Bioenergy in the Black Sea Basin Countries: Status, Prospects and Possibilities

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Abstract:

In recent years, concern about global climate change and air quality has increased interest in bioenergy from renewable sources. Bioenergy has several environmental advantages over fossil fuel. Amongst renewable energy sources, the biggest contribution (63%) comes from biomass. Biomass represents the cheapest and most abundant feedstock available in large volume. Approximately 80 billion tons of biomass in forest is produced in the world annually. Within the scope of sustainable development, bioenergy usage becomes crucial also in Black Sea Basin Countries. In this paper, status, prospects and possibilities of bioenergy production and usage in the Black Sea Basin Countries were reviewed.

Key Terms: Renewable energy sources, biomass, bioenergy, Black Sea

Introduction:

Energy is one of the major factors that improves level of living and provides economic and social development. As a result of rapid industrialization, population increase and urbanization, energy consumption has increased so much in recent decades. Especially in developing countries, it is estimated that depending on these factors, energy demand will continue to increase rapidly in the upcoming years. Based on recent reports, it is predicted that under current energy policies, in 2035 world energy demand will be 47 % more than 2008 by 1,4 % average yearly increment (IEA 2010; EIA 2010; Sağbaş and Karamanlıoğlu 2011). Currently, 80% of energy demand is supplied from fossil resources such as coal, petroleum and natural gas (Vogel 1999; Ericsson 2006; URL 1). Intense usage of fossil fuels results in a lot of environmental problems as global climate change (being in the first place), global warming and pollution.

Carbon dioxide is the most important anthropogenic greenhouse gas that leads to global warming (IPCC 2007). Because of global warming, average surface temperature has increased from 1.4 ºC to 5.8ºC (Beier et al. 2008). There have been many international studies and cooperation to avoid climate change's negative effects. Countries combat with global warming and climate change through international agreements such as United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol and regional cooperation as European Union (ÇOB 2008; ÇOB 2010).

Oil, natural gas and coal supply 34,8%, 21,1% and 23,5% of world energy need respectively. But all these fossil resources have limited reserves. It is estimated that, fossil fuel reserve depletion times for oil, coal and gas are approximately 35, 107 and 37 years, respectively (Singh and Singh 2012). For this reason, alternative energy resources become popular. In this context, renewable energy, energy efficiency and solid waste management come to the forefront (Williamson 2006; Tiftik 2006).

To be able to establish sustainable global development, with growth in population and living standard, it is necessary to develop renewable and cleaner energy sources, which have minimum level greenhouse gas emission (Acaroğlu 2008; IEA 2010; Singh and Singh 2012). As being one of these renewable and cleaner energy sources, biomass energy (bioenergy) is the most important energy resource aiming sustainable energy production and sustainable environmental management (Kyriakos 2004).

Like in other developing countries, Black Sea Basin Countries (Turkey, Georgia, Russia, Ukraine, Romania and Bulgaria) rely heavily on outside energy sources. At the same time, as a result of international agreements obligations, it becomes necessary for these countries to use renewable and cleaner energy sources. In this study, it was aimed to evaluate bioenergy status, prospects and possibilities in the Black Sea Basin Countries.

Biomass: Renewable energy sources are non-fossil energy sources such as hydraulic, wind, solar, geothermal, biogas, wave, marine current and tidal energy. Beside this, run-of-the river stations and hydroelectric plants smaller than 15 km^2 reservoir area are also considered as renewable energy sources (Resmi Gazete 2005). Renewable energy sources are classified into three groups based on their main sources (Table 1) (Ateş 2001).

Table 1. Classification of renewable energy sources

Primary Source	Primary Energy Sources	Natural energy conversion	Technical energy conversion	Energy type
SUN	Water	Evaporation, rain	Hydropower plants	Electrical energy
	Wind	Air motion in atmosphere	Windpower plants	Electrical and mechanical energy
		Wave motion	Wavepower plants	Electrical and mechanical energy
	Solar rays	Warming of the earth and atmosphere	Heat pumps	Heat energy
		Solar rays	Collectors	Heat energy
			Solar cells	Electrical energy
	Biomass	**Biomass production**	**Heat power plants**	**Heat and electrical energy**
			Conversion plants	**Fuel energy**
WORLD	Geocenter heat	Geothermal energy	Geothermal energy plants	Heat and electrical energy
MOON	Moon gravity force	Tidal	Tidal power plants	Electrical energy

Biomass energy is environment friendly source as other renewable sources. Main difference of biomass energy is that, its energy sources are not just substance in nature. Current potential can be expanded by producing new sources with proper growing techniques. Thus, biomass energy is ecologically renewable and sustainable energy source (Maniatis 2004; Gülay 2008; URL 1).

