of qualitative changes in this area and the study of the possibility of its use at higher education institutions that train professionals in environmental safety and life safety	Not started yet	
Launch of scientific research to determine the needs for professionals in environmental safety and life safety by 2030	Not started yet	
Development of an action plan for conducting a nationwide campaign on waste management (re-use of natural resources as well as recycling and disposal of waste)	Not started yet	

After the adoption of the National Waste Management Strategy, the next step is development and approval of the following:

- **The Waste Management Strategy Implementation Plan** (under development by the Minecology[30]): strategic measures with defined responsible bodies and established deadlines for the measures' implementation;
- **The National Waste Management Plan** (in progress with the support of international donors[31]).

Upon the Waste Management Strategy's approval in November 2017, the Minecology, jointly with other responsible ministries, was obliged to develop and submit to the Cabinet of Ministers of Ukraine a draft National Waste Management Plan. The ambition of the Minecology is to have developed drafts of both documents by May 2018 to initiate the consultation and adoption process. According to the Minecology's Order No. 498[32] 'On Approval of the Indicative Plan of the Consultations with the Public by the Minecology in 2018' dated December 29, 2017, the consultations on the draft Law 'On Waste' and the draft of the Action Plan for the National Waste Management Strategy are anticipated in the first half of 2018.

According to the Minecology's Order No. 475 'On Approval of Action Plan of the Minecology on Development of the Drafts of Laws and Other Regulations in 2018' dated December 14, 2017, the draft Law 'On Waste' should have been developed in March 2018, the draft of the Resolution of the Cabinet of the Ministers of Ukraine 'On Amendments for the License conditions for the Hazardous Waste Management Activities' should be developed by September 2018, the draft of the

[30] As a follow-up of the meeting with RST Director dated 7-03-2018 available draft of WM Strategy Action Plan was shared.
[31] Based on the one of project proposals by Minecology "Support of the Ministry of Ecology and Natural Resources of Ukraine in the implementation of the first stage of the National Waste Management Strategy in Ukraine by 2030. Drafting of the National Waste Management Action Plan".
[32] https://menr.gov.ua/files/docs/nakazy/nakaz_498.pdf

Resolution of the Cabinet of the Ministers of Ukraine 'On Amendments to the Provisions on the Control on Transboundary Shipments of Hazardous Waste and Their Recovery/Disposal' should be developed by September 2018.

According to the Minecology's Order No. 497 'On Creation of the Working Group on Development of the National Waste Management Plan and Ensuring Development of the Draft of the Plan till the March 15, 2018' dated December 29, 2017, the first meeting of the working group took place in the Minecology at the beginning of February 2018. Active work has started and is currently in progress with the RST support on the platforms of:

- The working group on development of the National Waste Management Plan;
- The working group on development of the draft laws.

The National Waste Management Strategy stipulates that **Regional Waste Management Plans** to facilitate implementation of the Strategy should be developed no later than in two years after the strategy adoption. The Regional Waste Management Plans are to provide a coherent long-term policy framework that will enable development of the necessary waste management infrastructure at the regional level. Opportunities for international donors and companies are related to the development of a standard methodological approach for drafting the Regional Waste Management Plans and are at their implementation stage[33].

4.3 Expected Forthcoming Changes in the Legislation

The actual legislation on waste does not comply with the commitments assumed by Ukraine in the Association Agreement, mainly the provisions of the EU Framework Directive 2008/98/EC on waste, legislation on waste management operations (*e.g.* the Directive 1999/31/EC on landfill of waste and the Directive 2010/75/EU on industrial emissions) and does not contain effective and consistent rules for waste management. The EU legislation on specific waste streams was not particularly indicated in the Association Agreement, but measures aimed at ensuring source separation, collection and recycling of priority waste streams are necessary to be included in the Law on Waste in order to properly regulate specific waste streams, such as waste batteries and accumulators, waste electrical and electronic equipment, end-of-life vehicles, packaging waste, *etc*. For more effective implementation of specific waste streams' management, in addition to the main Framework Ukrainian Waste Management Law, separate Laws on specific waste streams should be developed. The Ukrainian legislation on mining waste needs to be brought in line with the provisions of the Directive 2006/21/EC on the management of waste from extractive industries and the amending Directive 2004/35/EC.

Considering the recent adoption of the National Waste Management Strategy 2030 and in light of Ukraine's obligations toward the Association Agreement with the EU, drafting of the new framework Law on Waste and the law package related to the specific waste streams regulation was initiated with the support of international donors and expected to be launched shortly including, but not limited to:

- Draft Framework Law 'On Waste and Secondary Resources'
- Draft Law 'On Landfilling of Waste'
- Draft Law 'On Incineration of Waste'
- Draft Law 'On Management of Waste from Extractive Industry'
- Draft Law 'On Municipal Solid Waste'
- Draft Law 'On Packaging Waste'
- Draft Law 'On Waste Oil'
- Draft Law 'On Decommissioned Vehicles'
- Draft Law 'On Batteries and Accumulators Waste'
- Draft Law 'On Waste Electrical and Electronic Equipment'.

Upon development of the above-mentioned documents, elaboration of the necessary technical regulations for waste management and improvement of the regulatory and legal framework on organization of separate collection of all types of waste and their recycling and recovery are expected to be initiated in the short-term.

Ukraine also needs a boost in increasing the efficiency of its economy, in particular by attracting private domestic and foreign investments to implement public-private partnership (PPP) projects, especially in the form of concessions, as the country has significant potential for cooperation and mutual investment in various sectors and infrastructure development.

[33] There are results of various studies and recommendations based on different methodological approaches and best practices already provided under recent projects by IFC, EBRD, GIZ and other IFIs and donors, however, so far single approach is not selected as well as there is no evidence of completely implemented pilot initiatives

According to the central and local executive bodies, as of mid-2017, 189 agreements have been signed based on the PPP in Ukraine, of which 153 have been concession contracts, the majority of them being in the housing and communal services sector. The decision on the feasibility of implementing such projects has been taken without conducting any analyses used in international practice, in particular, 'value for money' or 'public private comparator'. Competitive terms have been developed for one participant (concessionaire), which serves as an explanation for the unsuccessful implementation of such projects. It should also be noted that in Ukraine no large-scale project on the terms of concession has been implemented since the adoption of the General Law on Concession in 1999, which is imperfect and does not correspond to the best international practices.

With the aim to improve the legal regulation of concession activities for the implementation of large-scale projects in line with international practice, with the support of the EBRD, a draft of a new Law on Concession was developed [34] and is under adoption now, which provides for systematization of current laws of Ukraine governing concession activities; harmonization of the legislation on concessions with the legislation on PPP; implementation of the best international experience in concession project implementation; elimination of inaccuracies and legal conflicts revealed during the practical application of the current laws of Ukraine in the areas of public-private partnership and concessions. The draft Law also provides for amendments to more than 30 legislative acts of Ukraine in order to bring them in line with the provisions of the Law and to remove barriers for the implementation of concession projects.

4.4 Minecology as the Main stakeholder of the National Waste Management Strategy Implementation – Open to Cooperation

As of the beginning of March 2018, the actual topics of technical and consultancy assistance approved according to the National Waste Management Strategy implementation are as follows:

- The first priority is development of the legislation acts drafts, elaboration of which are still not initiated specifically: a draft law on landfilling of waste; a draft law on incineration of waste; a draft law on management of waste from the extractive industry. According to the Technical Assignments of the Minecology in the form of Project Proposals 'Support to the Ministry of Ecology and Natural Recourses of Ukraine in the First Stage of the Implementation of National Waste Management Strategy in Ukraine until 2030', the project is proposed to be implemented in two stages:
  - January – October 2018: the draft laws are to be prepared;
  - November 2018 – June 2019: the elaborated draft laws are to be approved by the state authorities as well as by the Cabinet of Ministers of Ukraine and the Parliament of Ukraine.

  According to the market experts, the topics of waste landfilling, incineration, waste from extractive industries are significantly broader than the issue of legislation development and may form the basis for long-term cooperation opportunities.
- Separate assistance is needed to establish a central executive body on waste management. According to the Project Proposal by Minecology ''Support of the Ministry of Ecology and Natural Resources of Ukraine in the Fulfilment of the Stage I Measures of the Implementation of the National Strategy for Waste Management in Ukraine until 2030. The Establishment of a Central Executive Body on Waste Management', the project is proposed to be implemented in two stages.
  - January – June 2018: the analysis of the best European experience in the creation and operation of such a state institution. The section of the optimal model and its adaptation to Ukrainian realities;
  - June – December 2018: the draft law on creation of a central executive body on waste management, coordination with the relevant central executive bodies and support to the Cabinet of Ministers of Ukraine and the Committees of the Parliament of Ukraine.
- The National Waste Management Strategy stipulates development of the Regional Waste Management Plans to facilitate implementation of the Strategy. Assistance is needed in the model methodology for Regional Waste Management Planning as well as in consultancy and implementation support.
- The introduction the EU Regulation 1272/2008 in Ukraine of is not defined in the Association Agreement; however it is an integral part of the implementation of Annex 3 of the Directive 2008/98/EC – to establish a procedure how to define waste as hazardous.

