

BIOMASS-THE TASK OF ECOLOGY AND FACTOR IN ENERGY

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Abstract

Constantly decreasing primary energy sources and environmental issues are part of the reason to seek alternatives by developing new technologies. Biomass as organic matter of vegetable origin and animals can be recycled, processed and used for the extraction of energy. In the presented work looking at the different types of biomass as a potential source for energy. A rating of the energy potential of different types of biomass. Furthermore, an overview of the main methods for processing and to generate energy. The final result of the work is a classification of different types of biomass and grouping in terms of their efficient processing to produce energy on a particular method.

Key words: biomass energy, bioenergy, potential, ecology, bio-product, processing, gasification, pyrolysis, fermentation., burning.

1. INTRODUCTION

Biomass is organic non-fossil material of plant and animal origin. Undergoes appropriate processing, it can be used to generate energy.

The deepening of global, financial and energy crisis in Europe, European women forced countries to seek new alternative sources of heat and energy. Compared with traditional energy resources (oil, natural gas, coal) biomass is high capacity and can be used to improve the energy efficiency of the country. Renewable energy sources play a key role in this global strategy to reduce greenhouse gases and partial substitution of fossil fuels. Global warming has emerged as a critical issue for the international community. Developed countries must reduce their greenhouse gas emissions below levels specified for each of them by 2012 ([United Nations, 1998\[40\]](#)). Meanwhile, the European Commission to set mandatory targets for Member States of the European Union (EU) to reduce greenhouse gas emissions by 2020 ([European Parliament and Council, 2009a\[15\]](#)). Directive 2009/29/EC aims to increase incentives for greater use of alternative energy sources ([European Parliament and Council, 2009a\[15\]](#)) Biomass includes, inter alia, vegetation, energy crops, livestock, forestry and agricultural residues, organic fraction of municipal waste and certain industrial wastes. The production of second generation biofuels derived from waste, actively support worldwide ([OECD / FAO 2007](#)),[31] Waste offer a solution to produce clean electricity and environmental protections. Many research efforts are aimed at developing the potential role of biomass as a future source of energy ([Parikka. M. \(2004\)](#)),[32], [Yamamoto, H. \(2001\)](#),[41]). Biomass has the potential to become one of the world's major primary sources energy.

2. AIM

The purpose of this work is to demonstrate the wide variety of biomass and its processing methods to obtain a useful target product. Recycling of waste products unnecessary, leads not only to improve energy efficiency in economic terms but also to solve one of these many tasks of ecology- the cleaning of the nature of contaminants.

3. PROBLEM FORMULATION

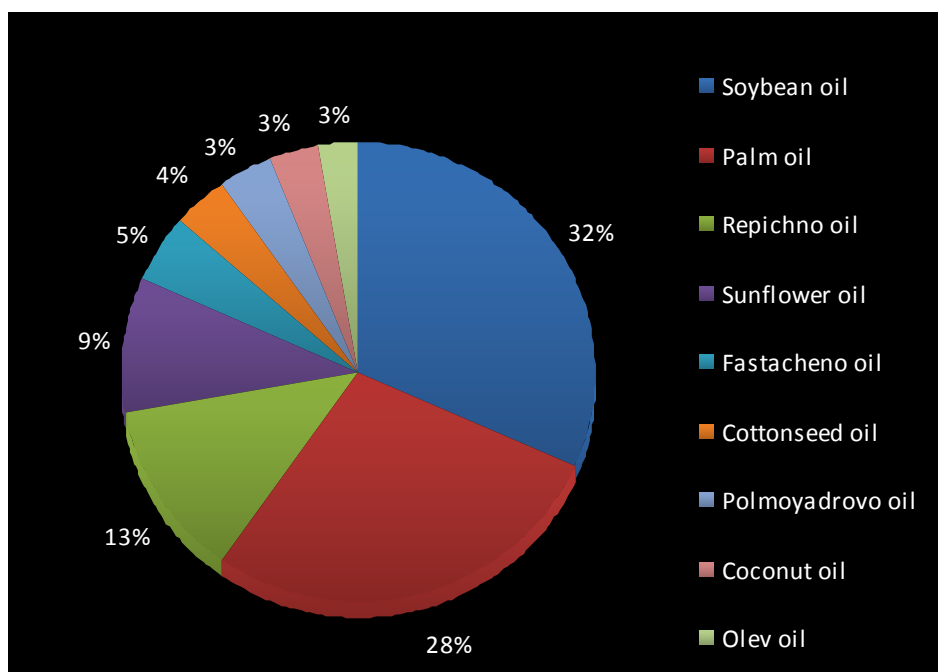
3.1. Primary biomass.

