SUSTAINABLE DEVELOPMENT AND ENERGY RESOURCES

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Abstract
The environment is negatively influenced by the intensive use of resources. Changes in consumption and production modes, by reducing the resources used, can lead to more resource-efficient use. However, the depletion of natural resources may lead to an increase in the amount of waste. This article makes an analysis of how waste is generated and treated. Sustainable development of a community can be based on a good use of resources. The health of community members and the quality of their lives depend on environmental concerns. People's activities are negatively influenced by climate change. These can lead to changes in the way electricity is produced, but also in terms of electricity consumption. In this context, the article presents the evolution of electricity production as well as electricity consumption in industry.

Key words: *Environment, electricity, waste.*

JEL Classification: *O13, Q53*

I. INTRODUCTION

People, through their economic activities, put pressure on the environment. Based on economic growth, increased consumption and increased use of resources, environmental effects are increasing. Worldwide, several factors have led to increased waste quantities. These factors include industrial expansion, population migration from rural areas to urban areas, and population density in urban areas. These factors have led to the manifestation of both environmental and socio-economic issues (Moya, Aldás et al, 2017).

The change in economic conditions led to the change the reference for economic value estimation. Thus, value is associated with the ability to overcome the main limitation of economic interaction. Under these circumstances, based on the limited availability of natural resources, value estimations are pushed toward low entropy. (Bran, Ioan et al, 2014).

Based on population growth and rising living standards, consumption of goods and energy has increased. At the same time, the increase in consumption has led to an increase in the amount of waste. Thus, it is considered that waste energy generation can be a key to a circular economy (Malinauskaite, Jouhara et al, 2017). In all areas of life, due to climate change, issues related to rising energy prices and lack of resources are becoming increasingly important (Kreitlein, Hofmann et al, 2016).

II. WASTE AND ELECTRIC ENERGY

Due to urbanization, it is considered that the development of efficient waste management systems in urban areas allows for better general waste management (Malinauskaite, Jouhara et al, 2017). The composition of solid urban waste varies from one country to another depending on the energy, crop, climate, and economic energy sources used (Moya, Aldás et al, 2017).

Many of the waste has a harmful effect on both human health and the environment. Thus, one of the main environmental issues is given by the management of hazardous waste (Öncel, Bektas et al, 2017). Waste quality also exerts a strong influence on the environment as well as on the energy impact and on the efficiency of the process (Matino, Colla et al, 2017). Waste reuse, recycling, and reduction of waste generation lead to environmental impact mitigation (Klavenieks, Dzene et al, 2017).

Thus, high importance is given to the generation of waste. In figure no. 1 presents the situation of the European Union member states which in 2014 (the most recent information on the EUROSTAT website) generated the highest quantities of waste.

