Municipal Solid Waste in Ukraine: DEVELOPMENT POTENTIAL

Scenarios for developing the municipal solid waste management sector

In partnership with

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The development of this Report was based on a Municipal Solid Waste sector modelling study conducted by IFC in 2012-2013. The modelling data used was from the period of 2011-2012. The study was reviewed and enhanced in 2013-early 2015 and now reflects changes in the Ukrainian MSW regulatory landscape that were gradually introduced from 2013 and to the beginning of 2015.

This report does not contain exhaustive information on the topic at hand and should not serve as the basis for commercial decisions.

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Municipal Solid Waste in Ukraine: DEVELOPMENT POTENTIAL

SCENARIOS FOR DEVELOPING THE MUNICIPAL SOLID WASTE MANAGEMENT SECTOR

Final Report

Acknowledgments

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* The list displayed in an alphabetical order. A job title and an employer are current as of the time the report was prepared.

Acronyms and Abbreviations

BOT agreement – build-operate-transfer agreement is an agreement for construction of facilities with the subsequent transfer;

CMU – Cabinet of Ministers of Ukraine;

EPR – extended producer responsibility;

EU – European Union;

EU-12 – Central and Eastern European Countries and Cyprus that joined the EU after April 30, 2004;**

EU-15 – countries that joined the EU before April 30, 2004;

Eurostat – Statistical Office of the European Union;

GDP – gross domestic product;

GRP– gross regional product;

HDPE – high-density polyethylene;

IFC – International Finance Corporation, World Bank Group;

JV – joint venture;

LDPE – low-density polyethylene;

MSW – municipal solid waste;***

MW – megawatt;

NGO – non-governmental organization;

NPO– non-profit organization;

OECD – Organization for Economic Cooperation and Development;

PET – polyethylene terephthalate;

PPP – public-private partnership;

UNDP – United Nations Development Program.

** Croatia – the thirteenth country that joined the EU after April 30, 2004. However, having become a member as of July 1, 2013, it is not reflected in statistics of this report. Only EU-12 data are present in the analysis.

*** This report uses the term "municipal solid waste" in accordance with the EU and OECD international practices, although under the Ukrainian law it should be "household solid waste".

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CONTENT

Over 13 million tons of MSW is generated annually in Ukraine. More than 95% is sent to landfills and dumps.

Over 15% of waste disposal facilities are overloaded and fail to meet sanitary requirements. Possibilities to expand active landfills are largely limited.

Introduction

11–13 million tons of municipal solid waste (MSW) is generated every year in Ukraine. A per capita annual volume constitutes about 300 kg with the significant difference observed between urban and rural areas. The growth in waste generation is linked to the increase in society welfare, given a correlation between dynamics of GDP per capita and specific waste generation.

According to various sources, an MSW recycling level in Ukraine varies from 3 to 8 percent, while in the European Union countries it is up to 60 percent of MSW[1]. That said, more than 90 percent of MSW is forwarded to landfills and unauthorized dumps. According to official estimates, 10,000 ha[2] of land is covered by approximately 6,700 landfills and dumps, though unofficial numbers may be even higher.

Nevertheless, the Ukrainian Ministry of Regional Development, Construction, Housing and Utilities estimates that at least 626 new landfills are needed[2].

Apart from occupying land resources, landfills also emit pollutants and greenhouse gases into atmosphere, surface soils, ground water and subsoil, adversely affecting plants and wild animals, and worsening the quality of life in nearby residential areas. Because of the lack of segregated collection and removal of waste containing toxic components, environmental contamination with hazardous substances is growing.

Until recently the economic aspect was not a decisive factor in defining a governmental strategy for waste management. However, the missed economic benefit from unsustainable management is quite significant. In 2011, UNDP[3] estimated a potential revenue from utilization of paper at 180 million UAH, metals – at 225 million UAH and plastic – at 740 million UAH per year. The economic effect might reach 1.3 billion UAH (€130 million as of 2011), in view of heat and electric energy generation.

Since the 2000s, the Cabinet of Ministers of Ukraine (CMU) has passed a number of legislative and regulative acts aimed at making the waste management policy more systemic and achieving two objectives, namely, to decrease the negative environmental impact and enhance resource and energy efficiency.

1) The continuously refined Law "On Waste"[4] and the most recent program on MSW management[5] focus on development of recycling technologies and minimization of volumes of disposed waste. The Law prohibits disposal of non-recycled waste on landfills starting from January 1, 2018.

2) The new rules for MSW management[6] oblige local authorities and citizens to organize segregated waste collection. Respective fines for households were introduced in 2013.

3) Decisions have been made by the CMU on obliging manufacturers of packaged goods to arrange for return and recycling of packages; in addition, respective targets were defined[7] (35 percent package utilization starting from 2011).

[1] Eurostat data.
[2] Status of the Ukrainian Household Waste Management Sector in 2013. Ukrainian Ministry of Regional Development, Construction, Housing and Utilities, as of March 24, 2014.
[3] UNDP report "Municipal Solid Waste Management Systems", 2011.
[4] Law of Ukraine No. 187/98-VR of March 05, 1998, "On Waste".
[5] CMU's Resolution No. 265 of March 04, 2004, "On Approval of the MSW Management Program".
[6] CMU's Resolution No. 1070 of October 12, 2008, "On Adoption of the Procedure for Municipal Waste Transportation Rate-Setting".
[7] CMU's Resolution No. 915 of June 26, 2001, "On Introduction of a System for Collection, Preservation and Utilization of Waste as Secondary Raw Materials".

4) An environmental tax is envisaged; the funds collected should be channeled to compensate environment recovery costs when MSW landfills are functioning[8] (i.e., implementation of the polluter pays principle has been started).

5) The announced long-term goal for the sector is to reach EU-accepted waste recycling standards, partially already binding under the EU-Ukraine Association Agreement, which will require:

   - ensuring environmentally safe MSW management (in particular, meeting requirements for landfill facilities);
   - practical implementation of an MSW management hierarchy which favors MSW prevention and recycling over incineration and disposal;
   - full-fledged implementation of the polluter pays principle;
   - phased achievement of targets for segregated collection and recycling of the most important utilizable fractions; 60 percent segregated collection and 50 percent recycling for the overall MSW volume are among the most significant targets;
   - a 55 percent level of recycling for packages and packaging waste according to the EU packaging directive 94/62/EC and a 70 percent level of recycling for construction waste according to the EU waste directive 2008/98/EC.

Unfortunately, the envisioned legislative measures are not always fully implemented on the ground. In order to create a well-performing waste management system, it is necessary to consider and adapt the best suitable international practices, like those from the European countries that have already harmonized their legal frameworks with the EU legislation and made them compliant with the corresponding European directives.

The purpose of this study is to demonstrate the sustainable potential of the MSW management sector in Ukraine by analyzing experience abroad and modeling various development scenarios for the country. The study considers institutional and economic arrangements that would help realize the waste recycling potential in the most efficient manner.

The methodology of this study is based on the following approaches and principles:

- identification and justification of the analogue country (group of countries) to base a development trajectory of the MSW sector in Ukraine;
- review of options (scenarios) for sector development;
- considerations for the best technologies and wide-spread practices in the European MSW management industry;
- advancement in terms of legal, institutional and economic features to ensure attainment of development indicators outlined in the scenarios.

[8] Tax Code No. 2755-17 of November 08, 2014, Chapter VIII "Environmental Tax".

Structure: This report consists of an introduction, three chapters, conclusions and recommendations, and three appendices.

Chapter 1 analyses the current status of the MSW management sector in Ukraine and in Europe, defines development trends, and draws parallels between the present situation in Ukraine now and in specific European countries 10-15 years ago.

Chapter 2 assesses the potential of the Ukrainian MSW management sector and reviews two implementation scenarios for the period till 2025: business-as-usual and innovative ones.

Chapter 3 suggests phased-in legislative, institutional and economic changes needed to ensure innovative advancement of the MSW sector, and also reasons socioeconomic importance of developing MSW recycling, while recommending specific measures on the national and regional levels.

This report employs a common terminology that is used internationally. The terms and definitions are provided in **Appendix 1.**

Appendix 2 contains a description of the most frequently used waste management technologies at various stages of the waste life cycle. Details of the terms of approximation to the EU legislation in line with the EU-Ukraine Association Agreement are presented in **Appendix 3.**

The target audience for this report includes government bodies, as well as regional and municipal authorities that make policies, introduce rules and administer MSW management facilities within their jurisdictions.

This report would be also of interest to potential investors and private companies planning to enter the waste management sector in Ukraine.

The methodology and findings from the study may be used while:

- setting performance targets for development of the MSW management sector on the national and regional levels;
- developing action plans on implementation of national and regional strategies for sector development (waste management plans);
- identifying financing pools for projects;
- selecting efficient technological solutions for development of the sector.

In Ukraine, only one of four incineration plants (located in Kyiv) is operational. Its service life (25 years) is in fact over.

As of 2013, twenty one waste sorting lines operate in a number of cities, segregated collection is performed in 503 cities. Waste collection services are available for 78 percent of the population, with rural areas being significantly underserved.

Chapter 1. Analysis of the current situation in the MSW management sector in Ukraine and abroad

Chapter 1 examines:

- quantitative and qualitative features of MSW generation in Ukraine compared to other countries;
- international trends in MSW management;
- common MSW management practices in Ukraine;
- environmental and economic aspects of the present MSW management system;
- the current regulatory and legal framework for MSW management, the environment of fees and payments in Ukraine;
- MSW management experience of the older EU members (EU-15) and the new ones – Central and Eastern Europe countries (EU-12).

Analysis of the current situation in MSW generation and management in Ukraine and abroad leads to the following conclusions:

1. Though MSW has a small share in the overall waste volume, it significantly affects human health and environment.
2. The quantitative and qualitative characteristics of MSW generation in Ukraine still differ from the advanced EU countries, but the gap is rapidly narrowing.
3. MSW generation volumes will grow.
4. The necessity to spur up MSW management efficiency is admitted on the national and regional levels, although measures taken so far are not sufficient to change the situation.
5. The main barriers to increase effectiveness of the MSW management system are:
   - the unregulated framework of ownership rights on waste and shared responsibility,
   - insufficient private sector participation, lack of transparency, imprecise fee-setting policy, and
   - absence of economic incentives for recycling.
6. In many aspects, initial conditions in Ukraine are similar to those in the EU-12.
7. It is possible to make a transition to recycling over the next 10 to 15 years.
8. A range of European administrative and pricing models proven to be effective can be successfully applied in Ukraine taking into account local specifics.

Chapter 1

Analysis of the Current Situation in the MSW Management Sector in Ukraine and Abroad

1.1. Trends in Waste Generation and Recycling/Disposal

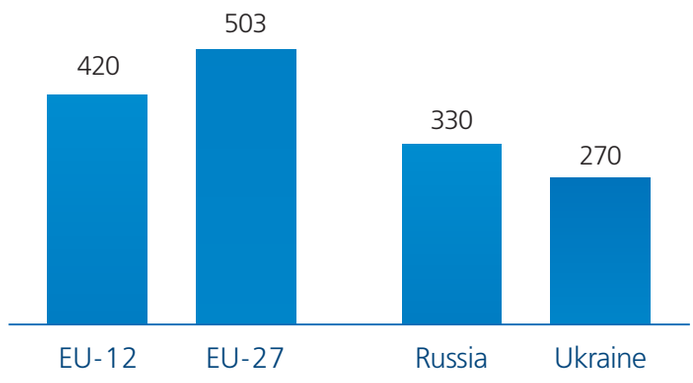
According to the Ukrainian State Statistics Service[9], around 500 million tons of waste is generated in the country annually, including primary industry waste (76 percent), secondary industry waste (around 18 percent), agricultural waste (approximately 2 percent), and solid waste from the households (roughly 2%). According to Eurostat estimations[10], total waste generation in 27 members of the EU in 2012 constituted 4.9 tons per capita on average against 9.9 tons per capita in Ukraine in 2013[9,11] . However, it is important to accentuate that Ukrainian industries stand for up to 94 percent of the total waste generated.

According to the Ukrainian Ministry of Regional Development, Construction, Housing and Utilities[12], around 59 million cubic meters or 13 million tons of MSW was generated in the country in 2013. Thus, the share of MSW in the total waste generated in Ukraine may seem to be insignificant – 2-3 percent.

However, despite the low share of MSW in the waste structure, efficient functioning of this sector is of utmost importance, given a direct influence on the environment of residential areas. Furthermore, recycled waste is an additional source of raw materials and energy supplies for the national economy.

The volume of MSW generation tends to gradually rise despite the decreasing population[11]. According to the Ukrainian State Statistics Service, the annual volume of MSW grew by 70 percent between 2000 and 2010. However, it should be noted that the data collection system for volumes of MSW generation has been introduced quite recently and still, according to a number of sources, there is a high level of data uncertainty.

Fig. 1 Comparative characteristics of specific MSW generation, kg per capita as of 2010



Source: IFC.

[9] Environment of Ukraine. Statistical Yearbook 2013. Ukrainian State Statistics Service. Kyiv, 2014.
[10] Generation of waste. Eurostat, as of November 26, 2014. Online source: http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do.
[11] Statistical Yearbook 2013. Ukrainian State Statistics Service. Kyiv, 2014.
[12] Status of the Ukrainian Household Waste Management Sector in 2013. Ukrainian Ministry of Regional Development, Construction, Housing and Utilities, as of March 24, 2014.

180 kg of MSW per capita was generated on average in 2000 in Ukraine, and it increased to 270 kg by 2010[13]. As Figure 1 demonstrates, the specific volumes of waste generation in Ukraine are still significantly lower not only than the European average (503 kg per capita per year in 2010). They are also below the level of the new EU member states (420 kg per person) where individual incomes are similar to those in Ukraine.

The structure of consumption was changing starting from 2000 towards more waste-intensive goods and services. An increase was noted in the proportion of non-food items consumption which is associated with greater volumes of packaging waste.

The MSW structure is the determinant for waste management system development. That is, the qualitative composition of waste defines requirements for collection and disposal systems, as well as the configuration of measures in MSW management. The importance of this indicator is largely increasing when MSW recycling patterns are being selected for implementation.

Unfortunately, there have been no systematic studies on the MSW structure in Ukraine yet. The only sources of statistical information are small studies performed by MSW operators and associations for specific regions at different times. Their findings differ significantly. For instance, the studies completed by the national project "Clean City" (see Figure 2) assign the most significant shares in the MSW structure to food (more than 30 percent 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 percent, paper and cardboard – 10-15 percent, secondary polymers – 9-13 percent, glass – 8-10 percent, metals – 2 percent, textiles – 4-6 percent, construction waste – 5 percent, wood – 1 percent, and other waste – 10 percent[14]. The spread of data is most likely related to limited samples. Besides, a part of organic waste was possibly not included.

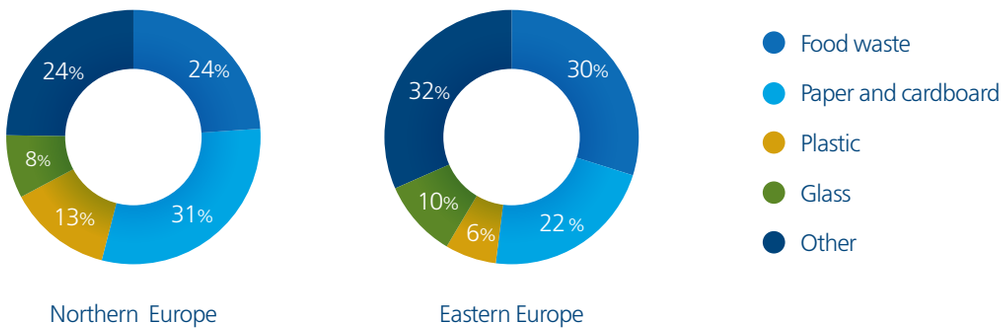
Fig. 2 MSW structure in Ukraine

Source: VI National Communication of Ukraine on Climate Change

[13] Given the incomplete population coverage by the waste collection and registration system. According to the official data, this figure will reach 240 kg per capita per year.
[14] Sixth National Communication of Ukraine on Climate Change. Ukrainian Ministry of Ecology and Natural Resources, Ukrainian State Emergency Service, National Ukrainian Academy of Sciences, Ukrainian Hydrometeorological Institute. 323 p. – Kyiv, 2014.

When the MSW generation structure in Ukraine is compared to that of the EU countries (see Figure 3), one can conclude that it is closer to the Eastern European countries (Poland, Czech Republic, Slovakia, Baltic states, and others). The organic fraction in Ukraine is greater than in the European countries, while the shares of glass and plastic are relatively low.

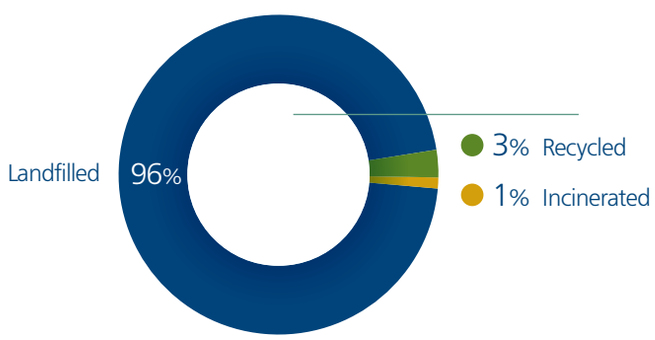
Fig. 3 MSW structure in the European countries



Source: Eurostat

Less than four percent of municipal waste is recycled in Ukraine, primarily packaging waste (Figure 4).

Fig. 4 MSW Recycling Structure in Ukraine in 2013



Source: Environment of Ukraine in 2013. Report by State Statistics Service of Ukraine

Only one of four waste incineration plants constructed during the Soviet era, a Kyiv-based facility with an annual capacity of 300,000 tons, operates now in Ukraine. However, the service life of all of four incinerators (25 years) is in fact over. In addition, there are two mobile installations in Kharkiv and a stationary one in Kharkiv region[15].

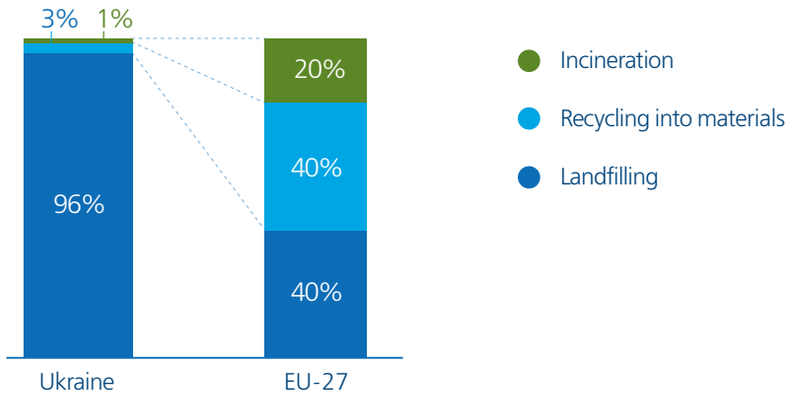
Twenty-one sorting lines function in several cities. The number of cities and towns that have introduced segregated waste collection has significantly increased: from 5 in 2004 to 53 in 2010, 130 in 2011 and 185 in 2012. In 2013, segregated waste collection was introduced in 503 cities[16], which covers only 1.7 percent of the overall number of urban and rural inhabited localities.

[15] Information on Introduction of Modern Methods and Technologies in the Solid Waste Management Sector, as of October 01, 2014. Ukrainian Ministry of Regional Development, Construction, Housing and Utilities.
[16] Status of the Ukrainian Household Waste Management Sector in 2013. Ukrainian Ministry of Regional Development, Construction, Housing and Utilities, as of March 24, 2014

The waste collection system covers on average 78 percent of the population in the country[15]. Depreciation of specialized vehicles in 2013 was 66 percent[15].

Only 3.7 percent of MSW in Ukraine is recycled and incinerated: 1.2 percent is incinerated and 2.5 percent is recycled[16], while in the EU the recycling level reaches about 60 percent (see Figure 5).

Fig. 5 Comparative Characteristics of MSW Recycling Level



Source: Ukrainian State Statistics Service, Eurostat

According to the inventory data for MSW landfills, over 6.7 thousand dumps and landfills were active in 2013, covering an area of more than 10 thousand hectares. Over 15 percent of landfills were overloaded, and 21 percent of them did not meet sanitary requirements. A significant fraction of waste was disposed of on unauthorized dumps (30 thousand dumps that cover an overall area of 2 thousand hectares)[17].

The overall current situation in Ukraine has the following features:

- an increase in specific MSW generation volumes (by 70 percent between 2000 and 2010), despite the shrinking demographics;
- a growing share of recycled fractions in the MSW structure and, consequently, increasing recycling capacities;
- a low coverage of rural areas by waste collection;
- a low waste recycling level (up to 8 percent), despite the rapid growth of cities covered by segregated waste collection;
- a growing volume of MSW disposed of on landfills and unauthorized dumps.

[17] Status of the Ukrainian Household Waste Management Sector in 2013. Ukrainian Ministry of Regional Development, Construction, Housing and Utilities, as of March 24, 2014

Recycling of Secondary Waste

The Ukrainian Ministry of Regional Development, Construction, Housing and Utilities published data on collection and disposal of different MSW fractions in 2011. Waste not transported to landfills and dumps was considered either recycled at incineration plants or taken to secondary raw materials collection centers.

Primary waste transportation records do not reflect actual recycling and are most probably overestimated: a part of the materials may be rejected and sent to a landfill; besides, after recycling, unused remnants are also forwarded there.

Nevertheless, these data confirm that the situation is improving in the area of segregated waste collection and recycling of valuable MSW components in Ukraine. The recycled share comprises: paper stock – 28 percent, plastic – 35 percent, metals – 1 percent, glass – 14 percent, and textile – 18 percent.

Undue waste disposal on landfills and dumps contributes to the pollution of air, soil, ground and surface water reservoirs, and the malfunctioning of ecosystems. Waste accumulation on landfills and dumps also harms agriculture and construction, because it is accompanied by the recall of land suitable for use. Landfill gas emissions adversely affect the climate change.

The existing structure of waste management does not allow for utilization of secondary resources and reduction in the environmental burden. Most of the active landfills are worn-out and obsolete and will not be in a position to take up a growing waste volume in the future.

Further use of the MSW disposal infrastructure on the ground will ultimately lead to serious environmental consequences that are dangerous to the national health.

1.2. Analysis of Legislative and Institutional Fundamentals of Waste Management in Ukraine

Compliance with Legal Requirements and Initiatives

Legal Framework

The main documents defining waste management principles and priorities in this area are the laws "On Waste"[18] and "On Protection of the Natural Environment"[19]. Amendments and provisions to legal acts introduced in 2008–2014 set forth the following strategic priorities in advancement of the sector:

- the need to develop technologies and measures focused on minimization, recycling and decontamination of generated waste (including municipal and industrial components);
- economic benefits to businesses introducing such technologies and measures;
- diversion of recyclable waste from landfilling;
- assignment of responsibility for adverse environmental effects (and restoration of the disrupted environment) to the actual polluter;
- imposing an environmental tax.

According to the law "On Waste", the main governmental policy vectors in waste management sector are the following:

1. Ensuring full collection and timely decontamination and disposal of waste, as well as compliance with environmental safety rules when handling waste;
2. Minimizing waste generation and decreasing waste harmfulness;
3. Provision of comprehensive utilization for primary material resources;
4. Facilitation of the maximum possible waste utilization;
5. Provision of safe disposal for waste that is not subject to utilization through development of corresponding technologies and environmentally safe waste management practices.