Biomass resources are divided into two main categories - primary and secondary biomass.

Primary biomass is plant material that can be used directly or after conversion to generate energy. This group includes specially selected tree growing from five to eight years of their planting. These are fast growing species with a hard crust and hybrid willow, poplar, ash, maple, walnut, sycamore and others. The utilization of biomass this group would rather to endanger the environment, than to its preservation. The reason for this is the danger of cutting healthy forests type. They are the lungs of nature

The main oil crops that are material to obtain energy for engines and turbines are soybean, palm, rapeseed, sunflower and peanut butter. In a smaller quantity used cotton, palm, coconut and olive oil. Us with the highest productivity are rapeseed and sunflower oil. However, use of sunflower seed to generate energy is not very rational and useful for growing food industry. From an economic point of view, resources for production, transportation, processing and delivery to end users (Biofuel Supply Chain) does not justify the cost of the resulting product. I to nezbravyame however, that this group biomass is mainly used to satisfy the nutritional needs of populations and livestock species.

Fig1: Features and oil crops, which are used as a source of primary biomass.



Interest in recent times is the processing of specially selected group of algae (rich in fat) to obtain fuel. It is possible the construction of energy complexes in which the evolved carbon dioxide from the pyrolysis of municipal waste can be used to power photo bioreactors - special greenhouses to grow algae.

3.2. *Secondary biomass.*

The group of secondary biomass decreased waste products. They are widespread in nature and have great energy potential. Purify the environment from these pollutants is the one of the main tasks of ecology. Developing technologies to generate energy from waste products can significantly help to solve this a real problem.

As a source of bioenergy use municipal waste, crop, livestock, industry, food industry, sludge from treatment plants and others. The fact is that domestic waste rots in landfill, and agricultural residues are burned even in the field. Instead, better concentration, the quantity of solid bioenergy and directing it to the needs of the population.

4. METHODS FOR TREATMENT OF BIOMASS.

Methods for processing biomass is divided into three main types: thermo-chemical, biochemical and chemical

Andrew Benev (2008),[3] has included in his report. Twelve very good interpretation of tabular methods for utilization of biomass.

4.1. *Thermochemical processing of biomass*

In the group of thermo-chemical processing includes the processes of pyrolysis, gasification and direct combustion.(Balat, M), [5].

Used to date methods for utilization of biomass are based on well-developed technology of direct combustion. Process takes place in oxidative environment by submitting a secondary air at 800-900 °C. Direct combustion of unfolding of vegetable oils to obtain heat energy is known since ancient times. This type of combustion efficiency is low due to heat loss through the casing of the boiler or flue gases. A significant disadvantage is the release of harmful substances into the atmosphere and the destruction of some price components contained in waste. Variation of this type of combustion is parallel burning. In its biomass is introduced into high boilers operated with coal as an additional source of bioenergy.

Efficiency of the burn depends on the choice of an appropriate boiler. The types of boilers burning biomass are the following:

- boilers designed to burn biomass pressed - briquettes and pellets;
- boilers which can burn biofuels with humidity to 30%;
- boilers wet biofuels, ie fuel moisture content to 55%;
- boilers specially designed for burning wood chips and sawdust, stone, for peat

