The Use of Biomass Can Help Save the Planet

PhD. Stud. Eng. **Elena SURDU[1*],** PhD. Stud. Eng. **Dana-Claudia FARCAȘ-FLAMAROPOL[1],** Assoc. Prof. PhD. Eng**. Nicoleta SPOREA[1],** Sl. Dr. Eng. **Gheorghița TOMESCU[1]**

[1] Politehnica University of Bucharest, elena.surdu@yahoo.com; claudia.flamaropol@gmail.com; nsporea@yahoo.com; tomescu.gb@gmail.com.

* elena.surdu@yahoo.com

Abstract: *Climate change is a serious problem, so both the natural and the socio-economic system are sensitive to climate change, and the magnitude and speed projected for them will have a significant impact, which will threaten the sustainability of these systems. The motivation for action in relation to climate change must not necessarily be found in what mankind has observed so far, but in what scientific models anticipate for the near future. If the warming process continues at the rate forecast today, the world will enter a period of unprecedented climate change in human history. In this sense, we identify the categories of waste that have a major impact on the environment and we want to propose efficient alternatives for recycling also.*

Keywords: *Global warming, biomass, waste.*

1. Introduction

Mankind is facing climate change, which is increasing every year and has an impact on all aspects of life, both socially and professionally.
With globalization and massive industrialization the pace of change is very fast and also the reduction of greenhouse gases, the reduction of pollution on a large scale, recycling becomes a key factor in this fight. This phenomenon of global warming has various consequences, such as rising sea levels by melting glaciers, the restriction of certain species of flora and fauna and last but not least affects human health through sudden and very brutal climate change.
Climate change is one of the biggest threats to the environment, the social and economic environment. The warming of the climate system shown in Figure 1 is unequivocal, due to the transformations on the environment caused by global warming. Observations indicate increases in global average water and ocean temperatures, widespread melting of snow and ice, and average global sea level rise. It is very likely that, for the most part, heating could be attributed to greenhouse gas emissions from human activities.
Climate change is found in: high temperatures, changed rainfall, melting glaciers and snow, and the average sea level around the globe is rising. To a large extent, warming is most likely caused by the marked increase in atmospheric concentrations of greenhouse gases as a result of emissions from human activities. To mitigate climate change, we need to reduce or prevent these emissions [1].

Fig. 1. Global warming [1]

With the globalization and stimulation of consumerism, the resulting amount of waste has increased exponentially. Thus arose the urgent need for recycling on a global scale as well as on a small, family level.
Nowadays the amount of waste is determined directly by the standard of living and consumption. Unfortunately, the higher the standard of living, the higher the amount of waste. On the other hand, up to a certain threshold, waste can be considered as an easily accessible resource.
The development of modern society due to technological progress in recent decades brings to our attention the issue of resource use in the field of energy. The advancement of technology and science in general depends to a large extent on how energy supply and demand will be met, all with minimal impact on the environment.
In this paper, we aim to identify the categories of waste with major impact on the environment and also to be able to offer alternatives for their efficient recycling.
Alternative uses of waste for energy production could improve energy efficiency and increase the share of energy in the system by increasing flexibility, for example by producing biofuels from waste.
Renewable energy sources can be used to reduce the consumption of energy from the use of oil, coal and natural gas that are no longer regenerated [2]:

- wind energy (wind);
- direct solar energy;
- hydraulic energy of watercourses;
- wave energy;
- tidal energy;
- biomass.

2. Biomass

Biomass is the category of energy source resulting from (figure 2.): wood biomass, combustible residues from agriculture, agricultural production of sweet, starchy or cellulose substances that can be converted into petrol-substituting bio-ethanol. All of these are called biofuels [3].