[34] http://w1.c1.rada.gov.ua/pls/zweb2/webproc4_1?pf3511=63630

- Assistance is needed in development of the waste prevention program and the Strategy of Reduction of Biodegradable Waste Landfilling.
- In a more general sense, besides the topics of efficient and safe waste management, the Minecology looks for support in implementation of its strategic directions of work[35], namely:
  - Good environmental governance
  - Preservation of natural heritage
  - Sustainable management of water resources
  - Development of the mineral raw material base
  - Climate policy
  - Air quality
  - Industrial pollution

  In addition, specifically, the Minecology is looking for the support in preparation and implementation of the introduction of the integrated pollution prevention and control (IPPC).

The note shall be done that despite the continuous support and funding from various international donors as well as the intention to further support Ukraine in its waste management reform and compliance with the EU Directives and beyond – considering the historical overlapping and inefficient coordination experience, it is recommended to initiate coordination meetings among international donors on the independent platform to jointly elaborate and monitor coordinated activities as well as to provide feedback.

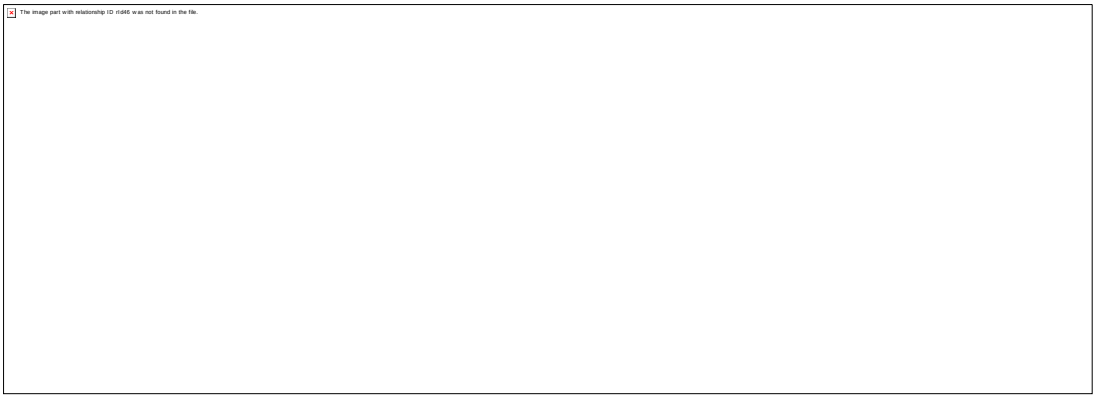
[35] Based on Presentation “Strategic Directions of Activities of the Minecology, 2017: Achievements. Priorities and Plans. Former and Existing Support”

5 Trends in Waste Management Financing and Required Investments

5.1 Trends in Financing of the Waste and MSW Market

The nominal amount of capital and operational expenditures in the waste management sector from all sources of financing has increased from UAH 1.67 billion (or € 263.49 million) in 2006 to UAH 9.98 billion (or € 332.59 million) in 2017 (please refer to **Table 5-1**). According to the official statistics, of the overall € 4.3 billion invested in 2006–2017 in the sector, 83% were operational expenditures and 17% (or the equivalent to € 732 million) were capital expenditures. The annual investments have been increasing being on average UAH 5 billion (or € 359 million), including UAH 0.9 billion (€ 61 million) of the CAPEX and UAH 4.2 billion (€ 298 million) of the OPEX.

Table 5-1. CAPEX and OPEX in the waste management sector from all sources of financing, 2006–2017E



Source: Summarized based on data of the State statistical service of Ukraine and with application of official annual foreign currency exchange rate for UAH - > EUR.

The main sources of waste management financing in Ukraine are the following:

- Own investments by the private sector (business)
- General and Special Funds of the State-, Oblast- and Municipal Budgets
- State- and regional (Oblast and Local) Environment Protection and Environment Protection Funds.

The overview of the state financing framework and the procurement for investments in the waste sector is given in **Annex 3**.

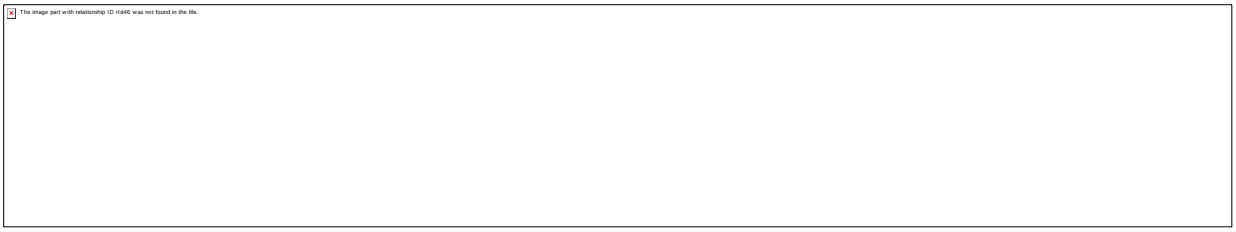
The main source of investments in the waste management sector is business entities' own financing. From 2013 to 2016, the share of financing by companies increased (please refer to **Table 5-2**). The financing from local environmental funds has also increased in the last years, which is related to the intensification of the decentralization process and the start of intermunicipal cooperation projects; however, its share in the overall financing of the waste management sector is still insignificant.

Table 5-2. Sources of capital investments in the waste management sector in Ukraine, 2013–2016

Source: Completed based on the data of the State Statistical Service of Ukraine

The financing of the MSW management sector is part of the financing of the waste management sector (about 20% of the overall actual financing of the waste sector in 2016). The largest part of the MSW sector's financing is from local budgets and other sources (which includes the financing by companies) (please refer to **Table 5-3**). The domination of the municipal budget financing is related to the fact that municipal companies account for a significant share of the Ukrainian market of MSW management services.

Table 5-3. Financing (investments) of MSW by main sources, 2013–2016



Source: The Ministry of Regional Development, Construction and Housing and Utility Services of Ukraine

Most of the funds allocated to MSW relate to the renewal of vehicles and containers (please see **Table 5-4**). Compared with the required amount of funds to update and further develop the sector, the actual spending is very limited and unrealistic for the plans.

Table 5-4 Financing (investments) of MSW by main directions of investments, 2013–2016

Source: The Ministry of Regional Development, Construction and Housing and Utility Services of Ukraine

The list of projects with the State Regional Development Fund (SRDF) financing can be found on the Minregion website[36]: Only one MSW project with the overall budget of about UAH 6 million (approximately € 200 thousand) has been implemented ('Innovative Model for Solid Waste Management in the Bashtanka City Council', Mykolaiv Region)[37]. Main part (84%) of the financing has been allocated from the SRDF, 15% has been provided from the local budget.

Besides the state and regional financing, partner funding can potentially be used for implementation of such projects. However, out of 47 implemented projects, only three involve partner funds. Moreover, this partner funding is anticipated in a very limited amount (less than 1% of the overall financing).

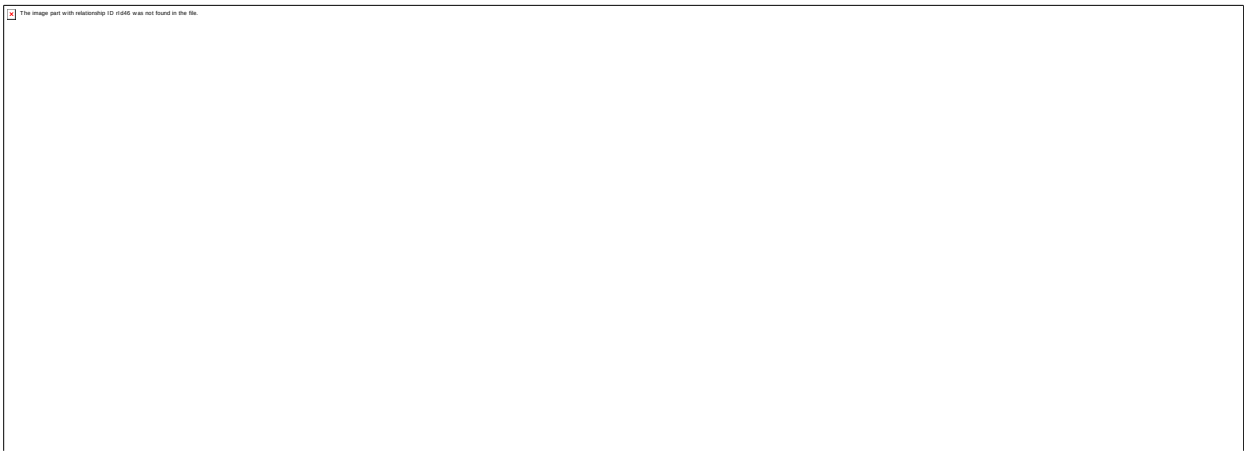
37 projects with 91% of the overall financing volume are registered in the database in 2018.