Biomass is organic non-fossil material. All plant and animal origin organic materials whose main components are carbon hydrate compounds are considered as biomass energy source and energy derived from these sources are called biomass energy (Acaroğlu 2008). Biomass is used for all solid, liquid and gas fuels obtained from organic wastes, plantal oils wastes, agricultural wastes, agricultural and forest products. Biomass is any material which stores sunlight in the form of chemical energy as a result of photosynthesis. Nearly 90 % of biomass stands in forests worldwide (Saraçoğlu 2004; OGM 2008).

In Turkey, 64% of biomass energy is obtained from forest and wood wastes such as forest tending and logging wastes, sawdust and wood chip. Also, municipal solid wastes, agricultural wastes and landfill gas comprise 24%, 5% and 5% of biomass energy, respectively (Taşkıran 2009).

Biomass releases less CO_2 emissions and biomass energy is the third largest renewable energy source. CO_2 emission of biomass is 0,73 tonnes per tonne, while this amount is 2,80 tonnes for coal. Especially after 1990s, awareness about environmental problems has increased and people started to prefer energy sources having less CO_2 emissions. As a result, demand for biomass energy has increased. Nowadays, utilization from biomass energy is seen as alternative of fossil fuels and solution

for environmental pollution (Dangzhen et al. 2009; URL 2; URL 3).

Bioenergy in Black Sea Basin Countries: 14-15% of world energy consumption is met by bioenergy and this ratio reaches 43% in developing countries. As about 90% of world population is in developing countries, it is possible to say that bioenergy plays a crucial role in meeting energy demand (Ateş 2001; Demirtaş and Gün 2007). As given in Table 2, bioenergy amount was 930 Mtoe (millions tons of oil equivalent) in 1995 and it is expected to be 1193 Mtoe in 2020 (D'Apote 1998; Kaygusuz and Türker 2002).

Table 2. Biomass energy amounts in the world (Mtoe)

	1995				2020			
Region	**Biomass**	**Conventional energy**	**Total**	**Biomass ratio(%)**	**Biomass**	**Conventional energy**	**Total**	**Biomass ratio(%)**
China	206	649	855	24	224	1524	1748	13
Eastern Asia	106	316	422	25	118	813	931	13
Southern Asia	235	188	423	56	276	523	799	35
Latin America	73	342	416	18	81	706	787	10
Africa	205	136	341	60	371	260	631	59
Developing countries	825	1632	2456	34	1071	3825	4896	22
Non-OECD countries	849	2669	3518	24	1097	5494	6591	17
OECD countries	81	3044	3125	3	96	3872	3968	2
WORLD (in total)	**930**	**5713**	**6643**	**14**	**1193**	**9365**	**10558**	**11**

In parallel with bioenergy demand increase in worldwide, in Black Sea Basin Countries (Turkey, Georgia, Russia, Ukraine, Romania and Bulgaria) need for bioenergy gradually increases. Primary solid biofuels, biogases and liquid biofuels production amounts are given in Table 3 (URL 4). In 2006-2010 period while Turkey, Romania and Russia are prominent in primary solid biofuels production, in other countries primary solid biofuels production is very low. Whereas for biogases production Turkey takes place on the top, in recent years there is a substantial increase in Liquid Biofuels production in Romania and Bulgaria.

Table 1. Bioenergy Production Amounts (2006-2010).

		Turkey	**Bulgaria**	**Georgia**	**Romania**	**Russia**	**Ukraine**
2006	**Primary Solid Biofuels (TJ)**	214924	32182	15617	135437	143345	34377
	Biogases (TJ)	331	0	3	0	0	0
	Liquid Biofuels (1000 tonnes)	22	9	0	0	0	0
2007	**Primary Solid Biofuels (TJ)**	209100	29671	16496	138338	153277	33172
	Biogases (TJ)	629	0	3	53	0	0
	Liquid Biofuels (1000 tonnes)	14	4	0	22	0	0
2008	**Primary Solid Biofuels (TJ)**	199518	29314	15825	156993	130081	36971
	Biogases (TJ)	1091	0	3	25	0	0
	Liquid Biofuels (1000 tonnes)	20	12	0	93	0	0
2009	**Primary Solid Biofuels (TJ)**	192119	32084	15994	160705	122953	60737
	Biogases (TJ)	1968	14	3	45	0	0

	Liquid Biofuels (1000 tonnes)	10	19	0	86	0	0
2010	**Primary Solid Biofuels (TJ)**	186289	38688	15031	163287	123275	61050
	Biogases (TJ)	2846	112	3	129	0	0
	Liquid Biofuels (1000 tonnes)	7	19	0	67	0	0

If foreign trade situation of bioenergy is viewed, it can be said that only in Romania and Bulgaria bioenergy is imported and exported. In other countries there is no recorded international trade for bioenergy (URL 4).