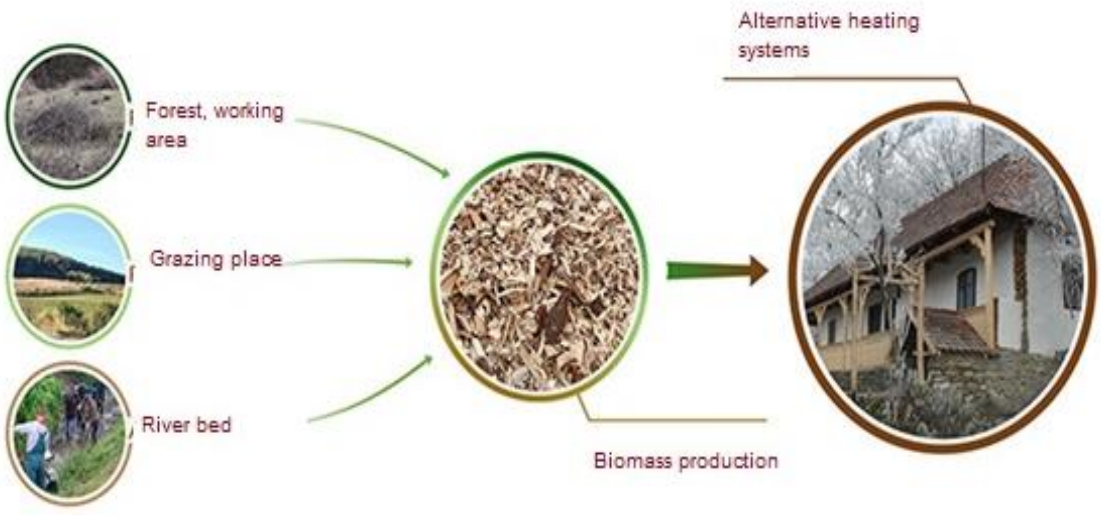

Fig. 2. Energy source [4]

Biomass is the first form of energy used by man, with the discovery of fire [3]. The energy use of biomass is based on its combustion, a process by which biomass releases thermal energy [3, 5].
The separate collection of biodegradable waste to obtain compost is a first step, useful and efficient, for the recovery and reduction of organic waste from storage (figure 3).
Composting is the way to obtain a stable product, starting from a similar oxidative biological transformation of what happens naturally in the soil [5, 6].

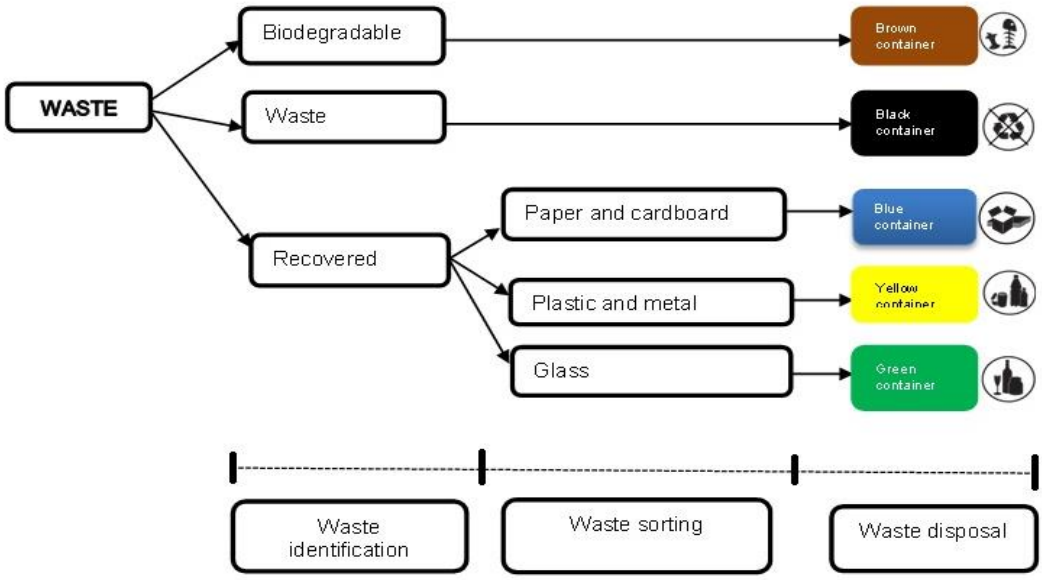

Fig. 3. Identification, sorting, disposal of waste [4]

