

Environmental Aspects Of The Waste Management Technologies In Bulgaria And EU

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Abstract — This paper attempts to compare the applied waste management practices in Bulgaria and EU countries on the basis of the official Eurostat and National Statistical Institute of Bulgaria (NSI) statistics over a 10 – years period of full Bulgaria membership in the Union. The recycling of MSW as material is the most important indicator for achieving a cyclical (circular) economy with full useful recycling of all waste - a goal the EU has set itself to achieve in the next decades. Bulgaria is lagging behind in the application of industrial technologies for thermal processing of waste with energy production. In conclusion, the trends and results of the MSW management policies in Bulgaria are critically analyzed, as well as the potential economic and environmental benefits missed. The special importance of the education of the population and institutions for the negative impact of the landfilled waste on the environment and human health is emphasized.

Keywords — municipal solid waste processing, energy production, human health, ecology.

I. INTRODUCTION

The global increase in human population, urbanization and the increase in purchasing power of the population are the main reasons for the increase of generated municipal solid waste MSW worldwide. Ecologically safe treatment of household waste is a technological process applied in developed countries, connected with serious investments, infrastructure and economic realization of final products. European countries are among the leading in the implementation of such technologies.

Bulgaria has been an equal member of the EU since 2007, which presupposes the transposition of European waste management policies and practices in Bulgaria, and their results can be objectively evaluated on the basis of available statistical information for a period of 10 years.

II. COMPARISON OF MSW GENERATED AND RECYCLED IN BULGARIA AND THE EU

The analysis is based on freely available statistical information [1] and [2].

A. MSW generated

Sustainable development implies minimizing the generated MSW, especially in densely populated urban communities, since their management and processing is a serious challenge, both economically and environmentally. The statistics show that for the period of 2008-2017, there is a steady decrease in the absolute amount of generated MSW per capita, both in Bulgaria and in the EU, as in Bulgaria it is more visible – the linear approximation (trend) decreases with greater slope, Fig. 1.

The explanation may be sought in the declining purchasing power of the majority of the population and in a conscious change in attitudes towards the environmental protection. At the beginning of the period considered Fig.2, the Bulgarian population generated more MSW than the EU average of about 15%, while at the end, the generated waste was about 10% less, i.e. the relative amount decreased by about 25% within 10 years.

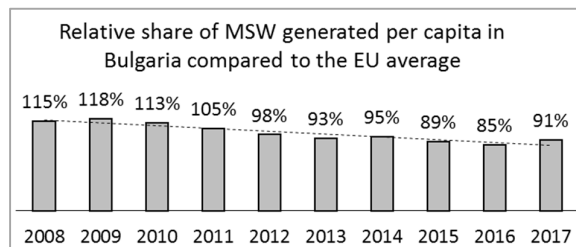


Fig. 2

B. MSW recycled

With regard to the management of waste already generated, recycling is most important, which reduces the need for primary raw materials and energy for their production, the amount of landfilled waste and its environmental impact. The share of recycled MSW as material in Bulgaria is slightly lower than the EU average of Fig. 3, with the trend line showing a progressive lag in time.

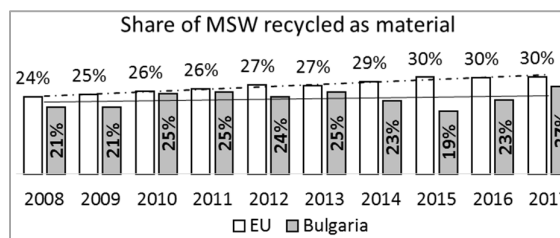


Fig. 3

The relatively high percentage of recycled waste in our country Fig. 3 can be explained by the financial interest for its commercial realization, both by the subjects that generate and recycle it, and by the unregulated activity of the trash collectors digging the waste containers and landfills. Mostly metals, plastics, paper and cardboard are recycled, which do not require specialized processing – they are sold directly as raw material. Wood, textiles and more are not of commercial interest as they are not subject to direct use.

High-moisture biodegradable MSW is usually composted with energy recovery for biogas and bio-fertilizer production. The resulting biogas is used as a fuel with a slightly lower calorific value than methane in combustion plants. Composting without biogas recovery but bio-fertilizer only is not advisable from an environmental point of view, since the

methane produced is released into the atmosphere as a greenhouse gas and energy is lost. The economic feasibility of biogas conversion projects and the utilization of gas in combustion plants is determined by the value of the investment and the possibility of profitable realization of the energy produced. It is a main factor that could make sense of the application of this technology on a case-by-case basis. The average share of composted waste for the EU in the period considered Fig. 4 is stable with an increase of 14 to 17%, while in Bulgaria composting is noted only after 2010. The relative share at the end of the period for Bulgaria is about 8 – 9% of the generated amount of MSW, i.e. approximately twice lower than the EU average.