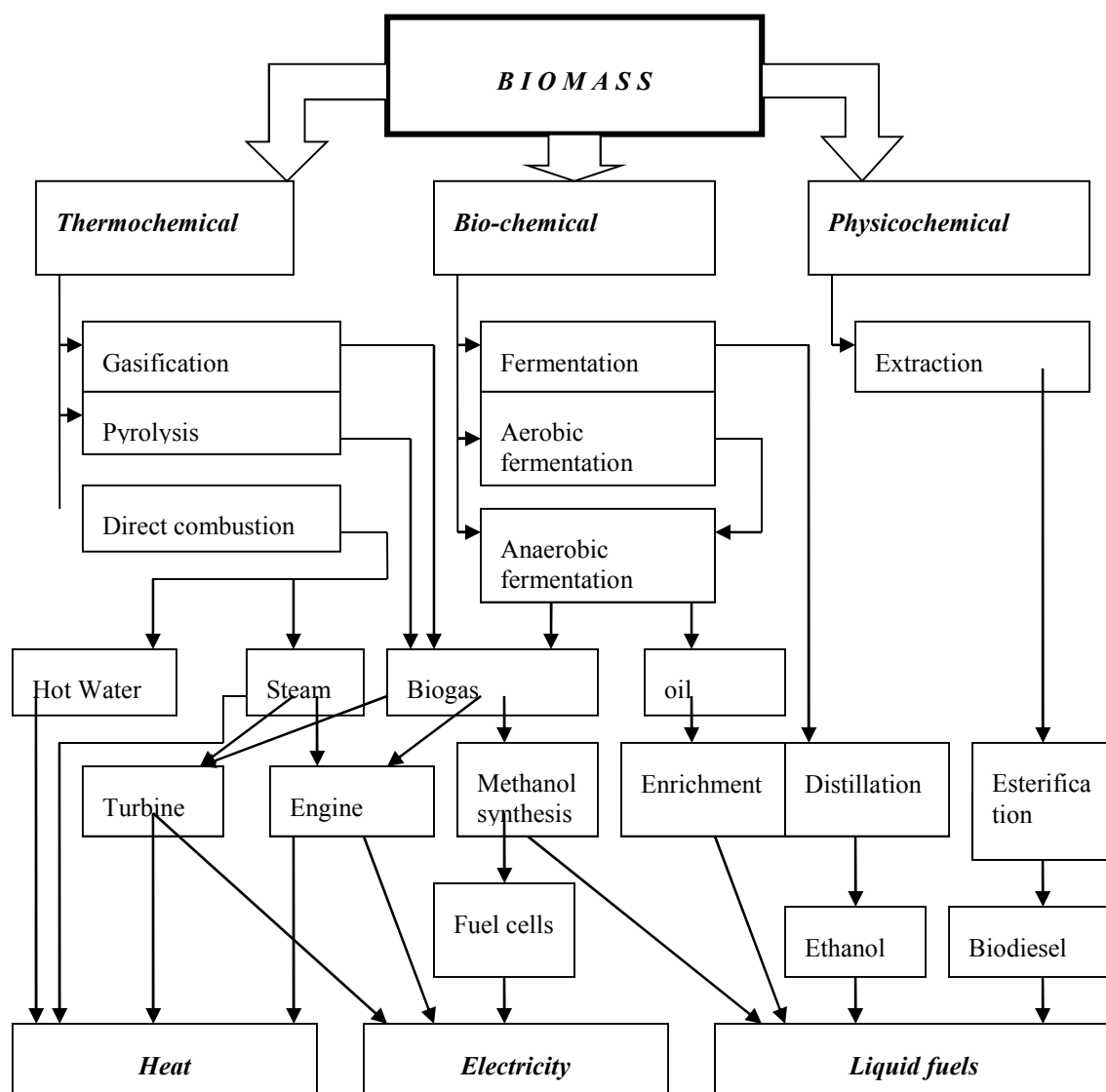


Fig.2 Types of processing of biomass for energy

E. Iakovou et al (2010), [13] is found detailed information on the types of methods for utilization of biomass materials for their production and end products of counsel processes.

