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## Municipal waste management system in Poland - analysis of changes in 2012-2016

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### ABSTRACT

The following study deals with the subject of municipal waste management, rules of conduct, good practices in reducing waste in the environment and the manner of their proper disposal. The study includes adopted principles of waste management in Poland, and the responsibilities of municipalities in this area, as the entity responsible for their proper disposal. The study also concerns the analysis of changes in the waste management system in Poland in 2012-2016 resulting from the introduced system of law in this area.

**Keywords:** waste management system, sustainable development, hierarchy of waste management, municipal waste

### 1. INTRODUCTION

The problem of waste exists wherever a person's conducts a commercial, production or service activity. Growing countries are particularly threatened by the constant increase in the amount of waste. The resulting waste is a threat to all environmental components: soil, surface and underground waters and air [1] The main place of municipal waste generation are inhabited areas, for which a particularly important aspect is the development of a proper waste management system, which consists of: collection by type, disposal - transport from the place of generation to the disposal site and disposal by segregation and recovery. [2]

Until recently, the most common method of waste disposal was their storage, which contradicts the principle of disposing as little as possible of landfills. In the economically and ecologically developed countries, more waste is transferred for reuse. [3] Strict compliance with legal regulations and regulations allows a significant increase in the amount of waste sent for recycling and creation of legal and economic grounds for the development of the waste collection and management system. [4]

Currently, the overriding objective of the state policy in the field of waste management should be prevention of their occurrence at source. That is why, year by year, due to appropriate legal regulations, the amount of industrial and municipal waste collected inlandfills is reduced. These wastes begin to be used again in technological processes, and are more widely used in road construction and in the production of construction and other materials. [5]

In Poland, one can observe that one of the most neglected areas of environmental protection is waste management. There is an increase in the amount of waste generated, resulting from the intensification of production activities and consumption. The level of recovery of secondary raw materials is still low. Selectively collected waste is still too low a percentage of municipal waste stream. The majority of municipal waste goes to landfills. In accordance with the principles of sustainable development, municipal waste generated requires a specific method of management through their disposal and re-use, that is recycling. [6]

## **2. RULES OF PROCEDURE WITH MUNICIPAL WASTE**

From the point of view of the EU environmental expectations, as noted by the management of municipal waste, it can be considered in three dimensions: [7]

- social (including fulfillment of international obligations, burden on household budgets related to collection and management of waste, ecological awareness, comfort of living, etc.),
- economic (including, among others, investments in municipal waste management, economic efficiency of waste management, organization of waste sector enterprises, municipal waste market, costs of system servicing, workplaces, etc.),
- ecologic (including, inter alia, impact on environmental protection through appropriate - environmentally friendly - management of municipal waste, production of "green energy", etc.).

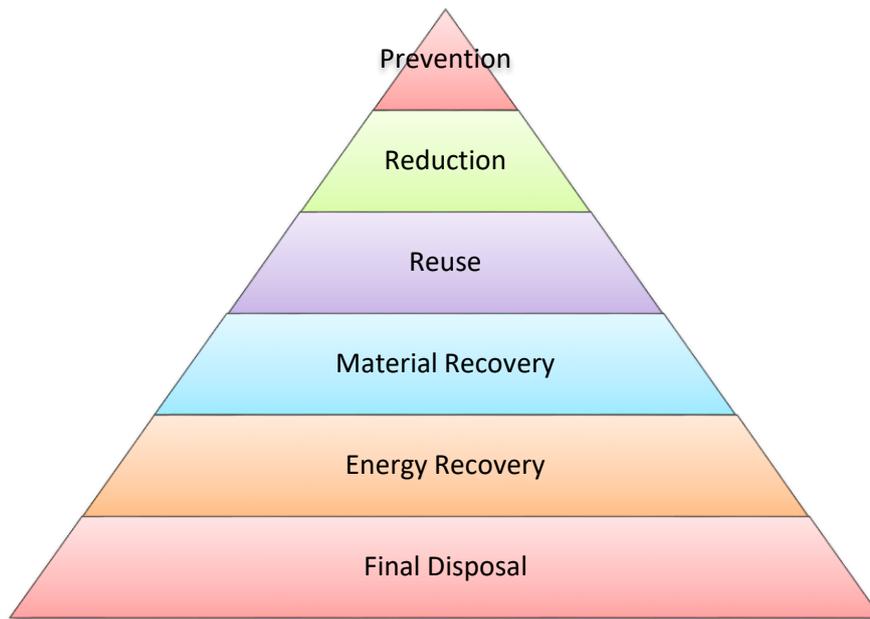
The decisions regarding waste management have implications in other aspects of functioning social, economic or environmental.