These areas are prioritized in line with Lansink's ladder, and they are compliant with the European directive on waste (see section 1.3 hereof).

According to amendments to the law passed in 2012, different categories of consumers have to sign direct contracts on MSW disposal, pay for these services, and ensure segregated waste collection (Article 35-1). It is prohibited to dispose of not recycled waste on landfills starting from January 1, 2018 (Article 32).

The main Ukrainian environmental policy areas for the period till 2020, as adopted in 2011[20], do not distinguish MSW management as a main priority. MSW management is assigned with modest goals (as compared to other areas):

- to increase recycling of MSW by 1.5 times until 2020, i.e. to reach only a 12 percent recycling level, given the current figure of 3 to 8 percent, while the corresponding EU directive requires 50 percent of recycling for the same period;

[18] Law of Ukraine "On Waste", as revised and amended with law No. 1697-VII on October 14, 2014.
[19] Law of Ukraine "On Protection of the Natural Environment", as revised and amended with law No. 1697-VII on October 14, 2014.
[20] Ukrainian Parliamentary Herald, issue No. 26. – 2011. – P. 218.

- and for cities with a population over 250 thousand people, to reach the 2015 target of 70 percent for MSW disposal on environmentally safe landfills, which is not ambitious (There are 26 cities in Ukraine with a population over 250 thousand people, 34 percent of the overall population lives in them. Consequently, only one third of the nation will be covered with environmentally safe waste disposal).

At the same time, the EU-Ukraine Association Agreement ratified on September 16, 2014, defines principles of cooperation, which shall aim at preserving, protecting, improving, and rehabilitating the quality of environment, protecting human health, instilling prudent, and rational utilization of natural resources, and promoting measures on the international level to deal with regional or global environmental problems, inter alia in the areas of waste and resource management. The Association Agreement also stipulates a timetable of gradual approximation of the Ukrainian legislation on waste and resource management to the EU law and policy on environmentally safe waste and resource management.
For more details, please see **Appendix 3**.

Also, it is worth mentioning that waste management has been addressed in the coalition agreement of Ukrainian Parliament's parties (signed on November 21, 2014). The document procures introduction of the polluter pays principle and extended producer responsibility relating to packaging waste, which provides for liability of a producer (primary importer) for the entire life cycle of products, including (direct and/or financial) responsibility for the waste management of this product.

An important factor in stimulating utilization of waste and landfill gas as an alternative fuel is the passed amendments to the law "On Electric Energy" under which a tariff for the electric energy obtained from landfill gas burning is multiplied by 2.3 (i.e., by the so-called "green" or feed-in-tariff factor). This will promote closure of landfills for the purpose of utilization of landfill gas. Initially, the "green" tariff was introduced in the second quarter of 2013 for new facilities only. It shall be noted that another draft law has been submitted to the Parliament recently (not yet officially registered), which proposes a 3.0 "green" tariff factor (instead of 2.3) for electricity obtained from biogas, which explicitly includes landfill gas. With such an amendment, current discussions about whether "biogas" includes landfill gas or not would become irrelevant.

The law "On Amending Certain Ukrainian Legislative Acts in the Field of Waste Management"[21] passed in January 2010 entails adoption of norms on municipal waste transportation services. Only one fourth of the cities have elaborated and approved sanitation schemes, but the situation is gradually changing.

Legislative Framework for Recycling and Introduction of the EPR Principle

Several steps have been undertaken on the national level to set out management of waste from packing and packaging (such regulation covers collection and utilization of paper, glass, metals, textiles, and tires)[22]. This is, in fact, an introduction of the extended producer responsibility principle, although the latter has not been explicitly mentioned in any of the legislative or regulatory act.

Manufacturers of packaged goods have been obliged to organize return and recycling of packages either on their own or by transferring this obligation to the state-owned enterprise "Ukrecoresoursy" (established in 2001) or any other specialized organization[23]. Proper use of funds for intended purposes is controlled by the Ukrainian Ministry of Economic Development and Trade.

[21] Law No. 1825-VI dated January 21, 2010.
[22] CMU's Resolution No. 1136 of July 27, 2011, "Some Issues of Collection, Preservation and Utilization of Worn-out Tires"
[23] CMU's Resolution No. 915 of June 26, 2001, "On Introduction of a System for Collection, Preservation and Utilization of Waste as Secondary Raw Materials".

The collected funds should be spent on[24]:

- purchase of specialized equipment, machines, mechanisms for waste collection, preservation, and utilization;
- development of a system for packaging collection, preservation, and utilization in the country regions;
- capacity building for waste utilization in the form of secondary raw materials;
- development and implementation of investment projects in the regions;
- partial reimbursement of costs associated with interests on corporate loans for purchase of special equipment, machinery, and mechanisms for business activities related to collecting, storage, and disposal of waste as secondary raw materials;
- construction and maintenance of collection facilities for secondary raw materials, including automated ones;
- establishment and operation of information and analytical system and database in the field of management of waste as secondary raw materials.

"Ukrecoresoursy"

It is a state-owned enterprise subordinated to the Cabinet of Ministers of Ukraine. The charter of "Ukrecoresoursy" (full name: the "State-Owned Enterprise for Management of Waste as Secondary Raw Materials") lists the following challenges[25]:

- establishing and ensuring appropriate functioning of the collection, preservation, and utilization of waste as secondary raw materials;
- ongoing analysis and refinment of existing systems for waste collection, preservation, and utilization;
- monitoring of utilization rates in containers (packaging) according to the established minimum norms, targeting actual utilization volumes to regulative ones;
- implementation of environmental safety principles according to the EU Directive 94/62/EU and European system PRO EUROPE for utilization of packaging waste.
- The state-owned enterprise "Ukrecoresoursy" planned to invest 100 million UAH in 2013. Only 75 million UAH was actually contributed in 2012 instead of the planned 150 million UAH. Still, the projects not completed in 2012 were to be put off for 2013.

The state-owned enterprise "Ukrecoresoursy" planned to launch a recycling line for plastic bottles in Khmelnytskyi Oblast. The line aimed to produce top-class polyethylene terephthalate (PET) flocks. The line was designed to recycle waste made of high and low pressure polyethylene (HDPE and LDPE, respectively), and polypropylene into granules. Granules recycled on the line could be used for production of garbage bags, technical film, sewage conduits, paving tiles, etc.

[24] CMU's Resolution No. 39 of January 20, 2010, "On Establishing a Procedure for the Use of Funds Received For Services Associated with Collection, Preservation and Utilization of Used Packaging Materials and Containers".
[25] CMU's Resolution No. 1393-2002-p of October 10, 2014, "On Approval of the Charter of the State Enterprise for Management of Waste as Secondary Raw Materials and the Composition of its Supervisory Board"

The state-owned enterprise "Ukrecoresoursy" was authorized to subsidize companies rendering segregated waste collection services. However, as a matter of practice, this is a legalized monopolist in the sector, because it solely manages received funds and may not always use them in the most efficient manner.

Instead of anti-monopoly regulation, it would be feasible to introduce competition and allow winning bidders to work on the interregional level.

Businesses are obliged to keep records on packaging materials brought to the market and provide information on volumes of utilized containers and packages to the regional offices of the Ukrainian Ministry of Ecology and Natural Resources[26].

The CMU's Resolution No. 915[27] and amendments thereto introduced a commitment to utilize 5 percent of packages according to the total mass and constantly increased this indicator afterwards (2009 - 25%; 2010 - 30%; 2011 and following years – 35%).

Starting from 2011, the package recycling target has been 35 percent. Although it was tightened (already 20 percent of packaging was supposed to be utilized in 2005), no-one followed up on the degree of performance under this indicator in the country overall, and the data themselves were introduced without any justification of achievability.

In addition, joint order of the Ukrainian Ministry of Economic Development and Trade, the Ministry of Ecology and Natural Resources, and the Customs Administration No. 789 dated July 30, 2009, "On Approval of Customs Clearance for Imported Goods in Containers and Packaging Materials" established conditions for the implementation of a monopoly scheme led by the SOE "Ukrecoresoursy" (reporting to the CMU).

Moreover, provisions of Order No. 789 are discriminatory against importers who are obliged to pay for 100% utilization of used packaging materials (containers) while under the Regulation No. 915 the norm for utilization of used packaging materials (containers) in Ukraine is only 35%.

It shall be noted that, following an instruction by the Prime Minister of Ukraine, in late October 2014 the Ministry of Economic Development and Trade published on its website a draft[28] introducing amendments to Resolution No. 915 with an aim to secure competition in the sphere of collection, storage, and utilization of used packaging materials and containers.

It is of special interest that, according to the draft resolution, the Ministry of Ecology and Natural Resources shall develop and submit to the Cabinet of Ministers a draft law regulating relationships in the sphere of packaging and packaging waste management, despite such draft law has been already drafted and registered in the Parliament[29].

At the same time, pursuant to instruction of the Prime Minister of Ukraine No. 20241/1/1-14 of June 16, 2014, the Ministry of Economic Development and Trade on January 05, 2015, published on its website a draft[30] on cancellation of Resolution No. 915, aiming at eliminating restrictions and/or distortion of business competition.

[26] CMU's Resolution No. 915 of June 26, 2001, "On Introduction of a System for Collection, Preservation and Utilization of Waste as Secondary Raw Materials".
[27] According to amendments to the CMU's Resolution No. 915 passed in September 2014, the effect of this Resolution does not apply only to containers and packaging materials of export products, bread and bakery products, milk, but also of raw milk, dairy products, production of humanitarian and technical assistance.
[28] "On Introduction of Collection, Storage and Utilization of Used Packaging Materials and Containers".
[29] Draft Law of Ukraine "On Packaging and Packaging Waste" No 4266a dated July 8, 2014.
[30] http://www.me.gov.ua/Documents/Detail?lang=uk-UA&id=96c12c8c-594a-4eff-906c-fd129ab6d219&title=ProektPostanoviKabinetuMinistrivUkrainiproViznanniaTakimi-SchoVtratiliChinnist-DeiakikhPostanovKabinetuMinistrivUkraini.

In 2013, the Ukrainian Parliament registered the legislative draft No. 2353 "On Limitations in Manufacturing, Import and Distribution in Ukraine for Polymer Bags and Packages with Long Decomposition Life" which prohibits manufacture, utilization, import and paid or unpaid distribution of long decomposition life polymer bags with a capacity of less than 35 l and a thickness of more than 0.025 mm, and also long decomposition life packages manufactured with the use of paper and distribution of such bags by trading or food-service enterprises.

The most notable changes in the MSW sector were subject to draft Law of Ukraine "On Packaging and Packaging Waste" No. 4266a dated July 8, 2014. The draft was developed in order to establish a legal basis for creating in Ukraine a system for separate collection, complex recycling, and utilization of packaging, increasing volumes of their use as secondary raw materials, creating conditions for fair competition between economic entities in this sphere, introducing European experience of such system's functioning, and harmonizing Ukrainian legislation with respective regulatory acts of the European Union.

The document proposed introduction of the extended producer responsibility concept, which provides that companies and importers of packaged goods are responsible not only for the quality and safety of the product, but also for the disposal of packaging waste.

It shall be noted that in general draft law No. 4662a was actively supported by business representatives and market experts as such, being in compliance with the European legislation.

Notably, that under the Ukrainian legislation a draft law is not considered by the Parliament of a new convocation and is deemed as withdrawn from consideration in case it has not been adopted by the previous convocation at least in the first reading. Therefore, the draft law No. 4662a is not effective anymore.

However, the Ukrainian Ministry of Ecology and Natural Resources and the Ministry of Regional Development Construction, Housing and Utilities, in cooperation with the industry and based on the consensus approach between the parties, have already developed another **draft law "On Packaging and Packaging Waste"**. It aimed at demonopolization of the waste management market and was expected to be submitted for consideration to the Cabinet of Ministers of Ukraine in March 2015.

National Projects and Programs

In 2010, the State Agency for Investment and National Projects of Ukraine launched a national project called "Clean City"[31] (see description in the frame below) aiming to demonstrate possibilities of modern MSW recycling technologies. However, according to UNDP and Deloitte experts, even after implementation of the "Clean City" and other ongoing projects 75 percent of MSW will have to be disposed of on landfills[32].

In this respect, it is crucial to refine the formulation of the recycled waste as waste that has changed its physical, chemical, and biological features while going through various technological operations (amendments to the law "On Waste" of October 2012).

[31] This project is a national priority according to Presidential Decree No. 895 of September 08, 2010, and corresponds to the Presidential Program of Economic Reforms for the Period of 2012-2014.
[32] InvestUkraine, Deloitte "Solid Waste Management in Ukraine", 2011.

Examples of Projects Currently Implemented in Ukraine

National Project "Clean City"

To date, the national project "Clean City" has been launched in Ukraine (with feasibility studies for relavent projects approved only), targeting the upgrade of the MSW management system.

Construction of 10 complex recycling (recycling level not less than 50 percent) enterprises is planned for the first stage in large Ukrainian cities: Kyiv, Kharkiv, Dnipropetrovsk, Chernivtsi, Ternopil, Khmelnytskyi, Lviv, Sumy, Dnipropetrovsk, Donetsk, and Lugansk.

Technologies and measures for recycling will differ depending on a region. The public-private partnership model was supposed to be considered as a mechanism for implementing specific investment programs.

According to information available, there has been no further progress.

Source: IFC.

In this case, introducing segregation lines on its own will not suffice to comply with this Law, and, starting from January 2018, only waste after primary recycling and incineration can be disposed of on landfills.

However, notwithstanding the undertaken measures, the targets for recycled waste established by the CMU's Resolution No. 915 (as further revised and amended) have not been met. Most of the operators provide services in waste collection and transportation only.

Since projects on recycling and utilization of secondary raw materials are isolated instances, they are not sufficient for dramatic improvement of the industry situation, if the growing tempo in waste generation is considered. One of the promising directions in utilization of MSW as raw materials may become the use of it as a fuel component within production of cement.

Segregated MSW collection was supposed to be organized under the initiative, as well as construction of recycling enterprises, but the program was shut down prematurely in 2009 because of chronic funding shortfalls.

Over five years of the program implementation, the territory covered with dumps almost doubled, and no new incineration plant has been constructed so far.

On January 3, 2013, the Cabinet of Ministers of Ukraine approved a concept of the National Waste Management Program for the Period of 2013–2020 (see excerpts on page 24) drafted by the Ministry of Ecology and Natural Resources.

Presently, regional programs on waste management are active in almost all Ukrainian regions. They have been developed based on the previous (prior to 2012) national program.

This strategic document assumes achievement of the recycling targets and reduction of the environmental impact in the range of regions, while others consider the use of the best technologies

as a priority. Estimated costs of the investment programs vary by region from €20 to €100 million. All of them primarily bank on budget funding.

Concept of the National Waste Management Program for the Period of 2013-2020, as approved by the Cabinet of Ministers of Ukraine's Regulation No. 22-r of March 1, 2013.

The purpose of the National Program is introduction of new technologies and implementation of measures to decrease the volume of generated waste, and also its collection, transportation, processing, utilization, elimination and disposal, in order to prevent an adverse impact on the environment and human health.

The scope of financing amounts to 4.656 billion UAH (€466 million). 37 percent is supposed to be financed from the Special Fund of the State Budget, and about 63 percent — from the local budgets.

The first phase (2013–2015) is for removal of the most environmentally dangerous toxic waste storage facilities, reduction of waste generation and prevention of their unauthorized removal, and also for construction of pilot landfills and capacity building for waste decontamination.

The second phase (2016–2020) envisions creation of a modern infrastructure for collection, preservation, and utilization of waste as secondary raw materials, and investment promotion in the field of waste management.

Source: Governmental Portal of Ukraine.

Improvement of Statistical Reporting

To get a complete picture of the situation in the sector and for the sake of more effective management, in 2010 Ukraine introduced a new format of statistical reporting (form No. 1 "Waste Management")[33]. It is unified, harmonized with Eurostat standards of reporting on waste generation and management, and assumes obtaining annual information from enterprises based on the territory where manufacturing takes place.

Respondents are legal entities and their divisions with activities is linked to the sphere of managing waste of hazardous classes I-IV. The respondents' catalogue is created by the Ukrainian Statistics Service.

The main drawback of the existing statistical reporting system is the definition of waste hazardous classes. The system defines all waste types as hazardous, although in fact only waste of classes I-III is hazardous, and its share is less than 1 percent. Besides, this form specifically presents waste by generation sources in accordance with the EEA international classification, which is by no means important. However, MSW is not explicitly shown and waste generation by households does not reflect the overall MSW volume.

Harmonization with Eurostat requirements has not been finalized. Eurostat has a separate MSW form which Ukraine needs to introduce. The new National Program apparently also plans to harmonize the classification of waste.

[33] Order of the Ukrainian State Statistics Service dated August 19, 2014, No. 243 "On Approval of State Statistical Observations of Ecology, Forestry and Hunting".

The positive trend here is the continuous development of new regulations on delivery of services dealing with waste collection, transportation, segregation, recycling and disposal on MSW landfills, drawing-up of sanitation schemes for residential areas, unification of transport and containers, etc., as based on the European best practices. This creates a framework for businesses within the field of MSW management to ensure that a certain level of quality and observance of standards are achieved.

Less than three years are left for development of a comprehensive national MSW system which would in practice implement the prohibition to dispose of non-recycled MSW waste on landfills. The main factor is the presence of funding. Without budget funding it is not feasible to implement either the national project "Clean City" or the national program. The history of program predecessors is not quite successful (ex post no more than 10 percent have been funded).

Key vectors in refining the Ukrainian MSW management system should be a pricing policy and mobilization of private capital in implementation of projects in the sector, particularly as private-public partnership (PPP). At the same time, public authorities and parties have to understand that PPPs won't be realized, unless the following basic requirements are met:

- clear legal framework and competences put in place;
- economically viable tariffs set out;
- binding long-term agreements over the lifecycle of investments made.

In addition, the lack of the rule of law and a functioning court system in Ukraine still keep private investments away.

Permits for Waste Management Simplification

On April 26, 2014, Law of Ukraine No. 1193-VII "On Amending Certain Ukrainian Legislative Acts in Respect of Shortening the List of Permissive Documents" dated April 9, 2014, entered into effect. This has cancelled the requirement for approximately 100 permits and significantly simplified the procedure for obtaining a number of other permits, eased respective permitting procedures, and shifted the current approach from government- to business-oriented. According to the law, all permits to be granted to a legal entity have to be included in the List of Permits, as approved by Law of Ukraine No. 3392-VI dated May 19, 2011.

Among other things, amendments were made to the law "On waste", changing the approach to waste disposal licensing. The license for collecting and preserving certain types of waste as secondary raw materials (according to the lists established by the Cabinet of Ministers of Ukraine), as well as a number of waste management permitting documents, were abolished.

Law No. 1193-VII introduces a new concept – "indicator of general waste generation", which is calculated using a special formula. According to the mentioned amendments, only economic entities with an indicator in excess of 1,000 units shall obtain permits. Entities having between 50 and 1,000 units are not required to get them. Instead of permits, they must submit declarations on waste. Finally, businesses generating less than 50 units of waste may handle it with no permit or declaration.

Furthermore, the approval of limits for waste generation and disposal is no longer necessary. Prior toNo. 1193-VII, waste disposal permits had been invalid unless accompanied with the approval of limits by local administrations and a prior agreement with environmental authorities.

In accordance with Article 20 of the Law of Ukraine "On Waste", the subnational and local administrations are entitled to issue permits for operations in waste management for a period of three years.

Article 18 of the Law of Ukraine "On Waste" provides for the scope of competence of the Cabinet of Ministers of Ukraine which, inter alia, includes:

- approval of the procedure for granting permits for operations in waste management;
- adoption of the declaration form on waste and the procedure for its submission.

Thus, the aforementioned amendments were aimed at speeding up and simplifying the waste management permitting procedure.

Ownership and Administration of MSW

Under Article 22 of the law "On Waste", the Ukrainian Ministry of Ecology and Natural Resources[34], the State Ecological Inspectorate of Ukraine, the State Sanitary and Epidemiological Inspectorate, the Ministry of Regional Development, Construction, Housing and Utilities, and the regional administrations are specifically authorized executive bodies in matters related to waste management. Their functions are briefly presented in Table 1.

The Ukrainian Ministry of Ecology and Natural Resources is a leading policy-making ministry in development and control of implementation of MSW management policies in terms of compliance with the environmental law. The Ukrainian Ministry of Regional Development, Construction, Housing and Utilities coordinates activities of local authorities in implementation of these policies and provides for the regulatory framework in the sector.

Government authorities admit that the waste management system in force is not capable of delivering quality and efficient services. Enforcement in implementation of waste recycling and minimizing technologies as well as attraction of investors is supervised by local authorities according to the law "On Local Self-Governance".

When local authorities for some reason do not undertake measures on construction of MSW recycling plants, higher-level bodies may resort to an operational entity representing the State Ecological Inspectorate which may take a decision on closure of a dump or landfill due to non-observance of sanitary norms, but such decisions are rarely passed, and fines imposed for the breach of environmental provisions are minor.

A number of fundamental rights and responsibilities related to MSW management have been introduced to the Ukrainian legislation. The distribution of functions among market participants is presented in Table 1.

[34] According to CMU's Resolution No. 159 of March 13, 2013, "On Liquidation of Local Bodies of the Ministry of Environmental Protection" the mentioned authorities were abolished. In order to ensure the transfer of authorities from the local bodies of the Ministry of Environmental Protection to the subnational and local administrations under CMU's Resolutions No. 338 of March 15, 2013, and No. 606 of April 18, 2012, respective units in charge of ecology and natural resources were set up in the local state administrations.