<i>Technologies</i>	<i>Process</i>	<i>Major biomass feedstock</i>	<i>Energy (or) fuel produced</i>	<i>References</i>
Direct combustion	Thermochemical	Wood	Heat	Atimtay and Kaynak (2008)[1], Ballerini et al. (1994)[6], Gungor (2008)[17], Ma et al. (2005)[24],
		Agricultural waste	Steam	Mellveen-Wright (2007)[26], Mitchell et al. (1995)[27], Ravelli et al. (2008)[34],
		Municipal solid waste	Electricity	Skoulou and Zabaniotou (2007)[37]
Gasification			Producer gas	Brown et al. (2007)[8], Goyal et al. (2008), Kirubakaran et al. (2009)[21], Kobayashi et al. (2008)[22],
				Mitchell et al. (1995)[26], Skoulou and Zabaniotou (2007)[37], Walter and Llagostera (2007)[43]
Pyrolysis			Synthetic fuel oil (biocrude)	Chiaromonti et al. (2007), Demirbas (2000), Goyal et al. (2008), Mitchell et al. (1995)[26], Van de Velden et al. (2008), Yanik et al. (2007)[34]
			Charcoal	
Liquefaction			Methanol	Demirbas (2000)[12], Kobayashi et al. (2008)[22], Kunaver et al. (2007), [21], Wang and Chen (2007)[44]
Anaerobic (biogas production)	Bio-chemical	Animal manure	Biogas	Albertson et al. (2006)[2], Chynoweth et al. (2001), Gunaseelan (1997), Ma et al. (2005)[24], Misi and Forster (2001)[25], Mitchell et al. (1995)[26], Murphy and Power (2006)[29]
		Agricultural waste		
Aerobic decomposition		Animal manure	Heat	Kaltschmitt et al. (2004)[21], Murphy and Power (2006)[29]
		Agricultural waste		
		Municipal solid waste		
Aerobic (ethanol production)		Wood waste	Ethanol	Bai et al. (2008)[4], Ballerini et al. (1994)[6], Lal (2008), Reijnders (2008)[34]
Mechanical extraction–esterification	Physicochemical	Energy crops	Biodiesel	

To carry out complete combustion of the raw material necessary to maintain a sufficiently high temperature. The combustion process can be divided into four stages - evaporation of moisture from biomass, wind and sadarzhimo, izsparyavane of gases in mixtures with air and burning carbon. In the only complete combustion can be used all the energy from biomass. The submission of an insufficient amount of air would also result in incomplete combustion, resulting in what dimniti gas will contain a significant amount of carbon monoxide. Upon submission of more air than necessary, some of the heat lost in flue gases. The exact determination of the required amount of air ensures efficient fuel process. Typically, regulation of air supply is carried out through a flue or fan.

Humidity of fuel is among the main factors influencing the efficiency of the boiler. The maximum efficiency of the boiler would be achieved only when it works with the type of fuel that is designed. For example, boilers burning biomass with a humidity of not more than 30% would not be efficient combustion of biomass with a water content of about 50%. The reason is that the burning of materials with higher humidity is necessary to reach a higher temperature inside the boiler. And when the facility is designed for material with less humidity, it is designed for lower operating temperature, leading to substantially reduce its effectiveness in combustion of biomass with high humidity.

Thermo-chemical processing of biomass can be achieved with the process piroliza. Tya is subject to examination by [Seung-Soo Kim \(2010\), \[36\]](#), [P. Ammendola, \(2009\) \[35\]](#), [J.A. Medrano, \(2010\), \[19\]](#) at all in is biomass is subjected to high temperature-500-800 °C in the absence of oxygen. Pyrolysis products are solid, liquid and gaseous. The nature, quality and quantity depends on the speed and the temperature regime of the process.

Of pyrolysis can be subjected to any solid organic matter. From 1 m³ of timber is obtained: 140-180 kg charcoal (coke); 280-400 kg of liquid fuels and compounds (methanol, acetone), 80 kg flaming gases. Fry the dried wood or even straw can be obtained from a wide range of high-energy fuels. This process is used for centuries for the production of charcoal.

