

INDUSTRIAL WASTE MANAGEMENT IN TERMS OF SUSTAINABLE DEVELOPMENT

MANAŽMENT PRIEMYSELNÝCH ODPADOV V KONTEXTE UDRŽATEĽNÉHO ROZVOJA

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ABSTRACT

This paper presents the results of the initial analysis of industrial waste generation in Slovakia and Poland. For easier comparison between both countries and simplifying data the waste generation intensity indicator was used, which integrates population growth, the gross domestic product and the waste generation into one. Based on this analysis the waste generation trends can be pointed out as well as measures which are necessary to implement sustainable and effective waste management.

Key words: industrial waste, waste management, sustainable development

INTRODUCTION

As European society has grown wealthier it has created more and more waste. Each year in the European Union alone is collected 3 billion tonnes of waste - approximately 90 million tonnes of it hazardous. It is clear that treating and disposing of all this material - without harming the environment - becomes a major challenge. In these terms authors of the paper prepared project of a bilateral cooperation focused on identification and characterization of chosen industrial waste management processes, characteristics supplemented by comparison of Polish and Slovakian industrial waste Management, development of information set allowing improvement of industrial waste management and the exchange of experience in research done within the examined area by research teams in both countries. In this paper we point out some facts about industrial waste management, provide comparison of waste generation in Poland and Slovakia and outline the aims of future cooperation.

MATERIALS AND METHODS

The main objective of this paper is to compare waste generation in Slovakia and Poland, which can serve as a basis for further trend evaluation of waste generation and help to set the measures for improvement of industrial waste management. To achieve this, we used the available literary sources and we extracted relevant data from the European Commission Statistical office - Eurostat.

Industrial Waste management

Waste management is one of the most important and challenging issues for sustainable development. It is also one of the most controversial issues and is the subject of an ongoing debate between different stakeholders. The increasing amounts of waste each year demand an immediate and practical solution to the problem which currently cannot be solved by recycling alone. [1]

By 2020, the OECD estimates we could be generating 45% more waste than we did in 1995. Obviously, we must reverse this trend if we are to avoid being submerged in rubbish. [4] Currently, 67% of waste is landfilled in the EU countries, so EU wants to reduce the quantity of waste going to landfill by 50% up to 2050.

Waste, especially industrial and hazardous waste, create a number of problems. First, large amounts of waste generated by industry each year require large space for its storage and disposal. Secondly, landfilling waste emit carbon dioxide (CO₂) and methane (CH₄) into the atmosphere and also number of chemicals into the soil and ground waters. So waste must be collected, sorted and transported before being treated which can prove expensive. Waste also represents valuable resources which can be recycled to recover materials or energy. [5]

The main challenge associated with industrial waste is how to manage them in the most sustainable way. Following the widely adopted waste management hierarchy [2], it is clear that reducing waste generation in the first place is the most sustainable option. However, the wealthier societies in particular have not been very good at achieving this goal so far and at present they are left with an ever increasing pile of waste each year. Reusing and recycling waste to recover materials would also be a sustainable way to deal with the problem of waste, however, various factors such as lack of appropriate technologies, high costs of collection, sorting and recycling of waste as well as insufficient public participation make these activities difficult. [1]

Waste management is a fundamental task of logistical management of waste streams. Its processes mainly concern the appropriate organizations how to deal with waste. Waste management can be viewed in terms of process and the object. [7]

Objects of control in the process term are:

- Prevention of waste, including became obvious by the rationalization of production and consumption;
- Generation of waste, including the design of products taking into account the rest mass of recycled after use;
- Separate collection, mainly by the segregation of waste at source;
- Recovery of matter and energy contained in waste, or waste recycling in whole or in part, or recovery from waste substances, materials or energy and their application;
- Recycling, a recycling of substances or materials in waste in the production process in order to obtain the substance or material the original or other purposes;
- Disposal of waste consisting of being subjected to processes of biological, physical or chemical treatment to bring about a state that does not pose a risk to human life, health or the environment. [8]

In terms of the preferred process is to prevent waste, became obvious in the rationalization of production and consumption, and became obvious and the least desirable waste disposal. [10]

Analyzing the possibilities of industrial waste management in terms of sustainable development there should be paid attention to minimizing the causes of excessive amounts of waste. Such opportunities give the rationalization of resources management, in which all activities must have a common planning, organization and implementation of a uniform goal.