From the regional perspective, Poltavska Oblast is the absolute leader in assessed initiatives (70% of the overall financing), followed by Kharkivska,Odeska, Luhanska, Zakarpatska Oblasts. The mentioned projects can be classified according to their objectives in the following way:

- Elimination and reclamation of spontaneous landfills and garbage disposals;
- Introduction of efficient and advanced systems for collecting and processing of MSW;
- Construction and reconstruction of new landfills;
- Purchasing of machinery and equipment for MSW services.

36 http://dfrr.minregion.gov.ua/index.php?PGID=5&PN=1&PAREA=0&PDIST=0&PSTAT=0&PTHEM=30254&PCATE=&PYEAR=0&PYEAR_B=0&PYEAR_E=0&PZVIT=0&PROJTSFERA=30996&SELFGOV=0&PREIT=0&PSUMALL=0

Table 5-5. Overview of projects within SRDF and local budget financing, 2017–2018



Source: The Ministry of Regional Development

According to the Law of Ukraine 'On Public Procurement' No. 922-VIII dated December 25, 2015[38], the legal and economic principles for procurement of goods, works and services to meet the needs of the state and the territorial community were established. Examples of the recent tenders can be found on the Prozorro procurement page: https://prozorro.gov.ua/en/tender/UA-2018-02-19-002249-c. This Law shall not apply to cases where the subject of procurement is services/ goods procurement of financial institutions, including international financial organizations, in the provision of loans, guarantees, financial leasing and services auxiliary to financial services. According to Article 6 of the Law, if an international treaty of Ukraine the consent to which the Parliament of Ukraine has made binding, provides for a different procurement procedure – the provisions of the international agreement of Ukraine shall apply. Thus, procurement of goods, works and services for loans granted in accordance with international treaties of Ukraine by the **International Bank for Reconstruction and Development, the International Finance Corporation, the Multilateral Investment Guarantee Agency, the International Development Association, the European Bank for Reconstruction and Development, the European Investment Bank, the Nordic Investment Bank as well as other financial organizations**, or co-financed among projects realized with the loan financing in the framework of International Treaties, are carried out in accordance with the rules and procedures established by these organizations and, in case of the absence of such rules and procedures, in accordance with the Law. More detailed information about projects and initiatives of IFIs is described in the separate chapter (please refer to **Chapter 6** and **Annex 4**).

5.2 Scope of Required Financing for the Waste Management Sector and Priority Areas

There are no available integrative and stage-by-stage estimates of financing required for implementation of the recently adopted National Waste Management Strategy 2030 of Ukraine. A potential split of state and regional budgets and funds, as well as potential international donors' co-financing is not clear at the moment as well. Only various separate estimates of required financing, including those for the MSW management sector in Ukraine, are currently available, with some of them listed below:

1. The Minregion estimate dated 2012. It was estimated that the CAPEX necessary for development of MSW infrastructure is about UAH 160 billion (approximately € 14.8 billion[39]). The scope of infrastructure development did not take into account the EU requirements and included the following main items:
    - 30 MSW recovery facilities (UAH 120 billion or € 11.1 billion, 75%);
    - Reclamation of landfills (UAH 22 billion or € 2.0 billion, 13.8%);
    - 30 MBT facilities (UAH 12 billion or € 1.1 billion, 7.5%);

[38] http://zakon2.rada.gov.ua/laws/show/922-19

[39] https://www.slideshare.net/ECO-invest/ss-14634976

- Extension of MSW separate collection (UAH 1 billion or € 92.5 million, 0.6%);
- 60 MSW sorting lines (UAH 0.48 billion or € 44.4 million, 0.3%).

2. According to the IFC estimate[40] dated 2015, the CAPEX assessment was made for two scenarios (Business-as-usual scenario and an innovative scenario) of MSW sector development up to 2025 (see **Table 5-6**). The CAPEX required under the Business-as-usual scenario was €13.8 billion and under the Innovative scenario – € 14.4 billion. The CAPEX forecast included the following main items:

   - Modernization of the MSW collection, transportation and landfill disposal system;
   - Construction of new recycling facilities, excluding planned projects;
   - Construction of new disposal facilities.

Table 5-6. CAPEX assessment under the Business-as-usual scenario and innovative scenario of MSW sector development up to 2025 (IFC, 2015)

Main directions of investments	Scenarios by 2025	
	Business-as-usual scenario, billion euro	Innovative scenario, billion euro
Modernization of MSW collection, transportation and landfill disposal system	5,9/ 43%	5,1/ 35%
Construction of new recycling facilities, excluding planned projects	0,5/ 4%	4,3/ 30%
Construction of new disposal facilities	7,4/ 54%	5,1/ 35%
Total CAPEX	13,8	14.4
Recycling level, %	8	41
Per capita costs, euro per year	35,4	30.1

Open sources refer to the World Bank estimate that Ukraine needs 58 700 separation containers, building 45 waste recycling plants and purchasing 658 collection vehicles.

3. The estimate of CAPEX for implementation of the Directive 1999/31/EC and some provisions of the Directive 2008/98/EC made by the Institute of Environmental Economics and Sustainable Development in 2013[41]: the suggested CAPEX is at the level of € 3.1–4.2 billion. Later, these estimates were clarified in the EU technical assistance project 'Additional Support of the Ministry of Ecology and Natural Resources of Ukraine in the Implementation of Sectoral Budget Support'[42]; and the required financing was re-estimated at the level of € 5.3 billion. The detailed estimate of different components is presented in the Indicative Cost Assessment of the EU Directives Implementation in Ukraine[43].

4. Some estimates are part of regional strategic documents developed with the support of various technical assistance projects. *E.g.* a Strategy for Zakarpatska Oblast developed in 2011 required the financing of about UAH 1.2 billion for the 14-year period for the regional Strategy implementation[44].

5. The recent study by the German ReTech Partnership[45] identified a backlog in the sorting sector and in the number of mechanical and biological treatment facilities and recommends the best business opportunities in sanitation and reconstruction of existing landfills, in capturing landfill gas and its utilization for energy as well as in the construction of new modern and sanitary deposit sites.

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[40] Municipal Solid Waste in Ukraine: Development Potential. Scenarios for Developing the Municipal Solid Waste Management Sector http://www.ifc.org/wps/wcm/connect/region__ext_content/ifc_external_corporate_site/europe+and+central+asia/resources/municipal+solid+waste+in+ukraine+development+potential+scenarios+for+developing+the+municipal+solid+waste+management+sector

[41] Інституціональний розвиток сфери поводження з відходами в Україні: на шляху європейської інтеграції / В.С. Міщенко, Ю.М. Маковецька, Т.Л. Омельяненко. – К.: ДУ "Інститут економіки природокористування та сталого розвитку НАН України», 2013. – 192с

[42] http://ecos.kiev.ua/share/upload/mono_29.pdf

[43] http://old.menr.gov.ua/adaptation/3133-natsionalna-stratehiia-nablyzhennia-aproksymatsiia-zakonodavstva-ukrainy-do-prava-yes-v-haluzi-okhorony-dovkillia

[44] http://ekosphera.org/faily/dokumenty-faily/stratehiia-povodzhennia-z-vidkhodamy-u-zakarpatskii-oblasti-na-15richnyi-period/

[45] 'Länderprofil zur Kreislauf- und Wasserwirtschaft in der Ukraine, 2017': http://www.germanwaterpartnership.de/fileadmin/pdfs/gwp_materialien/Laenderprofile/170510_Laenderprofil_Ukraine_Gesamt_Final.compressed.pdf

6. The most recent and precise expert estimates of the required financing were presented in the EBRD Project 'Supporting Investments in Sustainable Municipal Solid Waste Management and Recycling in Ukraine'[46]. According to those estimates, the indicative overall CAPEX figure for the measures anticipated in the proposed draft Strategy for the 13-year implementation period is approximately € 2.8 billion, including:

   - Extension of the coverage of organized MSW collection services;
   - Construction of a network of transfer stations;
   - Establishment of centers for 'second hand' goods and products;
   - Extension of MSW separate collection scope (*i.e.* primary source separation of 'dry' recyclables);
   - Construction of waste sorting lines;
   - Construction of waste collection/ reception centers;
   - Home composting units for use in individual households in suburban areas of cities and towns and in rural areas;
   - Construction of state-of-the-art landfill facilities in full compliance with the Directive 1999/31/EC;
   - Rehabilitation and closure of existing landfills/dumpsites in Ukraine.