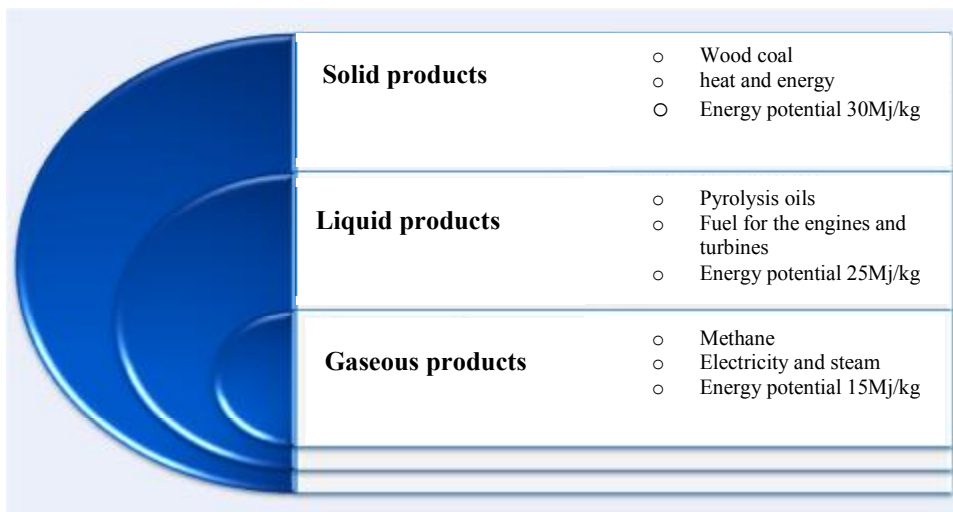
Gaseous products are a mixture of different gases- methane, carbon dioxide, carbon monoxide, nitrogen, hydrogen and water vapor. Calorific value of gaseous products in the range of 15-22Mj/m³. The resulting products are burned directly or after purification. Primarily are used to electricity, steam and technical needs.

Liquid products from pyrolysis oils are pyrolysis. These are dense resin materials with low water content and consist of a complex mixture of high nitrogen materials. Possess high energy density and calorific value of about 20-25Mj/kg³. Used as fuel for engines and turbines and raw material for synthetic oils are goriva. Piroliznite convenient transportation sahraneneie and exploitation.

Solid product obtained in the slow pyrolysis are wood coal energy potential of about 30Mj/kg. The most commonly used for heat energy.

Gasification is the process of thermo-chemical processing of raw materials vaglerodsadarzashti a result, which yields karburiran gas (synthesis gas) with energy content of 10-20Mj/m³. The gas contains carbon monoxide, carbon dioxide, hydrogen, methane, ethane, water vapor, nitrogen and various impurities such as resins and ash. Used for boiler feed gas tupbini and internal combustion engines. Process occurs at high temperature - 800-1300 °C. In the gasifier at the same time in different zones of the apparatus are carried out several processes.

Fig3 Products of gasification of biomass



Initially, the raw material is subjected to temperature drying. Pri 100°C moisture izparjava. Sledvat prosotsite of pyrolysis, oxidation and reduction. An oxidizer can be used air, oxygen, steam or mixtures of these gases. Gasifiers are classified depending on: the manner of submission of biomass in a reactor; direction of movement of biomass and oxidizer; method of heating the raw material.

Gasifiers with the downward movement of biomass and oxidizer (fixed-bed downdraft) is the subject of researches by I. De Bari at all (2000), [11], S. Monteiro Nunes (2007) [28], Dabai, F. (2010) [10]. Typical of these gasifiers is unidirectional movement of oxidizer and biomass. As oksislitelitel commonly used air or oxygen. Biomass should be relatively dry with humidity no higher than 20-30% and ash content of less than 3-5%. To be considered suitable biomass composed of particles with size ranging from 1 to 30 cm results are obtained in relatively clean gas with very low tar. Due to the full utilization of the resultant pitch is not necessary to purify the gas. Among the advantages of this method are its simplicity, efektivniost and relatively low cost. The main advantage of this method is to obtain a relatively pure gas, which is why these gasifiers are considered very suitable for the production of elektricheskaenergiya disadvantage is the need for pre-drying of biomass, the high temperature of the gas and the restriction should not be used with very small particle size

Gasifiers with the downward movement of biomass and oxidative grid allow gasification of biomass with low bulk density and loose composition as chopped straw, leaves from trees, stalks of agricultural crops, sawdust and the like. The advantages are relatively low cost of gasifier, the lack of need for special preparation of feed material and simplified design of the cooling-purifying installation of generator gas. Disadvantage is more complicated structure of the gasifier and the need for frequent replacement of air throats, which are subjected to large thermal stresses and aggressive action of the reaction products.