Waste generation in Slovakia and Poland

According to GUS data, now in Poland are produced about 120 million of industrial waste annually, of which about 80% are destined for recovery, 21.7% for disposal (including 17.7% for landfilling), and 3.4% for temporarily storage. The largest percentage - about 90% of the total waste generated in Poland are industrial waste, more than 80% of them are produced by the extractive industry, especially mining, energy industry and metallurgy. [9]

The waste generation in Slovakia, according to economic activities classification by SK NACE, reports that manufacturing industry has been the dominating component over the recent years, with 65 % share. Sector of building industry follows with 13 %, agriculture with 8 %, and trade with 5 % share. In 2010 the total amount of produced waste was 8,9 million tons of waste, 466 421,51 tons was categorized as dangerous waste. It is necessary to point out that the total amount of waste produced by particular economic sectors does not include municipal waste. [11]

There were 5 558 179,57 tons of waste recovered in the SR in 2010. This represents 62 % of total volume of waste located on the market (not included municipal waste). Recycling or re-extraction of other inorganic compounds has the greatest share on waste recovery with a 24 % share. Significant share of waste recovery has also recycling or reclamation of metals and metal compounds (21 %) and the treatment of soil to benefit the agricultural production or to improve environment (15 %). [11]

Waste generation by year and waste category in kg per capita in Slovakia and Poland is showed on fig. 1.

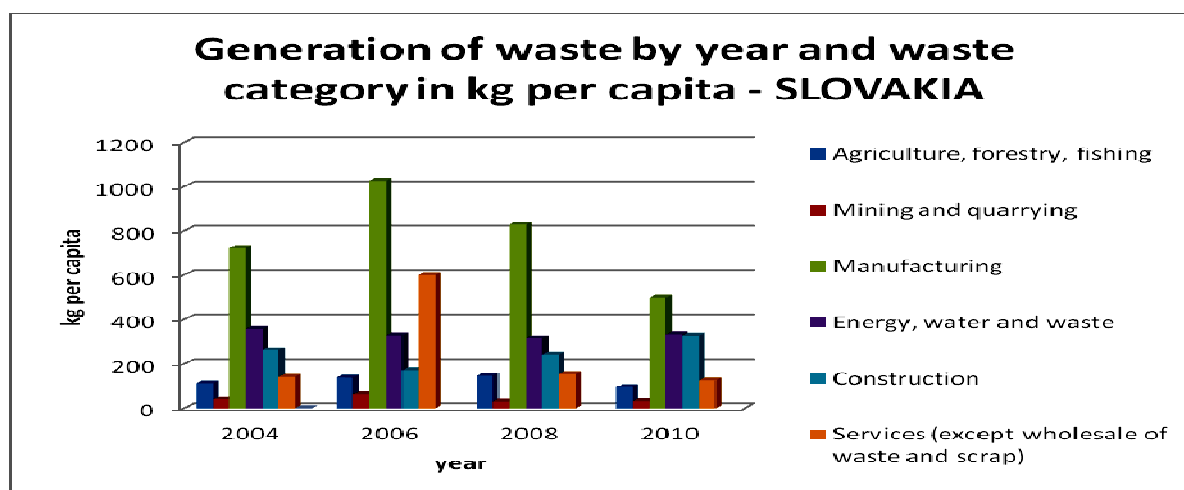
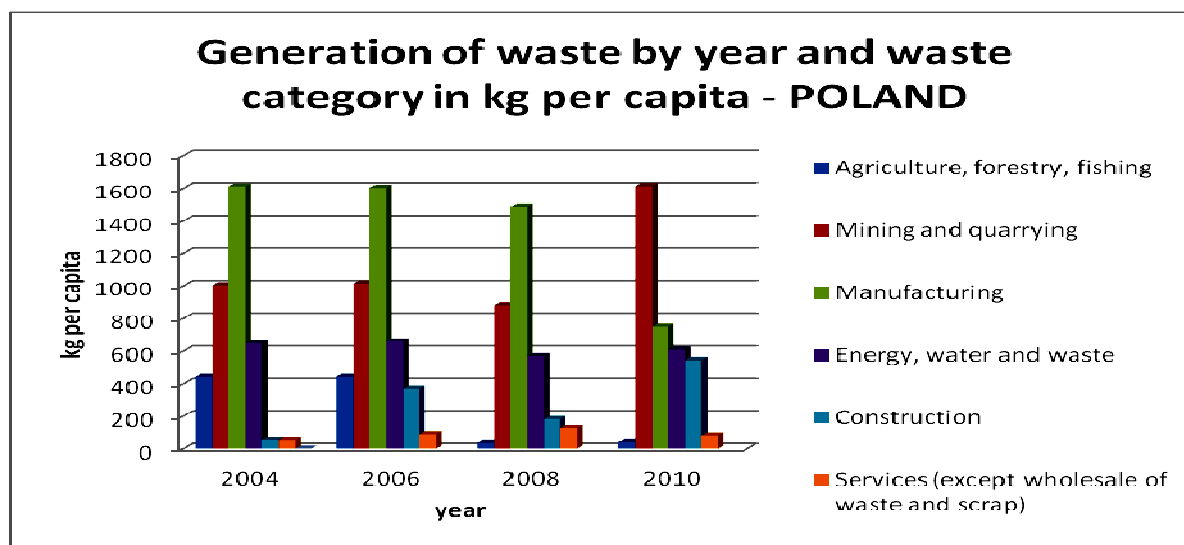