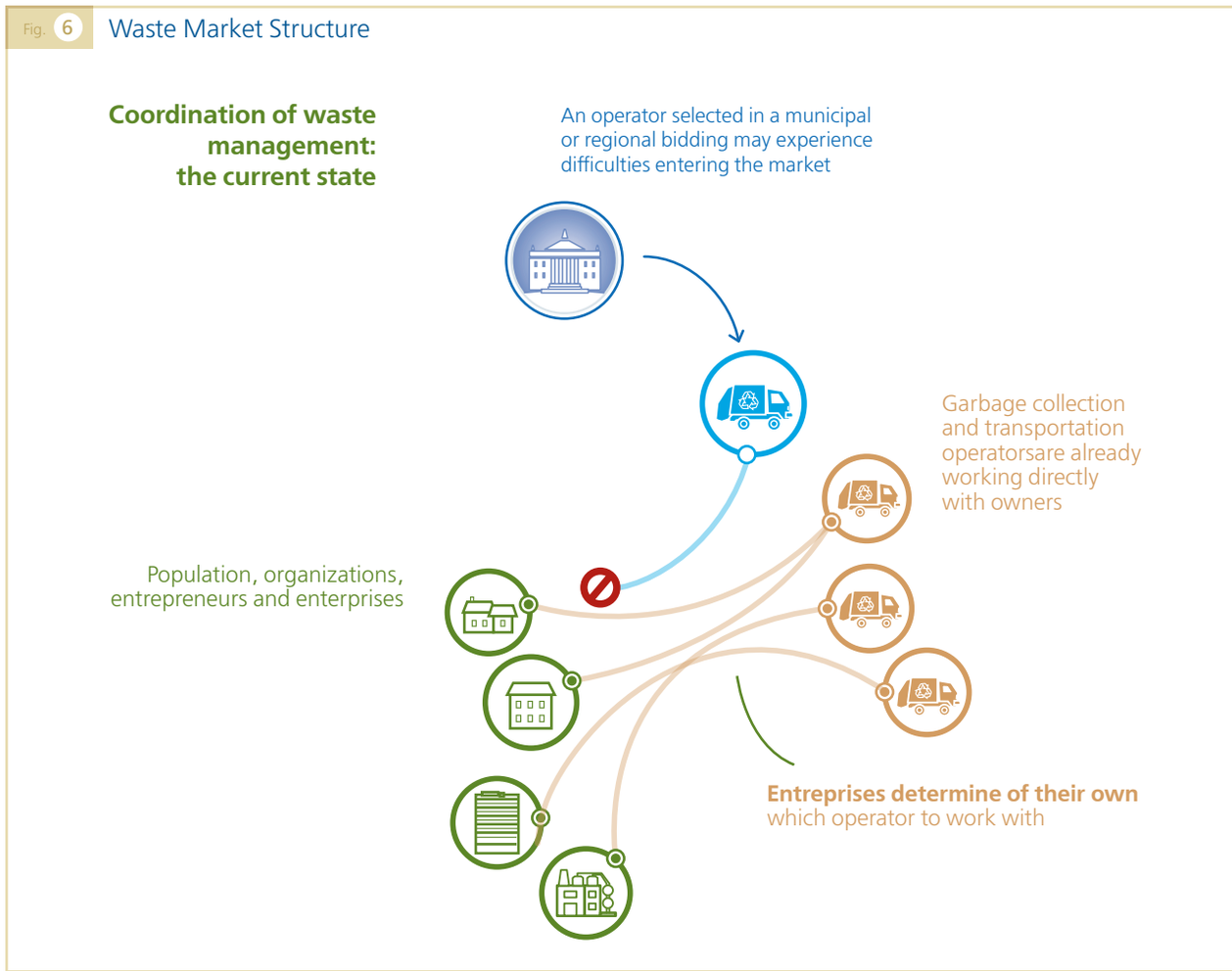
Table 1. Distribution of Responsibilities among Waste Management Cycle Participants

Function	Participant
Direct ownership of waste, obligation to prevent environmental harm	Population, organizations, entrepreneurs
The right to gain profit by managing assets and transferring ownership. The responsibility to compensate for adverse environmental impacts	Organizations, entrepreneurs
Organizing collection and removal of garbage from residential areas	Local state administrations
Coordination of collection, recycling, utilization, and disposal of waste	Local state administrations
Proper operation of infrastructural facilities and delivering waste collection, transportation, and utilization services for a specified fee	Specialized organizations authorized under contracts
Compilation and maintenance of a register of waste generation, processing, and utilization, as well as a register of waste disposal sites	Local state administrations
Coordination of maintaining records on generation, processing, decontamination, utilization, and removal of waste, environmental certification	Local state administrations
Coordination of specially designated authorities for MSW management, licensing, and monitoring the delivery of full-cycle services, assessment of technical, sanitary and environmental safety of existing facilities, and control over record-keeping of waste generation, collection, processing, utilization, and disposal; limits concurrence for generation and disposal of waste, control over record-keeping of a register of facilities	Ukrainian Ministry of Ecology and Natural Resources
Policy enablement and implementation of state programs in the area of MSW; coordination of activities undertaken by local executive authorities in the area of municipal waste; regulative and procedural guidelines on municipal waste management; development and approval of governmental standards, norms, and rules in municipal waste management, schemes for sanitary cleaning of residential areas	Ukrainian Ministry of Regional Development, Construction, Housing and Utilities

Sources: Law No. 280/97-VR of May 21, 1997, "On Local Self-Governance in Ukraine", law No. 187/98-VR of March 05, 1998, "On Waste", law No. 1264-XII of June 25, 1991, "On Protection of the Natural Environment".

As Table 1 shows, there is a split between waste ownership and the responsibility to organize waste management. If the approach to the organization of market operations is considered, the relationships of market participants on the district level will look as demonstrated in Figure 6.

Fig. 6 Waste Market Structure



Source: IFC.

The aforementioned gap leads to a number of negative consequences:

- There is a lack of interest among small companies to work in the "challenging" sectors of the economy, with "pricing pressure" on local administrations being in place;
- There is a risk that companies will establish monopolies (a local administration could make an effort to control the entire system of services) along with an inefficient fee and pricing policies;
- Companies that have necessary technological and financial capabilities to resolve waste problems have limited access to the market.

As a result, municipalities may make faulty decisions which would not ensure necessary environmental soundness and a required recycling level, and would be costly for administration and citizens.

The current law stipulates that entrepreneurs and businesses own/are responsible for the waste they generate. This is an important prerequisite for the benefits that may be obtained by them from recycling waste into secondary raw materials. Meanwhile, municipalities are responsible for organizing the collection and transport of waste. In practice, local authorities are often required to sign waste

disposal contracts with specialized municipal enterprises.

Both management companies in the residential sector and individual homeowners face this obligation. Sometimes, contractors are selected in a competitive bidding for an urban area.

The outlined situation brings about certain aftermaths:

- An operator willing to provide services in a region should sign a contract with each consumer. There can be several thousands of consumers;
- Any consumer is free to enter into a contract with any entity (regardless the choice made by the municipality), and this entity is unlikely to have full control of all waste streams in the area;
- Conflicts may arise between operators regarding the right to access landfills that fall under the authority of a regional administration. If an operator plans to engage in collection, transport, and disposal, it must coordinate such intentions with the authorities.
- Companies that wish to transport or receive certain amounts of waste for recycling must make individual contracts with a multitude of different consumers, risking the ability to retain them for a long term.

In the sector where the scale and continuity of the production process are crucial, the absence of a guaranteed waste stream and uncertainty in the choice of contract counterparts make it difficult to raise private capital.

Creating Economic Incentives and a Funding Mechanism for Developing a Waste Recycling System

Household and enterprise waste disposal fees are main sources of funding for the MSW sector in Ukraine. Currently, residents in apartment buildings and some enterprises are charged for collection and transportation of waste both separately and as part of utility fees (for maintenance of premises). Common practices assume definition of the necessary service range based on a specific coefficient per unit area (rate of accumulation).

This norm may be developed and approved by local authorities. Therefore, payment for each element in the chain of waste management is constructed under the cost plus principle, based on an estimated amount of waste. Additional uncertainty results from the simultaneous application of two inventory methods – according to waste volume and weight.

Charging System in Force Fails to Promote the Use of Advanced Technologies

Charging System in Force Fails to Promote the Use of Advanced Technologies

Losses associated with illegal activities – uncollected funds for waste handling - are not significant for an official landfill. However, a business rooted in MSW recycling technologies, garbage incineration in particular, is negatively affected by the existence of illegal dumps. This is why, for instance, the loading level of the incinerator "Energiya" in Kyiv has decreased from 90 to 40 percent. Instead of 700 tons of waste daily needed for its effective operation, only 320-330 tons is brought on average. The reason for the low loading is the relatively high waste disposal fee for incineration: 127 UAH/ton compared to 40-50 UAH on illegal landfills and 100-110 UAH on authorized grounds.

According to clauses 6 and 13 of the Rules for Delivery of Municipal Waste Transport Services, as approved by the CMU's Resolution No. 1070 of December 10, 2008, the scope of services is defined based on the MSW accumulation norms that are established by self-local governments, while a fee is compounded monthly based on contractual provisions and fee rates to be calculated in accordance with the CMU's Resolution No. 1010 of July 26, 2006.

The fees are set differently in different regions and include compensation for garbage transportation and disposal costs. According to the abovementioned CMU's Resolution No. 1010 of July 26, 2006, the municipal waste disposal services include all activities related to municipal waste management (collection, accumulation, use, decontamination, transportation, and disposal), meaning that the higher the recycling level, the greater the fee.

Different fees for various client categories (residents, budget spending units, and all others) under the CMU's Resolution No. 1010 of July 26, 2006, "On Approval of a Pricing Procedure for Services Associated with Municipal Waste Transport" are explained by differences in allowed levels of economic feasibility for given categories.

An investment constituent, which compensates capital investments for a service provider within the framework of an investment program agreed with local authorities, is included into the fee for a period of five years (for a sum which does not exceed 20 percent of total expenditure). MSW recycling expenditures are to be reimbursed under the law, but in practice the increase in fees is limited due to their social importance.

According to the Ukrainian Ministry of Regional Development, Construction, Housing and Utilities, an average fee (2013) for MSW recycling is 40.6 UAH per cubic meter, including the landfill disposal fee —12 UAH per cubic meter (26 percent)[35], versus 31 and 9 UAH in 2010, correspondingly. This constitutes about 11.6 UAH per capita in 2013 (less than 0.4 percent of average monthly wages)[36]. In other words, given the current per capita tariffs, MSW disposal operators believe that their costs are not sufficiently reimbursed, but the population is overreacting to any raise in prices. The current structure of fees and payments is shown in Figure 7.

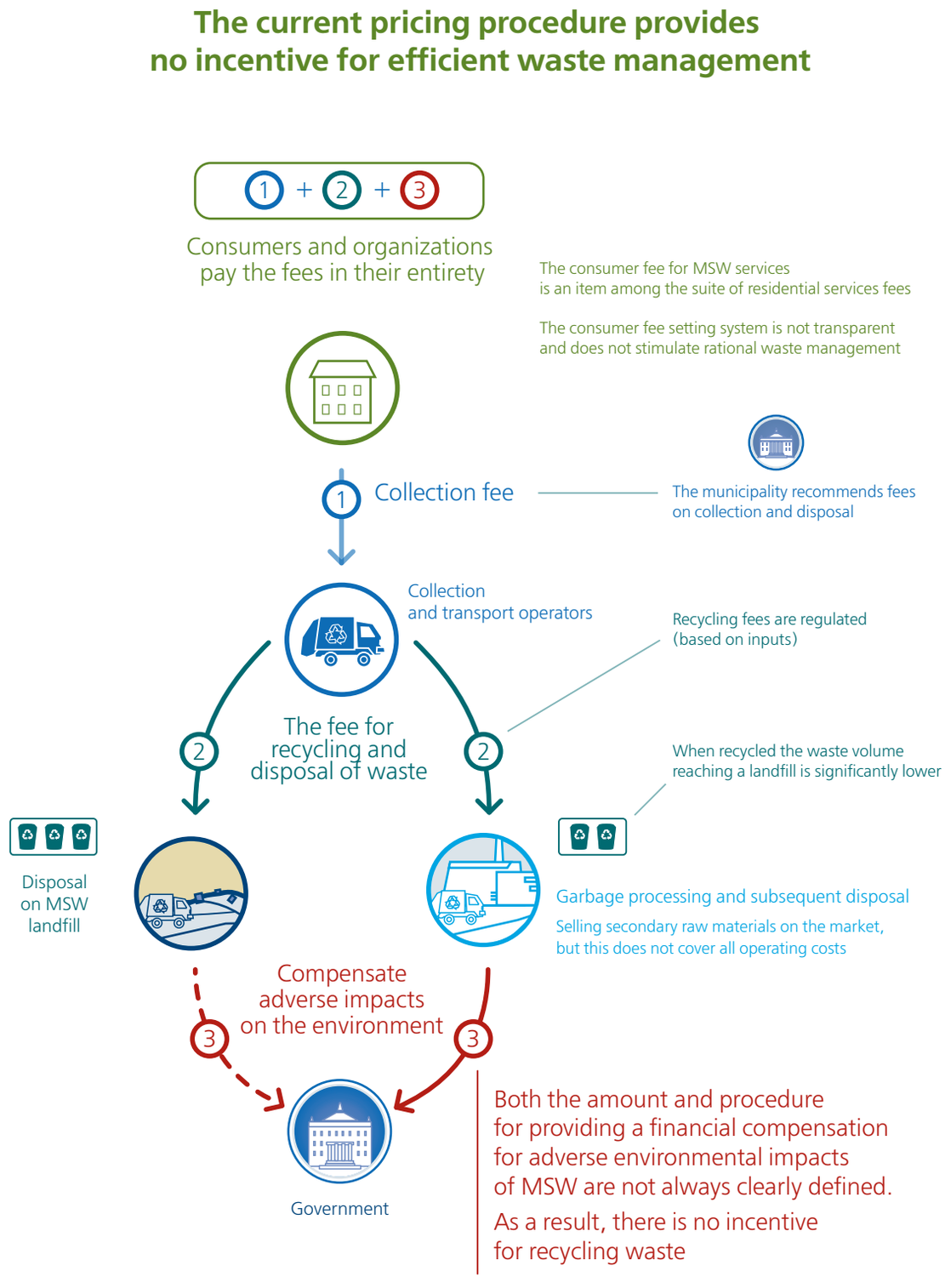
As of now, the environmental impact compensation mechanism is included in the disposal fee paid by an entity disposing of the waste on a landfill, including specifically designated sites (except for disposal of certain types (classes) of waste, such as recyclable waste, which shall be placed on site owned by commercial entities), according to the law "On Protection of the Natural Environment", as well as the Ukrainian Tax and Budget Codes. The tax levy is distributed between specialized national, regional and municipal environmental funds in the proportion 65/10/25.

Definition of the responsibility for disposal fees — is one of the most complex issues in the field of MSW management. This is related to establishing the owner of waste as described above in detail. Currently, different practices have been set out on the municipal and regional levels both in terms of the fee charging entity or the fee charging/payment chain for waste management.

The obligation to pay is assigned to entities that actually dispose of waste on landfills. That said, the payment is sometimes included into a fee and then transferred to the payer level, but it does not happen in other cases.

[35] Status of the Ukrainian Household Waste Management Sector in 2013. Ukrainian Ministry of Regional Development, Construction, Housing and Utilities, as of March 24, 2014.
[36] Based on Statistical Yearbook 2013. Ukrainian State Statistics Service. Kyiv, 2014.

Fig. 7 Pricing for MSW Disposal



Source: CMU's Resolution No. 1010 of June 26, 2006, "On Approval of the Pricing Procedure for Services Associated with Municipal Waste Transport", Ukrainian Tax Code No.2755-VI of December 02, 2010, Chapter VIII "Environmental Tax"

Examples of Projects applicable for PPP

Landfill Gas Utilization

In order to collect landfill gas from two MSW landfills in the city of Mariupol (in Primorsk and Ordzhonikidze districts), it is planned to construct gas removal systems. Each would include wells covering the entire surface of the dumpsite. In addition, a pipeline system would connect the wells with gas accumulating points; landfill gas would be pumped from the wells; and flame would provide for permanent burning of surpluses.

The obtained landfill gas would be utilized by cogeneration units with an electric capacity of 200 kW (landfill No. 1) and 800 kW (landfill No. 2). The produced electricity would be sold to a distribution network for the "green" fee and partially used as needed by the gas removal system itself; the heat would be transferred to nearby plants.

Source: "TIS Eco".

In this situation, the fee does not motivate recycling, but is rather perceived as an additional tax.

The current practices have two main results:

- The fees are not transparent to the consumer, since they are often not tied to the actual volume of waste and vary disproportionately to the amount of services provided;
- The fees are insufficient for operators, since frequently costs of maintaining an environmentally friendly infrastructure are not covered.

The economic incentives for waste recycling are inadequate. Although laws prescribe reduced waste disposal fees for entities that introduce recycling and low-waste technologies, as well as accelerated depreciation of fixed assets, these measures often have not been comprehensively elaborated on the level of regulations.

As a result, the cost of recycling is passed along in its entirety to the consumers as a regulated fee, which is often more expensive than waste disposal on a landfill because an additional element is included into the chain. The relatively "low cost" of disposal creates distorted incentives for operators and local authorities in their choice between landfilling and recycling.

However, on October 3, 2014, the draft law No. 5129 "On Amending Certain Ukrainian Legislative Acts in the Field of Municipal Solid Waste" was registered in the Parliament. It was submitted by the Cabinet of Ministers. All apartment owners or homeowners will be obliged to make contracts with eligible companies. Moreover, the residents will have to pay for waste transportation to a separate account and not as part of the total amount of fees for municipal services.

The Cabinet proposes the Parliament to penalize citizens in an amount of UAH 1,360-1,700 for failing to conclude a household waste management contract.

Local councils will select companies for waste transportation, and such decisions can be made without any tender or bidding procedures. The draft law proposes to withdraw all the "waste" issues from the scope of the law "On Public Procurement" in order to save time and costs. The recycling and landfilling of waste are to be excluded from a list of monopolies in order to avoid unnecessary difficulties in terms of clearance of tariffs with the Antimonopoly Committee.

Also, the bill proposes to move away from the integrated approach of services delivery when a company provides all the services, including collection, transportation, sorting, recycling and land-

filling. It is stipulated that local councils will be able to contract different companies for each of these activities.

The draft law is quite disputable since it reduces competition and control, and requires more management power of local authorities.

Private Investments Can Be Raised through Public–Private Partnerships (PPPs)

Over the past few years, the importance of PPPs for implementation of large infrastructure projects and programs has been increasingly recognized in Ukraine. Law No. 2404 "On Public-Private Partnership" signed on July 27, 2010, has been in effect since autumn 2010.

The virtue of this document is that a governmental partner within the PPP framework will be represented by specific bodies of executive power and local government. The above arrangement serves as a guarantee for private partners.

However, the PPP law has not lead to a significant increase in the number of PPP projects in Ukraine. The document itself raises many theoretical and practical questions, and poses respective barriers. Nevertheless, PPP is becoming more and more popular and some kinds of public-private cooperations are somehow realized in practice (despite the unclear legal framework).

Commercial cooperation between governmental and local authorities, on the one hand, and private companies, on the other, is already underway in such areas as the housing and public utility sector, and the transport and sports infrastructure. In each case the private partner in a PPP, under a set of specified terms, receives state-owned assets for commercial use (or uses them to create new assets) while sharing financial, technological, and operational risks of administration.

In fact, the use of PPP mechanisms for waste management is feasible, given the background of MSW:

- The waste management infrastructure is state-owned and privatization is often not a viable alternative in the light of the industry's social significance;
- MSW operators do not have sufficient capabilities (technological, financial, etc.) or incentives to modernize and build a new infrastructure;
- Because of significant risks and a high degree of state regulation, the private sector does not have an interest in entering the MSW market without extra guarantees.

Utilization of MSW as a Fuel in Cement Manufacturing

Experience abroad demonstrates that various waste can be efficiently utilized in cement manufacturing; these include metallurgical production slags, ash slags from heating and power plants, industrial and municipal waste, and worn-out automobile tires. High efficiency of utilization is driven by the low-waste technology of cement manufacturing, low cost of waste burning, and also because the process in rotating cement ovens is compliant with environmental requirements.

The best possible option would be for municipalities to provide cement plants with fine-crushed dry MSW. It is feasible in financial terms for both parties: cement plants will obtain a cheap fuel and cities will get rid of enormous expenditures associated with construction, operation and reclamation of landfills, and cut transportation costs. Besides, this will facilitate improvement of the environmental situation in Ukraine.

Source: HSM.

The Ukrainian Ministry of Regional Development, Construction, Housing and Utilities has developed a PPP Framework for MSW Management, with funding needs are estimated at 160 billion UAH. The major part of these — 120 billion UAH — is required for construction of 30 MSW recycling plants, 12 billion UAH — for construction of 30 plants for MSW bio-mechanical recycling, 0.5 billion UAH — for construction of 60 garbage sorting stations, 1 billion UAH — for a segregated MSW collection, and 22 billion UAH — for landfill restoration.

Representative offices of the biggest international corporations in Ukraine operating in MSW — German Remondis and French Veolia – are dealing with collection and disposal only.

Data Support for Decision-Making

The shortage and poor quality of information about the volume and composition of waste complicates a preliminary cost-benefit analysis needed for implementing waste management projects. At present, statistics entities gather information on the volume and hazard category of waste generated in municipalities or at enterprises, and the number of recycling and disposal sites in the region.

No regular, centralized data collection and analysis of the key waste fractions (packaging, hazardous or bulk waste) are done, and operators (or a municipality acting as an initiator of the project), as a rule, conduct such an analysis independently.

Information on the amount of waste is not always reliable. Reporting formats for waste accumulation in the residential sector often use outdated data based on accumulation norms in cubic meters and do not include weight data (as weighing is not always done on landfills).

In the past, MSW was recorded precisely by using volumetric data. This was done given the need to calculate the capacity of garbage truck containers and bins. Weight data became crucial for determining a portion of recyclable fractions.

Inefficient data gathering practices presently hamper robust monitoring and planning on the national and regional levels, and also decrease industry transparency for investors.

Based on the analysis of the MSW management policy and legislation in Ukraine, we can draw several conclusions.

- Throughout the last decade, Ukraine has been gradually introducing some elements of the EU legislation on MSW, although the process is reminiscent of a patchwork — compiling various fragments or patches into an integral whole. A consistent strategy for development of the industry which would direct all activities is missing; there are no aligned goals achievement of which would facilitate gradual implementation of requirements outlined in the European directives on waste and landfills.
- Better dynamics in reaching target indicators for utilization of specific fractions is reinforced neither by financial resources nor technological decisions, nor statistical data. Performance of the state-owned enterprise "Ukrecoresoursy" is not evaluated based on achievement of target indicators. In addition, the perceived lack of transparency in decision-making raises lots of complaints regarding its operation.
- The fees calculation principles are heavily outdated and do not favor implementation of new waste recycling technologies. The established rates for the environmental tax and unauthorized garbage disposal fines are too low to make a difference in terms of the waste owner's behavior.
- Successful implementation of national and regional programs to a large extent depends on availability of budget funding. The traditional sources of financing are not sufficient for fundamental modernization of the MSW management sector, and, therefore, involvement of IFIs and/or private funds is exceedingly needed.

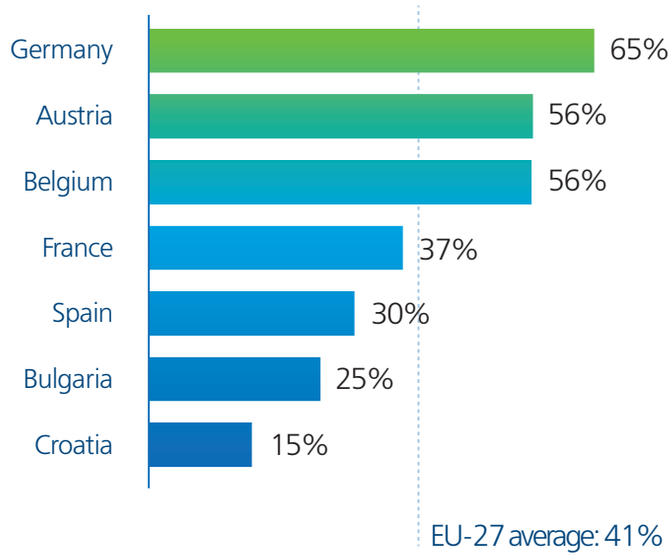
Experience gained by European countries demonstrates that a combination of landfills development and modernization of equipment and machines for waste collection and transportation allows cutting costs for construction of new disposal sites within a period of 10-12 years.

1.3. Analysis of MSW Management Abroad

Program– and Goal–Oriented Approach with Strict Prioritization

In the EU, 61 million tons of MSW[37] is recycled into secondary raw materials annually, which exceeds the annual MSW generation in Ukraine four times. The recycling level of municipal waste in Europe varies greatly from country to country (Figure 8).

Fig. 8 MSW recycling rates in select European countries, 2010



Source: Eurostat data, 2012.

It is necessary to create a balanced waste management system. To achieve this goal, we need to identify long-term strategic priorities that would combine environmental efficiency and rational use of material and energy resources.