Gasification with increasing flow (fixed-bed updraft) is of interest for Lin, JCM (2006), [15] Chen, HC (2007) [10], Mandl, (2010) [12]. For this type of Gasification are characterized by opposite movement of biomass and oxidizer. The main drawback of this technology is that the resulting gas has a high content of tar. This requires its preliminary purification before use. Advantage of this Gasification is simple structure and high thermal efficiency. Can be used biomass with high humidity

to about-50%. There is no strict requirements regarding the composition of biomass in terms of individual particles. Information on gasifier fluidized (bubbling fluidized bed) occurs in a statistical Chanchal Loha,[8] Sommas Kaewluan, P.Subramanian,[20] This is technology allows to achieve high efficiency thanks to the almost complete combustion of gorivoto.palno burning of biomass gasifiers Characteristic fluidized high speed flow of heat and masoprenosnite processes and better mixing of the solid phase. The use of fluidized bed gasifiers recommended the use of biomass with a relatively small size of individual particles. This requirement often requires pre-grinding method biomassata.Tozi than gazifiatsiya biomass is widely used and gasification of peat. Its use is associated with the establishment of fluidized bed, which it filed biomass. Usually the creation of a fluidized by injection of air or other gas through a layer of inert material. Often used in the gasifier inert material is sand. Reduction of tar in fluidized can be added katalizator.Tipichnata operating temperature in the gasification of biomass in these gasifiers is order 800-850°C. Compared to the gasifiers considered here the content of tar in the gas from the gasifier fluidized loan averages.In practice are used and installations, including two reactors, fluidized. Similar systems are used primarily when it is necessary to get gas with higher calorific value.

Gasifiers with circulating fluidized bed (circulating fluidized bed)recommended for installations with relatively large capacities. Typical of them is a high rate of scavenging of particles of inert layer, compared to fluidized bed gasifier, which is why they are disposed of layers together with the products of combustion. To capture them using cyclones and they returned to the fluidized bed. Resulting from these gasifiers gas is suitable to be used mainly in boilers and TPPs. In a stream gasification using biomass containing very fine particles that are caught by the incoming oxidant air or steam, whereby gas flows of particles. Gasifiers of this type operate at very high temperature of about 1200 - 1500 ° C, which is determined depending on the type of oxidant air or oxygen. Gas is characterized by low concentrations of tar. .

Liquefaction is the conversion of biomass into a stable liquid hydrocarbon (Xu and Etcheverry, 2008[42]) There are several liquefaction methods under research, such as acid hydrolysis, enzyme hydrolysis, steam explosion and supercritical water for the production of bio-ethanol or polylictic acid (Kobayashi et al., 2008)[21].

4.2. Biochemical processing of biomass

Fermentation is a biochemical method for converting biomass, involving the digestion of sugars using microorganisms, in consequence of which is derived ethanol. The most suitable plants for the production of ethanol and methanol are: sugar cane, sugar beet, cereals (technical) cultures associated with the production of vegetable oils, wheat, barley and others. She is known fermentation by the presence of oxygen (aerobic fermentation) and oxygen (anearobna fermentation).Bio-chemical conversion is based on biological processes. The most significant options are: alcohol production from biomass containing sugar, starch /or celluloses, and biogas production from crops or organic waste material (e.g. animal manure).

Fermentation takes place in units called bioreactors. Are known various constructions of bioreactors. Can work as a regular and continuous.Modes in fermentation can be thoroughly mixed, full displacement, mixing continuously and constantly shifting.The products of this process are biogas and oils which are subsequently used to produce heat energy and fuels. Here it should be borne in mind also that the pure hydrated ethanol, can be used directly in cars. Under the "stations" one liter of ethanol is available at 0,63 US \$, while the price of petrol is 1,07 US\$.

4.3. Chemical processing.

Chemical processing of biomass is based on the extraction process. This is - common methods in the chemical and food promishlenost.Posredstvom it is done extracting the target component using an appropriate solvent. It is possible that the extraction of the target component- oil eksragenta rape and its use for biodiesel. This treatment also undergo sunflower oil, palm oil, groundnut oil and soybean dr.Tova are hard, rich in fat and suitable for extrusion. They are extracted fat, as a valuable target product with high calorific value

5. BIOPRODUCTS

The main products from the processing of biomass heat energy and fuels.

Bioethanol is the most -the fuel used dnes.Kapatsiteta is 1.8 billion gallons per year. Produced during the conversion of carbohydrate biomass into sugars and subsequent fermentation. One of the most modern refinery and grain alcohol, not only in Bulgaria and the Balkans in the village Tserkovski (Karnobat Municipality).Plant was opened in September 2001 Rektifikatsionata column, in which the treatment produced alcohol is the biggest in Bulgaria height H=32.