In particular, the estimates of CAPEX[47] envisaged the following:

- In the recent EBRD study devoted to the MSW Strategy and its implementation, it is proposed to leave existing points for collection of recyclables and, in the mid-term, open additional waste reception/ collection centers for 'recyclables', which in the long-term would result in 250–270 of such centers. The estimated CAPEX is approximately € 150 000 per center, *i.e.* up to € 7.5 million overall in the mid-term and € 30 million in the long-term.
- The estimates of the required number of transfer stations with an annual capacity of about 25 000 tons result in the total CAPEX of about € 183 million in the long-term.
- 31% of the population in Ukraine is rural and 69% is urban. With the high efficiency of use and the overall coverage of 28% of the rural population and 10% of the urban population in Ukraine, home composting could achieve an overall reduction of about 2.3% of the total MSW stream by 2030. This level of coverage would require a total cost of approximately €105 million.
- On a per-input-ton basis, composting costs range from € 2.35 to € 6.85 per ton handled. Assumed is the average cost of € 4.5 per ton. Based on the assumptions of the coverage of 271 reception/ collection centers in Ukraine, where green waste composting sites could be co-located, and based on the collection of 160 tons of green waste per site per year, the annual cost of green waste composting would reach about € 200 000.
- Taking the investment cost of € 150 per ton (*i.e.* a mid-figure for bio-stabilization), the total investment required for treatment facilities for wet material suitable for bio-stabilization would be approximately € 0.5 billion for Ukraine. The annual operation and maintenance costs (not including capital replacement costs) would be approximately € 87.5 million. The level of the required costs is considered to be unaffordable for Ukraine in the current economic situation.
- For anaerobic digestion in large vessels, the CAPEX is even higher, 200–400 €/ ton. This technology is mainly used in the farming sector for manure processing.
- The capital expenditures on a landfill gas extraction installation are connected to the cost of an energy-generating unit and can vary from 1.2 to 3 thousand euros per kilowatt.

[46] http://publications.chamber.ua/2017/F_B/National%20Solid%20Domestic%20Waste%20Strategy%20Ukraine%20March%202017.pdf
[47] The CAPEX data are taken from the document 'Supporting Investments in sustainable municipal management and recycling in Ukraine', Draft MSW Strategy, developed by the order of EBRD, March 2017.

6 Initiatives/ Projects of IFI and International Donors in the Waste Management Sector and Their Procurement Opportunities/ Requirements

The overview of initiatives/ projects of IFIs and international donors in the Waste Management Sector of Ukraine and their procurement opportunities/ requirements are given in **Annex 4** and **Annex 4a**. The short summary is presented below. **Annex 4** also addresses some recent memoranda of cooperation between foreign and Ukrainian governments and IFIs/ donors in the sphere of waste management.

Ukraine has access to and benefits from support of various international donors and financial institutions which provide financing for initiatives of different stakeholders in the waste management sector: governmental and private, centralized and regional municipal authorities, R&D and NGO/ CSO.

Among internationally financed projects registered by the Ministry of Economic Development and Trade of Ukraine, the major part of waste management projects relate to management of radioactive waste. However, as the focus of this study is on MSW, radioactive waste treatment projects are beyond the research's scope and are not discussed here.

International donors and IFIs focus on institutional and legislative framework development in the waste management sector, including support for alignment of the national legislation with the EU requirements and best practice benchmarking. Another interesting aspect concerns the EU as the most active donor of local waste management projects in Ukraine.

There have been dozens of MSW management project initiatives since 2009; some projects are still in progress or have been recently launched to capitalize on the opportunities opened by the recently adopted National Waste Management Strategy 2030. The international community also actively supports addressing the most urgent and critical issues of waste management such as the waste collection and treatment emergency in Lviv City and Lvivska Oblast, waste issues in Kyiv City and Kyivska Oblast, wastewater and sewage management, *etc.*

To address the critical ecological challenges as well as to integrate the country into the global community, Ukraine actively cooperates with international organizations in environmental protection. *E.g.* the activity of the Minecology under multilateral agreements with international organizations enables attracting financial resources to address urgent domestic ecological issues, such as protection of biological diversity, cross-boundary water flows and international lakes, greenhouse gas emissions reduction, protection of atmosphere air, waste management and environmental impact assessment. International cooperation of the Minecology includes joint initiatives with the following international institutions and funds: the UN agencies (UNEP, UNIDO, UNDP, UNESCO, and OSCE), NATO, WTO, EBRD, World Bank Group, EIB, EEA, and GEF. International donors also finance implementation of reforms via funding so-called Reform Support Teams (RST) on the platform of some ministries including the Minecology and the Minregion. RST activities include drafting legislation and project proposals for the waste management area.

The EU is the largest donor and co-financing party for Ukraine. Usually, waste management issues are components of broader topics of environmental safety and sustainability, reforms and Association Agreement implementation, regional development as well as implementation of innovative technologies. Recent initiatives of the EU Delegation in Ukraine include coordination of international donor financing for development of the Regional Waste Management Plans. According to the Summary of the Single Support Framework for the EU Support for Ukraine (2018–2020), waste management is a part of the priority group 'Connectivity, energy efficiency, environment and climate change' (indicative 15% of the allocated funding), the specific objective being 'Reduced waste (promotion of circular economy), better control of emissions, improved biodiversity and nature protection'.

The EBRD as one of the leading IFIs in Ukraine has multiple projects that relate to waste management, with the most recent initiatives in this sphere supporting development of the MSW Strategy of Ukraine and investments in sustainable MSW management and recycling. The EBRD currently supports implementation of the Lviv Solid Waste Project and co-finances work of RSTs at the Minecology and the Minregion.

In addition to the above-mentioned projects, waste management is an important component of the Environmental Impact Assessment (EIA) of projects and, subsequently, of their Environmental Action Plans (EAP) as well as Resource Efficiency Assessments which are the condition of the issuance of loans or the EBRD's any other financial instruments. In the waste management section of the EIA and the EAP, the EBRD includes management of all types of waste, however, highlighting those related to the specific project. Thus, EBRD financing includes projects managing construction waste, waste coal, radioactive waste, agri-waste and defines the rules how to treat them specifically for each project. Observed is the trend of managing agri-waste by the construction of biogas plants. However, in some cases there is a vague division between solid waste and agri-waste management, and wastewater treatment measures in this sector. Other EBRD projects support industrial waste recycling businesses and wastewater biogas initiatives.

The EBRD recently (in November 2017) updated its Procurement Policies and Rules It is recommended familiarizing oneself with this document when approaching the procurement selection process for project, corporate and consultancy services.

The World Bank Group institutions active in Ukraine include the International Bank for Reconstruction and Development (IBRD) and the International Finance Corporation (IFC). The **IBRD** activity in the field of waste management has been quite unsuccessful. Since 1990s, several projects have been initiated and dropped. However, currently a new large project 'Second Urban Infrastructure Project' in regard to the financing of waste management initiatives has been active. Although the project will end in 2020, at least one waste management subproject in Kharkiv seems to be promising in terms of creating new waste management capacities. The most recent bid (on procurement of vehicles and containers for solid waste) was open on February 8, 2018.

As part of the Ukraine Resource Efficiency Program, in 2012 and 2015, **IFC** issued the reports on the MSW sector in Ukraine and wrote the scenarios of development of the MSW Sector, which are one of the main reference documents recognized within recent IFI studies covering analysis of the current situation in MSW management, assessment of the potential of the Ukrainian MSW sector, changes needed to ensure innovative advancement, waste management technologies and methods, requirements under the EU-Ukraine Association Agreement. The latest study was co-sponsored by the Ministry of Economy of Freistaat Sachsen, the Ministry of Economic Affairs (NL Agency), the Ministry of Foreign Affairs of Finland.