Municipal waste management in EU member states (EU) is carried out in accordance with national waste management plans (KPGO). However, there are clear differences between individual countries and regions. They mainly concern the quantity and composition of waste generated, as well as the methods of their management. The diverse amounts of waste generated and the hierarchy of dealing with them in individual countries depend on many socio-economic and technical factors, including the level of affluence of the society, as well as the development and application of modern installations for recycling and neutralization. [8]

The figure shows the hierarchy of activities related to the management of municipal waste. In accordance with the hierarchy of waste management adopted in European countries, the overriding goal is to prevent their formation and to limit the quantity. [9] In addition to

activities aimed at preventing and minimizing waste generation, the most important aspect of waste management is reuse, which means that the product without any additional treatment is reused for the same or other purpose.

This means that the product is placed again at the same stage of the life cycle, and its reuse generates the greatest efficiency. Examples of such products are reusable packaging (eg bottles). Unfortunately, in recent years the number of reusable packaging has been falling in favor of one-off packaging, despite the popular belief that such packaging is environmentally friendly. Therefore, there is a need to build an appropriate system of circulation for reusable packaging. Recycling means, on the other hand, that the products can be reused but after repair or regeneration (eg regeneration of some car parts). Therefore, it is important to develop an efficient system for the flow of regenerated products. [10]



**Figure 1.** Hierarchy of waste management

[Source: Hansen, W., Christopher, M., & Verbuecheln, M. (2002). EU waste policy and challenges for regional and local authorities. Ecological Institute for International and European Environmental Policy: Berlin, Germany, p. 4]

Recycling, this is an action aimed at using waste as production raw materials. It is a system of organizing the flow of materials that can be reused, including recycling-friendly state policy, technology development, design of goods using recyclable materials. The main task of waste management in this area is the development of an efficient sorting system, collection and collection of waste in the recycling system. On the other hand, storage with energy recovery is based on the fact that part of the landfilled waste can be transformed into useful energy, eg obtaining energy through the production of gas, fuels or electricity from rubbish. The lowest place in the hierarchy involves transferring them to the environment by creating permanent landfills. The task of waste management in this area is proper adaptation of the area for this purpose, as well as collecting, sorting and collecting waste [11].

### **3. SYSTEM OF MUNICIPAL WASTE MANAGEMENT IN POLAND**

It has long been recognized in Poland that one of the biggest environmental problems in the country is waste and that the management system requires thorough reforms. Amendments to the law on maintaining cleanliness and order in communes of January 1, 2012 (Journal of Laws of 2012, item 391) and January 25, 2013 (Journal of Laws of 2013, item 228) revolutionized the Polish waste management system. The main change was the obligatory takeover by the municipalities of obligations in the field of municipal waste management, which so far were burdened with property owners. Permanent changes to the law in this area are constantly being introduced, which indicates how important this is for Poland. The matter is not facilitated by the fact that failure to meet the requirements set by the European Union will result in high fines. The forecast of the amount of municipal waste generated by 2020 shows an upward trend, therefore it is necessary to undertake actions aimed at proper management of waste management and securing appropriate infrastructure. [12]

In connection with these changes and the requirements of the European Union on July 1, 2011, the the Polish National Parliament passed the Act amending the act on maintaining cleanliness and order in communes and certain other acts. The Act introduced a deep reform of municipal waste management in Poland. The changes consisted primarily of the obligatory takeover by the municipalities of the obligations of property owners in the field of municipal waste management. The communes thus became fully responsible for creating a coherent municipal waste management system in their area, which became effective from July 1, 2013.

The main tasks of the communes include, above all: [13]

- ensuring the construction, maintenance and operation of own, or joint with other municipalities, regional installations for processing municipal waste,
- covering all property owners in the commune with a municipal waste management system,
- supervision of municipal waste management, including the implementation of tasks entrusted to entities collecting municipal waste from property owners,
- establishment of selective collection of municipal waste covering at least the following waste fractions: paper, metal, plastic, glass and multi-material packaging as well as biodegradable municipal waste, including biodegradable packaging waste, ensuring the achievement of appropriate levels of recycling, preparation for re-use and recovery by other methods, and limiting the mass of biodegradable municipal waste transferred to landfilling.

Gmina organizuje odbiór odpadów poprzez wyłonienie, w drodze zamówienia publicznego, firmy świadczącej taką usługę. Gmina jest obciążona odpowiedzialnością za realizowanie pozaekonomicznych celów gospodarowania odpadami, w szczególności:[14]