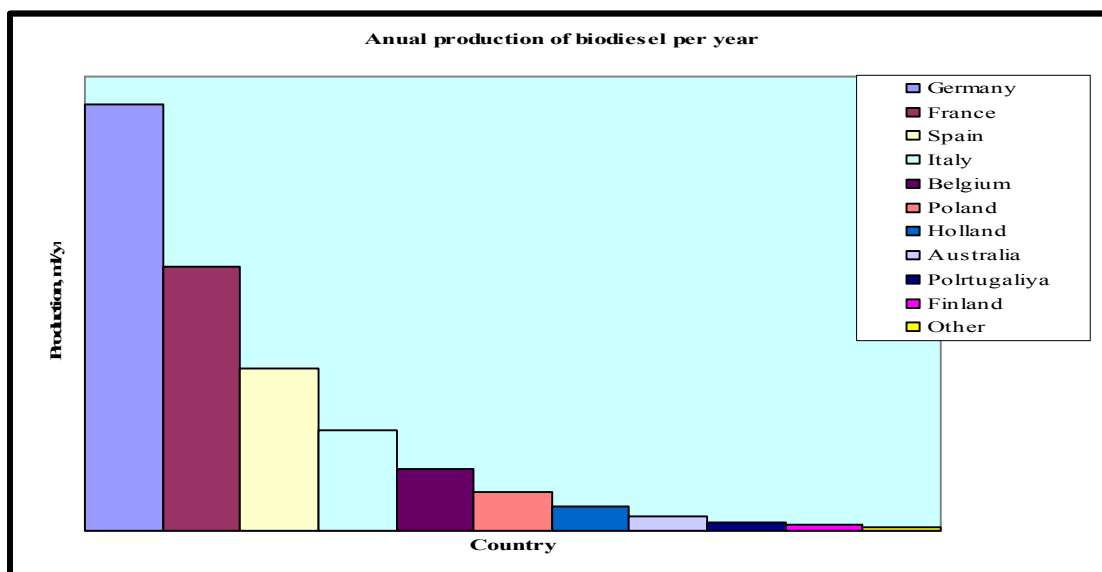
Top - major producers of bioethanol are Brazil, Spain, France. Getting ethanol from biomass is the subject of investigation by Benoit Gabrielle (2008)

Bloodies is obtained by esterification of vegetable oils, can is produced from traditional biomass crops (for the Americas, soybeans, Europe, rapeseed, coconut-Asia) or animal fats. Proyzvodstvoto development of bloodies for the past 7 years is given in Table 1

Table 1 Annual production of biodiesel per year (ml/yr).

Country	Annual production of biodiesel per year (ml / yr).							
	2003	2004	2005	2006	2007	2008	2009	TOTAL
Germany	805	1166	1880	2998	3255	3175	2859	5633617
France	402	392	554	873	982	2044	2206	3481755
Spain	7	15	82	111	189	233	967	2150280
Itali	307	360	446	503	409	670	830	1328617
Belgium	0	0	1	28	187	312	468	820667
Poland	0	0	113	131	90	310	374	506932
Holland	0	0	0	20	96	114	364	313141
Australia	36	34	96	139	301	240	349	192666
Polrtugaliya	0	0	1	102	197	302	282	119591
Finland	0	0	0	0	44	96	248	72687
Other	56	181	413	637	685	1239	1240	42690
EU - 27	1614	2177	3586	5507	6435	8733	10187	38239