Cooperating with the private sector, IFC offers investment and advisory services and has recently concentrated its efforts in Ukraine on providing services to the agricultural sector. Similar to EBRD projects, in order to get access to IFC loans, IFC projects have to correspond to environmental and social requirements, among which are conditions of sustainable waste management. IFC clients should develop an environmental action plan to tackle the environmental issues defined by IFC and be resource efficient. Thus, waste management is one of the topics addressed in the IFC policies. There are several agricultural projects which include biomass use that can relate to waste management approaches.

Part of the World Bank Group, IFC applies the World Bank Group's vendor guidelines to procurement. However, procurement announcements for goods and consultancy services for IFC projects are made in a separate official source. Additionally, there is the World Bank Group's website named eConsultant2 for selection of operational consultants. A company needs to register in the system in order to get access to the data, set relevant notifications and participate in proposed expressions of interest.

Focus of the **EIB**'s activity with Ukrainian companies and organizations is on support of development of SMEs through work via intermediaries which are primarily state banks but also include several commercial banks. Similar to other IFIs mentioned above, the EIB has environmental requirements to projects that the Bank will finance. Therefore, waste management approaches should be defined and implemented by host agricultural and industrial companies. Additionally, to support the private sector in Ukraine, in 2015 the EIB signed an agreement on providing a loan to the Minregion to implement up to 40 municipal infrastructure projects in Ukraine worth about 400 million euro in total. Improvement of waste management services is included in this initiative.

Each submitted project proposal goes through financial, economic, social, environmental, and technical assessment to ensure the project feasibility. The EIB has a system of environmental and social principles and standards which all projects must abide by. Usually, a project appraisal is carried out by the EIB's teams of engineers, economists and financial analysts. Each project is assessed individually while being verified against the eligibility criteria (whether it corresponds to the EU's priority objectives) and overall quality and soundness. The Bank does not keep an official list of consultants and suppliers. All calls for tenders on EIB projects are published in the Official Journal of the European Union (this condition is mandatory for all non-EU projects).

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH acts on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ) or as an EU implementing agency. Recent activities of GIZ include cooperation with the national and international private sector with regard to training, knowledge transfer, networking and strategy development including those in MSW. According to the Memorandum of Cooperation, GIZ together with the EBRD, the Minregion and the Ministry of Economic Development and Trade of Ukraine provided support for development of the National Waste Management Strategy of Ukraine until 2030. There are also projects enabling development of local MSW strategies, practical insight into German advanced practices of MSW management and strengthening intermunicipal cooperation.

GIZ involves private companies for consultancy purposes and international and national companies for procurement of technical equipment and materials. The organization has adopted General Purchase Conditions. Also, GIZ divides tenders by materials and services and whether they are above or below the EU threshold. GIZ tends to organize local invitations to tenders, with requests issued by GIZ offices outside Germany and in this case suggests contacting the local offices directly.

DESPRO is a Swiss-Ukrainian Project 'Decentralization Support in Ukraine' funded by the Swiss Confederation through the Swiss Cooperation Office (SDC) and implemented by the Swiss Center for Resource and Consultation on Development (Skat). The DESPRO project has been supporting pilot MSW management projects in some regions of Ukraine providing expert, information and technical support (the morphological study project model included separate waste collection, composting of green waste, construction of new landfills and disposal of leftover waste, closing and reclamation of local existing landfills).

The goal of cooperation between the **Swedish Environment Protection Agency (Naturvårdsverket -- SEPA)** and the Minecology was to promote efficient environmental protection in Ukraine with the special emphasis on alignment with the EU's legal framework and international conventions; contribute to the improvement of the Ukraine authorities' capacity to develop and implement environmental legislation and regulations in accordance with the EU's legal framework and international conventions in 2010–2013. SEPA prepared and approved with the **Swedish International Development Cooperation Agency (Sida)** six separate projects for SEK 25 million.

The Sida Procurement Guidelines (SPG) are a set of rules that Sida applies to contracts with international cooperation partners. The SPG rules are based on the World Bank's recommended regulations, however they also reflect the EU directives and guidelines related to procurements as well as the recommendations established by the OECD body – the Development Assistance Committee (DAC). Sida procurements should correspond to Sida's guidelines on ecological sustainability and the general Sida Procurement Guidelines. All Sida procurements are advertised on Kommers Annons where registered users may express their interest in a procurement, download attachments, submit questions and read about planned, ongoing and completed procurements. All of Sida's procurements are governed by the Public Procurement Act (LOU), with the exception of procurements carried out in accordance with other international regulations (LOU Chapter 3, § 7-9). For Sida, these other cases usually apply to cooperation procurements, which are governed by the Sida Procurement Guidelines or other international procurement regulations. Further information about procurements and the Public Procurement Act may be found on the website of the National Agency for Public Procurement.

NEFCO finances environmental projects in Ukraine, including waste management projects. Nevertheless, its main focus is on wastewater treatment projects, especially those that relate to the Baltic Sea basin, such as the project in Lviv City aimed at construction of a biogas unit for sludge digestion. Apart from that, NEFCO financed several biomass-based projects for agri-business enterprises of Ukraine.

All projects financed by NEFCO follow procurement procedures for suppliers, contractors and consultants in relation to goods, works and services. The latest version of the NEFCO Procurement Guidelines was adopted by the Board of Directors of NEFCO on December 12, 2013.

In 2013, **USAID** launched the Public Private Partnership (PPP) Development Program which provided assistance to the Government of Ukraine in improving the legal environment for PPPs, increasing the capacity of authorities to develop and manage PPPs, and provided assistance in all stages of preparation and implementation of PPP pilot projects. USAID Missions' typical approach includes development of an overarching Country Development Cooperation Strategy (CDCS) with substantial input from partner governments, industry, civil society, and development partners to understand challenges and resources available. Based on this document, USAID then designs projects and activities to create an acquisition and assistance plan.

UNDP's 'Development and Commercialization of Bioenergy Technologies in the Municipal Sector in Ukraine' project started in April 2004 and has been carried out in cooperation with local councils, governmental committees, the Minregion as well as with Ukrainian universities. The main goal of the project is to build up the capacity of local communities to participate in the decision-making process and work together to strengthen the local socio-economic and environmental governance to achieve sustainable development. The project is funded by the Swiss Agency for Development and Cooperation and the Embassy of the Kingdom of Norway. UNDP procurement notices can be found on the dedicated website (see details in **Annex 4**).

UNEP's 'Strengthening the Implementation of the Rotterdam Convention in Ukraine and the Creation of Capacities to Combat Illicit Trafficking in Chemicals' was launched in 2017. The project's specific objectives are to develop and enforce a viable national policy on the prior informed consent (PIC) and information exchange in the frame of the Rotterdam Convention, to develop and enforce a national framework to detect and prevent illegal trafficking of pesticides, with the focus on pesticides subject to the provisions of the Rotterdam Convention and pesticides for fumigation. UNEP tendering opportunities can be found on the dedicated website (see details in **Annex 4**).

The Japan International Cooperation Agency (**JICA**) is the Japanese state development bank providing loans, grants, and training programs for countries around the world. Out of the $3.1 billion that Japan has invested in Ukraine, around $1.69 billion has come in the form of long-term loan agreements. The country extended a $1.1 billion loan to modernize the Bortnychi sewage plant in a bid to improve Kyiv's disposal of waste (the project for the reconstruction of Bortnychi aeration station with Eastern Europe's largest loan in the utilities sector in and unique financial conditions). At the end of 2017, JICA opened its regional office in Ukraine. A number of important projects are being implemented in such areas as development of port and road infrastructure, bridge construction and household waste management. Ukraine raised a discussion on the possibility of introducing large-scale infrastructure innovation projects in Kyiv, Dnipro and Kharkiv.

Employment of consultants and procurement of products and services under projects financed with Japanese Grants from JICA are carried out in accordance with the general principles and procedures laid down in the Procurement Guidelines. The borrowers of Japanese ODA Loans are responsible for carrying out the procedure, and in principle, International Competitive Bidding is applied. JICA sets Standard Bidding Documents for various types of goods and services for smooth implementation of these procedures. Information on Japanese international agreements and their procurement needs pre-assessment is presented on the JICA website and is regularly updated.