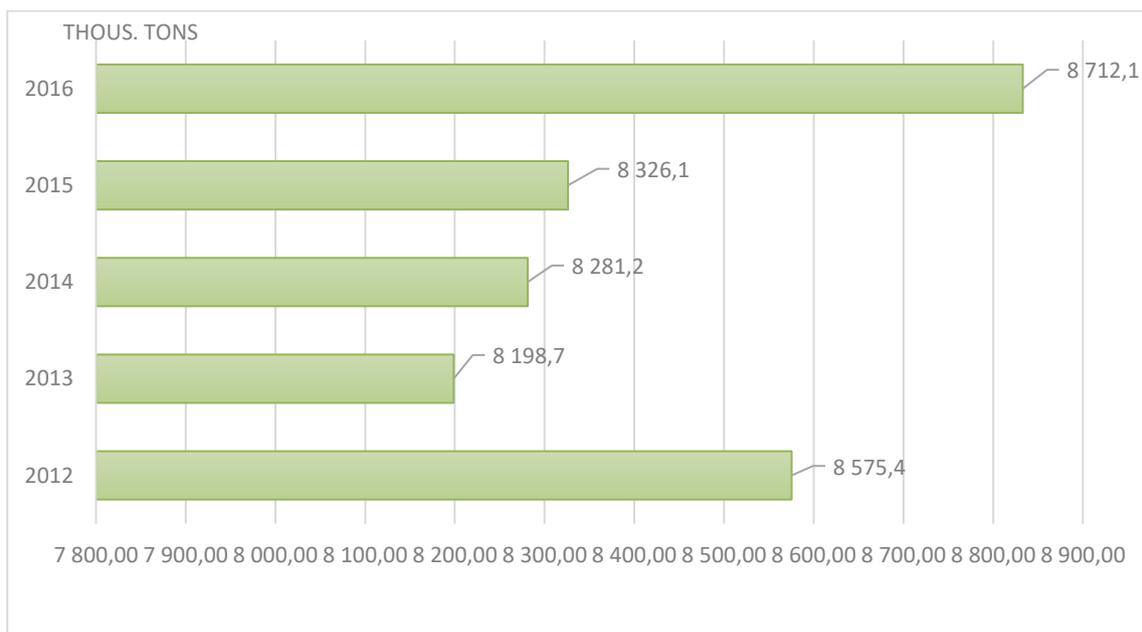
- 1) Ensuring the achievement of appropriate levels of recycling, preparation for re-use and recovery by other methods:
  - the level of recycling and preparation for re-use of the following municipal waste fractions: paper, metals, plastics and glass in the amount of at least 50% by weight,
  - the level of recycling, preparation for reuse and recovery by non-hazardous methods of construction and demolition waste, constituting municipal waste of at least 70% of the total weight.

2) Ensuring the limitation of the mass of municipal waste, biodegradable, transferred to storage:

- until July 16, 2013 - up to 50% of the total weight of municipal biodegradable waste transferred to landfilling,
- until 16 July 2020 - up to not more than 35% of the total weight of biodegradable municipal waste sent to landfill, in relation to the weight of this waste generated in 1995.

The consequence of the legal solutions adopted by the legislator was the assignment of the public-law responsibility as the basic unit of territorial self-government, so that the municipal waste management system accomplishes the objectives (tasks) to achieve the required levels of municipal waste management. As a result of the accented legal regulation, the issue addressed in this study is closely related to the above-mentioned issues of municipal waste management. Due to the state of municipal waste management in Poland, achieving the required levels of municipal waste management and the implementation of tasks that the municipality must face in order that the indicated goals could be realized is not easy. This provided additional justification for undertaking a thorough analysis of the indicated research problem. [15]