Unlike in the industrial waste sector where applying more efficient technologies leads to a significant decrease in the volume of generated waste, preventing MSW generation is a hard-to-achieve and not very promising measure due to the low potential in cutting waste, as it is an integral part of goods and services consumption by households (packaging, food waste, used home appliances, etc.).

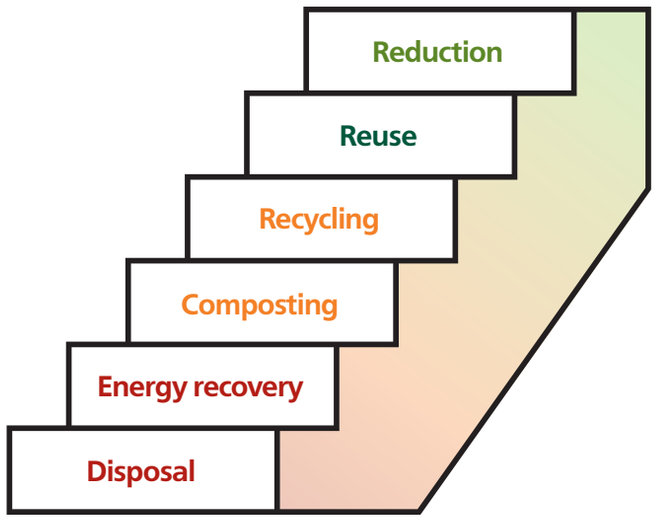
That is why the EU policy in MSW management has focused not on preventing waste generation, but on building the most environmentally safe management system for waste streams. The basic European document in the field of MSW management – Directive 2008/98/EU passed in 2008 – defines environmental protection, minimization of adverse impacts the generation and management of MSW has on the environment and human health as main objectives in the MSW management policy.

The paper sets out basic principles and requirements in organization of MSW management while direct configuration of the system is defined independently on the country level.

[37] Composting not taken into account. Eurostat data, 2010.

According to the Directive, basic principles in the choice of MSW management methods should be environmental safety and efficiency. All MSW management methods are presented in the so-called Lansink's ladder (Figure 9)

Fig. 9 MSW Management Methods



Source: Eurowaste, "Types of Waste", 2014.

The top priority is prevention of waste generation. The highest-priority waste processing method is the reuse of waste, because it does not practically lead to an adverse environmental impact (an example would be the reuse of glass containers), the lowest-priority method is depositing waste on dumps and landfills.

Waste incineration and recycling into secondary raw materials and energy occupy an intermediate position in the hierarchy. The assumption is that as a waste management system develops there is a gradual movement up the ladder, i.e., the most environmentally friendly waste management methods will begin to prevail.

As the EU experience has shown, waste management priorities are determined, above all, by choices the society makes and by goals set on the national level. At the same time, in order to set attainable targets for projects and programs, it is feasible to take into account regional differences in the volume and composition of waste, a potential demand for secondary raw materials and energy, climatic and seasonal factors, and the availability and quality of soil assets.

As part of accomplishing the overall task of a higher level of recycling, the EU countries prioritize methods that minimize net losses of materials and energy. Countries, when selecting result-oriented approaches, also consider local factors determining which projects to embark upon and select specific technologies.

The key to development of waste management systems in the EU countries was to make a shift from a process approach (targeted at technical and sanitary regulation of separate procedures and stages in waste management) to a programmatic one (building a hierarchy of performance targets and developing ways to achieve them, taking into account local conditions).

Waste management priorities are established by the EU Directives setting basic principles, requirements and performance targets for operating the MSW system. National legislators refine approaches and mechanisms for achieving the set goals, including incentives.

Market operators determine specific procedures and technologies for providing services to reach the performance targets and guarantee compliance with the EU sanitary and environmental requirements.

The overall basic principles of the EU policy on MSW management can be consolidated into the following three main groups:

1. Environmental safety assurance according to the set standards (requirements) along the full MSW lifecycle;
2. Setting priorities according to the above outlined hierarchy in MSW management;
3. Implementation of the polluter pays principle to a full extent in two directions:
   - the principle of the extended producer responsibility — the producer pays;
   - the one who disposes of garbage (households and organizations) fully pays for its most environmentally sound way of recycling and disposal.

Importantly, at an initial stage of system creation, it is necessary to ensure fulfillment of the basic social and environmental standards: the full coverage of households with MSW collection and transportation services, responsible landfill disposal of MSW on landfills in compliance with necessary sanitary requirements. Only after the basic-level infrastructure has been built up, further development of the sector is possible through sophistication of recycling methods. That said, different countries progress differently: the advanced European countries went through all stages evolutionary, but the new EU member-states (EU-12) did so with accelerated progress.

In achieving the set targets and efficiency of the policy in place in the regions, the key issue is the ownership of waste. Property rights for waste, secured by the legislation in Ukraine, are preserved in the former socialist countries of Europe. Countries that are most successful in MSW management (for example, in Scandinavia) have the system where a municipality is the owner of waste.

If an enterprise or a household puts aside waste, then they reject it and do not own it, polluting the environment at the same time. That said, they need to pay for waste management in full. The municipality decides how to handle waste and in what way: independently or in coalition with other peers. The highest fee for households is for landfill disposal, while they pay slightly less for incineration, etc. In synthesis, households are interested in recycling and segregated collection.

The EU countries approached the next important stage — development of national MSW management plans aimed at prevention of waste generation which were due by November 1, 2013.

A complex system for provision of waste-free production and consumption is the next stage after reaching the limit of financial feasibility and increasing the extent of recycling (indicators not lower than 50–60 percent as a whole and for separate components). The principle of zero waste is massively promoted in "green" construction, as well as in corporate ethics with regard to operations in offices.

Evolutionary and Accelerated Upgrade of the MSW Management System in Europe: Key Take-aways for Ukraine

The development of the Belgian and Hungarian MSW management systems is illuminating.

Belgium has one of the most advanced waste management systems: as of 2009, less than 4 percent[38] of MSW was disposed of, nearly 40 percent was sent for recycling to obtain secondary raw materials, 23 percent was composted, and 34 percent was incinerated.

Presently, the share of MSW that is being incinerated has declined. Additionally, a plan was set to reduce the amount of waste incinerated from 161 kg per capita in 2005 to 150 kg in 2010.

Belgium followed a long path to building its current waste management system. The main developmental stages of the Belgian waste management system can be demonstrated with an example of the evolution of recycling in Flanders between 1985 and now. The development was represented by five stages of the vertical movement up Lansink's ladder (Figure 10).

Therefore, it took Flanders 35 years to achieve cutting-edge development for its waste management system. But this does not mean that another country would need the same time to achieve a comparable level of recycling.

Today, there are new technologies and methods for MSW management. In fact, in some Eastern Europe countries an advanced waste management system evolved more quickly to achieve compliance to the EU standards. So let us consider the case of Hungary.

An intensive change began to occur in Hungary's waste management system with its admission to the EU. The Waste Management Act, signed into law in 2000, harmonized the Hungarian legislation with that of the European Union. The act defined and revised rules and requirements, specified the responsibilities of parties involved in the MSW system, and established basic principles regarding responsible waste management, including the EPR principle, responsibilities of parties along the process of waste management.

Later this act led to the adoption of a National Waste Management Action Plan for 2003-2008 which aimed at introducing new requirements to upgrade the institutional infrastructure for developing the sector, as well as to raise public awareness and stimulate scientific and technical research. A similar document has been adopted for the period of 2009–2014.

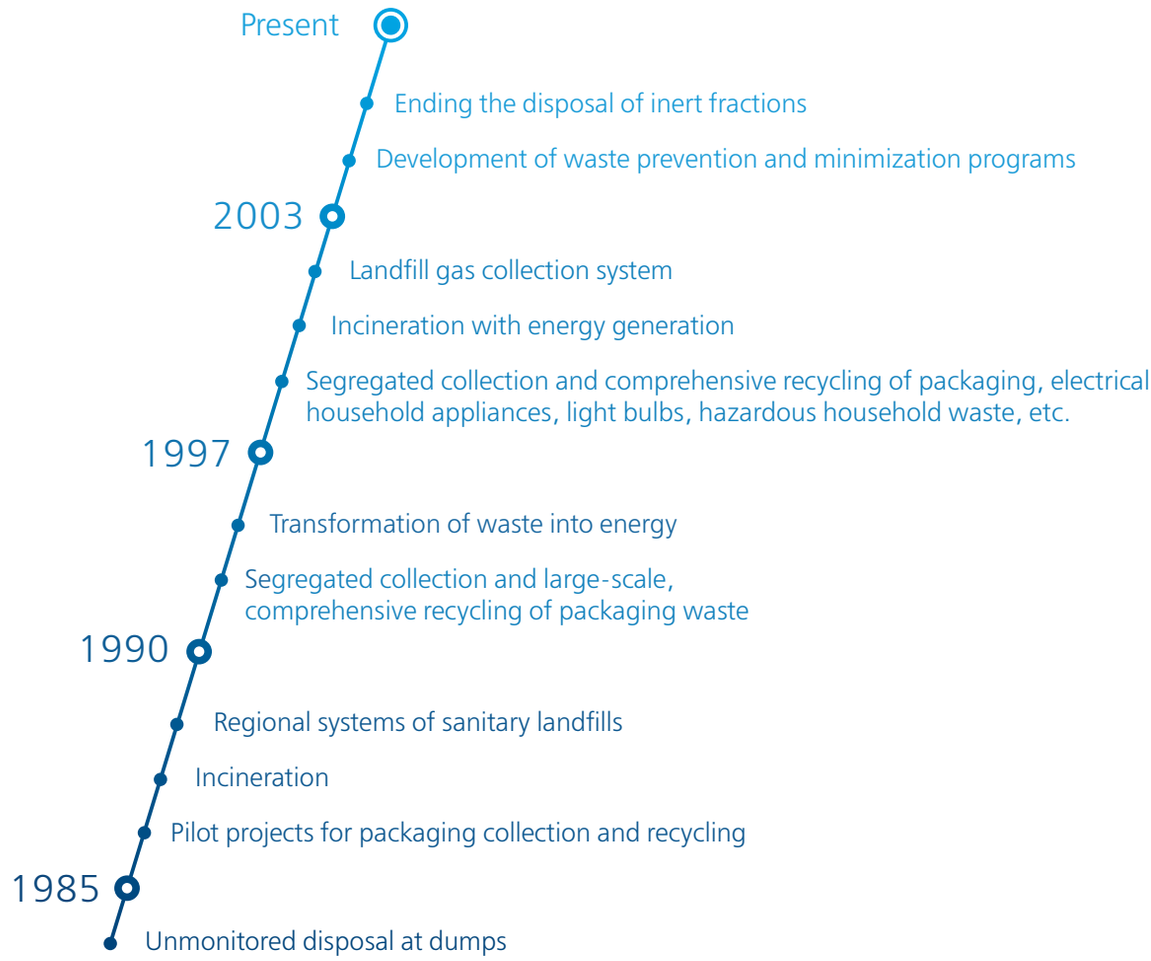
These activities brought about significant positive changes in the MSW management structure: the share of disposal went down from 95 to 80 percent, while the share of recycling into secondary raw materials grew almost tenfold: from 2-3 percent to 15 percent in 2010. Currently, the share of recycling reaches 21 percent.

It is projected that if the trend continues, then Hungary will have reached the recycling level of 42 percent versus required 50 percent by 2020. For this purpose in early 2012 Hungary set up a single coordinator between companies that collected and transported waste and recycling companies: the National Agency for Waste Management.

A tax was introduced in 2013 for waste disposal on MSW landfills, amounting to €10.5 per ton, which will increase to €42 per ton in 2016. The Hungarian example shows that countries with initial conditions similar to the Ukrainian ones managed to develop a waste management system over a short period of time.

[38] Hereinafter – IFC data.

Fig. 10 The Establishment of an MSW Management System in Flanders as an Example of Evolutionary Development



Source: IFC.

Notably, effective cooperation between private operators and government authorities responsible for waste management is a key factor for achieving positive results. In this regard, the experience of the Eastern European and Balkan countries is of interest.

The state of the MSW sector in this region during the mid-1990s was similar to the current situation in Ukraine:

- The municipal infrastructure for waste collection and management was obsolete;
- The principal funding source for the sector, fees, did not allow basic modernization, not to mention the introduction of advanced technologies;
- Municipal authorities could not resolve problems independently: they were hampered by the lack of knowledge regarding mechanisms for regulating the sector and the use of new technologies;
- Residents did not express an interest in receiving a higher quality service.

Only the combined efforts of government authorities and private operators made it possible to both generate demand for advanced MSW management mechanisms and implement them more efficiently than municipal operators could have done by acting alone.

The experience of countries such as Hungary demonstrates that by developing recycling, vigorously rehabilitating and reclaiming landfills, and upgrading the equipment and machinery for waste collection and transport, it is possible to reduce expenditures on construction of new disposal sites within a time-span of 10–12 years.

Similar programs were implemented effectively in 2005-2008 by some of the Balkan states (Serbia, Montenegro, and Albania). The countries that achieved the highest level of recycling (Belgium, Germany, and the Netherlands) have, for all practical purposes, ceased disposal of MSW, and no longer built new landfills.

As a result, in the Baltics, as well as in the Czech Republic, Slovakia, and Hungary, the share of recycled waste increased from practically zero to 20-25 percent between 1998 and 2005[39]. Additionally, disposal on unregulated dumps was almost completely eliminated.

Most waste was now sent to new sites that were built with participation of private operators, including major European players such as Remondis, SITA, and A.S.A. It is possible to learn from the experience gained in implementation of methods and programs with such transformational effects and apply it in Ukraine.

The Coordinating Agent Model for Managing the Municipal Waste Stream

One of the common models in the international MSW sector is the coordinating agent model. Coordinating agents are distinct entities or non-profit organizations that have an exclusive or partial right to manage waste generated within a certain area. The coordinating agents enter into contracts with and make payments to entities that provide services and use the infrastructure, as shown in Figure 11.

In this system, the coordinating agent is authorized to manage waste streams, select service providers, and set fees for public consumers. Municipalities are one of the several customer types (for transporting garbage from public places, site clean-ups, and other services provided to the public sector). Application of this model is of vital importance for Ukraine now.

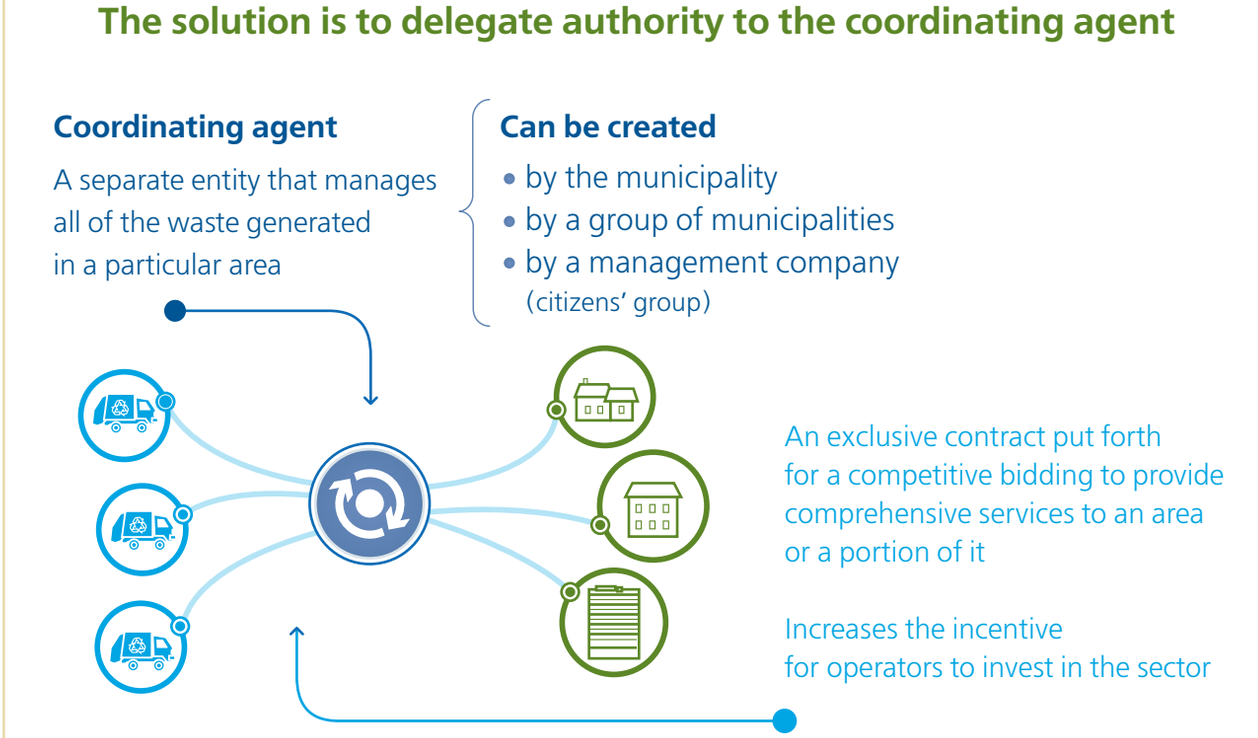
This model combines efforts of municipalities to achieve targets for waste recycling and decreasing waste disposal on landfills in the most economically efficient way. Financial capacity of local budgets is often limited. The use of the best possible recycling technology and the scale effect decrease unit costs of the recycled MSW.

This coordinating agent approach combines a number of characteristics that are essential for implementing the innovation scenario proposed in Chapter 2 of this report:

- a common vision of the end result (an efficient system) that makes the market more predictable and transparent for regulators, operators, and investors;
- a variety of approaches among different regions for selecting technology, processing/recycling methods, funding mechanisms (taking into account specific environmental factors and economic conditions);
- preservation of a common approach to monitoring factors that directly affect the environment (technical and sanitary integrity of infrastructure facilities).

[39] Data from the Eurostat Environmental Data Center on Waste, 2012.

Fig. 11 The Coordinating Agent's Role in The Waste Management System



Source: IFC.

The Coordinating Agent Model for Implementing the Extended Producer Responsibility Principle

One of the examples of using the collective approach to MSW management is the Green Dot, an international system that consists of companies that produce goods and services, and waste management organizations. The collected funds are used for creation and maintenance of a sufficient recycling infrastructure.

Once a participant pays a fee, its obligations for contributing to recycling is considered fulfilled, because the National Green Dot system of monitoring and reporting is coordinated with governments. An example of such mechanism is presented in Figure 12.

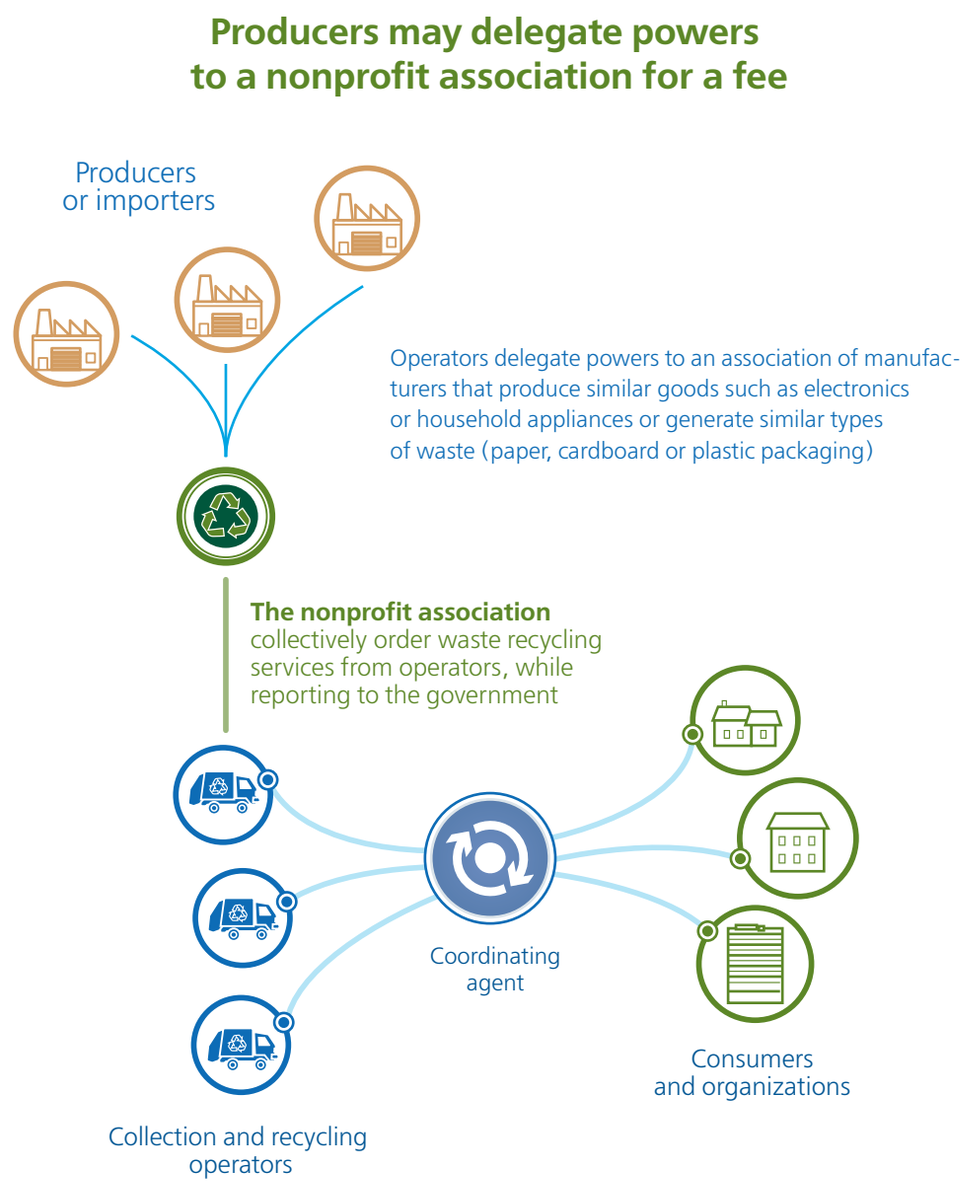
Additionally, municipalities often participate in the Green Dot systems. In such cases, the EPR principle is fully integrated into the regional MSW management system. In a number of countries, garbage collection and transportation services are rendered exclusively within the framework of municipal or regional systems and are funded by fees.

Although a new competitive selection was announced in 2009, potential rivals will have a hard time when competing with an organization supported by the government.

Therefore, taking into account the experience of the Eastern European countries with similar initial conditions, Ukraine can achieve significant results in development of the waste recycling industry and minimization of the waste disposal on landfills.

Success depends upon implementation of an effective administrative system. Various versions of the coordinating agent model have performed well in Europe. They might be utilized in Ukraine as well.

Fig. 12 Organizing Solid Waste Management With Participation of a Green Dot association



Source: IFC.

Examples of Green Dot System Implementation

Almost every EU state and a number of other countries have national associations that are members of a single coordinating organization called PRO EUROPE. Green Dot organizations perform the same functions in each country and are structured according to a common principle.

The main task for these organizations is implementation of the extended producer responsibility principle in the area of packaging waste recycling. Operating on the national scale, these organizations can, for a fee, liberate manufacturers and sellers from the obligation of recycling packaging waste.

These institutions are set out to provide recycling services in a financially and environmentally beneficial fashion. Manufacturers and sellers make contributions to the national Green Dot organization. Packaging with prepaid recycling fees is marked with the Green Dot symbol.

The Green Dot organization, with the help of private and municipal operators, collects and recycles packaging waste marked with the Green Dot symbol.