The use of household waste as a caloric source must take into account its calorific value. Organic agricultural waste and household waste are the best source for their transformation into composts used in soil fertilization, so that the solution for recycling all organic waste is agriculture and soil because it, in addition to supporting functions and nutrient environment for plant, also has the function of accumulation and degradation of many organic substances. Natural resources are limited and cannot regenerate very quickly, over time, as the amount of waste increases to occupy large areas of land. That is why it is important to understand that almost half of the waste we throw away can be reused.
The environment is more and more polluted, by recycling waste, we try to save the environment and the earth [4, 7].
Biomass comes from different sectors, such as: agricultural sector, forestry, industrial and urban sector.
Another classification can be made by its nature: energy crops, agricultural or forestry residues and waste. The biomass represented by energy crops obviously comes from the agricultural and forestry sectors.

3. Wastes from forestry and wood industry

Waste from forestry and the wood industry is part of the biodegradable and / or combustible organic vegetable waste sector with an adverse impact on the environment. The exploitation of forest areas results in large amounts of waste (branches, stumps, roots, leaves, tree stems considered unsuitable for processing), and large quantities of raw material in the form of sawdust and bark are removed from the wood processing industry. Branches and stumps are classified as useless waste, thus losing very large amounts of potential energy sources that could be capitalized on with minimal production costs.
Technologies for recycling waste from forestry and the wood industry are classified according to how they are recovered [8, 9, 10]:

- waste recycling technologies for energy recovery;
- waste recycling technologies for composting (figure 4.).

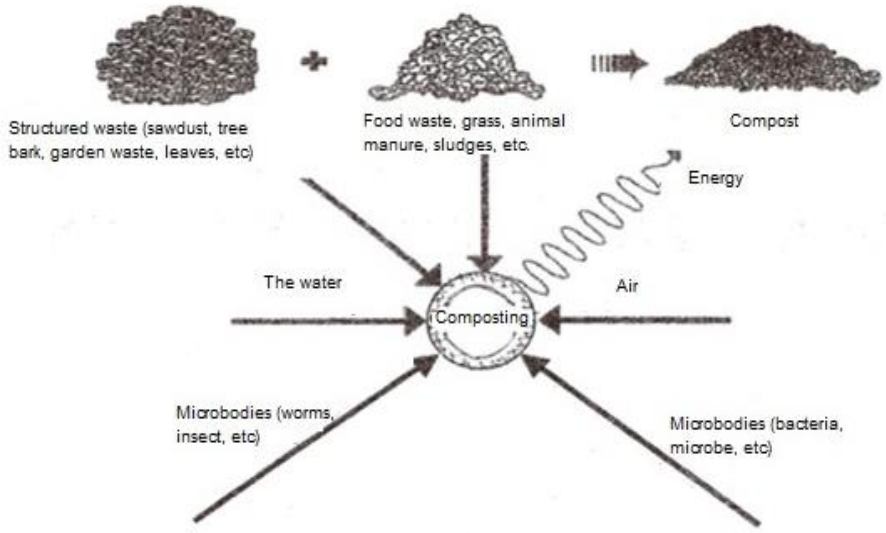

Fig. 4. Waste composting [11]

Waste recycling technologies for energy recovery are used to recover energy stored in waste and convert it by specific methods into thermal or electrical energy. Energy recovery of forest waste can be done by three methods [8, 6]:

- direct combustion;
- pyrolysis;
- gasification.