7 SWOT Analysis of the Waste Management Sector in Ukraine

Table 7-1. SWOT analysis of the Waste Management Sector in Ukraine (in the context of international cooperation)

Strengths	• The market is large in terms of short-, mid-and long-term development and investment needs in all waste streams including MSW • Recently approved National Waste Management Strategy 2030 with clear strategic targets for short-, mid- and long-term waste infrastructure development • Fixed Ukrainian government commitment regarding alignment of the local waste legislation with requirements of the Association agreement with the EU • Continuous support to the institutional and business environment's development from international financial institutions, donors and foreign governments including development of strategic and legislative documents, elaboration of new ways of working, funding of reformation groups, pilot initiatives at the regional, municipal, public and NGO levels
Weaknesses	• Low enforcement of legislative and normative requirements, historically low and inefficient penalties, limited responsibility of companies, consumers, producers (no EPR) and competent authorities for their agreements and fulfilling obligations on waste services for the population and companies • Low affordability of tariffs for the population is a political issue, with low tariffs on waste services ruining the economic base of the market's functioning and the implementation of innovative investments at all stages of the value chain • A significant unofficial sector: 60% of MSW is used in the shadow economy and only 10% is under control • Insufficient financing from the state and private sources, IFIs; lack of PPP; absence of incentives; imperfect mechanism of state guarantees for regional borrowing • Lack of intermunicipal cooperation, which limits investment implementation, decreases financing attractiveness and affects quality of services • Undeveloped infrastructure monopolized by municipal companies; the imperfect tender procedure for waste management services • An insufficient amount, an unstable inflow and poor quality of materials for recycling due to the low level of separate waste collection • Lack of reliable statistical data and reporting systems at all levels • Absence of effective programs and lack of campaigns aimed at environmental education and waste management awareness
Opportunities	• Technical assistance (TA) and private investment project opportunities related to the Ukrainian vector toward the association with the EU and the implementation of the recently adopted National Waste Management Strategy until 2030: ▪ TA in implementation of the EU Directives, IPPC introduction ▪ TA in elaboration of proposals on improvement of the institutional structure of waste management on an innovative basis, including: o A central government executive body for waste management; o A single center for implementation of international requirements (Basel, Rotterdam, Stockholm, Minamata) o Interministerial coordination councils and working groups, as well as municipal working groups for elaboration and implementation of local waste management plans o An interministerial coordination council on the platform of the National Academy of Sciences for R&D of multi-use of natural resources, processing and utilization of waste ▪ TA in support to drafting legislative and normative documents: o Drafting laws of the 'waste management package': a draft Law on Landfilling of Waste, a draft Law on Incineration of Waste, a draft Law on Management of Waste from Extractive Industries o Development of necessary technical regulations for waste management, including BREFs on incineration, other BREFs related to waste management o Improvement of the regulatory and legal framework for organization of separate collection of all waste and its recycling and recovery o Drafting regulations, requirements and a certification system for compost or compost-like output (CLO) products o Development of a model draft of an educational plan of re-use of natural resources, waste recycling and disposal focused on the introduction of qualitative changes in this

	area and study of the possibility of its use at higher educational institutions that train professionals in environmental safety and life safety o Conducting scientific research to determine the need for professionals in environmental safety and life safety by 2030 o Development of an action plan for carrying out a nationwide campaign on waste management (re-use of natural resources as well as recycling and disposal of waste) ▪ Pilot/ demonstration projects on a regional level on: o Development/ implementation support/ monitoring of the Regional Plans for Waste Management o Exchange of experience of successful intermunicipal cooperation o Consulting/ support in preparation of (bankable) applications for funds from financial institutions o Introduction of the system to define the MSW composition o Step-by-step introduction of the system for separate collection and sorting lines/ treatment for green or bio-waste o Advisory on making the informal sector, separate collection and points for secondary raw materials procurement transparent; transformation of existing waste collection points into Reception/ Collection Centers o Consultancy on development of the feasibility study for an incineration plant/ investment project and complete project cycle services and supply for incineration plant projects o Consultancy and investment in new regional landfills planned to be constructed according to the National Waste Management Strategy 2030 o Modernization of the biggest landfills (with the capacity over 50 000 tpa), remediation of old dumpsites ▪ Equipment/ technologies opportunities: o New or second-life balers and transport vehicles o Vehicles for glass and other recyclables collection o Introduction of optical sorting systems o Construction of big capacity sorting lines o Turners and all necessary equipment for composting o Turn-key technological solutions for specific waste collecting points with specific waste streams and specific morphology o Innovative techniques for extraction of gas from landfills (allowing faster gas extraction) o Lining and capping for landfill arrangement
Threats	• Controversial lobby in the Parliament and risks of substantial changes in draft laws at the stage of governmental approval and the final stage prior to adoption; low level of coordination between executive and Parliament decision makers • Inconsistent actions of governmental authorities at national and regional levels in terms of implementation of the National Waste Management Strategy; uncertainties related to the coming 2019 elections and corresponding changes in all Parliament and governmental structures • Insufficient commitment and slow progress in adaptation of the Association Agreement requirements

8 Modern Waste Management Technologies and Their Applicability to the Ukrainian Market. Capabilities and Opportunities – Dutch Stakeholders

8.1 Capabilities of Dutch Stakeholders in Waste Management

Waste management is one of the areas where the Netherlands is recognized as the world leader and the provider of best available and innovative techniques as well as advanced governance and policies. In the late 1980s, the Netherlands suffered from a lack of landfill capacity to serve waste flows. In the 1990s, the country made a transition from its small-scale, inefficient and regionally organized activities toward the professional, internationally oriented and increasingly innovative sector. According to the European Environmental bureau[48], in 2016, the Netherlands held the sixth place in the world in waste recycling, with the recycling rate of 57%.

Figure 8-1. Top 25 MSW recyclers (data by the European Environmental bureau)

The Dutch Government's policy 'from waste to resources' strives to eliminate landfilling of waste and give the private sector confidence to invest in more sustainable solutions. Elements of the policy include:

- The order of preference
- Strict waste treatment standards
- Cooperative approach
- EPR
- Various instruments to promote waste prevention and recycling.

Based on the available information from open sources, capabilities of Dutch companies and other stakeholders in the field of waste management cover the complete value chain and can be summarized with some examples of market players as follows:

[48] https://eeb.org

Table 8-1. Capabilities of Dutch companies and other stakeholders in the field of waste management

Chain element/ waste streams	Some identified Dutch stakeholders	Area of expertise/ main capabilities
Waste management (institutional)	• Ministry of Infrastructure and Water Management of the Kingdom of the Netherlands • RVO (Dutch government service for enterprises) • Netherlands Environmental Assessment Agency • (VNO-NCW) Confederation of Netherlands Industry and Employers • NVRD • Union of Netherlands municipalities VNG	• Overall coordination of activities of Dutch stakeholders • Regulatory and policy framework • Intermunicipal cooperation
Financial incentives	• Sulo • WSS • Bammens	• Systems for volume-based waste fees
Waste collection	• VDL Translift • Geesinknorba • Royal Dutch Bammens	• Supply of **underground containers** for recyclables such as paper, glass and plastics as well as residual waste
	• DAR • ROVA	• **High frequency waste collection systems** • **Small to medium waste collection systems**
Waste sorting	• VDL Translift • Geesinknorba • Royal Dutch Bammens • Omrim • Wieland Textiles	• **Separation techniques** to purify, sort and separate different waste streams (from E-waste to residual and C&DW and textile)
Organic waste	• De Neerlanden Holding	• **Organic waste processing**
Waste composting and anaerobic digestion (modern high performing in vessel composting facilities)	• Attero • Christiaens Group • Gicom Composting Systems • Orgaworld • Vandenbroek International • Van Kaathoven Group • VAR • Waste Treatment Technologies • Dorset Green Machines	• Supply of equipment and technology for **composting** (bio- stabilization) • Waste heat to dry biomass
	• Maris • VAR • HoSt • Nijhuis Water Technology • Oosterhof-Holman • BBE Biogas • Colsen • Frames Renewable Energy Solutions • Biogas Plus	• Supply of equipment and technology for **anaerobic digestion**
Solid recovered fuel (SRF)	• Bakker Magnetics • Boa Recycling Equipment • Banzo • Bollegraaf-Lubo • Europe Recycling Equipment, • Goudsmit • Machinefabriek Emmen • Nihot • N.M. Heilig,	• Supply of equipment and technology for **SRF production**