In addition, the Green Dot organization conducts campaigns designed to raise public awareness regarding the importance of proper waste collection.

An Example of Green Dot System Implementation: the Belgian Experience

Belgium is an example country that has been highly successful in recycling packaging waste. Its recycling level of packaging waste in 2009 was 93 percent.

Companies that supply packaged products to the Belgian market may enter into an agreement with the national Green Dot organization, Fost Plus. It has almost 5,500 members that make up 92 percent of the packaging market.

The member companies' individual fees are calculated based on packaging types and volumes that they declare each year. For example, in 2010 the usage fee per ton of glass was €18.4, €137.9 for aluminum and €199.4 per ton of PET bottles.

Small companies that produce less than 300 kg of packaging per year and wish to use the Green Dot logo on their products pay a fixed annual fee of €30. In addition to contributions from the participating companies, Fost Plus receives revenue from the sale of secondary raw materials.

To organize the collection and sorting of packaging waste, Fost Plus and municipalities enter into five-year agreements which detail waste volumes, collection methods, costs, and other conditions.

A municipality is entitled to carry out these operations independently or delegate them to private operators. Entities that recycle waste are chosen through competitive biddings. Fost Plus conducts active publicity campaigns and participates in developing environmentally safe packaging. The organization has a staff of about 50 people.

Sources: PRO EUROPE, IFC.

In case Ukraine chooses the innovative scenario for MSW sector development and reaches a 41 percent level of recycling, 7.4 million tons will be prevented from landfill disposal in 2025.

This is three time more than MSW generated in Finland and Norway.

Chapter 2. Assessessment of the Potential of the Ukrainian MSW Management Sector Using the Scenario Analysis

Chapter 2 examines:

- modeling MSW volume dynamics and composition structure with application of European experience;
- the most common MSW recycling technologies;
- two scenarios: business-as-usual and innovative; the former assumes preserving of a current situation, the latter - introduction of recycling;
- application of the model on the regional level.

Based on the estimations made, the following conclusions have been drawn:

1. Both scenarios— business-as-usual and innovative — suggest provision of environmentally safe disposal of non-recyclable waste, as well as closure and remediation of MSW landfills that are unsafe and over capacity.
2. Implementation of the innovative scenario will bring additional environmental and economic benefits[40]:
   - conservation of finite natural resources by replacing traditional energy resources with alternative sources — garbage and landfill gas;
   - generation of additional energy and heat;
   - recovery of raw materials and supplies back to the economic circulation (104 million tons);
   - production of more goods that are made with recycled fractions;
   - prevention of greenhouse gas emissions (46.2 million tons of carbon dioxide equivalent) on MSW landfills;
   - additional revenues gained from recovery of secondary raw materials and supplies in an amount of about €7.1 billion by 2025.
3. Estimations based on the model can serve as a basis for defining targets in strategy documents for MSW sector development on the regional level.

[40] Assessment of all indicators of additional benefits over a period of 15 years.

Chapter 2

Assessment of the Potential of the Ukrainian MSW Management Sector Using the Scenario Analysis

2.1. Establishing the Model's Input Parameters Based on the European Experience

MSW stream management has the following key parameters:

- volume generated;
- waste composition;
- level of recycling;
- maturity level of infrastructure development;
- disposal characteristics.

Some indicators are missing from the state statistical reporting, and Ukraine has insufficient experience in implementation of common approaches to waste management which would make possible to estimate unit costs depending on a scale and a recycling level. Therefore, a part of entry indicators for modeling is used based on European experience.

Relying on the principle of Lansink's ladder and the MSW management experience of the EU states, we can propose a number of solutions in MSW management that will be effective in Ukraine. The country has set a target to harmonize its legislation in the area of waste management with the European. That is why application of the proposed approach to modeling MSW management sector development in Ukraine can be considered feasible.

Generally speaking, the model is based on implementation of the three main EU policy principles in the sector of MSW management, as outlined in paragraph 1.3 of this report:

1. Environmental safety assurance according to the set standards (requirements) along the full MSW lifecycle;
2. Setting priorities according to the above outlined hierarchy in MSW management;
3. Implementation of the polluter pays principle to a full extent in two directions:
   - the principle of the extended producer responsibility – the producer pays;
   - the one who disposes of garbage (households and organizations) fully pays for its most environmentally sound way of recycling and disposal.

Unit Cost Estimates Based on a Level of Recycling

Below is a brief description of the most common waste recycling methods applied in the EU (technologies are detailed in Appendix 2) and the cost per ton of processed waste.

Costs will vary depending on a capacity of the recycling complex. These data are the basis of cost estimates for implementing various measures within the innovative development scenario.

The Following Technologies Are Most Common:

1 **Recycling a mixed waste stream** is the simplest method of recycling requiring the least preliminary waste preparation. This method can recycle waste of any morphological composition. In the European (and nascent Ukrainian) practices, it is possible to extract 5-20 different fractions from a mixed waste stream using manual and/or automatic sorting.

The end product of a recycled mixed stream can serve as an intermediate input for producing a component that a manufacturer would need to create its final product.

Examples of end products recycled from mixed waste streams include sorted and compacted paper and cardboard waste, glass scrap that has been sorted by color, and plastic bottles that have been cleaned, sorted, and compacted. Depending on technical characteristics of the process (quantity of fractions, level of automation, composition of incoming raw materials and cleanliness of the end product), the recycling level can vary from 5 to 20 percent of the incoming waste stream. The cost of recycling can range from €100 to €250 per ton of capacity (for small processing lines with a capacity of 15,000-20,000 tons of waste per year).

2 **Recycling waste that is sorted by type** is similar to the technology discussed above, except that it is more efficient, if preliminary sorting is done by either consumers, when they discard the waste, or at collection facilities for segregated waste and preliminary sorting centers. Waste preparation makes it possible to reduce the amount of investment required to build facilities and can lower operating costs with automation. Only the fractions that will be recycled are sent to the facility. As a result of the preliminary sorting of waste, only fractions that are subject to the second processing (recycling) are forwarded to the site.

There are two approaches to collecting presorted waste. The first one involves collecting the entire group of fractions to be recycled (paper, cardboard, glass, plastic, etc.), followed by extraction of damp organic waste and contaminated fractions (so-called wet/dry sorting). The second approach involves preliminary collection of presorted fractions for processing, which typically includes paper, cardboard, glass, plastic (bottles), and metals (aluminum cans).

In the first case, it is possible to recycle 30 percent of the incoming stream - in the second case, up to 40 percent. The amount of investments will also vary. In the first instance, it may be as much as €300 per ton, and in the second, up to €400 per ton. Noteworthy, a portion of the overall recycling costs (up to €50-70 per ton) will be assumed by the organization that is collecting the presorted waste, while the collection and initial processing of unsorted waste will be a little more expensive due to the elimination of preliminary sorting.

3 **Recycling organic waste by means of aerobic and/or anaerobic fermentation** allows organic fertilizers and biogas to be extracted from biomass. This technique is most often applied at small facilities (in the EU, up to 40,000-50,000 tons per year per facility). The use of open windrows is the cheapest and technologically simplest method. This approach is used to initiate biological processes, so that they do not develop directly on a landfill.

It should be noted that the use of a waste product as a fertilizer is feasible only if the incoming stream is carefully treated and cleansed of "parasitic" fractions such as glass and metal. Collecting waste to ensure the quality of raw materials could make this technology substantially more expensive. The unit cost of its implementation could run from €300 to €600 per ton of capacity, while the attainable recycling level would range from 20 to 40 percent.

4 **Waste incineration with energy recovery** achieves the highest level of recycling, and it is the most technically sophisticated of all the methods described. The complexity is caused by the use of expensive equipment and monitoring methods that limit atmospheric emissions and by the need to constantly regulate an incoming stream of raw materials in order to meet the thermal processing requirements.

The steady and reliable operation of an incineration facility is largely determined by the composition and quality of the incoming waste. Importantly, monitoring the combustibility of hazardous fractions that have a high heating value (and efficiency of energy production) is quite complicated. The efficiency of such a facility is only maximized when it has a large and continuous flow of waste (from 100,000-150,000 tons per year), which somewhat limits the use of this technology.

The efficiency of the incineration technology may be reduced when a number of fractions are removed from the waste stream for recycling. In fact, recycling in many EU countries has led to the fact that the efficiency of waste incineration plants is often called into question, since a traditional fuel must be purchased to ensure continuous operation.

The waste incineration technology that includes the recycling of energy makes it possible to achieve a recycling level of up to 85 percent. This is possible with an investment of approximately €1,200 per ton per year, depending on incoming raw materials and an annual capacity of the incineration plant.

Table 2. Technical and Economic Properties of Various Recycling Methods

Waste recycling measures	Attainable recycling level, %	Per-unit investments based on capacity, euro per ton (in 2010 prices)
Collection and recycling of a mixed waste stream	5-20	100-250
Recycling with segregated collection (separation of organic waste)	15-30	200-300
Recycling with segregated collection (4 fractions and up)	30-40	300-400
Biogas production from organic biomass	20-30	300-500
Composting (aerobic fermentation)	30-40	400-600
Garbage incineration with energy recovery	80-85	800-1,200

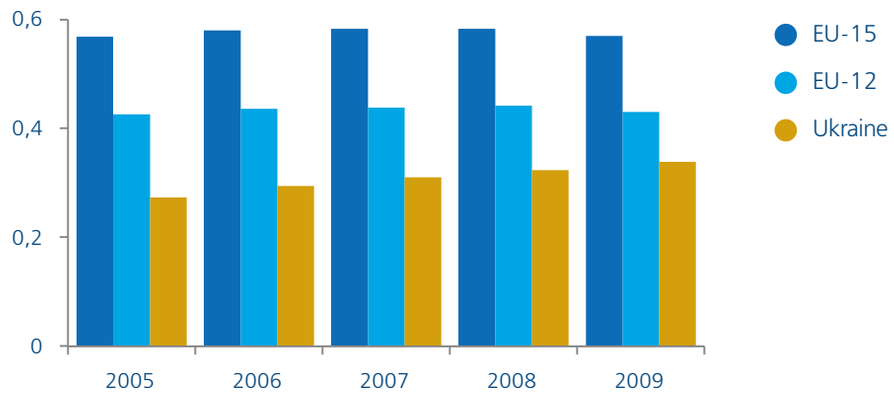
Source: IFC.

Estimating the Volume and Composition of Waste

Since 2005, there has been a steady increase in waste generation indicators in Ukraine, which corresponds to the rise in living standards. The EU experience demonstrates that waste generation eventually stabilizes. The stabilization level is different for the EU-12 and the EU-15.

This is shown in Figure 13.

Fig. 13 MSW Generation Dynamics in Ukraine and in European Countries, tons/person



Source: IFC.

Essentially, despite the fact that World Bank classifies Ukraine as an average-to-high income per capita nation (3rd group), it falls into the 2nd group - with an average-to-low income level – according to the MSW generation level per person per year. That said, the potential level of the per capita MSW growth is significant and has not yet been reached.

The growth of MSW per capita will expectedly continue in the short term and stabilize in a few years. The growth will be promoted by increasing living standards and changing consumer behaviors. The scenario of sector development in Ukraine may be similar to that in the new EU member-states (EU-12).

Given the projected GDP growth for the next 15 years, it can be expected that the saturation point will be reached on the level of 400 kg of MSW per person per year. If the current population growth dynamics is kept, by 2025 the annual volume of MSW will have reached 18 million tons.

The relationship between the amount of generated waste and the standard of living has been observed internationally. Average individual volumes of MSW generation in countries with different income levels are shown in Table 3 (based on the World Bank research[41]).

According to the data, high-income countries generate large amounts of MSW per capita. In addition, as income rises, the amount of organic waste relative to MSW decreases, while the share of recyclable fractions increases. This is demonstrated in Table 3.

[41] What a Waste: A Global Review of Solid Waste Management, 2012. World Bank report.

Table 3. Changes in the Composition of Waste Relative to Personal Income Levels

Fractions	Low-income countries (<$876 GNI/person)	Low- to middle-income countries ($876-3,465 GNI/person)	Middle- to high-income countries ($3,466-10,725 GNI/person)	High-income countries
MSW generation, tons per person per year	0.22	0.29	0.42	0.78
Organic waste, %	64	59	54	28
Paper and cardboard, %	5	9	14	31
Plastic, %	8	12	11	11
Metal, %	3	2	3	6
Glass, %	3	3	5	7
Other (sand, cinder, glass scrap, and rubber), %	17	15	13	17

Source: What a Waste: A Global Review of Solid Waste Management, 2012. World Bank report.

Changes in the composition of MSW are influenced by climate, cultural peculiarities, improvement of the waste collection and recycling infrastructure, as well as a growing share of SME in MSW generation (although the input from small businesses is not significant now). According to the data of the Ukrainian State Statistics Service and estimates made by MSW operators, the commercial sector's share of waste relative to the total volume of MSW in Ukraine is no more than 10 percent.

The share of recyclable fractions (paper and cardboard, glass, metal, and plastic) is expected to grow further with the simultaneous decrease in the share of organic waste.

The amount of these waste fractions per capita is close to that of European countries. In other words, the potential for MSW recycling is approaching the European level and the volumes of recyclable fractions relative to the overall composition of MSW will probably increase further.

Therefore, the volume of MSW is expected to expand during the next five to ten years, while the share of recyclable fractions as part of the overall MSW will rise, and the share of organic waste will decrease.

Taking into Account Regional Specifics

As shown above, both the types of waste that is generated and, accordingly, the approaches to MSW management are related to living standards (GDP per capita), climate, population density, a level of economic development (urban or rural areas), industry profile, and other factors.

2.2. The Business-as-Usual and Innovative Development Scenarios of the MSW Management Sector in Ukraine

Minimizing the impact of waste on the environment is the most important principle of a sustainable MSW system. The assumptions described in Section 2.1 were also used to model both the innovative and business-as-usual scenarios.

Hopefully, this has made it possible to fully demonstrate the effect of increased volumes of waste recycling compared with the baseline level. The planning horizon is 2025.

Business–as–Usual Development Scenario

The business-as-usual scenario assumes that the 2000-2010 development trends in the Ukrainian MSW management sector will continue, except that an EU level of environmental safety and targets under the EU-Ukraine Association Agreement will be achieved.

This scenario calls for a number of key accomplishments by 2025.

1. The remediation of inactive landfills that have yet to be shut down in an environmentally safe manner, including disposal sites that are scheduled to be closed by 2025.

2. The inventory-taking of active disposal sites in order to determine which landfills must be sanitized. This involves a set of measures to ensure compliance with the Ukrainian law and, in the longer term, with the EU standards.

Sanitization includes a number of basic measures:

- implementation of systems for inspecting the weight and composition of incoming waste, leachate collection, capture and utilization of landfill gas;
- removal of unsuitable types of waste from landfills, which involves pumping out hazardous liquid waste such as oils and properly disposing of construction waste;
- removal of other types of waste from landfills, such as automobile tires, bulk garbage, and industrial packaging;
- closure of landfills which cannot benefit from basic improvements, and subsequent rehabilitation of the territories they occupy.

3. Full upgrade of equipment at transfer stations, containers and specialized transportation vehicles, as well as equipment of reload stations. The need for modernization is based on the degree of equipment wear and tear. As of 2010, the level of wear and tear for various types of organizations varied from 50 to 70 percent. In 2013, average depreciation of specialized vehicles, according to the Ukrainian Ministry of Regional Development, Construction, Housing and Utilities, constituted 66 percent. The current pace of upgrades and investment programs targeting them is insufficient, especially considering the projected increase in the volume of MSW.

Construction costs for new, sanitary landfills with a service life up to 15 years are estimated at €17.4 billion in the 2010 prices. Modernizing existing waste collection and disposal sites will cost at least €5.9 billion.

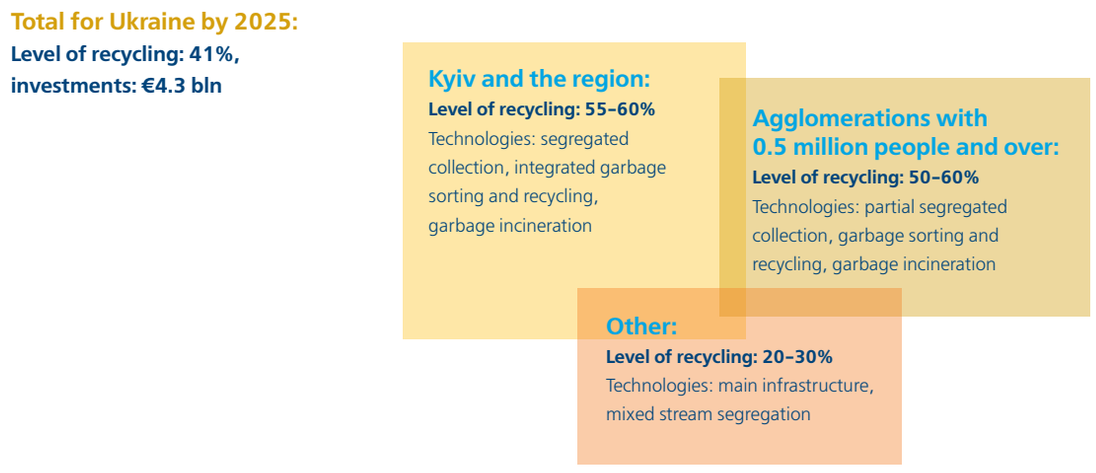
Therefore, the total cost of implementing this scenario for the Ukrainian economy will amount to €13.8 billion, including construction of waste collection facilities (€0.5 billion).

This total does not cover the volume of investments that are spent on waste recycling facilities (as a rule, with a low or average throughput capacity) in different regions along with approved earmarked programs.

Waste recycling capacities to be put into operation annually will cover no more than 100,000 per year on average (based on the 2010-2011 data) and allow maintaining an overall recycling level of 7-8 percent only. These projects will not affect the continued growth trend of accumulated waste throughout Ukraine.

Innovative Development Scenario of the MSW Management

Fig. 14 Calculating Results For the Innovative Scenario (recycling component)



Source: IFC.

Under the innovative scenario, the waste collection and disposal system is also modernized, since this is essential for ensuring the environmentally safe operation of the system's key assets throughout their service lives (€5 billion). Given that recycling is implemented in a phased manner, it cannot completely replace the need to build and operate new MSW landfills, although their number will decrease. The construction costs for new landfills will be €5.1 billion.

The innovative scenario should not be regarded as the only correct development path for waste management. It is merely an option showing how the European experience can be applied in Ukraine to generate attainable results.

On the regional as well as national levels, government authorities, state-owned and private companies may adopt waste recycling solutions with technical and economic characteristics that differ from those suggested in this report. No ceiling may be imposed in terms of the technological potential. Still, the proposed approach will undoubtedly be beneficial on any level, in particular for the regions, municipalities of large cities, and management of companies operating in the sector.

Implementation of the innovative scenario will result in the indirect economic gains described in Table 4.

Table 4. Average Annual Environmental Benefits and Indirect Economic Gains to Be Achieved under the Innovative Development Scenario for the MSW Management Sector in Ukraine

№	Indicator	Average annual value, physical units	Economic value, mln euro (in the 2010 prices)
1	Electricity generation at incineration plants (also from incinerating landfill gas)	117,500 MWh	18.8
2	Heat generation at incineration plants (also from incinerating landfill gas)	146,437 MWh	24.9
3	Conservation of primary energy sources	32,421 mln t of standard fuel	
4	Prevention of landfill disposal or valuable raw materials returned to the economic circulation	6.95 mln t	472.68
5	Reduction of greenhouse gas emissions due to a decrease in the amount of waste disposal on landfills	5.39 mln t of CO2-e	

Source: IFC.

Scenario Analysis Findings

The comparative analysis of the business-as-usual and innovative development scenarios of the MSW management sector in Ukraine for the period till 2025 is presented in Table 5.

Table 5. Results of Calculations for the Scenarios

Measures	Scenarios and their results by 2025	
	Business-as-usual scenario, bln euro	Innovative scenario, bln euro
Modernization of the MSW collection, transportation and landfill disposal system	5.9	5.1
Construction of new recycling facilities, excluding planned projects	0.5	4.3
Construction of new disposal facilities	7.4	5.1
TOTAL	**13.8**	**14.4**
Recycling level, %	**8**	**41**
Per capita costs, euro per year	**35.4**	**30.1**

Source: IFC.

Today, Ukraine can choose a scenario for development of the MSW management system that aims to create an environmentally sustainable disposal infrastructure and also assumes rapid introduction of recycling technologies.

If the Ukrainian MSW policy gets focused on modernizing the MSW collection, transportation, and disposal infrastructure, it is realistic to achieve environmentally safe waste management by 2025 at the current pace, for which recycling technology is being implemented. This would require investments of up to €13.8 billion (using 2010 prices).

The share of waste that is recycled will remain at 8 percent of the overall volume of MSW.

If Ukraine follows the example of the EU countries and concentrates policies on differentiated introduction of waste recycling technologies, then by 2025 the level of recycling will have reached 41 percent of the overall amount of MSW. Additionally, the country will be able to fully switch to environmentally safe practices in running infrastructure facilities, including MSW landfills.

Achieving this level of recycling will require total investments of €14.4 billion. It should be noted that our estimation is somewhat lower than that of the Ukrainian Ministry of Regional Development, Construction, Housing and Utilities regarding investments within the framework of the Ministry's PPP (paragraph 1.2 hereof), although direct comparison is not possible as long as our scenario envisions construction of new landfills.

Moreover, the investment program of the Ukrainian Ministry of Regional Development, Construction, Housing and Utilities within the PPP framework does not specify a recycling level to be achieved.

The innovative scenario is the most feasible to be considered for Ukraine. Not only will it allow reducing the volume of waste forwarded to landfills, but also more than 104 million tons of valuable materials will be recovered back to the economic circulation, saving resources that would have been needed for their production otherwise.

Additional revenues gained from recovery of secondary raw materials and supplies will have amounted to over €7.2 billion by 2025 (within 15 years). Additionally, the development of modern recycling technologies will enable cutting emissions by 81.3 million tons of CO2 equivalent within the same period.

The amount of associated capital investments differs by 0.6 billion euros, depending on a scenario. The difference will be compensated by revenues gained from selling secondary resources. Potentially, Ukraine could implement projects under voluntary carbon standards that regulate through methodological approaches calculation of reduction of MSW-emitted greenhouse gases, such as CO2 and CH4, and obtain additional funds.

Depending on a chosen scenario, capital and operating expenditures will amount to €35-39 per person per year in the 2010 prices, which is seven or eight times higher than the average proceeds from fees in 2010[42]. When adjusted for the projected inflation, the nominal payment amount will be even greater.

As of now, the industry is not funded sufficiently. In a number of regions, the total payment for MSW management per person is about €8-9 per year. This does not even cover the day-to-day costs of safely operating the MSW system, not to mention the cost of investing in a new infrastructure. By comparison, waste management costs per person for households in the EU countries average 0.5-1 percent of disposable income.

Ukraine faces the challenge of introducing an effective compensation system that will cover MSW operators' costs while encouraging recycling and minimizing the amount of MSW that ends up on landfills. However, such a compensation system should not result in a decline in the standards of living.

The 41 percent level of recycling under the innovative scenario is estimated as achievable in constructing new and upgrading active MSW management sites. The most economically efficient option would be to enhance recycling in large agglomerations compared to agricultural areas.

Model Application on the Regional Level

The model described above can be successfully presented on the regional level. The following information is necessary:

1. The quantity and composition of generated waste;
2. The condition of landfills and their available and used capacities;
3. The service life of landfills, recycling input degrees for fractions, segregated collection percentage, sorting, and other under the iterative regime.