#### **4. ANALYSIS OF CHANGES IN THE WASTE MANAGEMENT SYSTEM IN POLAND IN THE YEARS 2012-2016**



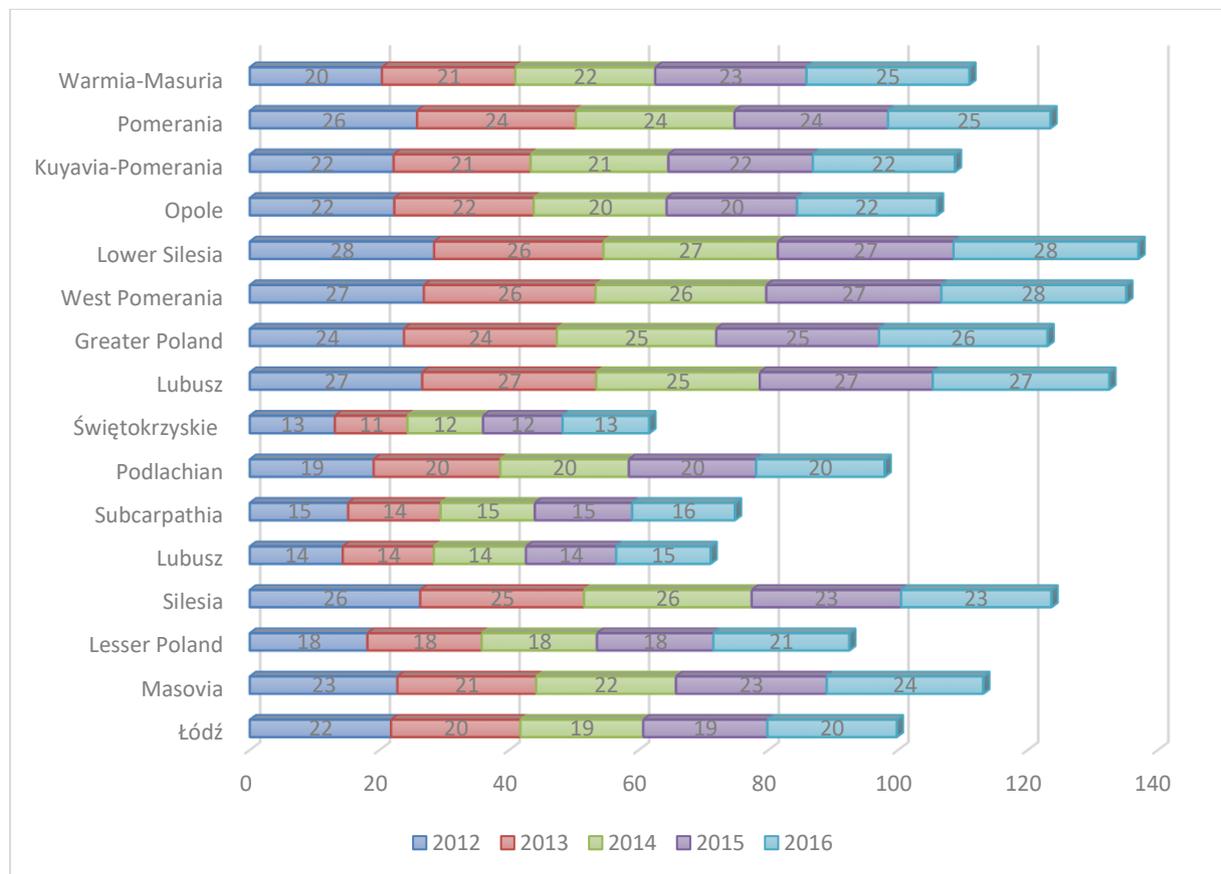
**Figure 2.** Waste mixed up in 2012-2016 in Poland

[Source: Central Statistical Office (GUS), “ Change of municipal waste management system in Poland in 2012-2016” Warsaw 2017]

An interesting issue is the analysis of the state of waste management in Poland after the introduction of the new law and entrusting the commune as the basic unit of territorial self-

government with the organization of municipal waste management system in Poland. Describing the analyzed system is justified, as changes in legal regulations made by the legislator have definitely influenced the shape of the waste management system, tasks of the property owners, terms of service, as well as criminal and administrative sanctions for non-performance of duties in the discussed area. At this point, it should only be recalled that the new system has been in force since July 1, 2013. [16]

Among the effects of introduced changes in waste management, after the entry into force of the law on maintaining cleanliness and order in communes, there was a decrease in waste mixed in 2013 compared to 2012 by 4.4%. In 2014-2015, the amount of mixed waste received was at a similar level. As part of the waste management system sealing, the municipalities carried out checks as to whether residents have signed contracts for the collection of municipal waste from residential and uninhabited real estate. In 2016, there was an increase in mixed waste compared to 2015, by 4.6%.

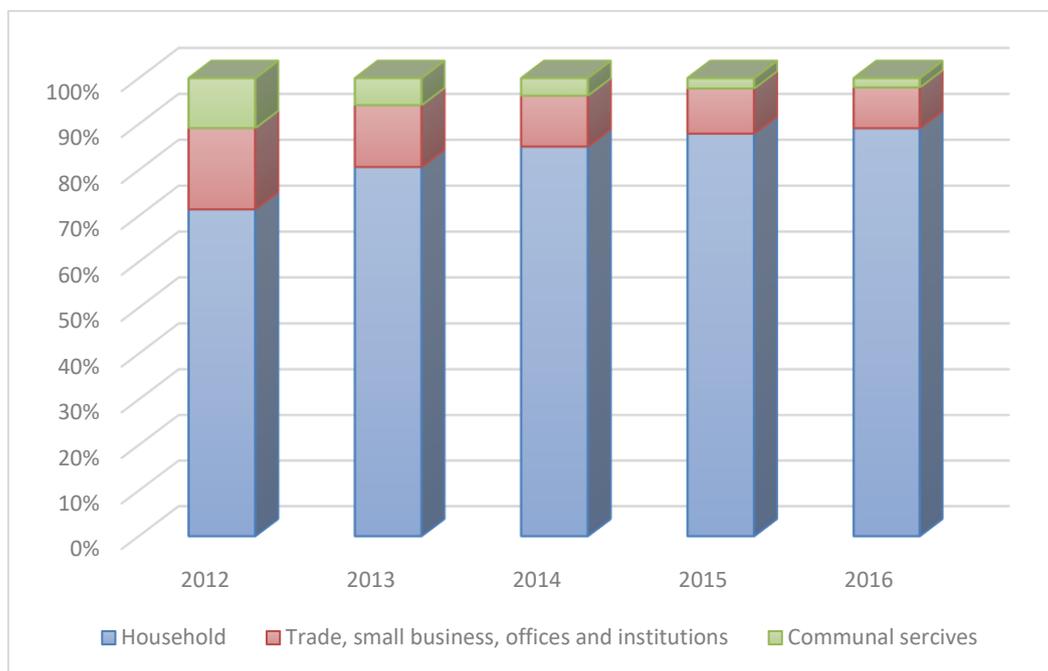


**Figure 3.** Waste mixed by voivodeships per 1 inhabitant

[Source: Central Statistical Office (GUS), "Change of municipal waste management system in Poland in 2012-2016" Warsaw 2017]