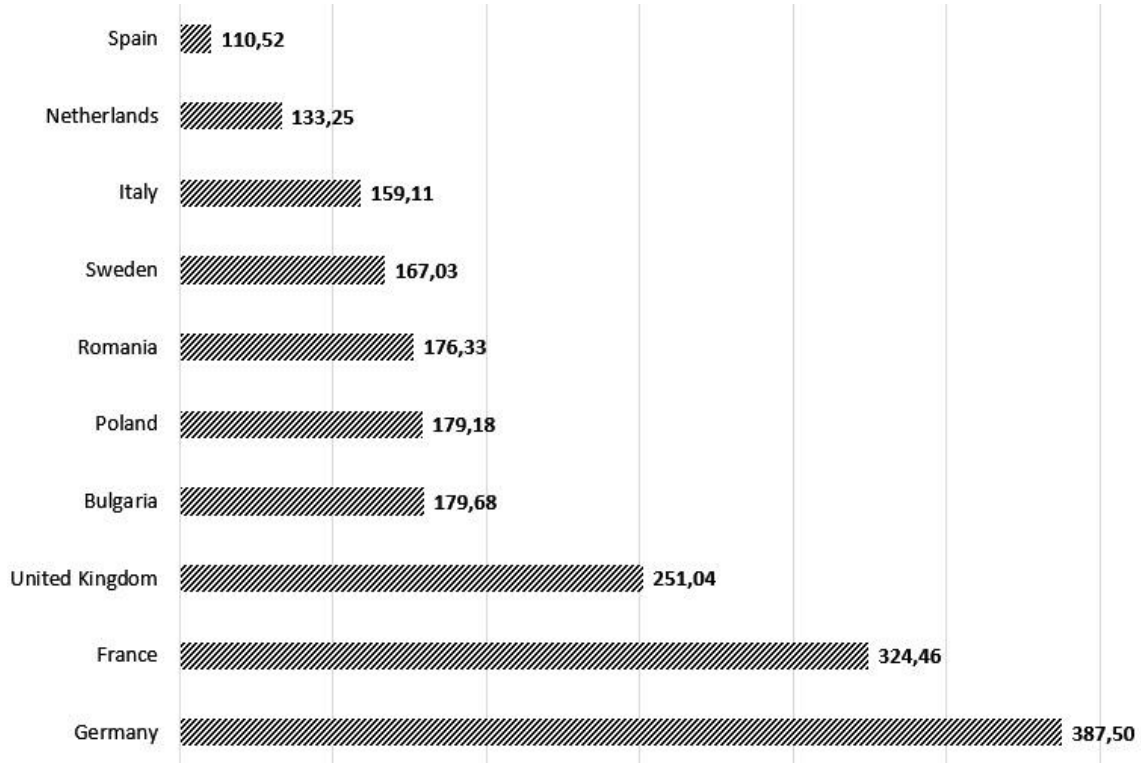

Figure 1 – Generation of waste by economic activity, 2014 (Millions tonnes)

In top places are Germany, France and Great Britain. The amount of waste generated by these three countries is almost equal to that generated by the following six countries (Bulgaria, Poland, Romania, Sweden, Italy and Netherlands).

Of the total activity, for Germany, the highest share is the construction sector (53.3%), followed by the manufacturing sector (15.8%), namely Waste collection, treatment and disposal activities; materials recovery (12%). In France, the construction sector has a weight of 70.1% and in the UK 48%. In the Netherlands, construction represents 68.1%. The Mining and Quarrying sector has a high share in Bulgaria (88.6%), Romania (86.6%), Sweden (83.2%) and Poland (42.3%).

With regard to waste management, at European level, the total waste treatment for 2014 was 771432522 tonnes. The following table shows total waste treatment for the top 10 values in Europe.

Table 1. Total waste treatment (tonne)

Country	Total waste treatment (tonne)
Germany	144751615
France	84700112
United Kingdom	83205594
Italy	78774654
Poland	78125133
Spain	54665958
Netherlands	45605663
Belgium	34761468
Romania	21386617
Greece	17608123

It is noted that Germany treats about 18.8% of total waste treatment, and Romania treats about 2.8% of total waste treatment.

The following table shows total waste treatment for 2014, based on kilograms per capita.

Table 2. Total waste treatment (kilograms per capita)

Country	Total waste treatment (kilograms per capita)
Estonia	8884
Belgium	3101
Netherlands	2704
Bulgaria	2325
Poland	2055
Finland	2026
Germany	1787
Sweden	1676
Greece	1617
Denmark	1541

It is noted that Estonia is the first with 8884 kilograms per capita. The average in the European Union is 1520 kilograms per capita, and for Romania we have 1074 kilograms per capita.

The following table lists the countries that generated the most waste per capita.

Table 3. Generation of waste (Kilograms per capita)

Country	Generation of waste (Kilograms per capita)
Bulgaria	24872
Finland	17572
Sweden	17226
Estonia	16587
Luxembourg	12713
Romania	8857
Netherlands	7901
Austria	6541
Greece	6404
Belgium	5025

Average total waste generated at European level is 4915 kilograms per capita. It is noticed that Bulgaria generated almost 5 times more per capita waste in 2014 than the European average. Romania generated 80% more waste per capita in 2014 than the European average.