Recycling technologies for composting waste produce biogas with a high methane content, which can be used as such, for example in stoves, or in thermal power plants to produce electricity. By composting in landscaped plants the natural process of decomposition of organic matter is accelerated. Composting can take place by both aerobic and anaerobic fermentation [11, 3].
Sawdust resulting from deforestation is usually not properly treated, so it is transported by surface water to meadows and rivers, with harmful consequences for fauna and flora, by the decomposition of sawdust and the effect produced by the resulting substances.

4. Wastes from agriculture and related industries

Wastes from agriculture and related industries are residual products used for biogas production, such as [7, 10]:

- wheat straw, barley, oats, rice, rye, rapeseed;
- cobs and corn cobs;
- leaves of sugar beet or fodder beet, sunflower;
- green or dried leaves of trees;
- waste of hemp, flax, green or dried alfalfa;
- different algae;
- cane and sugar cane;
- different seeds, hazelnut shells or seeds;
- substrate from mushrooms.

All these resources can be processed taking into account different technologies (figure 5) [7, 12]:

- direct combustion (electricity / heat production, cogeneration installations);
- anaerobic digestive (cogeneration, methane-rich gas);
- fermentation (sugars for alcohol, bioethanol);
- oil extraction;
- pyrolysis (manganese, gas and oils);
- gasification (carbon monoxide).

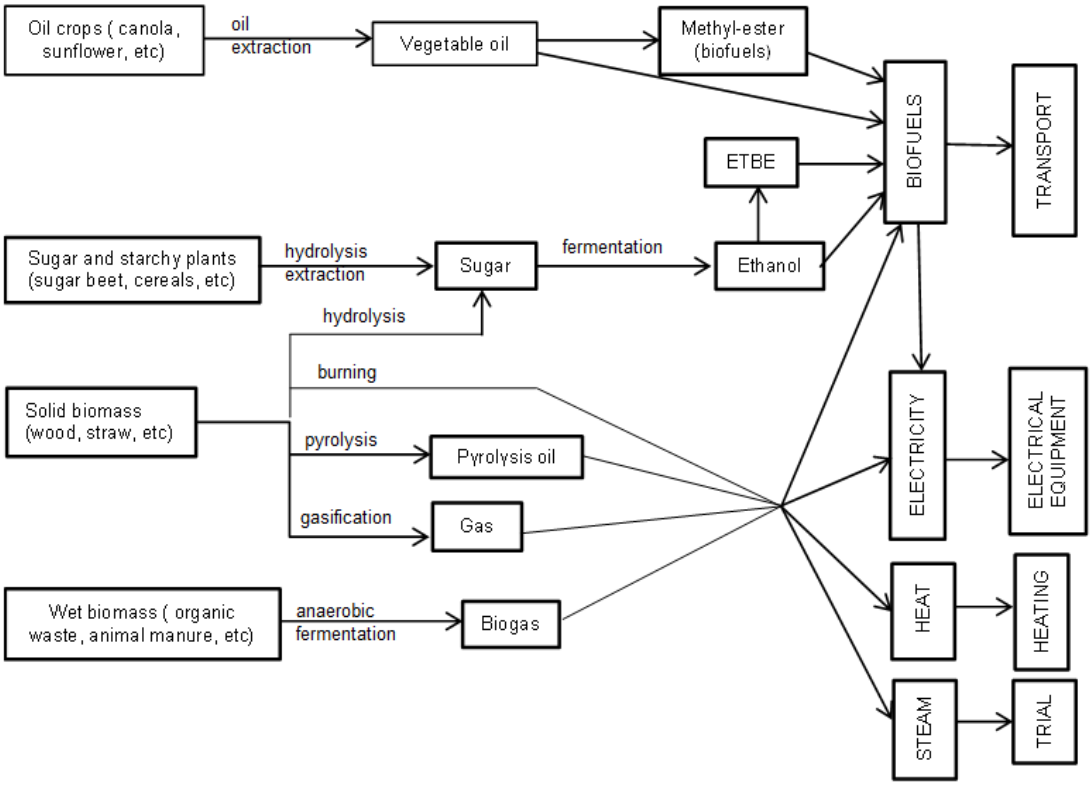

Fig. 5. Scheme of biomass technologies [12]

The technological process can be followed by a series of secondary treatments - stabilization, dehydration, refining; depending on the final products. It is important to identify the source of biomass, because some species of biomass can generate better fuel quality or energy at a lower cost.