Calculations for various scenarios will allow for defining target performance indicators, required investments and operational inputs, as well as a fee level.

When defining minimum and maximum fee levels, the best possible development path for the industry can be sorted out.

Reaching the upper fee level proves impossibility to achieve higher levels of recycling at the present moment, as well as the lack of economic feasibility and attractiveness of particular technology solutions for potential private investors.

Should a reliable information base be created and regularly updated, it would become possible to refine results for the model on a yearly basis, as well as to plan achievement of target performance indicators for particular years. The model shall be used even when the latter are adjusted. Thus, the model can be an essential tool for elaborating and adjusting strategic documents on MSW sector development.

[42] But only four times higher than the fee in 2013, in other words the situation is changing.

Attainment of a 41 percent recycling level will require investments of €4.3 billion.

This should result in a 30 percent decrease in the need for new landfills; an additional revenue from valuable raw materials returned to the economic circulation and generated energy will cover the difference in costs between the innovative and business-as-usual scenarios in less than two years.

Chapter 3. Changes Needed to Ensure Innovative Advancement of the MSW Sector in Ukraine

Chapter 3 examines:

- main financial, economic, organizational, information and cultural problems in ensuring effective MSW management and ways of resolving them;
- a process and stages in implementation of a Strategy/Action Plan for MSW Management before 2025;
- socio-economic importance and influence of developing a sustainable MSW sector.

Based on the estimations made, the following conclusions have been drawn:

1. In order to ensure that there are sufficient funds to cover operational and capital expenditures, the system of payments and fees must be refined and differentiated according to a volume and stage in the waste management cycle and based on the polluter pays principle.
2. An increase in effectiveness of management in the Ukrainian MSW sector is not possible without introducing a programmatic approach with clearly defined performance targets, timelines and a justification of reaching them in the Action Plan (MSW Management Plan), their regular monitoring and adjustment. These performance targets for the long-term perspective are outlined in the EU directives, while technical and financial possibilities of a country define them in the medium run.
3. Implementation responsibility for the Strategy and Action Plan should be assigned to a single designated public authority on the national and regional levels.
4. Development of competition and transparency/publicity in decision-making on implementation of the extended producer responsibility allows more efficient utilization of collected proceeds for recycling of the most utilizable fractions and achievement of set national goals, and, in the future, those established under in the EU legislation. There is a need to replace the state-owned enterprise "Ukrecoresoursy" monopoly with unified coordination agents to be created on the interregional level. Effective MSW sector management would not be possible without a regular inflow of robust information and public awareness-raising.

Chapter 3
Changes Needed to Ensure Innovative Advancement of the MSW Sector in Ukraine

3.1. Main Vectors for Increasing Efficiency of the MSW Management System

As demonstrated in Chapter 1, the MSW management sector has a great potential, and there is a growing interest towards it from market participants. However, an investment flow into the industry is not yet significant: local private companies and big international operators enter it with caution.

Development of the Ukrainian waste market with active participation of private businesses is hindered by a range of barriers that can be split into three large groups: institutional and administrative, financial and economic, cultural and informational.

MSW management industry development issues and suggested measures to be taken are prioritized. The first place among reasons why the sector is lagging behind its foreign counterparts belongs to the insufficient funding and hardly any economic incentives for growth.

Financial and economic impediments are conditioned, primarily, by complexities in providing stable funding to guarantee return on investment. Setting and regulation of tariffs and other payments related to waste, as well as the lack of economic incentives for development of recycling, account for the following problems.

Administrative barriers discourage new participants from entering the market because they curtail transparency of the industry. Potential market operators are not able to get comprehensive information needed to make smart decisions. Elimination of uncertainty requires large transactional costs.

Administrative barriers also include the ill-defined division of responsibilities among the market participants, the rigidity of PPP mechanisms, the lack of accurate data on waste and challenges associated with technical regulation and environmental monitoring.

Cultural and information barriers manifest themselves in poor public awareness regarding the importance of proper waste management by the society. As a result, there is practically no public demand for adequate services.

Implementation of measures aimed at effective waste management requires behavioral changes in the public as well as in the government. It is essential to cultivate a fundamentally different cultural attitude to waste and develop new standards and rules of behavior.

The situation in the industry is more complex than, for instance, in the municipal energy supply system, since consumers are not able to estimate their immediate saving benefits.

Overcoming the above described barriers is not possible without active involvement of authorities at all levels. In order to form a market for environmental services within the MSW management sector and make it attractive for private investors, institutional changes are suggested based on the analysis of the current situation in Ukraine and best international practices, as described in Chapter 1 of this report.

1. Improvement of the System of Fees and Payments

A well-shaped and stable source of funding is the basic condition for successful operation of MSW companies and the sector as a whole. To achieve this basic condition, the system of charges and payments must:

- generate enough funds to cover operating costs and capital expenditures;
- provide incentives for producers and consumers to manage waste more sensibly;
- encourage implementation of economically and environmentally beneficial waste management methods and low-waste technologies in general.

The polluter pays principle assumes the following:

- waste processing costs are covered by the party that produced the waste;
- full costs are considered related to the environmental impact, including costs of remediating areas after landfills, environmental restoration and depreciation of facilities (setting aside a pool of funds for construction replacing a facility that is taken out of use).

The term "polluter" is interpreted in a broad sense in the international practice: a polluter is not only a private citizen or organization, but also a producer and/or seller of a product that requires recycling at the end of its life cycle. Making a producer accountable means he/she should be required to organize a recycling system, either independently (by collecting and processing) or collectively (through industry associations and common coordinating agents).

Producers' investments can result in increased costs, which may be passed along to consumers. In order to minimize the financial burden on households, producers will have to invest in minimizing generation of waste: use environmentally friendly packaging, manufacture products from recyclable materials, and encourage consumers to manage waste sensibly. The Central and Eastern European countries implemented EPR programs for packaging in 1998-2008, and their experience proves that there has been no effect on the price of end products. In order to improve the waste management system, there must be a regulatory mechanism incentivizing producers to minimize the disposal of recoverable waste fractions on landfills without shifting the responsibility to consumers.

Without sufficient knowledge on how to reuse or recycle, and no access to low-waste producing technologies, even motivated end users and coordinating agents will not be able to expand production possibilities for recycling, safe disposal of waste, thus minimizing the volume of waste generated from production processes.

This barrier can be overcome by expanding the concept of the "polluter" within the polluter pays principle as well as including the chain of producers.

Applying EPR in Ukraine will allow stimulating the recycling of the most important MSW fractions, ensuring new investments in the sector, and helping make the waste management payment system more efficient.

Therefore, three problems are resolved:

1. Differentiation of fees in proportion to consumption levels will be enabled. For instance, a citizen consuming less packages will be able to reduce the overall payment associated with waste;

2. New participants will come to the market with an interest to coinvest in the collection, recovery, and disposal infrastructure;

3. A manufacturer will be motivated to change a product design and make it more suitable for secondary recycling or better transformed into smaller quantities of waste.

The following reforms are expedient for implementation in Ukraine as part of the polluter pays principle framework:

- to single out waste management for the public and commercial sectors as an independent service with a transparent payment structure;

- to start phased introduction of fees for services proportional to consumption levels, switch from setting fees and providing services in relation to the square footage of a site to a pay-as-you-throw system (payments based on the actual volume of discarded waste, prepayments for collection of waste containers, bulk garbage, electronic equipment, and hazardous waste); in apartment buildings, a precise allocation of discarded waste to a single household is not possible, subsequently the polluter pays principle does not fully work;

- to increase the environmental tax for landfill disposal of waste (progressive scale from 2016 onwards) up to a level significantly enhancing financial attractiveness of recycling and allowing modernization/closure of active landfills in accordance with European environmental requirements;

- to apply firstly EPR in segments which grow to be commercially attractive (packaging waste), and those requiring the most technologically sophisticated recycling and decontamination (batteries, lamps, aerosol sprays, etc.) through ensuring transparency of the budget of the state-owned enterprise "Ukrecoresoursy" or any other similar entity, setting spending priorities in accordance with the strategy for material utilization and reaching out recycling goals for particular fractions in order to clearly define unit costs in cutting the volume of generated waste;

- to define a clear calculation methodology and reflect all these MSW management stages in the fee accounting for compensation of total costs; landfill disposal should be the most expensive option, the second in cost should be incineration without energy production, etc.

Mechanisms for Implementing the Pay-as-You-Throw Principle

1. Prepaid waste collection containers near residences or at special collection stations. Operators may sell containers directly or via authorized entities, as agreed upon with the client (coordinating agent).
2. Special vouchers or labels guaranteeing transport and/or utilization of certain types of waste (bulk garbage, household appliances, and the like).
3. Fees in proportion to the weight of garbage that has been taken away.

Source: IFC.

Improvement of the System of Fees and Payments

A tariff size is defined on the regional or municipal level and depends on an environmental situation in the region – MSW volume, presence and state of existing infrastructure sites, possibility of construction of new facilities for recycling and disposal, as well as an alternative cost of the infrastructure for waste recycling which would exclude waste reaching landfills.

The fee is set in order to encourage the consumer to minimize disposal of waste on landfills. And, if sending waste to a landfill is unavoidable, it should cover the entire cost of the environmental impact. This practice accomplishes two tasks: it makes recycling cost-effective and allows creating a pool of funds on the regional level to cofinance rehabilitation and remediation projects for waste disposal facilities.

Source: IFC.

Recommendations for Improving the System of Payments and Fees for MSW Management Services

Disclose all the elements of the fees.

It would be feasible to distinguish waste management as a standalone service for all user categories and ensure full access to the information about all elements of a fee. This will result in transparency for all fees, enabling consumers to see how a bill is broken down into individually charged service items.

Implement a pay–as–you–throw fee system.

Regional MSW management systems should include pay-as-you-throw mechanisms, such as prepaid packaging, vouchers, weight-based fees, and others.

On the regional level of a waste management system, a mechanism should be created to determine compensation for the adverse environmental impact.

Introduce two new economic incentives in conjunction with the current fee structure for disposal and compensation for the adverse impact of waste.

1. The fee should include costs associated with the full cycle of MSW management taking into account sanitization and further remediation of a landfill, as well as the costs of other negative consequences. The fee amount should be determined on the regional level in line with a national methodology.
2. The environmental tax for waste disposal should be increased dramatically in order to stimulate recycling as an alternative to disposal. Furthermore, this tax should be used to cofinance recycling of accumulated waste and remediate closed landfills in regions that do not have access to other sources of funding.

Compensate the negative social effect of the fee increase.

To prevent a sharp hike in the tariff burden, it is necessary to introduce compensation measures for particular categories of consumers.

1. Benefits and compensations for low-income citizens as well as businesses and organizations that fulfill important social functions can take the form of full or partial exemption from payment.
2. National and regional subsidies for implementation of projects in recycling, reduction factors for environmental payments. Allocated subsidies will allow avoiding inclusion of depreciation costs of a portion of capital expenditures into the tariff structure.

2. A Programmatic and Goal–Oriented Approach to Waste Management

The following distribution of functions and responsibilities is recommended for various levels of governmental and municipal administration.

National level:

- creation of a national waste management strategy that sets out targets for collection, recovery, and disposal of waste. Targets should be set out for the total amount of waste and its main fractions; creation of a legal framework establishing sanitary and technical requirements to support infrastructure facilities, a system of their monitoring and review;
- development of a national action plan for implementation of the strategy with formation of the MSW stream on the country level; planning of events necessary for reaching the set targets in respect of all stages of the waste lifecycle; development of a map for allocation of main MSW management sites throughout the country; a feasibility study for combining efforts in particular regions; definition of funding sources and a unit cost of implementation (corresponding EU document[43] can be taken as a reference).

Regional level:

- creation of a regional waste management strategy that defines mechanisms for reaching the targets. The strategy should identify where infrastructure facilities should be located, the targeted volume of services in the field of MSW, how fees should be established along with who will be charged for particular services, possibilities to attract private capital;
- when defining performance targets, the segregated collection and recovery of MSW should be prioritized rather than MSW disposal, accounting for the condition of the infrastructure, the volume and composition of MSW, the demand for secondary raw materials, and the regional climate.

Municipal (regional and city) level:

- development of a scheme for sanitary cleaning in a city, implementation of segregated collection and individual composting in rural areas, monitoring of day-to-day activities of the operators.

In order to maintain a hierarchy system for targeted MSW management, a designated authority on the national level (national agency for MSW management) should be established or an existing executive agency should be vested with the powers.

The transferred powers may include:

- supervision of establishment and delegation of objectives and tasks on the regional and municipal levels, monitoring of progress in meeting objectives and completing tasks, evaluation of performance under national MSW objectives, regular review of strategic documents, and, when necessary, initiation of legislative changes;
- coordination of development of the National Action Plan for MSW Management;
- coordination of development of interregional plans and layouts for MSW management;
- coordination of activities of the state-owned enterprise "Ukrecoresoursy" and similar entities that deal with creation of a competitive environment in the industry, and monitoring of meeting the targets;
- synchronization of regional approaches;
- methodological support;

[43] Preparing a Waste Management Plan. A methodological guidance note, EC / DG Environment, 2012.

- alignment with other administrative bodies responsible for waste management (e.g., with the Ukrainian Ministry of Ecology and Natural Resources);
- coordination of the unified information database (cadasters, land registers, and reports).

In pursuance of Presidential Decree No. 715/2014 of September 10, 2014, the National Commission for State Regulation in Energy and Utilities was set up to replace the National Commission for State Regulation in Energy and the National Commission for State Regulation in Utilities (both wound up in August 2014). The newly established agency is responsible for methodological support in development of fees for recycling and landfilling municipal solid waste.

The monitoring of investment programs within the framework of national and regional action plans should be coordinated and implemented by this very entity.

3. Implementing Extended Producer Responsibiity (EPR)

Internationally, there are several EPR models, with some of their features being different. One pattern involves removing an item from the circulation once its service life is over. It is done so at the expense of the manufacturer, and the latter recycles the item. Alternatively, recycling is delegated to a specialized entity, which is paid for its services. This model or any other EPR mechanism can be applied by a single company or it can be executed on a collective basis via a nonprofit association of manufacturers making similar products.

Collective implementation is advantageous, since a common recycling infrastructure can be financed on a large scale by multiple companies.

Additionally, by implementing EPR via a collective organization, it is easier to reach agreements with governments regarding a monitoring and reporting system for a specific type of product. Also, manufacturer groups can be established for a whole range of products, making it possible to determine how much each company should pay to compensate for its fair share of recycling and processing. A large portion of manufacturers in the EU fulfill their obligations through a system of collective responsibility.

An individual system, as opposed to the collective one, is less transparent to the government, since the amount of waste each manufacturer generates is more difficult to monitor. On the other hand, such a system provides a better incentive for a specific company to use low-waste technologies and eliminates the problem of free riders. Free riders are collective system participants that take advantage of opportunities to pay less at the expense of others.

A number of large international companies such as Hewlett-Packard are proponents of an individual system. This is the case because they already have systems for recycling their products and possess enough resources to arrange for the necessary infrastructure (including transportation) on both national and international scales.

Figure 15 below demonstrates how regional entities interact within the framework of an EPR program that is compliant with the Ukrainian law. Based on this approach, producers act also outside a regional system decreasing volumes of waste and payments reaching it.

Currently, the state-owned enterprise "Ukrecoresoursy" has practically a monopolistic impact on the MSW sector which does not support efficient utilization of collected funds. It is necessary to demo-

nopolize the sector and conduct a tender procedure for implementation of EPR coordinating agent activities similar to those run by the EU coordinating agents. The tender organization will have to be done by the suggested national agency for MSW management.

It is feasible to choose common coordinating agents to work on the interregional level.

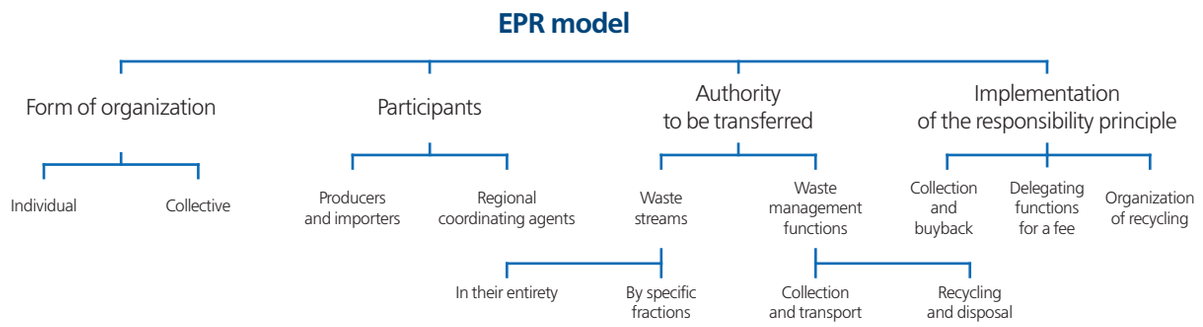
Competitiveness, transparency and accountability (monitoring) of coordinating agents will raise a degree of trust of potential private investors and, consequently, bring in a financial stream from outside of the budget, and allow choosing the best option in terms of a proportion of costs and effects from technological solutions for specific territories.

Fig. 15 Organizing Solid Waste Management with Participation of the Coordinating Agent

Source: IFC.

The diversity of EPR arrangements is defined by various ways in which key characteristics are implemented. A multilayered EPR model is shown in Figure 16.

Fig. 16 Multilayered model for implementing the EPR principle



Source: IFC.

4. Optimal Use of PPP Types to Implement Various Kinds of Projects in the MSW sector

PPP is a flexible mechanism which can be adjusted to various forms to fulfill specific needs in specific situations. The following PPP types may be used in the MSW management sector:

- service contracts;
- management contracts;
- leasing agreements;
- concession agreements;
- build-operate-transfer (BOT) agreements;
- joint ventures[44].

Types of PPP differ by effective agreement periods, distribution of ownership rights and responsibilities between partners: for infrastructure facilities, the division of (institutional, macroeconomic, market-related, investment, and operational) risks, sources of funding, and the management function. Types of PPP are presented in Figure 17 according to the degree of the private sector's involvement (from lower to higher) and in Table 6 according to the range of business responsibilities.

Fig. 17 Types of public-private partnerships

Source: IFC.

[44] Establishment of joint ventures is not allowed under the current PPP Law.

Table 6. Private Partner Activities Depending on the PPP Type in Effect

Types of PPP/ Functions	Service contract	Management contract	Leasing agreement	Concession/ BOT	Joint venture
Asset management	+	+	+	+	+
Key commercial risks		+	+	+	+
Implementation of investments			+	+	+
Asset ownership				+	+

Source: IFC.

An appropriate type of PPP to be used is determined by an objective set by local authorities. If it is to improve the efficiency and quality of specific services, a service contract will suffice; if large-scale investment projects are to be carried out, a PPP in the form of a concession agreement or a BOT agreement is appropriate. Table 7 shows how typical MSW management projects are better suited for particular PPP types.

Table 7. Using Certain Types of PPP for Specific Kinds of Projects

PPP arrangement	Project examples
Service contract (a private company provides one or more MSW management services)	• MSW collection and transportation; • maintenance and repair of the collection and transport infrastructure (for example: garbage truck maintenance); • operational management of a landfill
Management contract (a private company provides most or all MSW management services)	• comprehensive MSW management services: a private company organizes waste collection, transportation and disposal, manages landfills, prevents creation of illegal dumps and other
Leasing agreement (long-term, comprehensive management of a MSW system, management of a sorting facility)	• landfill management and modernization
Concession/BOT (a private company is entirely responsible for MSW management services, it builds and manages a specific infrastructure facility)	• construction of a landfill; • upgrade of an existing landfill (installation of sorting and landfill gas recovery systems); • construction of a garbage recycling plant
Joint venture (a private company and local authorities jointly own the infrastructure)	• construction of specific facilities (landfills, waste incineration plant); • projects for comprehensive development of the waste management infrastructure

Source: IFC.

The appropriateness and effectiveness of using a specific type of PPP is determined by several factors: maturity of the institutional environment, how well-balanced the fee system is, and the depth of experience of private sector involvement in waste management.

Comprehensively reforming the MSW sector, the PPP mechanism will become more effective. Reforms should improve organization and coordination of the MSW market, facilitate infrastructure upgrades, and encourage implementation of the EPR principle.

By developing a regulatory framework, reforming the fee system for MSW services, and collaborating with the private sector, PPP arrangements can be used to carry out large-scale investment projects for upgrading the MSW management infrastructure.

Furthermore, a PPP can be an effective means of involving importers in EPR programs, so that they could contribute to construction of the infrastructure and organization of collective recovery systems. PPP can be successfully applied in projects targeted at recovering landfill gas or utilization of MSW as a fuel.

5. Using Data to Guide Reforms

Government officials, MSW operators, and investors need accurate information in order to effectively implement almost every measure suggested in this report. This section describes additional data that should be collected and how to organize it.

First and foremost, the following additional data should be gathered:

- weight and structural data for all waste management operations (collection, transport, recycling, and disposal);
- condition of disposal sites (amount of disposed waste, waste composition, residual capacity of landfills and their operability based on projected filling rates);
- weight of goods (including packaging) removed from use and included in EPR programs;
- weight of secondary raw materials and supplies along with the volume of energy generated at recycling facilities and released to enterprises and distribution networks;
- garbage collection and transport infrastructure (number and types of facilities, degree of wear, and the amount of garbage collected and transported).

Two basic information gathering methods are possible:

1. Statistical reporting forms on the level of a municipality, region, coordinating agent or industrial enterprise;
2. A database on the level of a regional coordinating agent that receives information in real time regarding the services being provided; a record-keeping system can automatically measure the weight of waste that arrives to a landfill in garbage trucks.

Market participants will respond favorably to the new data gathering requirements, since they are interested in having detailed information. The ultimate outcome of collecting such data will be an up-to-date waste management map that conveys the physical inventory at each stage of a product's life cycle.

The pace of the sector reform depends on the quality of available data. Once sufficient data are in place, the suggested mechanisms will start functioning more effectively and market operators will be in a position to expand the range and flexibility of their services.

Data analysis will also lead to more accurate projections of recycling levels, inclusion of additional types of waste in the scope of EPR and, as a result, flexible fees for consumers.

Hiring a private, specialized company to both modernize (build) and manage a landfill makes it possible to acquire expertise needed to construct technologically complex facilities (e.g., to design landfill gas recovery or filtrate collection systems).

Non-specialized municipal companies are typically incapable of planning or constructing sophisticated sites.

Nonetheless, landfills will continue to be owned by municipalities regardless of who may be building or managing them.

6. Informing the Public

Transforming the MSW market requires not only technological and organizational changes. It is necessary to adjust consumer attitude towards this sector and develop a fundamentally new behavior pattern. That is why publicity campaigns are an important tool for the overall reforms.

Since participants in the waste management system lack sufficient knowledge regarding the waste management system, effective implementation of new projects is a challenge. If the technical measures suggested in this report are successfully introduced and forward-looking legislative initiatives are adopted, new innovative projects will become possible. However, these innovations will be new to the country and will require that market participants acquire new knowledge to competently manage and interact with the MSW system: market operators, legislative and executive authorities on the national, regional and municipal levels, and ultimate beneficiaries of the waste management system – households and businesses.