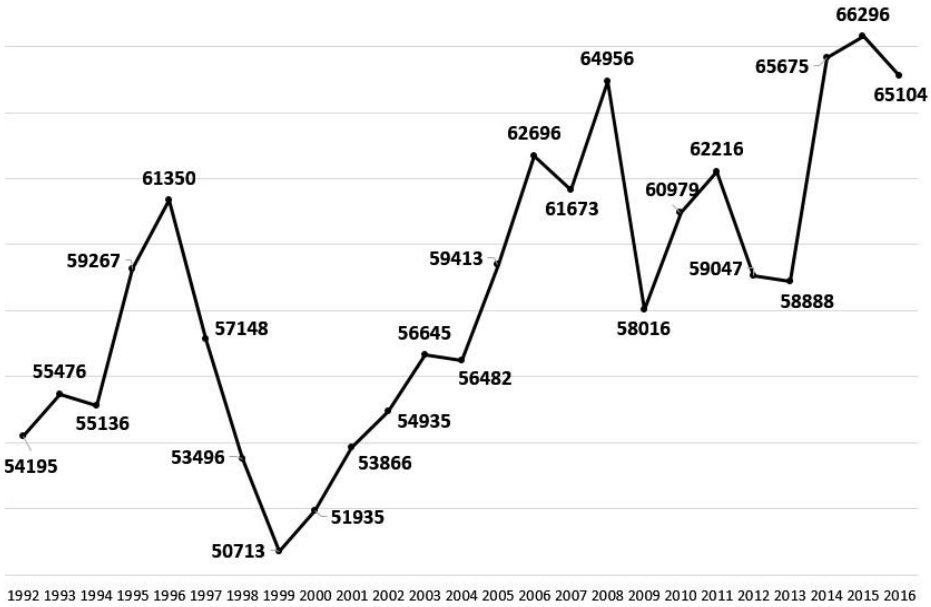

Figure 2 – The evolution of electricity production (Millions KWh)

Considering the waste situation presented above, we consider it important to present the situation regarding the production and consumption of electricity. Thus, for the period 1992-2016, electricity production in Romania increased by about 20%, from 54195 million kilowatt-hour to 65104 million kilowatt hours. The evolution of electricity production is shown in the figure 2.

On the whole, for the period 1992-2016, there is a tendency to increase the production of electricity. The longest period with increases was approximately the period 1999-2008. During this period, electricity production increased by about 28%.

Final consumption of electricity in industry for the period 1992-2016 is shown in the figure 3. Large variations in values are observed. There are periods when final electricity consumption in industry has decreased (1992-1994, 1997-2000, 2004-2009, 2011-2013) and periods when final electricity consumption in industry has increased (1994-1997, 2000- 2004, 2009-2011, 2013-2016). In Romania, in 2016 compared to 1992, the final consumption of electricity in industry decreased by about 18%. However, the evolution of the values for the last 3 years indicates a trend towards an increase in the final consumption of electricity in industry.

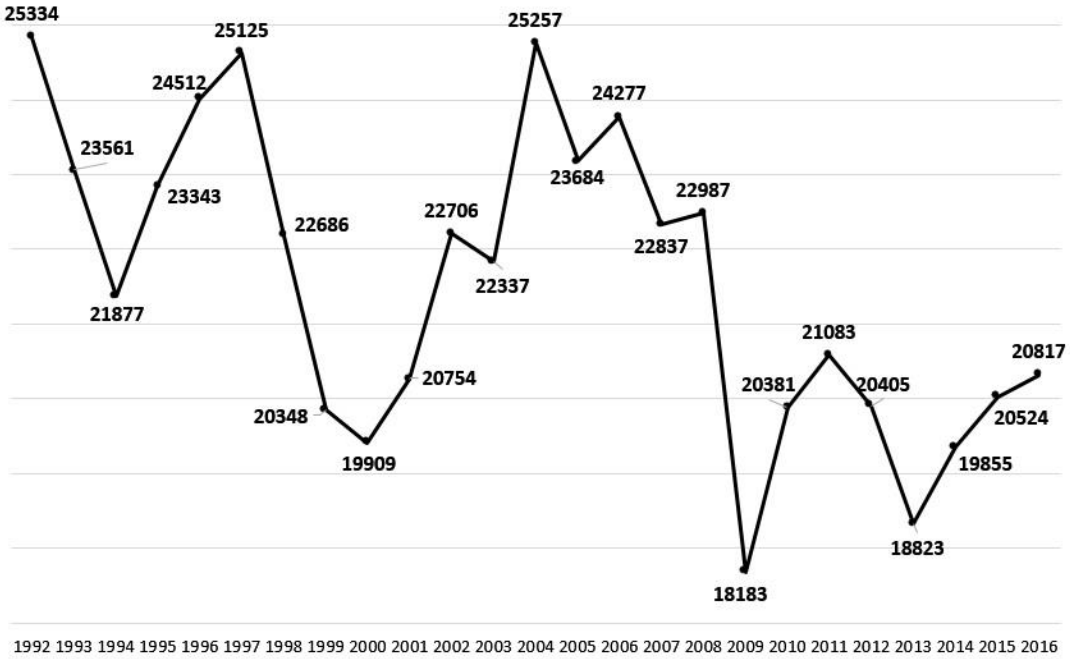

Figure 3 – Final consumption of electricity in industry, 1992-2016 (Millions KWh)

In table 4, based on data published on the website of the National Institute of Statistics (NIS), shows the evolution of the final electricity consumption in industry in Romania, for the period 1995-2016, for those industrial activities with the highest consumption. From the data presented, there is a decrease in the electricity consumption for metallurgy and for chemical and synthetic and artificial fibres. There is also an increase in electricity consumption for food, beverages and tobacco.