5. Statistical data at national level and the European Union

Current estimates indicate that around a third of food produced for human consumption worldwide is wasted or lost, leading to significant economic and environmental costs [13].
Romania produces 5.8 million tons of waste per year (Table 1), with an average of 272 kilograms per year per capita and a collection rate of only 82.3%. (The Waste Atlas study shows it). Of the total waste, 56% is organic matter, 9.9% paper and cardboard, another 9.9% is plastic waste, 4% glass, 2.3% metal and 17.8% other waste (Figure 2). Romania recycles only 3%, followed by Bulgaria with a recycling rate of 0%. Romania's collection rate is 82.3%, followed by Bulgaria with 81% and Estonia with 79%.
Out of the total of 5.8 million tons of waste per year, only Bucharest is responsible for the production of 709,720 tons per year, with an average of 375 kg per capita.

Table 1: Evolution of waste generation at national level [13]

Environment of residence	**Generation indicator (kg / inhabitant / day)**				
	2015	2016	2017	2018	2019
Urban	0.66	0.66	0.65	0.65	0.64
Rural	0.31	0.31	0.30	0.30	0.29

Table 2: Quantities of municipal waste at national level [13]

Types of municipal waste	Quantity (tons / year)				
	2015	2016	2017	2018	2019
Mixed and separate household waste	3,615,166	3,598,678	3,586,583	3,506,695	3,498,851
Similar wastes collected in a mixture and separately	903,791	899,670	896,646	876,674	874,713
Waste from gardens and parks	97,400	97,400	97,400	97,400	97,400
Waste from markets	71,800	71,800	71,800	71,800	71,800
Street waste	336,800	336,800	336,800	336,800	336,800
Total municipal waste generated	5,024,957	5,004,348	4,989,229	4,889,369	4,879,563
Municipal waste generation indicators (kg / place x year)	253	253	253	248	248

Table 3: Composition of household waste and assimilation [13]

Waste type	Share (%)				
	2015	2016	2017	2018	2019
Paper and cardboard	11.9	11.9	11.9	12.0	12.2
Metals	2.7	2.7	2.7	1.8	2.0
Plastic	11.7	11.7	11.7	11.5	11.3
Glass	5.1	5.1	5.1	5.0	5.0
Wood	2.2	2.2	2.2	2.5	2.5
Biowaste	57.9	57.9	57.9	57.5	57.0
Text	0.9	0.9	0.9	1.0	1.0
Bulky	0.9	0.9	0.9	2.0	2.2
Other waste	6.7	6.7	6.7	6.7	6.8

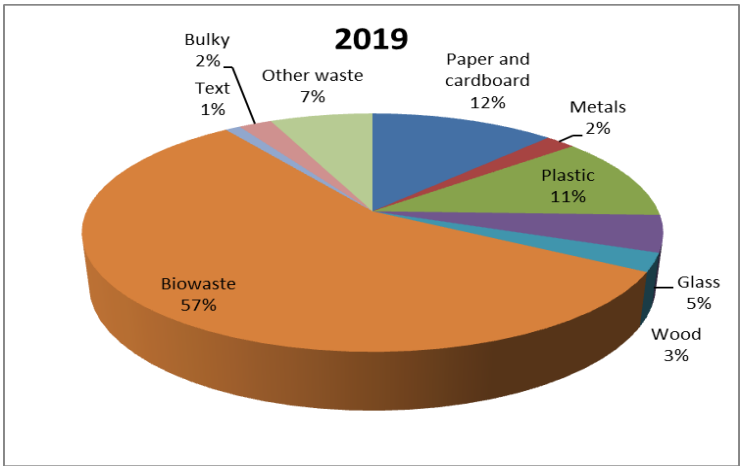

Fig. 6. Waste collection share at national level [13]

The figures on the amount of waste per capita mentioned at national level in the Waste Atlas are similar to those reported by Eurostat for 2016, of 261 kg.