There are five main informational and educational factors that will ensure a success of MSW management programs:

1. Raising general awareness of the impact of waste on the environment and human health;
2. Instilling a caring attitude towards the use of resources and explaining why sorting and recycling waste are beneficial;
3. Providing information about the types of recyclable MSW, advantages, features, and shortcomings of specific waste management methods and consequences of their use in a specific region or community;
4. Providing information about MSW laws, programs and initiatives, opportunities for financial support and procedures for meeting requirements;
5. Developing suitable models of consumer behavior in the market as it undergoes reform. The public at large can be informed with the aid of:
    - social ads in mass media and outdoor advertising;
    - visual information on waste management technologies and methods (as done in other countries and regions);
    - courses and seminars (for educational institutions as well);
    - implementation of pilot programs and demonstration projects.

Tons of valuable raw materials and supplies are lost on dumps in Ukraine.

The absence of recycling results in an annual wasted benefit of about 5 billion UAH.

3.2. Phases and Procedures for Implementing a Sustainable MSW Management System

Based on the implementation history of MSW programs in the EU countries from 1995-2008, the time it takes to reach various MSW targets after they are set by law or established as part of a policy is determined by the following factors:

- development and introduction of new economic and institutional mechanisms on the regional level;
- the pace and scale at which funds are accrued under newly established sector financing mechanisms;
- the scale of attracted private investments;
- construction deadlines for facilities and designation of land for them;
- experience gained in new approaches through pilot projects and the "mode of limited functionality" (particularly for some types of waste).

These factors should be considered when drawing up an MSW management strategy on the national level and setting priorities on the regional and municipal levels of larger cities.

Comprehensive implementation of new mechanisms in the Ukrainian market could last from six to ten years.

For example, after Lithuania, Latvia, and Estonia adopted packaging laws regulating the extended producer responsibility (EPR), it took them two to three years to pass necessary regulations and shape up associations. Another four to five years were spent to develop the recycling infrastructure.

The law "On Waste" has been in place for 10 years already, just like the state-owned enterprise "Ukrecoresoursy" established more than a decade ago, but the recycling infrastructure that would increase the share of recycling is yet to be created.

The main reason is the lack of a unified strategy for MSW industry development and a single body responsible for policy enforcement, coordination, and monitoring of projects in the sector, mobilization of financial resources for strategy implementation.

It is suggested that a strategy for increasing effectiveness in the Ukrainian MSW management sector should be implemented in three phases.

1. **Preparatory phase (2015-2017).** Development and implementation of measures on the national level to overcome systemic barriers. Such measures would include upgrading the statistical reporting system and establishing an informational and educational framework. Quantitative targets should be set on the national and regional levels, with fees refined and PPPs supported. Establishment of a single body responsible for implementation of the state policy in MSW. Development of a strategy and an action plan for MSW management (analogues to the European plan for waste management - the structure is provided in the text frame below) on the national and regional levels.

2. **Phased establishment of regional waste management systems (2018-2020).** Establish necessary organizations such as coordinating agents and/or associations. Modernize and construct MSW landfills that are compliant with the EU laws. Introduce segregated collection, sorting and recycling of specific elements of sorted waste.

3. **Final phase (2020-2025).** Implement all the necessary market mechanisms on the level of regions and municipalities in full. Evaluate results of these activities and make adjustments as needed.

Structure of a national/regional plan for MSW management

1. Background information:
   - area-specific problems in waste management;
   - EU legal framework;
   - national legislation;
   - national policy;
   - target-setting.
2. Current state:
   - amount of waste: stream, sources, recycling/disposal options;
   - recycling/disposal options by waste sources;
   - organizational structure and funding;
   - previous targets.
3. Planning:
   - planning prerequisites;
   - MSW forecasting in total and by types/streams;
   - target setting for projected streams, sources of waste, and MSW management options.
4. Action plan for reaching the set targets:
   - collection systems;
   - recycling and disposal systems;
   - distribution of responsibility;
   - financing.

Source: Preparing a Waste Management Plan. A methodological guidance note, EC / DG Environment, 2012.

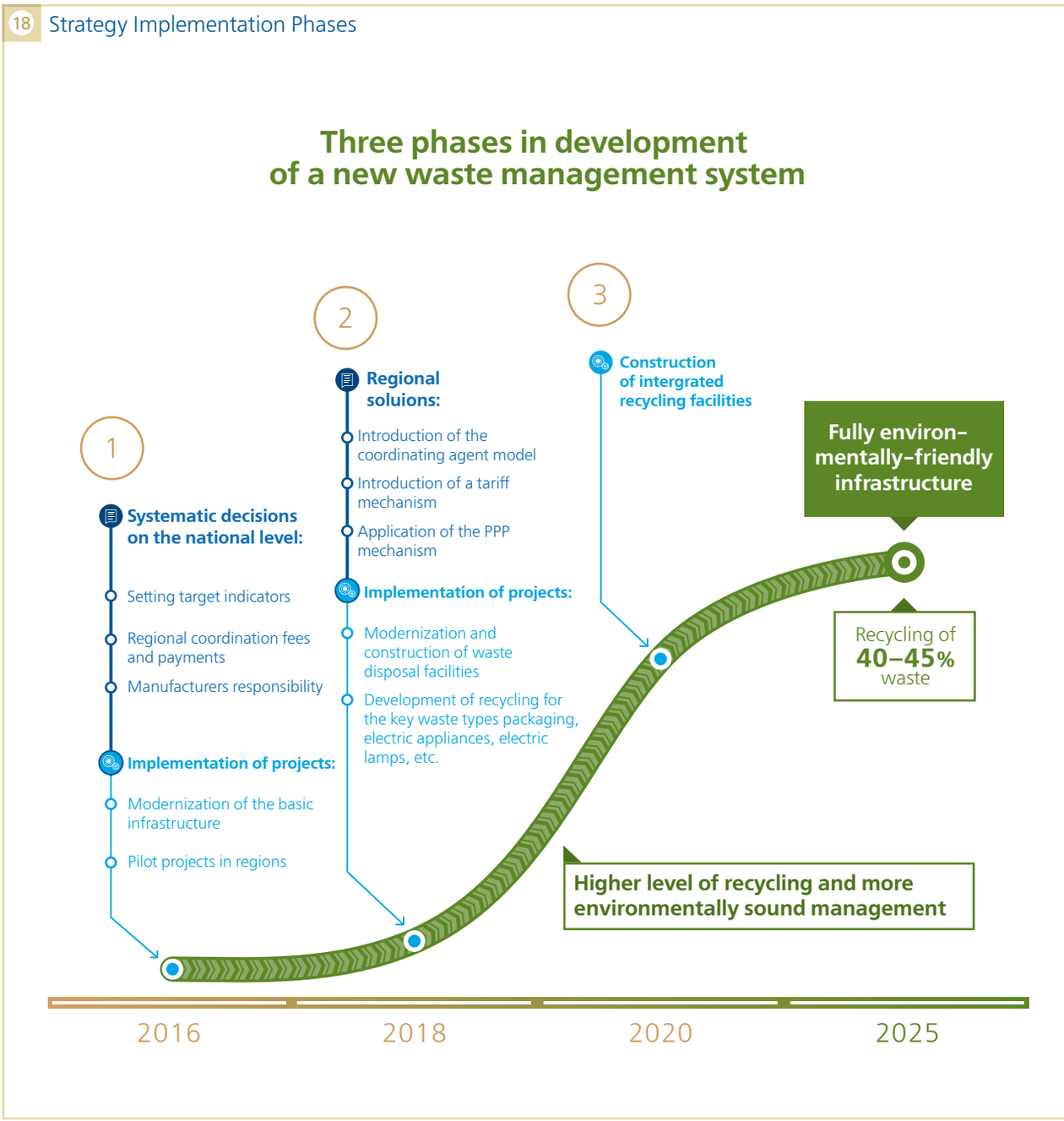
Construct integrated recycling facilities.

This planning assumes priority implementation of the least capital-intensive measures which do not require drastic market transformation. Modernization of the basic infrastructure described in Chapter 2 as well as pilot projects in regions can be attributed to them.

Once investment mechanisms are put into place, the pace of modernizing the capital-intensive infrastructure such as sorting stations and special processing/disposal facilities will accelerate. Beginning in phase 2, as EPR programs and the payment system are established, capital-intensive projects involving a high level of waste recycling will be initiated.

A general description of the strategy's phases, legislative decisions that must be made, and how investment projects should be implemented is provided in Figure 18.

18 Strategy Implementation Phases



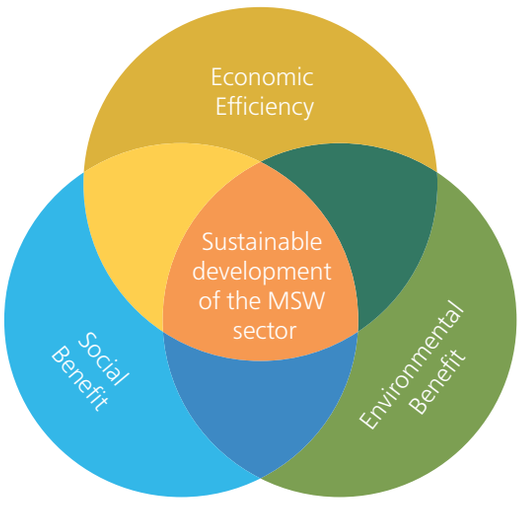
Source: IFC.

Development targets for the MSW management sector, as set out in the strategy documents, can be achieved in 10-15 years.

To manage the process of improving the MSW system, temporary quantitative and qualitative targets should be linked to the national and regional legal frameworks. Additionally, a mechanism should be established to monitor and analyze performance of the entire program, and to adjust the targets as needed.

3.3. Sustainable Development in the MSW Management Sector

Fig. 19 Sustainable development of the MSW management sector



Source: IFC.

Sustainable development of the MSW management sector means its economic development taking into account social aspects, resource saving and minimization of the adverse environmental impact.

The process is demonstrated in Figure 19 as a traditional scheme of sustainable development.

The innovation scenario for MSW sector development suggested in this report brings the following economic benefits:

- a GRP growth in absolute terms and per capita as a result of developing the MSW sector with environmentally friendly services;
- an increase in revenue for regional and local budgets, funded by taxed profits and properties associated with waste sorting and recycling operations that will emerged;
- introduction of low-waste technologies and resource conservation;
- release of areas for agriculture, construction and recreation instead of MSW management;
- generation of electricity and heat by using alternative sources of energy.

The social benefit of the innovation scenario will include:

- creation of new jobs and decrease in unemployment;
- cleaner urban and rural areas;
- a decreased morbidity rate;
- higher awareness;
- environmental education;
- ensured job safety in the MSW sector.

The environmental benefit will be represented by:

- prevention of air, groundwater and soil pollution;
- preservation of biodiversity and the environment;
- reduction in greenhouse gas emissions, namely those of landfill gas;
- conservation of finite sources of energy and increased use of their alternatives;
- contribution to a greener image of municipalities and regions, especially near the border.

The model for sustainable development of the MSW sector can be rolled out in the entire economy.

Ukraine has set a target to harmonize its environmental law with the EU legislation.

Achievement of the EU-set sector development targets is not possible without a National Strategy for MSW Management and an Action Plan to implement it. There should be a single government body with an agency status responsible for the implementation and monitoring of both.

Conclusions

Results of the research carried out lead to a number of conclusions:

1. Generation of waste is growing in proportion to rising living standards (GDP per capita). As observed in the European countries, the amount of waste generated tends to level off at about 400 kg per person per year. In Ukraine, as of 2010, the level of waste generated was 270 kg per person. Waste generation is expected to expand by 48 percent. The share of recyclable fractions relative to the overall volume of waste grows as living standards are moving up. Thus, the economic growth is projected to bring about an increase in reusable types of waste such as glass, paper, metals, and plastic, making it possible to advance the level of recycling.

2. The current state of the Ukrainian MSW sector is quite similar to that of the Central and Eastern European countries (EU-12) 10–15 years ago. If the task is to fundamentally transform this industry, then the accelerated development trajectory employed by the EU-12 should be undertaken, rather than embarking on evolutionary development of MSW management following the example of the more advanced EU-15 countries.

3. The MSW sector in Ukraine may evolve along two possible scenarios: business-as-usual and innovative. The former assumes keeping the current situation and implies that in the future recycling will remain on the level of 7-8 percent, while the growing volumes of MSW will be disposed of on active and new landfills. The latter suggests introduction of innovative waste recycling technologies and management models in the sector.

4. Whichever scenario Ukraine will opt to, the sector will be still in need of structural reforms, which should encompass:

   - Introduction of a programmatic approach with clearly defined performance targets on the national and local levels to monitor and control performance, and to make adjustments as needed. Achievement of the EU-set sector development targets is not possible without a National Strategy for MSW Management and an Action Plan to implement it. There should be a single government body with an agency status responsible for the implementation and monitoring of both;

   - Introduction of new economic and institutional arrangements via legislation and authorization by the single government body in charge of reforming the sector.

5. The innovative scenario for the Ukrainian MSW management sector with annual costs of €30 per capita will allow big agglomerations, such as Kyiv, Lviv, Donetsk, Dnipropetrovsk, Kharkiv, and others, to reach, by 2025, approximately a 57 percent level of recycling with introduction of segregated collection on a maximum possible range of fractions, including sophisticated recycling and incineration with energy recovery.

6. Small metropolitan areas and settlements will be in a position to achieve a 22 percent level of recycling of the mixed waste stream with partially segregated collection. This scenario will also address the problem of environmentally safe disposal of non-recyclable waste, as well as closure and remediation of MSW landfills that are unsafe and over capacity.

7. Implementation of the innovative scenario will take time: at least 10–15 years to introduce new sector management arrangements and to fulfill the measures. However, it will bring larger and more sustainable economic and environmental benefits. This is the reason why, by 2025, more than 104 million tons of valuable materials and supplies that in the past were irreversibly lost can be put back into the economic circulation. The anticipated revenue from this recovery is estimated at €7.2 billion. The decreasing volumes of waste disposed of on landfills, enabled by recycling, can reduce greenhouse gas emissions by 81.3 million tons of CO_2 equivalent. Landfill gas utilization and garbage burning at incinerators will allow producing 1.76 million MWh of electricity and about 2.2 million MWh of heat, as well as addressing the increasing share of renewable energy sources in the country's energy mix.

8. At a time when significant financial resources needed to operate regional waste management programs and public funding are limited, introducing the EPR principle and flexible PPPs for various kinds of projects will play a pivotal role in the waste management sector. The effective use of PPPs will become feasible once laws are changed to create economic incentives for implementation of the EPR principle and the PPP mechanism, the monopoly of the state-owned enterprise "Ukrecoresoursy" is abolished, and competitiveness in bidding is encouraged.

9. To ensure implementation of appropriate solutions in the sector and transparency of the process for all waste management stakeholders, a centralized database should be established. It is to be designed using government statistical reporting standards that will be based on uniform physical units and stay compatible with international environmental reporting systems. The database can be run by the National Agency for Waste Management.

10. In order for reforms to succeed, it is crucial that various segments of the society endorse them. Citizens must develop an environmentally friendly consciousness and also change their behavior. This critical factor highlights the importance of fostering a caring attitude towards resources and the environment.

Recommendations

We recommend the following considerations:

1 Legal Framework

The legal framework shall comply with the EU directives, needs to be simplified and streamlined, and has to provide clear regulations and follow the principles of subsidiarity.

EU law	• The EU-UA Association Agreement (AA) already sets out binding goals and obligations for Ukraine in the MSW sector • The waste hierachy is a central requirement in waste management
Ukrainian law and regulations	• The Ukrainian law shall comply with the EU directives pursuant to the AA • The Ukrainian legislation shall be simplified and optimized • The Ukrainian legislation shall be clear-cut (so far it's confusing)
Local governments	• All issues that can be better regulated on a local level should be handed over there (following the principle of subsidiarity) • Strengthening of local/municipal competences and commitments regarding local/municipal tasks/matters

2 Institutional Framework

Currently, the competences and responsibilities of stakeholders involved are overlapping and disputable between different line ministries. The competences in the regulation and administration of municipal waste sector should be clearly defined and delineated.

The introduction of a National (Coordination) Agency and the adoption of a National Plan for Waste Management would lead to concentration of professional knowledge and predictability in vectors of MSW sector development.

3 Implementation/Enforcement of Laws

So far, (too) many laws and regulations are in force, but not enforced. The reality has almost nothing in common with the regulatory framework. The municipal solid waste sector is driven by principles of "affordability" and reluctance of political decision-makers to raise tariffs to an economically viable minimum. This way changes will never be achieved.

Compliance with the requirements needs to be monitored, while infringements should face fines and punishments. The latter need to be substantial because otherwise market players will tend to tolerate them inter alia for the sake of better competitiveness/market position. A fine needs to be calculated using the approach of skimming excess profit plus a fine.

In order to change this situation, the following steps should be ensured:

I	II	III
Clear and obligatory legal framework for all parties involved	Strict monitoring of full implementation and adherence to regulations	Punishment of infringements (for all parties involved)

4 Sector Financing

Given a strong social dimension, an unmanaged rise of waste management tariffs is not a viable option for any local or national government. Private sector involvement should be promoted and aided by:

- an awareness raising campaign by the National Agency for Waste Management (or appropriate regional or local bodies), illustrating extra costs under the business-as-usual scenario;
- additional fee generation by strict implementation of EPR mechanisms; and a fee increase: in absolute terms, additional costs will turn out to be comparatively marginal even if the current tariffs (5-6 UAH per capita per month) are doubled or even increased tenfold.

5 National Agency (Agencies) for Waste Management

A National Agency may have additional (to those mentioned in the report) functions/responsibilities/tasks:

- Keeping statistical records on the volume and compounding of waste;
- Holding a register of landfills, incinerators, sorting and recycling plants, and all other waste management facilities;
- The Agency can be, at the same time, a focal point for local and foreign:
  - waste management service providers;
  - investors;
  - suppliers of waste management technologies;
- Advising municipalities, municipal enterprises, and other stakeholders on best practices, technologies, economic viability, etc.
- Raising public awareness on the importance of a clean and safe waste management system, and the necessity to bear appropriate costs compared to those arising in the business-as-usual scenario (including social costs for environmental damages, health care system, etc.).
- Similar agencies might be established, upon demand, on the regional (“oblast”) and municipal levels, based solely on the principle of self-governance.

Additionally, in rural areas smaller inhabited localities can combine their efforts and jointly operate/administer waste management facilities (partnerships of convenience/inter-municipal cooperation).

6 EPR/Green Dot

EPR is a recommendation of the directive EC/2008/98/EC, Article 8 on acceptance of returned products. However, the packaging directive 94/62/EC sets out binding regulations for taking back used packaging materials.

Recommendations

For both special items (like tires, batteries, etc.) and packaging materials in the industry/wholesale/retail, the legislator shall set out a clear framework and obligations:

- Which items are concerned?
- Who is responsible for setting up a return system?
- Under which conditions the responsible party can or has to transfer the obligation/become a party to a collecting system?

A system of collective implementation should be subject to fair and free competition of appropriate collection companies. None of the designated agencies should have any privilege. Several changes are required to the CMU's Resolution No. 915, under which contracts currently are to be signed with "the Company", and "the Company" according to the preamble is the specified entity. This privilege contradicts the right to freely choose service provider pursuant to Article 17 of the law "On Waste" and should be cancelled.

7 Compulsory Use of/Connection to Main Municipal Services

The use of collection and transportation services rendered by a designated service provider shall be deemed compulsory for all waste producers in the defined area. The right of waste producers to freely choose a service provider leads to unpractical and incalculable consequences for a determined service provider, with administrative costs being significant in this case. The same applies to water supply, wastewater treatment, etc. - "compulsory use of/connection to main municipal services".

This principle is laid down in Article 17 of the law "On Waste" and shall be implemented. Any possible complexities in relation to "ownership" and "possession" of waste this way lose their relevance.

8 Pricing

1. Waste disposal costs should exceed those of all other single waste management steps in the waste hierarchy. This can be mainly reached using the environmental tax as a central regulatory leverage for incentivizing prior waste treatment.
2. Price fixing at all stages of waste management shall be based on competition. The following steps should be taken:
   - Based on legal requirements (EU law, Ukrainian law), the municipality has to draft a waste management concept/to express a state to be achieved;
   - The municipality shall, based on the budget principle of cost-effectiveness, calculate and compare costs for services performed by itself or municipal companies (based on methodic principles of the National Commission for State Regulation in Energy and Utilities) and by private parties (PPP models). A private service provider shall be elected on a competitive basis ("competitive dialogue").

Recommended phased implementation of government policies for MSW management on the national level:

Phase I: 2015-2017

1 Develop a National Strategy for MSW Management:

- designate a single government agency (National Agency for Waste Management) to be responsible for development of the MSW management sector;
- define performance targets with specific and crystal-clear deadlines. Specify a procedure for both monitoring progress in reaching the targets and adjusting them as needed;
- advance government statistical reports on waste in order to track the performance targets and movement of waste along its life cycle;
- introduce a competitive approach along with practical implementation of the EPR principle;
- implement relevant EU legislation (see Appendix 3);
- compulsory use of/connection to main municipal services. The use of collection and transportation services rendered by a designated service provider shall be deemed compulsory by all waste producers in a given area.

2 Develop an Action Plan (MSW management plan) for implementing the strategy along with mandatory legislative changes, including:

- a new fee system based on prioritization of waste recycling over its disposal and on the level preceding the following one in accordance with the principle of Lansink's ladder;
- the new fee system shall be based on competition in order to reflect real costs of waste treatment;
- methodology guidelines for developing regional waste management programs that have attainable performance targets and balanced financing (factoring in PPPs and EPR);
- a national map of allocating MSW recycling facilities in accordance with regional peculiarities and identified interregional areas, managed by coordinating agents;
- a mechanism for funding waste recycling enterprises on the basis of EPR;
- regulations for the use of PPPs in regional waste management projects and government procurement procedures. The regulations should incorporate incentives for introducing low-waste technologies and prioritizing recycling over disposal;
- implementation of pilot projects for the environmentally safe disposal of waste on landfills. The landfills should be compliant with the European Union requirements. Additionally, remediation projects, landfill gas recovery and recycling systems should be brought into life;

Recommendations

- methodology guidelines for new governmental statistical reporting;
- an interactive database to be set up to cover the best available MSW management technologies and practices;
- an awareness raising campaign to be launched, including educational programs highlighting the consumer aspects of MSW management in kindergartens and schools.

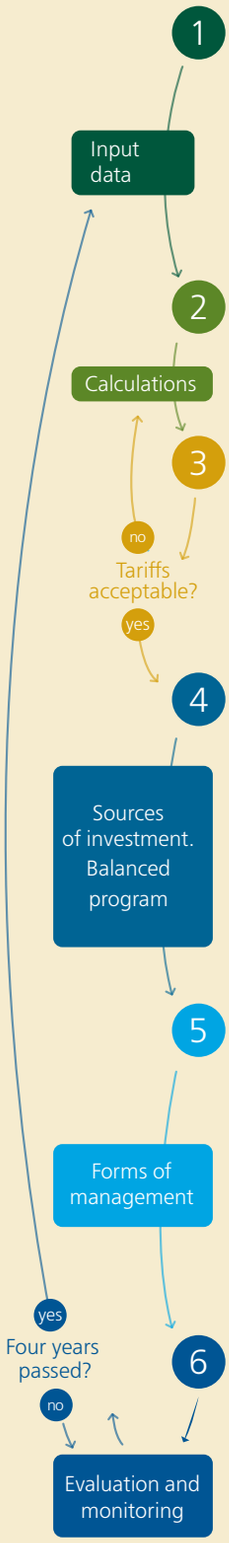
Phase II: 2018–2020

1. Implement the action plan items listed above.
2. Support high-priority regions in attracting foreign investments.
3. Support establishment of state-of-the-art enterprises that recycle utilizable fractions.
4. Coordinate and share the best practices emerging on the regional level.