If total TJ (terajoules) amounts of primary solid biofuels and biogases are taken under review, there is an increase in Romania and Ukraine during 2006-2010. On the other hand, in the same period there is a small decrease in Turkey (Figure 1).

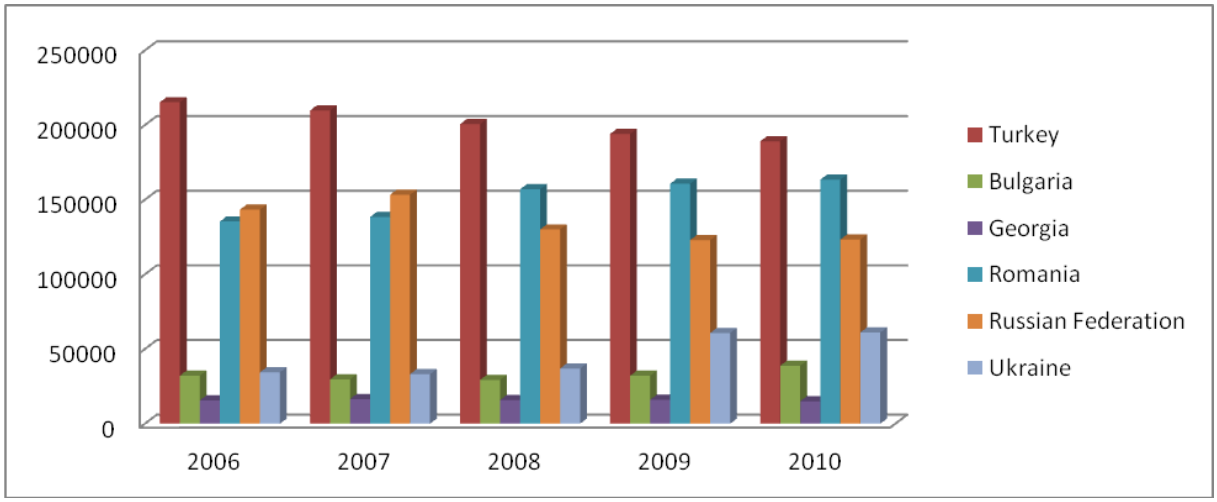

Figure 1. Bioenergy production amounts (2006-2010)

Although bioenergy demand increases and utilization from bioenergy becomes popular in recent years, still there are a lot of problems and bottlenecks. The problem areas about bio-energy usage are; financial and economic problems, problems relating to licenses, communication, the supply and availability of biomass, problems relating to knowledge and technology (MEA 2003). These problem areas are main obstacles for extending of bioenergy usage.

Conclusions and Suggestions: As a result of intense usage of fossil fuels to meet energy demand, global environmental problems such as global warming and climate changes occur. Also fossil fuel reserves are limited and their prices are increasing day by day. For these reason, demand for alternative energy sources is increasing. Biomass energy is one of the most important sources of these alternative energies.

Although utilization from bioenergy is still not at desired level, biomass and bioenergy usage look promising in the future for the world and Black Sea Basin Countries. To realize expectations about bioenergy, these suggestions can be made.

- This study just gives general information about bioenergy in related countries. By analyzing own situations and biomass policies of each country, a detailed and more efficient evaluation can be made.
- Precondition of utilization from bioenergy at desired level is forming comprehensive bioenergy policy. For this reason, bioenergy goals should be included in development plans, sectoral plans and related strategy documents in these countries.
- Beside national policies, cooperation among these countries and forming common

policies will be beneficial for extending bioenergy usage.

- Information about biomass and bioenergy inventory is not so much reliable. This results in problem occurrence in determination of biomass and bioenergy potentials. First of all, comprehensive inventory study is necessary. Thus biomass potential of the region can be determined.

- Biomass and bioenergy inventory and potential data should be recorded and updated by bioenergy specialists and statisticians. Then these data can be shared via related international agencies. For instance only Turkey is a member of International Energy Agency (IEA), which collects data about renewable energy sources. It will be better for other region countries to join such unions to obtain reliable information. Also by this way, joint agreed methodologies for the estimation of bioenergy usage can be developed.

- Incentives such as tax exemption, tax deduction and low interest rate loan can be given to firms which want to invest in biomass and bioenergy production.

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