Fig 4 Production of biodiesel for the past seven years

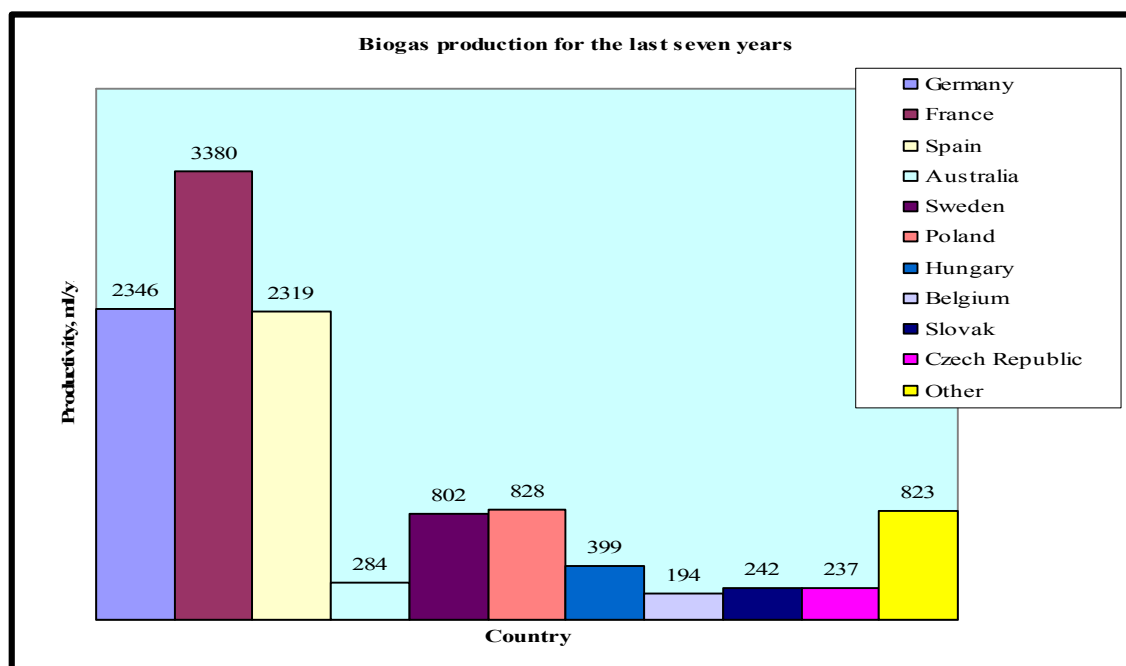


Biogas is used mostly for powering gas turbines to produce electricity. If the quality was improved to that of natural gas can be used to cars Energy value of biogas is 4,5 to 7,5 kWh/m³. Production development of biodiesel for the past 7 years is given in Table 2

Table 2 Annual production of biogas per year (ml / yr).

Country	Annual production of biogas per year (ml / yr)							TOTAL
	2003	2004	2005	2006	2007	2008	2009	
France	103	101	144	293	539	950	1250	3380
Germany	0	25	165	431	394	581	750	2346
Spain	201	254	303	402	348	346	465	2319
Australia	0	0	0	0	15	89	180	284
Sweden	65	71	153	140	120	78	175	802
Poland	76	48	63	120	155	200	166	828
Hungary	0	0	35	34	30	150	150	399
Belgium	0	0	0	0	0	51	143	194
Slovak	0	0	0	0	30	94	118	242
Czech Republic	0	0	0	15	33	76	113	237
Other	0	29	49	173	139	240	193	823
EU -27	446	528	913	1608	1803	2855	3703	11856

Fig 5 Biogas production for the last seven years



According to the statistics (**Fig 4, Fig 5**) and graphics based on this survey shows that countries with the largest production capacity of bio-products - biogas and biodiesel are France and Germany. In these countries, these products are used as a source of energy for road transport. Can be applied both separately and in appropriate proportions to traditional fuels. Other useful organic products are pyrolysis oil, green chemicals, retsikuliruma plastic, natural fiber, natural and bio-structured materials and recovery.

5. CONCLUSION

Organic products are a good alternative source of heat and energy. Construction of power plants using organic raw can help greatly the development of energy, ecology, economics and social policy. Therefore consumed on the residues of various aspects of human activity the price of electricity from such materials can be up to three times cheap. An important indicator is the provision of a direct link between the sources of biomass and businesses for energy and raw materials for energy recovery. Biomass is a clean fuel. Its use reduces emissions of carbon monoxide, which are the main gases conducive to the greenhouse effect and ozone depletion. There will be a project plan based on that developed countries must reduce their greenhouse gas emissions below levels specified for each of them by 2012. ([United Nations 1998\[40\]](#)). Another advantage of using biomass as an energy source is the separation of ash with a low sulfur content. This makes it suitable for fertilization soil. Thus furthering the development of new plant species, supporting the development of ecology and environmental protection.

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