Counting mixed municipal waste per one inhabitant, it can be concluded that in 2016 the largest increase in the amount of collected waste mixed in relation to 2012 occurred in the Warmian-Masurian Voivodeship and amounted to 23%. In the Lesser Poland Voivodeship, the

increase reached 16%, and Greater Poland Voivodeship - 9%. In Masovian and West Pomeranian Voivodships, an increase of 6% was recorded. In the Silesian Voivodship, a decrease in the amount of mixed waste by 12% was noticeable, while in the Łódź Voivodship it was 8%.



**Figure 4.** Sources of origin of waste collected selectively in Poland

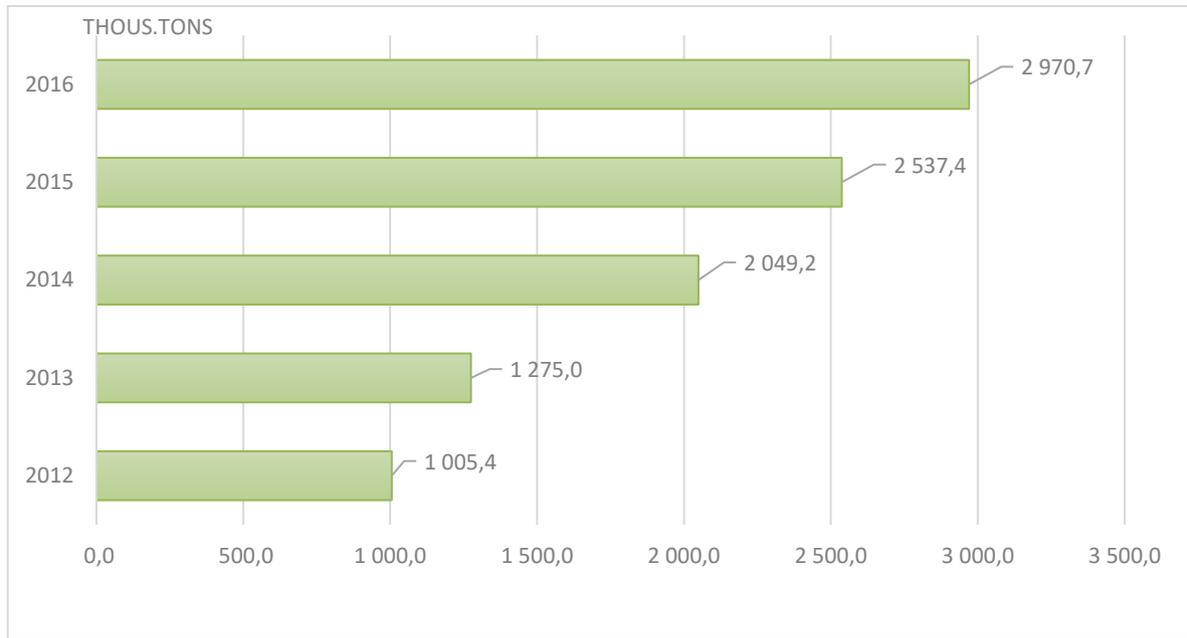
[Source: Central Statistical Office (GUS), "Change of municipal waste management system in Poland in 2012-2016" Warsaw 2017]

Waste collected selectively comes from three sources:

- trade, small business, offices and institutions,
- communal services,
- households.