The EU Member State that produces the largest amount of waste is Germany, with a figure of 50.5 million tonnes per year and 617 kg per capita. However, Germany also has the second highest recycling rate, 47%, plus a 100% collection rate.
Slovenia is the EU Member State with the highest percentage of recycled waste, 55%, plus a 100% collection rate. However, Slovenia produces only 852,075 tons of waste per year, with 414 kg per capita [14]. Sweden produces 4.3 million tons per year, or 458 kg per capita, but also has a recycling rate of 33%, plus a collection rate of 100%.
In terms of population, Denmark has the highest waste rate per capita, at 747 kg per year, totaling 4.1 million tonnes per year. At the same time, it has a collection rate of 100% and a recycling percentage of 28%.
Also worth mentioning are the United Kingdom, which has a recycling rate of 28% at a total of 30.7 million tonnes per year, the Netherlands and Austria - both with a recycling rate of 24% - or Italy with 26% [14,15].

Table 4: Amount of waste in different countries [15]

	Amount of waste produced		Recycling rate %	Collection rate %
	tons / year	Kg / inhabitant		
Germany	50.5 mil	617	47	100
Slovenia	852,075	414	55	100
Sweden	4.3 mil	458	33	100
Denmark	4.1 mil	747	28	100

In the EU, the amount of waste varies from one Member State to another according to statistics as shown in Figure 7. [16].

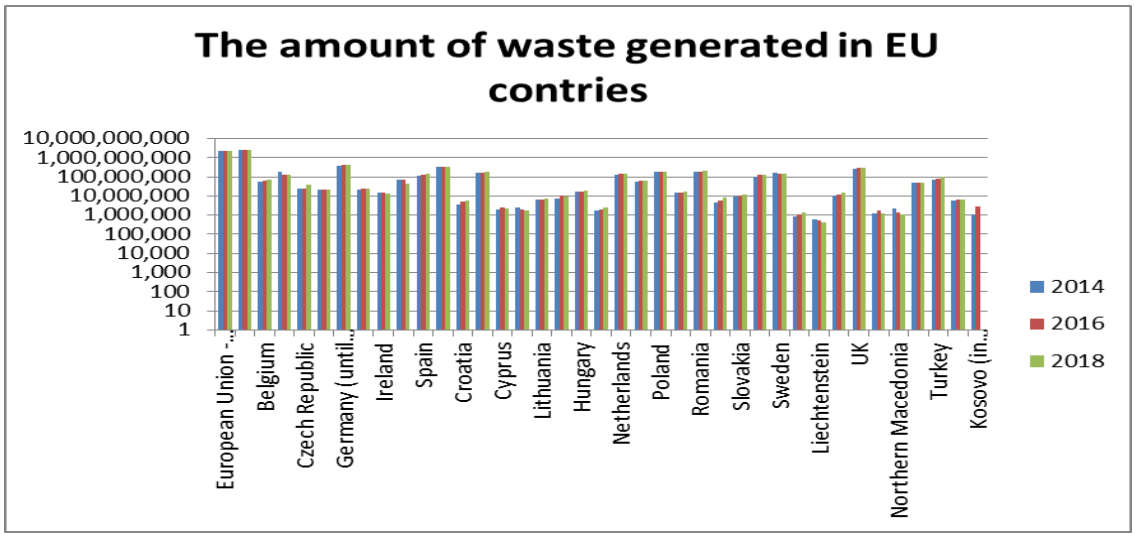

Fig. 7. Waste generated in the EU [16]

According to the study, in the European Community, the amount of municipal waste generated by each person in 2018 amounted to 492 kg, down 5% compared to the peak of 518 kg per person in 2008.
On the other hand, according to Eurostat, the amount of recycled waste reached new levels in 2018, both for the recycling of materials and for composting.