Chain element/ waste streams	Some identified Dutch stakeholders	Area of expertise/ main capabilities
	• Redox, • DB-Technologies and Waste Treatment Technologies	
Closed system of digestion to generate electricity or converted to LNG/ CNG	• Orgaworld • Maris • VAR • Host • Nijhuis Water Technology • Oosterhof • Holman • BBE Biogas • Colsen • Frames Renewable Energy Solutions • Biogas Plus	• Wet and dry anaerobic digestion of MSW • Source separated organics • Food waste • Manure
Incineration	• AEB • AVR	• Waste incineration and generation of electricity, heat and steam (including district heating) *Until MBT is widely spread in Ukraine, incineration can be considered a long-term feasible opportunity*
Landfill gas extraction	• Hofstetter • Multriwell • van der Wiel • GreenGas	• Innovative techniques for **extraction of gas from landfills** (allowing faster gas extraction)
Landfilling/ disposal	• Trisoplast Mineral Liners	• **Lining and capping**
Landfill remediation	• Afvalzorg • Attero	• Technology for **remediation of old dumpsites**
Specific waste streams	• ARN	• End-of-life **vehicles and car part recycling**
	• Wecyle • Stibat • Sims Recycling	• **E-waste, batteries**
	• Nedvang • SUEZ Recycling and Recovery Netherlands • Van Werven	• **Collection/ recycling of packaging waste** (including plastics)
	• Afvalstoften • Terminal Moerljik • RECO • Remondis • Argentia	• **Hazardous waste**
Consultancy	• Arcadis • Bilfinger Tebodin • DHV • Royal Haskoning • Tauw • W+B	• TA and IFI projects • Identification, due diligence, feasibility studies • EPCm • Market studies and potential assessment

8.2 Modern WM Technologies and Their Applicability to the Ukrainian Market. Opportunities for Dutch Companies and Other Stakeholders in Implementation of the National Waste Management Strategy 2030 for Ukraine

In developed economies, one can witness a move toward what is referred to as 'integrated solid waste management (ISWM)'. This involves an uplift in the waste 'hierarchy' away from sole reliance on a landfill (*i.e.* the 'least preferred option') and toward recycling, re-use and prevention (*i.e.* the 'most preferred options'). The description of the main recovery technologies for MSW management appropriate for Ukraine, in line with the 'National Waste Management Strategy up to 2030' is given in **Annex 5**. The current waste management value chain and that envisaged by the National Waste Management Strategy 2030 in Ukraine are described in **Figure 8-2** below.

Figure 8-2. Current waste management value chain and that envisaged by the National Strategy 2030 in Ukraine

Waste management technologies and equipment received the green light under the National Waste Management Strategy are as follows:

MSW

- Separate collection of 'dry' resource-intensive components and relevant collection containers, vehicles, facilities for separate acceptance of the following waste: recyclables/ secondary materials, hazardous as part of MSW, bulk (*e.g.* furniture), WEEE, batteries/ accumulators, park and garden bio-waste, C&DW
- Applications to reach the recycling target of 50% by 2030: waste sorting lines, specialized MSW collection points, waste recycling centers
- Regional points for re-use/ second-hand
- Pilot project facilities for production of fuel from domestic waste on the basis of objects of MBT, equipment for MBT processing (conveyors, elevators, cabins for manual sorting, trommel screens, disc screens, shakers, bag opening devices, electromagnetic separators, eddy current separators, ballistic separators, air splitters and near infrared (NIR) separators, shredders, compactors, *etc.*),
- Techniques to minimize and utilize bio-waste, home composting units for rural areas and suburbs, enclosed tunnel systems, anaerobic treatment systems
- State-of-the-art regional landfill facilities/ polygons for MSW disposal (clusters to cover a population of 400 000) with a minimum capacity 50 000 tpa (optimal – 100 0000 tpa) per 150 000 people
- MSW transit/ reloading stations connected to regional landfill facilities/ polygons
- Incineration technologies compliant with the EU requirements.

Table 8-2. Mid- and long-term goals of MSW sector strategy until 2030 per chain element

Chain element	Mid-, long-term goals of MSW sector Strategy until 2030
Collection & Transportation	• Increase of coverage of population with MSW services to 84% • Establishment of up to 250 waste collecting points, intermunicipal waste transfer stations • Increase of the number of settlements with separated waste collection up to 5 000 to cover 50% of population (15% recycling rate) • Establishment of 250 waste collection centers for repair and re-use (mainly for WEEE), increase volumes of MSW sent for re-use to 10% • The network of up to 20 centers for the introduction of cleaner production (technology). Decrease volumes of using primary raw materials from 90% to 70% • Introduction of EPR

Chain element	Mid-, long-term goals of MSW sector Strategy until 2030
Sorting	• Use of more 'Dry' sorting lines and automation/ sophisticated technologies as main waste treatment technique
Waste Processing and Recycling	• Increase of the share of waste for processing up to 20%, the share of waste for recycling up to 50% • Increase of the number of waste processing facilities up to 800
Composting	• Construction of MBT plants • Home composting installations • Aerobic composting facilities • Up to 500 facilities
Solid Recovered Fuel (SRF)	• Depending on demand from WTE and cement plants
Incineration	• Increase of the share of waste for incineration up to 10% • Increase of the number of incineration facilities up to 20
Landfill Gas Extraction	• Innovative and efficient technologies depending on the 'green tariff'
Landfilling/ Disposal	• Decrease of the share of waste for landfilling to 35%, the share of MSW for landfilling to 30% • Decrease of the number of landfills to 300; closing / rehabilitation of existing landfills • The number of regional landfills, according to the EU requirements, is 50

At this, the following considerations are to be accounted for:

- *In Ukraine, a quite wide range of equipment for waste collection and processing is produced locally: containers, conveyors, trommel screens, simple sorting lines. Therefore, it will be difficult for Dutch manufacturers to compete with Ukrainian producers in supply of basic equipment. However, some equipment, such as press, is now imported. In the process of implementing the National Waste Management Strategy 2030 in Ukraine, considering its declared innovative vector, there will inevitably be a need for more sophisticated equipment/ technology, which at the current stage of waste management in Ukraine is not demanded: e.g., sensor-based technology.*
- *Considering the high deterioration level of MSW collecting vehicles, there is a high demand for vehicles and containers; however considering limited available financing and the initial stage of development of MSW services and infrastructure, the preference is for local containers and imported second-life/ modified basic vehicles.*
- *Under the proposition of technological and logistical solutions, it should be considered that the MSW generation structure in Ukraine is similar to that of Eastern European countries (Poland, Czech Republic, Slovakia, Baltic States, etc.) and that the organic fraction in Ukraine is greater than that in other European countries, while the shares of glass and plastic are relatively low.*
- *The recent communication 'The Role of Waste-to-Energy in the Circular Economy' by the EU influences decisions of financing institutions and investors with regard to waste incineration projects. However, the National Waste Management Strategy still anticipates up to 20 incineration facilities to be developed until 2030.*

As to the other waste subsectors, the following priority technological directions are envisaged by the National Waste Management Strategy 2030:

Industrial Waste

- Industrial waste recycling and use (*e.g.* application in construction and transport infrastructure development)
- Clean production technologies
- Defining the Best Available Techniques (BATs) for secondary use, processing and utilization of industrial waste
- Techniques for environmentally safe disposal of industrial waste at equipped polygons using the centralized regional model
- Remediation techniques for abandoned industrial sites and waste disposal locations

C&DW

- Separate collection and storage of C&DW at construction sites, separate collection of C&DW as part of MSW
- Recycling and processing of C&D waste, production of materials from recycled C&DW with high quality characteristics

- Selective demolition techniques
- Centralized facilities for the C&DW recycling equipped with crushing equipment with a capacity of about 200 000 – 500 000 tpa
- Regional facilities for receiving and storing C&DW with intermediate sorting and milling with mobile crushing and sorting plants with a capacity of 100 000 – 200 000 tpa
- Mobile crushing plants

Agricultural Waste

- Equipment and technologies for collection, storage and transportation, processing, utilization and disposal of agri-industrial waste including:
    - Use of biomass of agricultural waste for energy production, combined heat and power generation processes using exclusively waste products of vegetable origin as raw materials
    - Composting techniques
    - Anaerobic technologies
    - Techniques for use of waste for feed production
    - Regional production of paper and materials from agri-industrial waste of vegetable origin
    - Regional environmentally safe processing facilities for agricultural waste of animal origin
    - Facilities, including mobile combustion plants, for emergency situations associated with infectious diseases
    - Storages and processing for animal excrements
    - Techniques for introduction of animal excrement into soil
- Handling of agrochemical waste

Hazardous Waste

- Separate collection and transportation of hazardous waste
- Centralized facilities for handling and processing of hazardous waste
- Modification of cement kilns for use of fuels derived from hazardous waste
- Arrangement of places for disposal of hazardous waste
- Techniques for safe closure and further maintenance of hazardous waste disposal sites