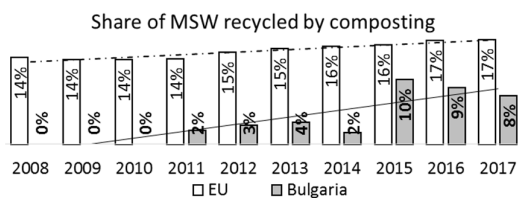


Fig. 4

III. LANDFILLED MSW IN BULGARIA AND THE EU

Non-recyclable and thermally processed MSW is disposed of in landfills, most often on open sites, without a waterproofing pad. It is the most environmentally unfriendly method of waste treatment. The relative share of landfilled waste has been steadily decreasing over the period considered, both for the EU and Bulgaria, but while the EU average is about twice - from 40 to 24%, for Bulgaria it is about 30% - from 79 to 62% , Fig. 5.

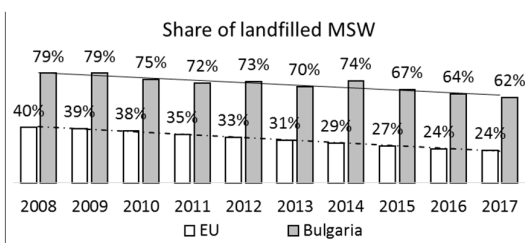


Fig. 5

Comparison of landfills in different EU countries shows drastic differences in absolute units, kilograms per capita. While in the most economically advanced countries, it is insignificant, in the more backward ones, especially in the southern geographical location, the values are very high, Fig. 6. Bulgaria occupies the unenviable 5th place, only outstripped by Cyprus, Malta, Greece and Croatia.

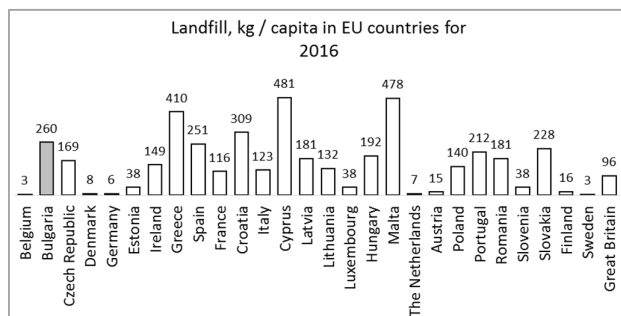


Fig. 6

Comparison of the relative share of landfilled waste without taking into account the population size (on the basis

of absolute units of thousands tons) for 2016 makes it possible to group Member States into four categories. The grouping is natural and very clear when viewed in Fig. 7.

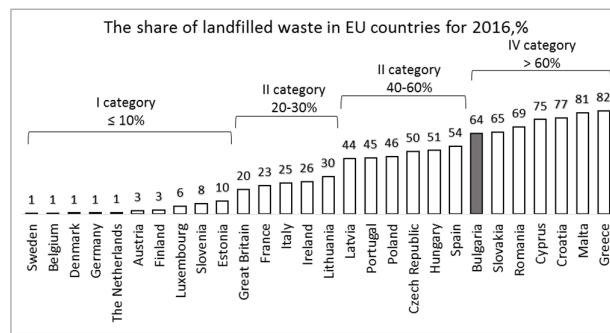


Fig. 7

If average values for each category of countries are deduced, (in a case each country has the same weight in %), the picture looks even more pronounced, Fig. 8.

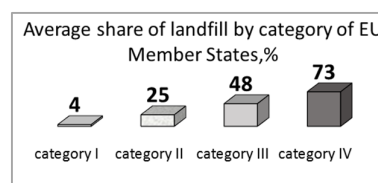


Fig. 8

The drastic differences in the relative share of MSW deposited between the categories are visible. Bulgaria falls into the category of countries with the highest share of landfill.

IV. MSW PROCESSED FOR ENERGY IN BULGARIA AND THE EU

A significant part of the generated MSW is combustible, and is used as a biofuel in developed countries. Over the period considered, the relative share of MSW for EU energy production increased by about 10%, from 16 to 27%, while for Bulgaria data is reflected from 2013, by a relative share of 2-4%, Fig. 9. Open burning without energy recovery in the EU after 2014 is not practiced, Fig. 10.

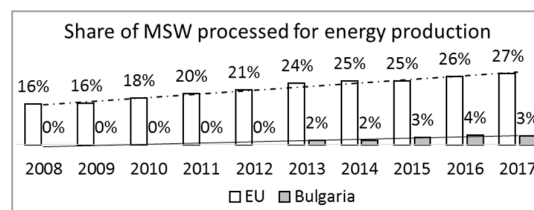


Fig. 9

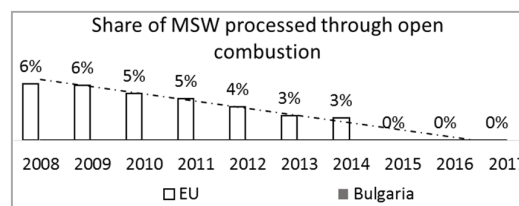


Fig. 10

When analyzing by Member State for 2016, Fig. 11, the huge difference in the utilization of MSW for energy is seen. Expressively, it leads Denmark with over 400 kilograms per capita, followed by the most economically advanced countries with between 270 and 160 kilograms per capita, and the

southeast EU countries with barely from 0 to 15 kilograms per capita. The picture is almost mirror-reciprocal with respect to the landfills.