5.1. The share of renewable sources in energy consumption in the European Union

Waste from agriculture, forestry and forestry has many potential benefits, including a reduction in greenhouse gas emissions, a diversification of energy supply and a reduction in dependence on fossil fuel markets (especially the oil market and gas).

Figure 8 shows the share of renewable energy in gross domestic energy consumption at EU level [17]:

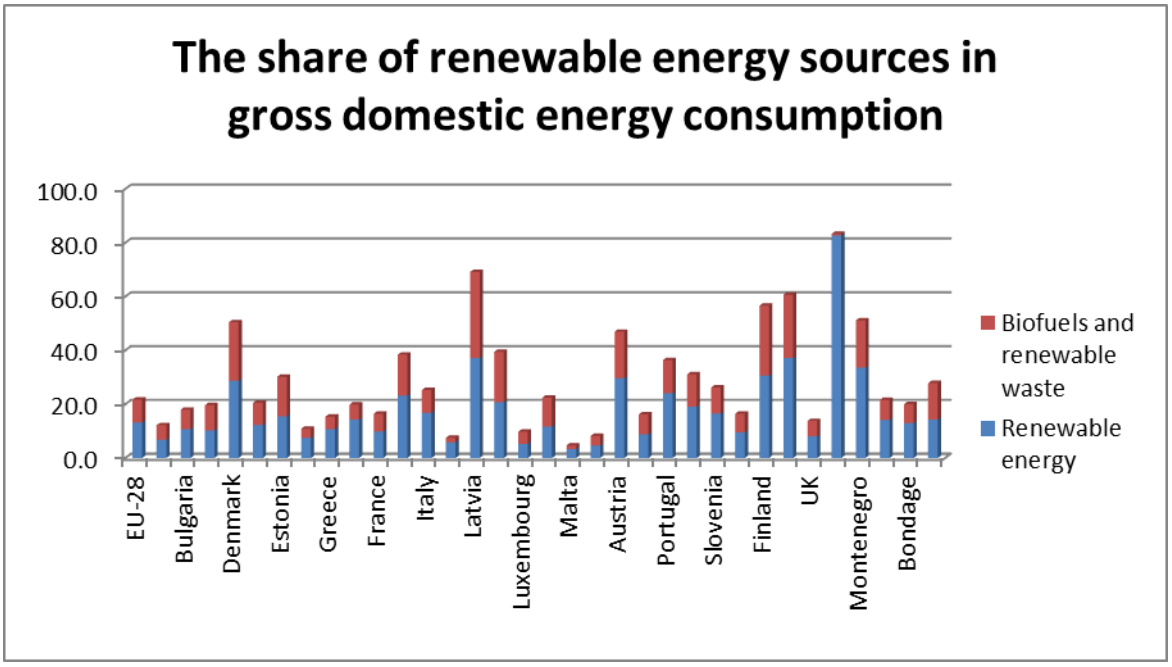

Fig. 8. Renewable energy sources in the EU [17]

The use of energy from renewable sources has many potential benefits, including a reduction in greenhouse gas emissions, diversification of energy supply and reduction of dependence on fossil fuel markets (in particular, on the oil and gas market). Figure 9 shows the primary production of energy from renewable sources at EU level.