WEEE/ Batteries/ Accumulators

- Separate collection of WEEE, batteries/ accumulators from population
- Collecting points of producers
- Regional centers for re-use and utilization

Healthcare Waste

- Separate collection (similar to MSW, infectious waste, sharp waste) and pharmaceutical waste collection with its identification (with packaging)
- Safe temporary healthcare waste storage and processing at the place of generation (equipped facilities, storage boxes, processing units) and transportation techniques
- Complex national network for healthcare waste treatment (initial processing facilities and high-temperature incineration)

In addition to the above specified technologies and hardware part, currently there is a diversified need in TA and consultancy services:

- Support to task teams at local executive governmental authorities, local self-government authorities to elaborate the Regional Waste Management Plans and implement the requirements of the National Waste Management Plans
- Development of draft proposals for laws and normative/ guidelines documents on waste, specifically on landfilling of waste, incineration of waste, waste from extractive industries
- Advice on improvement of intermunicipal cooperation in regard to waste management
- Introduction of the classification of different types of waste according to the EU standards; the labeling system for separate collection
- Development of technical requirements, BATs, guidelines for waste management meeting EU standards, including, but not limited to:

  - hazardous waste and operations with hazardous waste
  - handling and processing of agricultural waste; use of agri-industrial waste products and soil quality control, veterinary and sanitary requirements to the use of animal by-products
  - secondary materials from waste, quality of materials from waste (*e.g.* C&DW and compost)
  - technological instructions on storage of industrial, C&DW, agri-industrial and hazardous waste, agrochemicals
  - development of C&DW waste management plans as part of the design documentation
  - use of alternative fuels
- Studies on availability and composition, adequacy of infrastructure and services for collection, storage and transportation, processing and disposal of waste; definition of available potential for re-use/ recycling/ processing
- Inventory of abandoned industrial sites and waste disposal locations, hazardous waste storages to assess risks and rehabilitation measures; inventory and assessment of risks of existing landfills and measures for compliance/ closure
- Waste accounting and monitoring systems, electronic online reporting by entities; registration of waste sources (by entities), storage, providers of collecting and transporting services; improvement of licensing procedures
- Financial models and incentive schemes, a tariff system, an integrated permit system, tax incentives system, EPR
- Support in development of requirements for selection and in implementation of construction and operation of waste processing facilities; preparation of 'bankable' project proposals to attract financing for pilot projects
- Development of centers providing technical, consultancy and information support for clean production
- Development of educational and certification curricula for waste management experts
- Development and management of public awareness campaigns and dissemination of information on disposal of waste and potential impacts, introduction of alternative methods of utilization, BATs, awareness and commitments to sustainable MSW management

Table 8-3. Areas of potential cooperation of Dutch stakeholders with the Ukrainian stakeholder groups in waste management

Ukrainian stakeholder group in waste management	Challenges of Ukrainian stakeholder group	Areas of potential cooperation for Dutch stakeholders
Law-makers, Central Executive and Coordinating Bodies	• Development and adoption of the new law: 'On Waste', and associated by-laws • Development of effective Extended Producer Responsibility (EPR) schemes for selected waste streams, and in particular for hazardous waste streams, such as portable batteries, used lead-acid batteries, waste oils and/ or waste electronic and electronic equipment (WEEE) • Preparation of draft regulations and requirements, a certification system for the compost or compost-like output (CLO) products • Development/ introduction of a tariff policy stimulating the sector to develop • Development/ introduction of a system of integrated permits stimulating the sector to develop • Setting of stringent KPIs to improve the environmental situation and measures to respond to violations	**G-2-G/ TA/ Consultancy** • Support in development of outstanding draft laws on waste (landfilling, waste from extracting industries, waste oil) • Institutional strengthening: ▪ Central government executive body on waste management ▪ Single center for implementation of international requirements (Basel, Rotterdam, Stockholm, Minamata) ▪ Interministerial coordination councils and working groups for elaboration and implementation of plans • Policy cascading and planning • Development and introduction of BATs / technical regulations • Reformation of the tariff system • Introduction of an integrated permit system

Ukrainian stakeholder group in waste management	Challenges of Ukrainian stakeholder group	Areas of potential cooperation for Dutch stakeholders
	• Introduction of an online monitoring system as there are only a few laboratories which can measure dioxins in emissions from incineration plants • Introduction of a uniform system for determining the waste morphological structure • Roll-out of public information and awareness-raising measures in order to ensure participation of the public in separate waste collection	• Development and introduction of a tax incentives system • Financial incentives and guarantees package • International TA and loan projects • Development and management of public awareness campaigns and dissemination of information on disposal of waste and potential impacts, introduction of alternative methods of utilization, BATs, awareness and commitments to sustainable MSW management
Local and Regional Authorities (LRA)	• Lack of interregional/ intermunicipal cooperation, which: 1. Can allow consolidation of financial sources necessary to provide higher quality of MSW collection service. 2. Can allow optimal waste collection/ transfer center location in terms of available land plots, waste streams, *etc.*) to ensure maximum profitability. • Worn-out rolling stock and containers • A low level of collection of payments for MSW collection service • No mechanism to oblige people to enter direct contract agreements for MSW collection service with companies. There is significant indebtedness of the population for MSW collection services in some regions • The tendering procedure sometimes is not fair and, to be competitive, a company should have the lowest tariff on its service	**G-2-G/ TA/ Consultancy** • Development and implementation of the Regional Waste Management Plans • Interregional/ intermunicipal cooperation models • TA pilot projects on IMC to introduce the MSW management system from A to Z • Regional models for introduction of waste collection/ processing centers, regional transit centers and landfills including all aspects of activity (organizational, institutional, financial, logistical, technical, *etc.*) • Inventory and technology for remediation • Development and management of public awareness campaigns • Studies on the waste structure and potential for use, applicable technologies
Local and International Branch Associations and Businesses	• Lack of experience in development of the MSW management chain from A to Z	• **B-2-B, K-2-K** initiative facilitation
Service Provides and Equipment / Technology Suppliers	• A high cost of financial instruments in Ukraine • The Informal sector is a big challenge for separate collection's introduction; on the one hand, such a system allows collecting large volumes of recyclables and getting some additional income by people with low wages, the informal sector extracts recyclables not only from containers for separate collection, but also from containers for mixed waste. At the same	**B-2-B/ Consultancy** • Advice on cooperation options with involvement of reasonable financing costs • Joint ventures in the long-term • Supply of new or second-hand balers and transport vehicles

Ukrainian stakeholder group in waste management	Challenges of Ukrainian stakeholder group	Areas of potential cooperation for Dutch stakeholders
	time, removing all recyclables by the informal sector is a challenge for introduction of separate collection • Some basic equipment is not produced in Ukraine (*e.g.* vehicles and balers) and needs to be imported • Advanced equipment (*e.g.* NIR sorters, other sensor-based technology) is also not produced, but is considered expensive for imports at the current stage of MSW management in Ukraine	• Submission of turn-key technological solutions for specific waste collecting points with specific waste streams and specific morphology • Innovative techniques for extraction of gas from landfills (allowing faster gas extraction) • Lining and capping for landfill arrangement
R&D Institutes	• A limited resource, technical and know-how base	**K-2-K** • Institutional strengthening: ▪ An interministerial coordination council on the platform of the National Academy of Sciences of Ukraine for R&D of multi-use of natural resources, processing and utilization of waste • Cooperation under BATs and technical requirements • Development of the tariff methodology • Studies on the waste structure and potential for use, applicable technologies, adaptation of innovative and clean technologies • Development and implementation of educational and certification programs for waste management sectors
NGOs		• Development and management of public awareness campaigns and dissemination of information on disposal of waste and potential impacts, introduction of alternative methods of utilization, BATs, awareness and commitments to sustainable MSW management
International Donors and Financial Institutions International Companies Active in the Sector	• Low transparency of the sector and insufficient quantity and quality of projects for financing • A limited number of private and international players in the sector • Tariff policy does not allow big investments with a reasonable payback period, so long-term planning is not possible • Consultancy support in implementation of IFI projects is rather uncoordinated and in some cases with a limited practical spin-off	**K-2-K/ TA/ Consultancy** • Consulting/ support for Ukrainian companies in preparation of (bankable) applications to financing institutions • Joint TA and consultancy initiatives • Procurement opportunities

This is a publication of
Netherlands Enterprise Agency
Prinses Beatrixlaan 2
PO Box 93144 | 2509 AC The Hague
T +31 (0) 88 042 42 42
E klantcontact@rvo.nl
www.rvo.nl

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