Table 4. Final electric energy consumption in industry, 1995-2016 (Millions KWh)

Industry activities	1995	2001	2006	2011	2016
Metallurgy	7439	7271	8499	6757	5635
Metallic construction, machinery and equipment	3758	2721	2526	2795	3574
Other non-metallic mineral products	1458	1594	3139	1923	2556
Chemistry and synthetic and artificial fibres	4234	3081	3836	3134	1937
Food, beverages and tobacco	1130	1370	1418	1590	1867
Total industry (including constructions)	23343	20754	24277	21083	20817

Figure 4 shows the dynamics of electric energy production by type of energy plant in Romania for the period 1995-2016 (NIS, 2018).

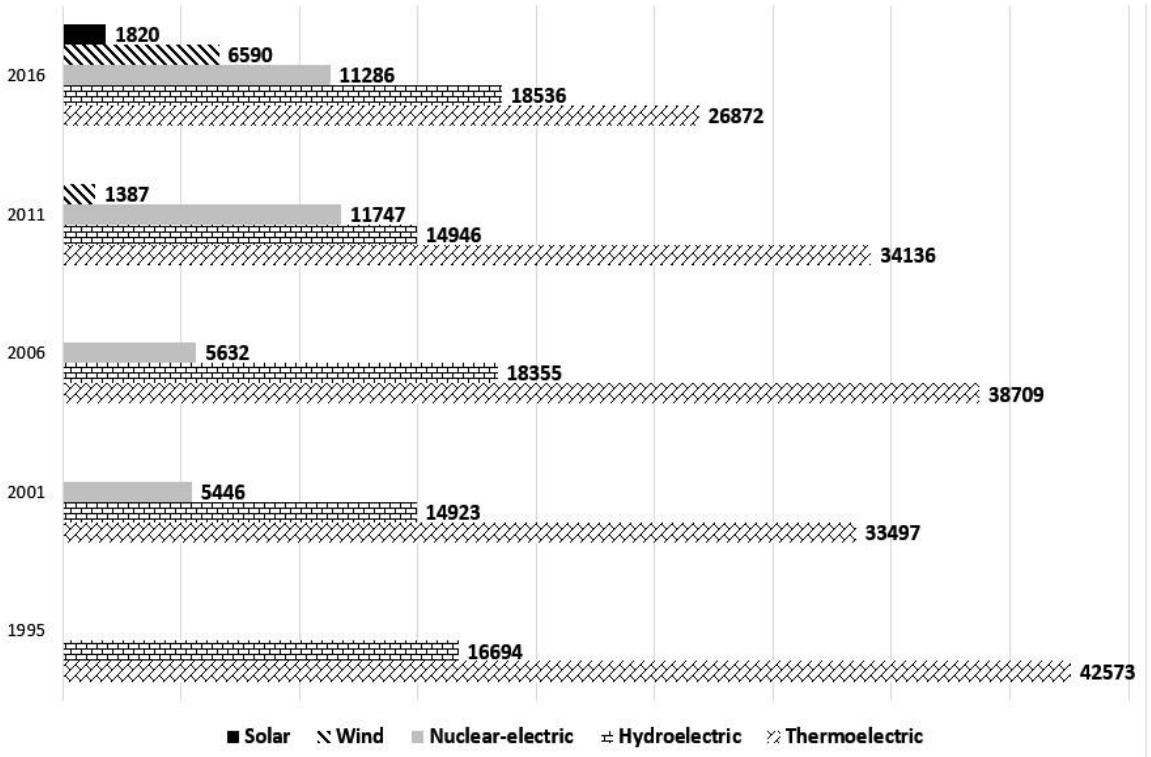

Figure 4 – Electric energy production by type of energy plant, 1995-2016 (Millions KWh)

There is a decrease in the production of thermoelectric power. It also reveals the emergence of new resources used in the production of electricity: wind and solar.

III. CONCLUSION

A better solution for increasing the sustainability of energy production and for more efficient use of energy can be the use of better monitoring and control systems. Another solution is considered to be the increase of renewable energy production (Caetano, Mata et al, 2017).

In order to achieve sustainable economic growth and also to reduce the social inequities, we can define the main problems and design those solutions that take into account the economic cyclicity - the Kondratiev cycle for the last two major crises from 1929 to 1933 and the one started in 2007 and human-economic cyclicity. (Bran, Bodislav et al, 2014).

To ensure sustainable development, effective monitoring and waste management measures are needed (Šooš and Ferencz, 2015).

Also, in order to ensure continuity of both economic life and social life, measures are needed to help protect natural factors.

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