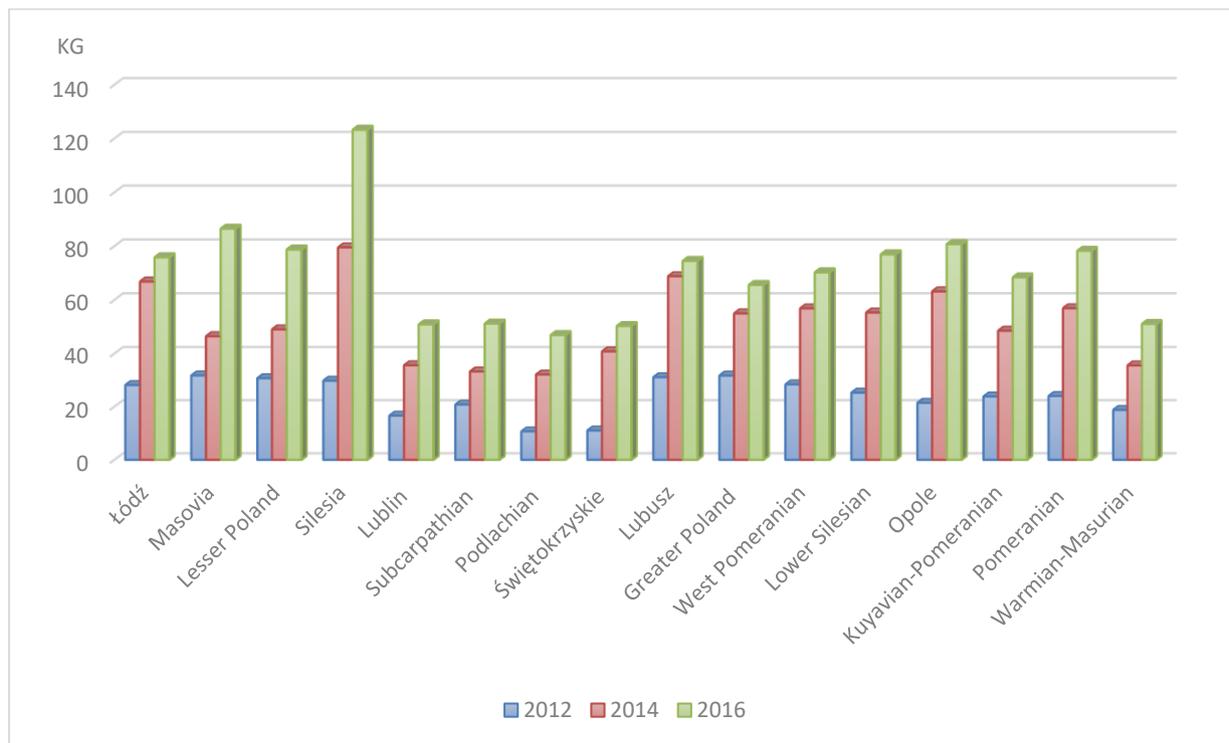
In 2012-2015, the share of municipal waste from trade, small business, offices and institutions, and municipal services decreased, while household waste increased. In 2016, almost 90% of municipal waste came from households, 2% from municipal services (cleaning of squares, streets and cemeteries), and the rest from trade, small business, offices and institutions.

In 2012-2016, there was an increase in the amount of municipal waste collected selectively in Poland. The largest increase in the amount of waste collected selectively was recorded in 2014 compared to 2013 - up to 60%. 2014 was the first full year of the amendment to the act on maintaining cleanliness and order in communes. In 2015, compared to 2014, the growth of separately collected waste was 23%, and in 2016, compared to 2015, it reached 17%.



**Figure 5.** Waste collected selectively in Poland in 2012-2016

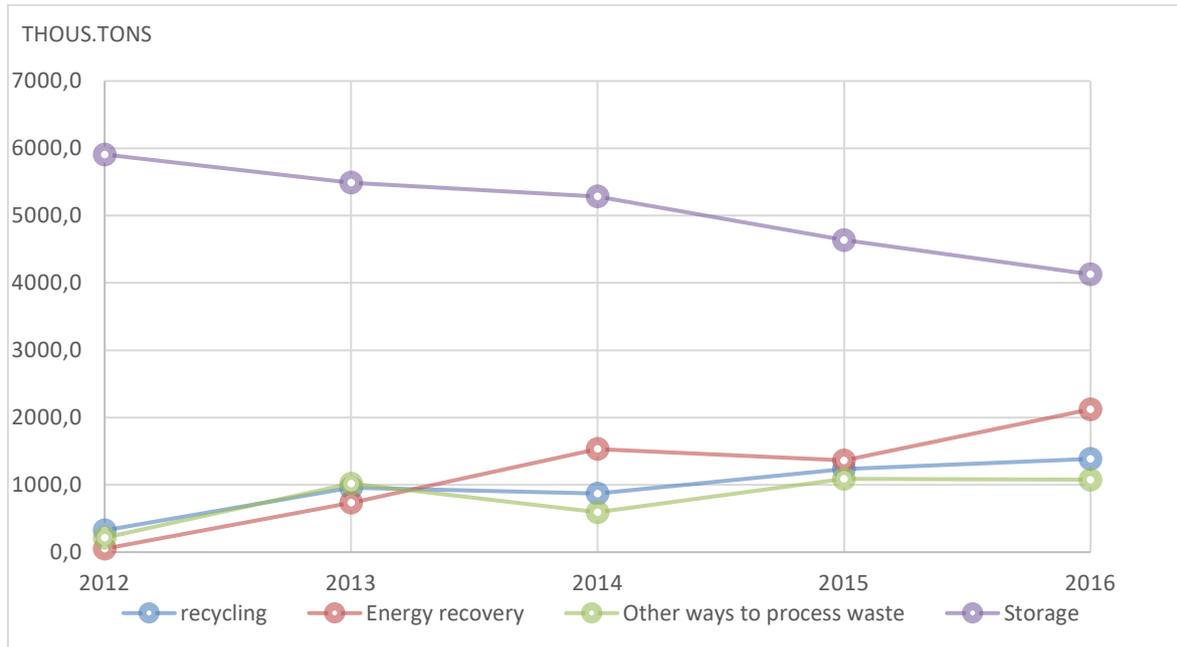
[Source: Central Statistical Office (GUS), “Change of municipal waste management system in Poland in 2012-2016” Warsaw 2017]