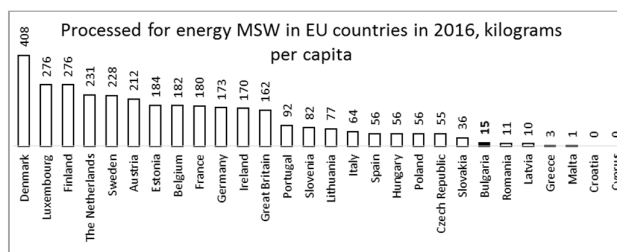


Fig. 11

Germany is the undisputed leader in EU energy production from non-renewable waste, Fig. 12. The number of population and gross waste generated is essential here, but Bulgaria is again one of the last places - after Luxembourg, whose population is much more slightly ahead of only Cyprus, Croatia and Malta.

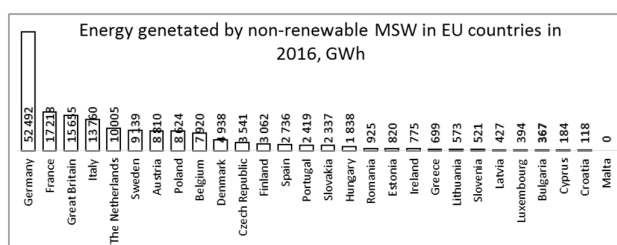


Fig. 12

The Waste Management (WM) legislation in Bulgaria is in line with the EU directives, a National WM plan and methodological guidelines for the development of regional WM programs have been adopted, European funding has been provided for the implementation of these programs. An ordinance for the construction and operation of municipal waste incineration plants has been adopted, including the utilization of the energy generated.

Despite the existing legal regulations and organizational measures taken, the actual WM policy in Bulgaria has not changed significantly since the time of socialism – the main way of processing the MSW is landfilling. When analyzing the trend-lines of occupied area and free capacity of landfills [2], Fig. 13 and 14, is seen that the free volumes increases and the occupied area decreases over the last 7 years, i.e. no measures are being taken to close landfills and recultivate damaged lands.

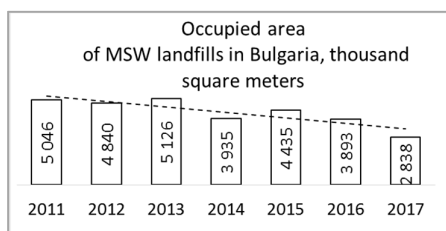


Fig. 13

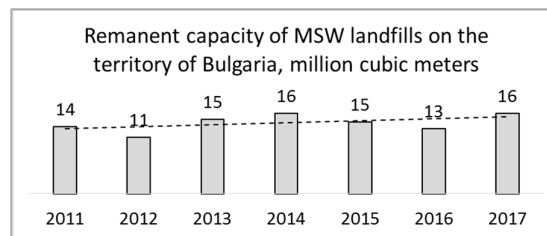


Fig. 14

Separate collection of MSW, which is very useful in the processing of MSW by technology other than landfilling, in our country proved to be a time-unlimited unsuccessful experiment than a real working system. Instead, an alternative approach has been adopted – separation in pre-treatment of mixed waste at separation plants.

V. CONCLUSIONS

The review of the statistics [1] and [2] shows two main trends. On the one hand, reducing the amount of MSW generated per capita and a sustainable and lagging increase in the share of recycled waste, and on the other, an economically inefficient and environmentally destructive approach to the treatment of non-recyclable mixed waste by landfilling.

The relatively low and progressively declining population of non-urbanized areas in Bulgaria, and the vast empty areas, do not suggest the apocalyptic consequences of the permanent disposal of MSW, both for the population and the environment, but when compared with good practices in developed EU countries, the results of waste management policies in Bulgaria can be described as unsatisfactory.

There is a need to work to change the mentality regarding MSW in Bulgaria at all levels – from the ordinary citizen to the responsible institutions. Every citizen must be convinced that, in the 21st century, waste is not a "smelly sack" that should be dumped irresponsibly into a neighboring yard, but an immediate threat to the environment and its own health. On the other hand, waste is a potential raw material for energy production using efficient, environmentally friendly and relatively safe technologies.

Implementation of financial instruments - incentives and sanctions are other unused measures by which the Legislator and the municipal authorities have the opportunity to influence the public to maximize the utilization of MSW and minimize their negative impact on the public health and environment.

ACKNOWLEDGMENT

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REFERENCES

- [1] Eurostat Database, <https://ec.europa.eu/eurostat/data/database>.
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