Phase III: 2020–2025

Monitor and analyze the Strategy implementation, adjust the target indicators, and update the legal framework in line with conditions. The following sequence is suggested for the regional level.

Fig. 20 Development of a Regional MSW Management Program



Based on official data and expert estimates, a scaled-up waste balance (waste generation – utilization – incineration – disposal on a landfill, unauthorized dumps equal zero) is consolidated on waste types, from the moment of generation up to disposal, on the regional level as a whole and across agglomerations starting from 250 thousand people. Appropriate waste recycling and disposal technologies, as well as remediation measures for expired landfills, are defined for agglomerations and the rest of the country.

Preliminary inputs are estimated and a source of financing is defined: investments from private companies within the framework of EPR, budget funding, and tariffs. The growth in tariffs along years and their acceptability are defined.

In case the level of tariffs is acceptable, technological solutions are tentatively implemented and target recycling indicators are defined on their basis to be considered in the strategy of sector development and a target-oriented program.
If the level of tariffs is not acceptable, then the range of measures is limited to cutting the necessary volume of investments and the financial burden of households.

All funding sources are defined, including PPP and debt financing, and favorable conditions are created to attract the private sector to a region (tax privileges, governmental procurement preferences, tariff-setting on a level compensating investments in the sector, etc.). A PPP type should be selected depending on a project in line with recommendations of this report.

Depending on a structure of the regional program, a decision is made whether to introduce intermunicipal cooperation responsible for achievement of regional targets within limits of competence.
The authorized government body coordinates the agents' activity and monitors strategy and program implementation on the regional level. It also fulfills stewardship functions for creation and operation of the regional database, including landfills register, waste cadaster, waste balance in total volumes and by types, databank of the best technologies and standard documents, along with informing the community and managing the educational process.

Implementation of the Strategy and the regional program is reviewed every five years by the authorized government body. It also identifies weaknesses and risks, and introduces necessary adjustments.

Appendix 1
Terms and definitions

Bulk trash

Bulk waste that comes from households and the commercial sector and does not include electrical and electronic appliances: furniture, certain types of finishing, and other interior elements of residential and commercial premises, etc.

Composition of waste

The morphological composition of MSW. It is determined by the balance of different groups and types of waste - MSW components - that vary according to their physical and chemical composition, origin, and other factors. The following MSW fractions are typically separated from the main waste stream and sent for reuse or recycling: food waste, paper, cardboard, glass, and plastic.

Hazardous municipal waste

The portion of MSW containing substances that, even in small quantities, poses a significant hazard to the environment and human health. Hazardous municipal waste may be explosive, flammable, toxic, highly corrosive, carcinogenic, etc. Hazardous waste in MSW includes used batteries, light bulbs that contain mercury, medical waste, household chemicals, glue, and paint.

Household solid waste/Municipal solid waste (MSW)

Waste generated by households as well as similar waste generated by enterprises and organizations. The Ukrainian legislation does not contain the term MSW - instead, the term “household solid waste” is used. In fact, household solid waste is all of the waste generated in cities and communities, including commercial-sector waste that has a similar composition to household waste.

Organic waste (biodegradable waste)

Organic waste is waste that is biologically degradable in aerobic or anaerobic conditions. It typically consists of food waste, household yard waste, wood waste, paper and cardboard. Paper and cardboard are also considered to be packaging waste because of their significant recycling potential.

Packaging waste

Any products or materials that are used for the storage, protection, transportation, delivery and sale of goods or services and end up as waste. Such products or materials may include glass, plastic bottles, aluminum cans, wooden pallets, plastic packaging, etc.

Waste

Remnants of raw and other materials, semi-finished products and other items or products that are generated during the process of production or consumption, including goods that are no longer usable for their intended purpose.

Waste from electrical and electronic goods (electronics)

Consists of used and electrical and electronic goods including refrigerators, computers, telecommunications equipment, washing machines, dishwashers, household appliances, and TV sets, etc.

Waste management

Collection, accumulation, use, decontamination, transportation, and disposal of waste. In the context of this study, the term "waste management" is used in a broad sense and does not refer to specific operations involving waste, but rather to the overall administration of the waste management system, including its economic, technical, and other aspects.

Appendix 2
Waste management technologies and methods

All measures for collected waste management can be divided into seven main groups based on the result and end product:

1. Reuse/recycling of waste into raw materials and supplies;
2. Use of waste for the production of organic fertilizers by means of fermentation (composting);
3. Use of waste for heat and electricity generation;
4. Anaerobic digestion to obtain biogas;
5. Direct incineration for recovering heat and electricity. This can also be accomplished at cogeneration plants;
6. Waste decontamination: minimization of the environmental impact of hazardous waste in MSW by deactivating hazardous substances using special processes which include controlled incineration;
7. Landfilling as disposal of waste (both the residue obtained after the processing described in items 1-4 and unprocessed waste) in specially designated areas while applying measures to mitigate negative environmental impacts.

MSW management approaches described are examined below according to their priority on Lansink's ladder

Segregated Collection

Segregated collection, an alternative to the traditional mixed collection of MSW, is a necessary preparatory stage for waste recycling. The degree of segregated collection determines the efficiency of the subsequent stages of waste recycling. The simplest segregated collection is sorting the entire waste stream into organic and inorganic fractions.

More sophisticated types of segregated collection involve the sorting of inorganic fractions into such categories as paper, glass, plastic, packaging waste, hazardous waste, and other waste types. Segregated collection is done differently depending on a country. Waste may be sorted into specific containers at a special site, or different types of waste may be collected and sorted by residents before it is collected at predetermined times.

The specific configuration of a segregated collection system is determined by a population size and density, socio-economic factors, the availability of funding sources, and the maturity level of the recycling system. Considering that segregated collection is organized on the household level, special attention must be focused on informing the public about segregated collection requirements and controlling compliance with them.

In Belgium, households collect and sort organic waste, paper, glass, hazardous waste, used electronics and plastic, metal and packaging for beverages.

Recycling Waste into Secondary Raw Materials and Supplies

Oftentimes, the recycling of waste into secondary raw materials involves basic fractions of MSW such as paper, plastic, metal, and glass. The technologies for recycling these fractions are substantially different, so they will be examined individually.

Recycling Plastic

Plastic waste is first sorted according to identification codes related to various types of polymers. There are fifty of them. The most common ones are polyethylene terephthalate (PET), polyvinyl chloride (PVC), and finally, high-density polyethylene (HDPE), from which almost all plastic bottles are made.

Additionally, plastics may be sorted by color.

After that, the remaining plastic is melted into transportable shapes, which are later used as resources for producing a wide range of products. For example, secondary plastic is used in the manufacturing of shopping bags, clothing, sewage pipes, and insulated glass units.

Recently, plastic de-polymerization technologies have also been used to decompose plastics into monomers. The latter are used to fabricate new polymers of the same type as the original plastic. Chemical de-polymerization may also be applied. In special cases, when it is difficult to split the plastic into constituent types of resins or if there is a high degree of contamination, thermal de-polymerization (pyrolysis, gasification) is conducted to make decomposition into liquid components. The liquid components may be used as a substitute for newly produced petroleum products.

Recycling Paper

Since the technological processes for recycling paper are not highly complicated, it is the easiest waste fraction to recycle. The paper collected by municipalities and private operators is sorted and then any dye or ink is removed. Next, the paper is chopped up and soaked. Then it is ready to be used in a new production process.

Recycling Metal

An average of 95 percent less energy is expended when scrap metal is used as a raw material instead of producing new metal. Another plus for reusing metal is that metals retain their inherent properties after recycling. There are two types of metal scrap: ferrous, which includes iron and steel, and nonferrous, which includes aluminum, copper, led, nickel, and other metals. Old motor vehicles, ships, and railroad tracks are primary sources of the latter. Metal recycling takes place in four stages: collection, pressing, crushing into small pieces, and delivery to a plant for reuse.

MSW contains a substantial portion of nonferrous metal waste such as aluminum cans and foil, which is collected via a segregated collection system and then melted down.

Recycling Glass

Discarded glassware is sorted by color and crushed into fragments. Obtained glass scrap goes through a multistep procedure to remove iron using magnetic filters, displace paper and ceramic particles (automatically and manually), and then the remaining material is melted down.

Ceramic particles that become embedded in the scrap degrade the quality of glass that is melted down, so special attention is given to their removal.

Color is then removed from the glass, making the material ready for use in production. Recycling is beneficial, since glass that is disposed of does not decompose. Also, recycled glass does not differ in quality from newly produced products.

Producing Organic Fertilizers by Fermenting Waste

Composting is the biological decomposition of the organic portion of MSW. It can be accomplished via aerobic or anaerobic processes.

Aerobic composting is easy from the technological perspective and, thus, it is the most commonly used form of composting.

Composting is used in varying degrees in almost every country, since organic fertilizers can be produced from waste. The technologies range from basic household composting to the operation of sophisticated composting facilities. Importantly, the efficiency of a composting system depends on how it is designed to accommodate different climates, waste compositions, and other factors.

Table 1A provides a description of three principal composting technologies in the order of increasing complexity. The simplest technology is a windrow system, followed by composting systems in enclosed tanks. The most complex technology is an anaerobic composting system, which uses bacteria to conduct anaerobic fermentation. Other forms of composting include individual composting, active pile systems, static pile systems, field composting, the use of waste from dumps, and worm composting.

Recycling in Belgium

Belgian producers are responsible for the recycling of packaging waste which is the principal source of glass, plastic, metal, paper, and cardboard in MSW. According to Fost Plus, the national packaging waste recycling organization, 91.5 percent of 755,000 tons of packaging waste generated in Belgium was recycled in 2010.

Source: FEVE.

Table 1A. Description of Composting Technologies

Type of technology	Advantages and drawbacks
Composting systems in open windrows	• composting with oxygen present in windrows; • a slow rate of compost formation; the extensive type of composting requires a large area; • the simplest and cheapest method
Composting in closed reactors and cylindrical vessels	• relatively expensive systems; • composting is noticeably faster and more effective compared with windrows; • complexity of the system affects reliability
Anaerobic fermentation	• costly and technologically intricate; • a high rate of fermentation due to the absence of oxygen and the use of controlled biological effects (bacteria)

Source: IFC.

Anaerobic Installations

More than 23 percent of MSW in Belgium is composted using anaerobic processing. Composting is typically carried out in small-scale installations with a capacity of 20,000-65,000 tons per year. Most installations that do aerobic composting are also designed to extract biogas which is used to generate electricity.

Source: IFC.

Generating Heat and Electricity via Waste Incineration

In Lansink's ladder, incineration has a low priority, ranking only above waste disposal. Waste incineration is a common practice throughout the world, since it substantially reduces the weight and volume of waste and eases demands on MSW landfills by reducing the weight and volume that would end up on landfills by 70 percent and 90 percent, respectively. In addition, the heat produced from incineration can be used to generate electricity.

The main drawbacks of incineration are the destruction of recyclable waste, significant capital and operating expenditures requirements, and the need for sophisticated atmospheric emissions purification systems. There are many types of incineration technologies, including simple incineration, pyrolysis, gasification and plasma-based incineration. Three most common types of energy recovery via waste incineration with heat generation are shown in Table 2A.

Table 2A. Waste Incineration Technologies

Type of technology	Advantages and drawbacks
Mass incineration	• the most common and simplest form of incineration; • an unsorted waste stream is taken from the storage facility and deposited in the furnace, where it is incinerated. The steam is generated thereby activating the turbine of a power generator; • the gases released are purged of nitrogen oxide, mercury, and dioxins; the ash is hauled away and buried.
Fuel recovered from waste	• a more complex and efficient system; • recyclable fractions are extracted first and the remaining combustible waste is crushed; • the crushed fuel that is generated can be incinerated using the procedure detailed above or added to solid-fuel boilers.
Thermal gasification	• a new, uncommon technology; • waste is converted to a synthetic gas (a hydrogen/carbon monoxide mixture), which, when purified, can be used as a fuel.

Source: IFC.

Waste Decontamination

Hazardous waste consists of flammable, chemically active, toxic or corrosive substances. Examples of hazardous MSW include storage cells, batteries, solvents, light bulbs that contain mercury, oils, cosmetics, fire extinguishers, and paint.

Hazardous waste collection is an important part of waste management, since it separates hazardous pieces from the overall mass of MSW, making the recycling process much easier. The main types of hazardous waste are typically collected separately (batteries, oils). When managing hazardous waste, environmental damage can be minimized by prioritizing recycling.

In addition, unlike all other types of MSW, special attention should be focused on prevention of hazardous waste generation. There are two main ways to avert hazardous waste generation, namely: safe materials should be used instead of hazardous ones and households should be incentivized to use products that do not generate hazardous waste (for instance, refuse from hazardous chemicals in daily activities).

About 30 percent of MSW (150 kg per person per year) is incinerated in Belgium. Incineration is done in large, highly efficient facilities that have the ability to process more than 500,000 tons per year while also generating a substantial amount of energy (48 percent of energy generated in Belgium comes from renewable sources).

Source: IFC.

The recycling of hazardous waste usually includes physical (disassembly, evaporation), chemical (neutralization of active elements, deactivation, and conversion to a solid state), and biological treatments.

The non-recyclable elements of hazardous waste are incinerated.

Incineration requires special monitoring and purification systems, since carbon dioxide and harmful substances such as dioxins are generated during incineration.

Some hazardous waste may be disposed of on landfills while other types of hazardous waste such as medical and flammable waste may not be disposed of there.

When hazardous waste is disposed of on a landfill, it must be separated from other types of waste and placed in a special area specifically designed for it. A filtrate-collection and water-prevention system must be used and, for the most hazardous types of waste, partial neutralization and chemical transformation should take place.

Electrical and electronic appliances are also considered as hazardous. These include large and small household appliances, computers, lighting, measuring and monitoring equipment, power tools, electric toys and leisure items, medical instruments, and vending machines.

This type of waste contains both hazardous substances (e.g., toxic substances in refrigeration equipment) and valuable materials (metals, etc.).

This is why it is expedient to create separate management systems and mechanisms for processing this type of waste. Just like in the case of hazardous waste, the main stages for managing electronic waste are the collection of discarded equipment from the public, sorting and mechanical disassembly, recycling, disposal and incineration.

The sorting and mechanical disassembly stage includes separation of hazardous elements and substances such as batteries, light bulbs that contain mercury, and hazardous gases from valuable materials such as computer circuit boards and rare metals.

Most of these processes are done manually. Then the waste is crushed and divided into separate streams of materials such as metals, plastic and rubber. The extracted metals are pretreated and melted down. Items that are especially complex, such as mobile phones and circuit boards, are melted down at specialized enterprises that have systems for dividing and neutralizing hazardous byproducts of the melting process.

It is also important to minimize the damage caused by waste when appliances and equipment are produced. In most cases, manufacturers are responsible for collecting and recycling used appliances in the framework of an EPR program. Such a program provides manufacturers with incentives to consider the costs of processing waste when new products are developed and also create appliances that have a smaller amount of hazardous substances, which are therefore easier to recycle.

Waste Disposal

Disposal of waste is the most ineffective and environmentally hazardous form of waste management.

It also happens to be its most common form. Waste is typically disposed of at three main types of facilities: unmonitored dumps, monitored dumps and landfills that comply with sanitary standards.

Unmonitored dumps are the simplest and cheapest disposal method. On the other hand, sanitary landfills require significant capital expenditures, but are the most environmentally safe ones. Table 3A shows the key characteristics of these disposal types.

Table 3A. Principal Types of Waste Disposal and Their Technological Characteristics

Type of technology	Advantages and drawbacks
Open unmonitored dumps	• no pretreatment, disposal plan, disposal monitoring or pressing; • no systems to: prevent filtrate leakage, release landfill gas or monitor the environmental impact; **Consequences:** fires, infestations by destructive insects and rodents, soil and air pollution.
Monitored dumps	• supervision of waste disposal; • no systems to prevent filtrate leakage or release landfill gas, partial monitoring of the environmental impact; **Consequences:** the same, but on a smaller scale.
Equipped landfills	• integrated pretreatment, a plan for disposal of certain types of waste, disposal supervision, pressing and transfer of waste layers; • availability of filtrate collection and landfill gas recovery systems, integrated monitoring of the environmental impact, can be remediated if temporarily shut down; **Consequences:** minimal.

Source: IFC.

In 2008, waste landfilling in Belgium accounted for less than 4 percent of the total volume of MSW. This is largely attributable to a ban on the disposal of household-generated waste there. Only waste that comes from organizations and is similar to MSW may be disposed of on a landfill.

Source: IFC.

The negative impact of waste disposal includes noise pollution, the spread of dust and unpleasant odors, pest reproduction, fires, and other undesirable effects.

The most hazardous consequence of disposal is the pollution of: 1) soil and groundwater as a result of filtrate contamination and 2) the atmosphere as a result of the release of landfill gas. Filtrate forms when the waste contacts rainwater. Its composition is determined by the composition of the waste, the conditions of water penetration, and the condition and age of the waste landfill site.

The greatest hazard is posed by filtrate containing heavy metals, hazardous chemical substances and liquids that come from decomposed organic waste. It is important to note that the concentration of organic waste diminishes over time, while the concentration of heavy metals depends on the acidity level of the filtrate.

Aside from filtrate, another powerful pollutant is landfill gas, which is a mixture of methane (35—55 percent), carbon dioxide (up to 45 percent), and water vapor. Landfill gas is formed during the anaerobic decomposition of waste. Depending on conditions, the gas may also include other components. For example, the disposal of large volumes of gypsum cardboard leads to the formation of hydrogen sulfide. The danger level of landfill gas is in direct proportion to the flammability of the methane in the gas, its toxicity, and its potential to affect vegetation.

One ton of waste on a landfill releases an average of 10 m3 of landfill gas per year. The landfill gas formation is influenced by the size of the landfill, composition of the waste, age of the landfill/waste, and waste storage conditions (for example, density and temperature range).

Landfill gas can also release small quantities of hazardous organic and inorganic volatile substances into the atmosphere. This small quantity can be no larger than 1 percent of the entire quantity of gas present on a landfill. For the most part, these substances are slightly soluble and were either disposed of on the landfill or resulted from chemical and biological processes that took place on the landfill (vinyl chloride, methyl, ethyl mercaptan, sulphureted hydrogen, etc.).

Furthermore, waste often includes hazardous components. These may have a negative impact on human health such as carcinogenetic effects, genetic changes, reproductive disorders, immune system events, and nervous system disorders. These adverse effects reduce life expectancy and harm public health.

Appendix 3
The EU-Ukraine Association Agreement

In the MSW sector, the **Association Agreement between the European Union and its Member States, of the one part, and Ukraine***, of the other part already sets out obligatory legal frames for the nation. Article 361, Chapter 6 (Environment), Title V (Economic and Sector Cooperation), aims at preserving, protection, improving, and rehabilitating the quality of the environment, including *inter alia* waste and resource management.

The necessary gradual approximation of the Ukrainian legislation with the EU environmental policies and law shall proceed in accordance with Annex XXX *Environment* to Chapter 6 of the AA in terms of waste and resource management in the MSW sector. In particular, Annex XXX* states:

"Waste and Resource Management

Directive **2008/98/EC** on waste:

- Adoption of national legislation and designation of competent authority/ies.
  Timetable: these provisions of the Directive shall be implemented within 3 years of the entry into force of this Agreement.
- Preparation of waste management plans in line with the five-step waste hierarchy and of waste prevention programmes (Chapter V of the Directive 2008/98/EC).
  Timetable: these provisions of the Directive shall be implemented within 3 years of the entry into force of this Agreement.
- Establishment of full cost recovery mechanism in accordance with the polluter pays principle and extended producer responsibility principle (Art. 14).
  Timetable: these provisions of the Directive shall be implemented within 5 years of the entry into force of this Agreement.
- Establishment of a permitting system for establishments/undertakings carrying out disposal or recovery operations, with specific obligations for the management of hazardous wastes (Chapter IV of the Directive 2008/98/EC).
  Timetable: these provisions of the Directive shall be implemented within 5 years of the entry into force of this Agreement.
- Establishment of a register of waste collection and transport establishments and undertakings (Chapter IV of the Directive 2008/98/EC), 29.5.2014 Official Journal of the European Union L 161/1951.
  Timetable: these provisions of the Directive shall be implemented within 5 years of the entry into force of this Agreement.

Directive **1999/31/EC** on the landfill of waste as amended by the Regulation (EC) 1882/2003:

- adoption of national legislation and designation of competent authority/ies;
- classification of landfill sites (Art. 4);
- preparation of a national strategy reducing the amount of biodegradable municipal waste going to landfill (Art. 5);
- establishment of an application and permit system and of waste acceptance procedures (Art. 5-7, 11, 12, and 14);

* Source: http://eeas.europa.eu/ukraine/docs/association_agreement_ukraine_2014_en.pdf

- establishment of control and monitoring procedures in the operation phase of landfills and of closure and after-care procedures for landfills to be disaffected (Art. 12 and 13);
- establishment of conditioning plans for existing landfill sites (Art. 14);
- establishment of a costing mechanism (Art. 10);
- ensuring the relevant waste is subject to treatment before landfilling (Art. 6);

Timetable: these provisions of the Directive shall be implemented for existing installations within 6 years of the entry into force of this Agreement. For any installations put into operation after the signature of this agreement, the Directive's provisions shall be implemented as of the date of the agreement's entry into force".

Note: The provisions shall be implemented with certain timeframes (3, 5, 6 years) after the AA entries into force. For any new installations (landfills), the AA has an immediate effect after it enters into force. Article 486 of the AA defines enforcement of the agreement:

"Article 486*

Entry into force and provisional application

1. The Parties shall ratify or approve this Agreement in accordance with their own procedures. The instruments of ratification or approval shall be deposited with the General Secretariat of the Council of the European Union.
2. This Agreement shall enter into force on the first day of the second month following the date of deposit of the last instrument of ratification or approval.
3. Notwithstanding paragraph 2, the Union and Ukraine agree to provisionally apply this Agreement in part, as specified by the Union, as set out in paragraph 4 of this Article, and in accordance with their respective internal procedures and legislation as applicable.
4. The provisional application shall be effective from the first day of the second month following the date of receipt by the Depositary of the following:
   - the Union's notification on the completion of the procedures necessary for this purpose, indicating the parts of the Agreement that shall be provisionally applied;
   - Ukraine's deposit of the instrument of ratification in accordance with its procedures and applicable legislation".

So far, the AA has not entered into force. Nevertheless, under par. 3 and 4 of Article 486, the AA is provisionally applied according to the procedure described. Both the EU and Ukraine ratified the AA on September 16, 2014. Accordingly, the provisional application started on November 1, 2014.

Par. 5 of Article 486* stipulates:

5. "For the purpose of the relevant provisions of this Agreement, including its respective Annexes and Protocols, any reference in such provisions to the "date of entry into force of this Agreement" shall be understood as the "date from which this Agreement is provisionally applied" in accordance with paragraph 3 of this Article".

Subsequently, provisions of the directives have to be implemented until October 31, 2017, 2019 and 2020, accordingly (as long they do not have an immediate effect).

The packaging directive 94/62/EC is not subject to the AA, since Ukraine has already adopted relevant regulations (Art. 17 lit b. of the law "On Waste" and the CMU's Resolution No. 915 of July 26, 2001).

* Source: http://eeas.europa.eu/ukraine/docs/association_agreement_ukraine_2014_en.pdf

Notes

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