**Figure 6.** Waste collected selectively by voivodships per 1 inhabitant

[Source: Central Statistical Office (GUS), “Change of municipal waste management system in Poland in 2012-2016” Warsaw 2017]

In the years 2012-2016, a four-fold increase in the amount of selectively collected waste per capita in the following voivodships: Silesian, Podlachian and Świętokrzyskie was observed. In the Lubusz, Lower Silesian, Opole and Pomeranian voivodships, a threefold increase in this waste has been recorded. In the remaining nine voivodships, the amount of waste received in the analyzed period doubled.

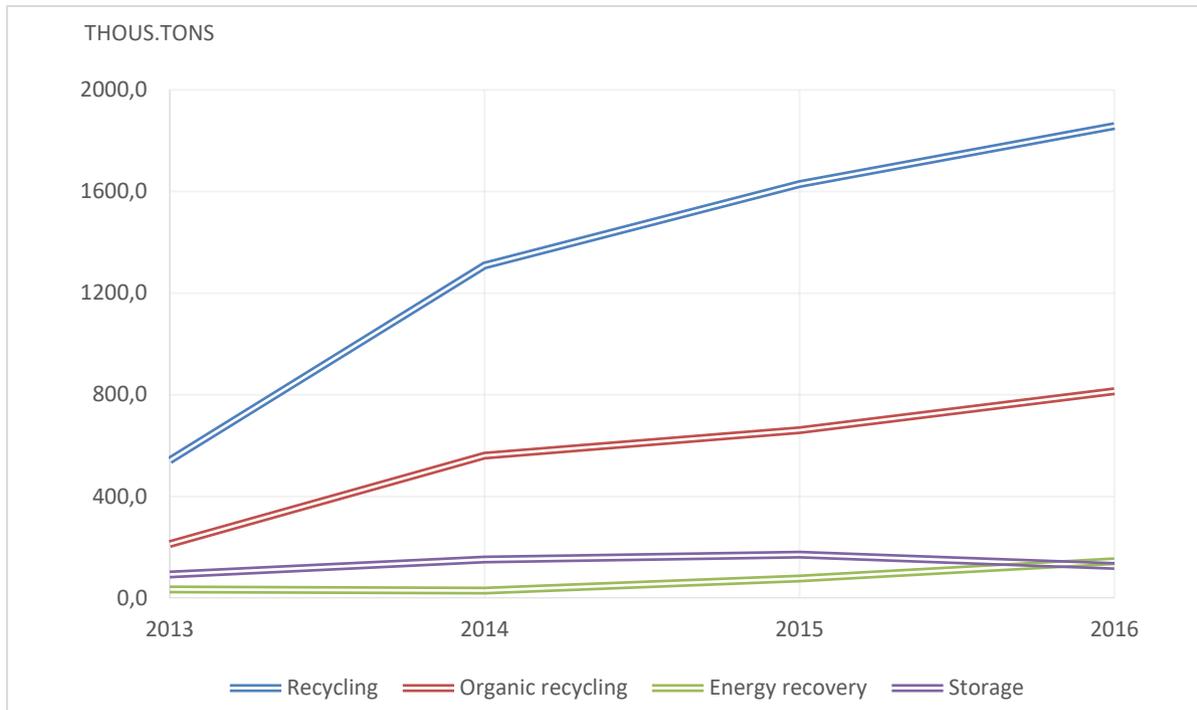


**Figure 7.** Management of mixed waste in Poland

[Source: Central Statistical Office (GUS), "Change of municipal waste management system in Poland in 2012-2016" Warsaw 2017]