Fig. 1 Generation of waste by year and waste category in kg per capita in Slovakia and Poland
Source: Eurostat

For providing a measure of the pressure on the environment caused by total amount of generated waste, we can use Waste Generation Intensity (WGI). Waste generated (kg per capita) per unit of GDP (per capita in PPS) will show whether there has been decoupling of waste generation from economic growth. Changes in the value of this indicator enable assessment of the effectiveness of waste management. The same method is presented by the Danish Ministry of the Environment [3].

The waste generation intensity can be calculated as follows:

$$WGI = \left(\frac{TWG}{GDP} \right)_{Index=100} \quad (1)$$

TWG – total waste generation (kg per capita) and GDP (€ per capita) are indexed by using the value of 100. In fig. 2 the waste generation intensity evolution in both countries is presented.

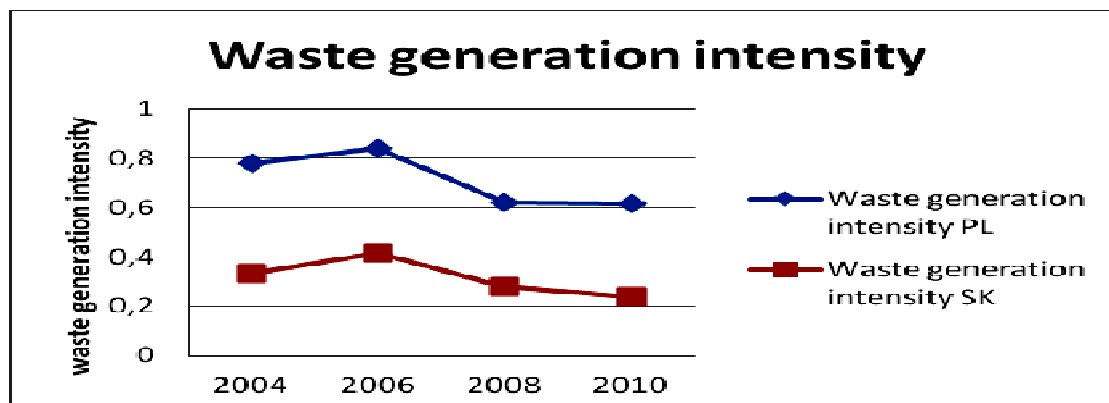


Fig. 2 Waste generation intensity

Though in both countries GDP is growing constantly, the WGI indicator has decreasing tendencies, which is positive result. The both countries show similar pattern of WGI indicator, though WGI in Slovakia is lower. It can be affected not only by the types of raw materials and the technology of production, technological progress, but also the consumption of material goods, culture and environmental policy.

Taking into account the various aspects of waste flows requires a combination of many elements involved in the movement into the sequence of events occurring in a specific order, referring to determined and pursued by all parties planning, joint organizing so that it would be possible to achieve the common goal coming out of implementing the principles of sustainable development.

RESULTS AND DISCUSSION

From the cooperation between Slovakia and Poland both countries can benefit. The main goal of the collaboration is to examine and compare the industrial waste generation and assess industrial waste management together with identification of its impact on fulfilment of the socio-economical and environmental principles of sustainable development.

The main goal will be reached by the realization of fragmentary goals, which are set as follows:

1. Identification and characterization of chosen industrial waste management processes:
 - a. Collection;
 - b. Warehousing;
 - c. Transportation;
 - d. Information flow.
2. Analysis of economical, social and environmental aspects of sustainable development from the industrial waste perspective.
3. Characteristics supplemented by comparison of Polish and Slovakian industrial waste management:
 - a. In legal and organizational terms;
 - b. In statistical and descriptive terms;
 - c. In scope of socio-economical influences;
 - d. In scope of environmental influences;
 - e. In scope of "the best practices" identification.
4. Development of information set allowing for improvement of industrial waste management (including preventive measures) in accordance with the sustainable development principles.

CONCLUSION

Industrial waste generation is an important but also very complex problem for sustainable development. To preserve the quality of the environment for future generations it is the necessity for society to implement sustainable waste management. Even if the costs of waste management and logistics management of waste streams are still quite high, it is very important to spread good solutions in literature, and also imply into practice.

In this paper some facts about industrial waste management are presented, and comparison of waste generation in Poland and Slovakia was made. To point out the correlation between economic development and waste generation, the waste generation intensity indicator was calculated for both countries. It can serve as a basis for further trend evaluation of waste generation and help to set the measures for effective and sustainable industrial waste management.

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