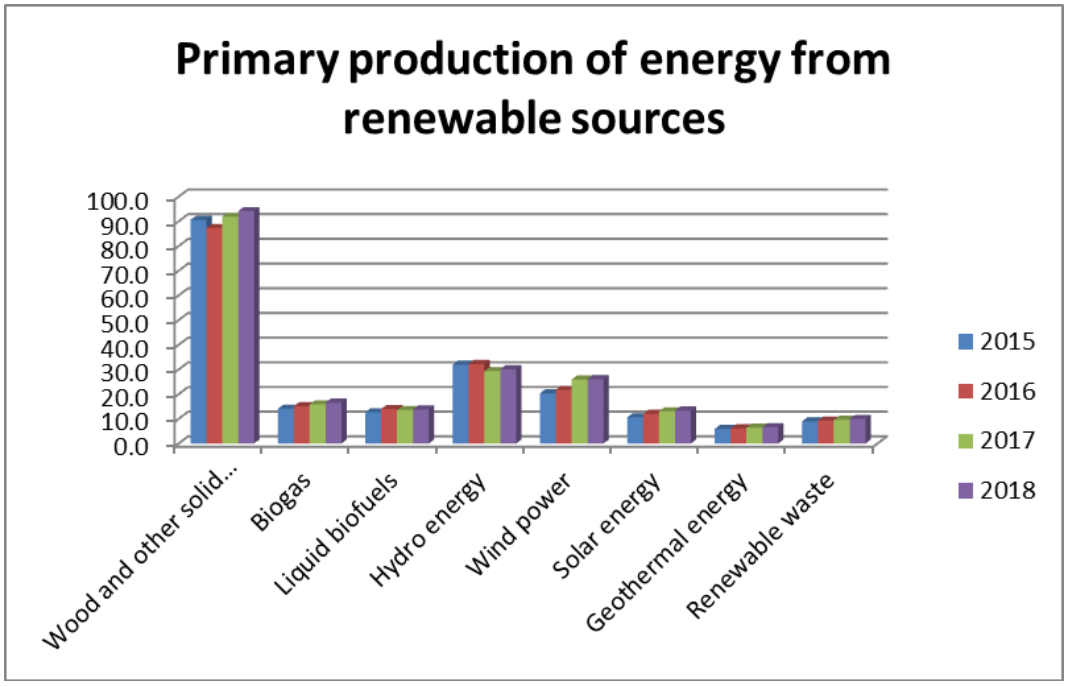

Fig. 9. Renewable energy production [17]

Renewable energy is growing more and more in recent years because it promises a clean energy future. Green energy is beginning to replace fossil fuel pests in the energy sector, providing a reduction in carbon emissions or other types of pollution. Renewable energy could provide a

solution to a major problem facing the modern world: reducing environmental contamination, which impairs the quality of life on Earth and harms human health.
Renewable energy sources (wind energy, solar energy, hydropower, ocean energy, geothermal energy, biomass and biofuels) are alternatives to fossil fuels that help reduce greenhouse gas emissions, diversify energy supply and reduce dependence on volatile and uncertain markets for fossil fuels, especially oil and gas [18].

6. Conclusions

Environmental pollution has as an effect the appearance of anthropogenic climate changes; these changes are generated by human intervention on the environment through the following activities:

- electricity and heating;
- transports, constructions;
- agriculture;
- burning of other fuels;
- industrial processes;
- deforestation and waste.

Climate change is affecting all regions of the world, with the effect of global warming manifesting itself in the following aspects:

- melting glaciers and rising sea and ocean levels;
- extreme weather phenomena;
- changing the precipitation regime;
- desertification of areas.

Our planet is heating up fast. Human activities are causing this change, and the consequences are beginning to be seen around the world. The more we disrupt the climate, the greater the risk of dangerous change, and the more difficult and costly it will be to limit future change and adapt to the inevitable impacts. The average temperature of the Earth's surface could rise by at least 4 ° C from pre-industrial levels before the end of this century if we do not take urgent measures to reduce greenhouse gas emissions.
By releasing more and more gases that keep heat in the atmosphere, we cause a very rapid rise in temperature on Earth.
Increased use of energy from renewable sources is essential to reduce both the European Union's greenhouse gas emissions and the Union's dependence on fossil fuels and energy imports, thus contributing to its security of energy supply. Moreover, energy from renewable sources can play an important role as a vector of sustainable development in rural areas.

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