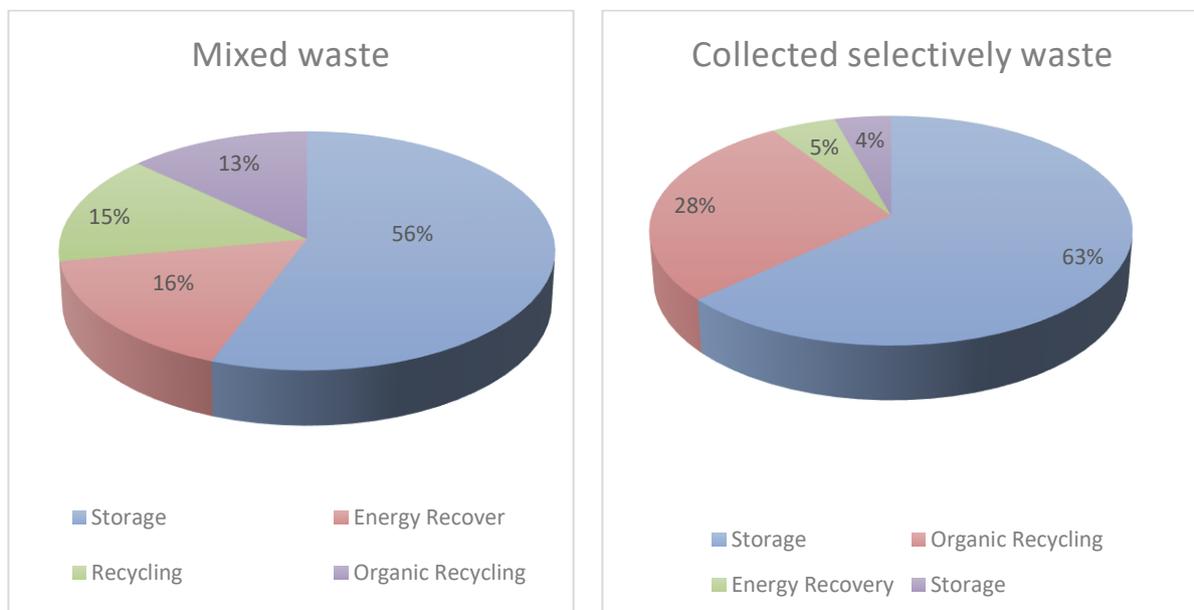
Municipal waste management, in accordance with the Act, takes into account the hierarchy of waste handling methods. Mixed waste is subjected to the following processes: recycling, thermal transformation, other treatment processes (biological treatment) and storage (mixed waste goes to the landfill after previous processing operations). The amount of mixed waste covered by recycling in 2016 compared to 2012 increased fourfold, and the amount of thermally transformed waste increased forty-two times. Such a large increase in the waste stream sent for thermal transformation was caused by the launch of new municipal waste incineration plants that started operations at the turn of 2015 and 2016. The increase in the amount of waste sent for thermal transformation was also influenced by the Regulation of the Minister of Economy of 8 January 2013 on criteria and procedures for the acceptance of waste for landfill. It introduced, from 1 January 2016, a ban on landfilling of waste after mechanical treatment and municipal waste, for which the heat of combustion exceeds 6 MJ / kg. The amount of mixed biological wastes subjected to biological treatment increased fivefold, while landfills decreased by as much as 30%.

Presentation of data on the directions of treatment of municipal waste collected selectively is possible from 2013, when the law on maintaining cleanliness and order in municipalities came into effect and the research methodology was changed.



**Figure 8.** Directions of selective waste treatment in Poland

[Source: Central Statistical Office (GUS), “Change of municipal waste management system in Poland in 2012-2016” Warsaw 2017]



**Figure 9.** Waste mixed and collected selectively in Poland in 2016.

[Source: Central Statistical Office (GUS), “Change of municipal waste management system in Poland in 2012-2016” Warsaw 2017]

In the case of waste collected selectively directed for recycling, more than threefold increase in their quantity was noted in 2016 as compared to 2013. However, the amount of biodegradable waste collected in a selective manner, aimed at organic recycling, increased almost fourfold. In 2016, four times more waste collected selectively than the year 2013 went into the thermal transformation. The amount of selective waste sent to the landfill increased by 37%.

Comparing the directions of mixed and mixed waste treatment, it can be observed that more than 50% of mixed waste goes to storage (mixed waste goes to a landfill after previous processing) and only 4% of separately collected waste. 16% mixed waste and 5% separately collected were thermally transformed. Only 15% of mixed waste gets picked up for recycling, and 63% selectively collected waste. 13% mixed waste is targeted for biological transformation and selectively 28% waste collected.

## **5. CONCLUSIONS**

The results presented above indicate the effective functioning of new solutions, which should be attributed to both the dynamic development of selective waste collection (its availability, universality and constant increase in the proportion of separately collected waste), as well as the effective use of existing municipal waste treatment installations. Summing up, it should be stated that the implementation of the Act on maintaining cleanliness and order in municipalities was a great challenge faced by Polish local governments. The commune must ensure the conditions for the operation of the separate collection and collection system for municipal waste in order to reduce the storage of biodegradable waste, extract hazardous waste from the municipal waste stream, and achieve recovery and recycling of packaging waste. In addition, the commune is building, maintaining and operating its own or other communes installations and facilities for recovery and disposal of municipal waste. There is, however, a need to improve the waste management status, the municipalities lack a well-developed system of selective waste collection and a radical improvement is needed in this respect.

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