

## **RENEWABLE ENERGY IN FUNCTION OF ENVIROMENT PRESERVATION**

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### **ABSTRACT**

*Progressive development of technologic disciplines in last century is opening questions which way will be moving development of energy and new age technology, and how will they implement in to the society. In addition to this subject, we will provide our vision about that how development of renewable energy will reflect on the energy situation in Bosnia and Herzegovina.*

**Keywords:** New age technology, Renewable Energy, Implement, Pollution, Preservation

### **1. INTRODUCTION**

Human, as solely being on Earth with intellectual capability and with innovation as fundamental virtue, it is turned to the future from his own beginning. From the beginning he longed for better improvement of life standard and development of new technology, sometimes even for the price of destruction natural resources. We are witnesses of great technology accomplishment through human history. From the James Watts "steam engine", Brothers Wright first airplane, T. Bell telephone, T. Edison electric bulb, atomic bomb, great inventions from Nicola Tesla, to modern nuclear facilities, satellite systems, enormous barrier systems, futuristic cars, airplanes, rockets...

On the other side we have direct connection between technological development and pollution of human environment, so it is not surprising that the greatest human achievements are on the other side the greatest danger to human and his environment (atomic bomb, nuclear generating station, SUS engine...). It is difficult to find balance between development and pollution.

### **2. WORLDS ENERGY FLOW AND TRENDS**

*"Much generation will pas until ours machinery will be moved by energy that is accessible in any point of universe...It is only a question of time when man will be able to connect his machinery on the powerful wheel of nature." – Nicola Tesla*

Mankind has grown a century old belief that energy that it uses is inexhaustible. There is more and more warnings from the world's scientist about natural reserves of oil an gas and theirs rapid reduce. It is supposed than between 1990 - 2020 the growth of global consumption will be increased 60%. This growth is condition of growth of human population, continuous urbanization and economical and industrial expansion. Consumption of electrical energy will increase 70% by latest predictions. Largest share of this growth is expected in regions in development, when around 2 billion people has no access to modern forms of energy, such as electrical energy and natural gas. But, fulfilling these

demands by conventional form of energy and technology will increase threat to the natural environment, world's health and international stability.<sup>[1]</sup>

In rich countries of the world alternative sources of energy are developing such as energy of wind, solar energy, fuel cells, hydrogen, and biomass. Main problem about these energy sources is that existing technology cant use then enough in order to replace conventional energy sources.<sup>[2]</sup>

It is estimated that 200 – 250 billions dollars are invested in energetic infrastructure and 1,5 trillion dollar are spent on consumption of energy per every year, from almost entire investment goes on conventional energy. As result, society is strengthening his own addiction to this unhealthy, untenable and uncertain energy structure.<sup>[3]</sup>

World now use ten times more energy of wind then it was using ten years ago, while consumption of solar energy increased seven times. Political support to this new energy sources is also increasing. Few countries have recently adopted new strong legislation that supports renewable energy sources.<sup>[3]</sup>

Although changes are never easy. Big countries, including industries with powerful political background are trying to keep this status quo. Conflict of sides for and against changes is best shown in World Summit that look place in Johannesburg in South Africa in summer 2002. European Union and Brazil have suggested on world plan adopting minimum of specific boundaries of using these new renewable energy sources. Strong opposition appeared to this proposal formed by the industry of fossil fuels, government of countries that produce oil and major consumptions of fossil fuel such as China and USA. Battle ended by adopting no numerical goal of increasing use of these new renewable energy sources. But the fact that this proposal was created in world summit is strong enough and important.<sup>[4]</sup>

International Panel on Climate Change, body that is assembled from around 2000 scientist and economist who advise UN on climatic changes has made a conclusion that global emission of coal-dioxide (CO<sub>2</sub>) most be reduced at least 70% in next 100 years in order to stabilize CO<sub>2</sub> concentration on 450 parts per million (ppm), which will be a 60% higher concentration of CO<sub>2</sub> than before pre industrial age. Because of the fact that more of 80% of coal-dioxide (CO<sub>2</sub>) that is released by human is made by burning fossil fuel, such reductions are not possible without significant improvement of energy efficiency.<sup>[5]</sup>

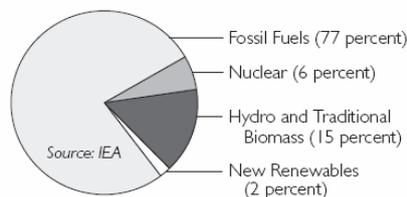


Figure 5-1. World Energy Consumption by Source, 2000

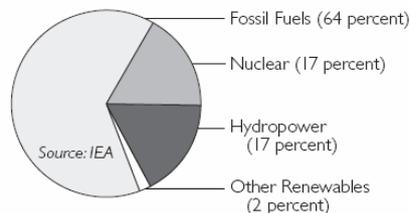


Figure 5-2. World Electricity Generation by Type, 2000

All renewable sources of energy, except energy of biomass, don't have any additional expenses for fuel and they don't have risk bind for possible fluctuation of prices in future. According to the latest research in California, by increasing use of renewable energy and investing in this technology will bring to the opening fourth time more jobs than opening new generators on natural gas and these fore millions of dollars that are planed to be spent on import of energy from other countries, will be saved.<sup>[6]</sup>

All of these renewable sources are successors of today's conventional sources of energy.

### 3. BOSNIA AND HERZEGOVINA THROUGH MAGNIFYING GLASS OF WORLDS TECHNOLOGICAL STANDARDS

Average consumption of energy per habitant in world in 2000 was around 70 GJ/capita. In developed countries this number was 236 GJ/capita; in Bosnia and Herzegovina it was around 45 GJ/capita, which is lot lower than world average.<sup>[7]</sup>

Basic source of primary energy in Bosnia and Herzegovina is coal and hydropower. Annual production of energy from these sources in Bosnia and Herzegovina in 2001 was around 62% of total spent primary energy, which indicate that Bosnia and Herzegovina depends on import energy, because some of the energy sources can't be replaced by home sources of energy. Total reserves of coal in Bosnia and Herzegovina are estimated around 3.856 millions tons (without reserves from Ugljevika, Gacka and Duvna). Total hydropower potential is estimated around 22,050 GWh per year.<sup>[7]</sup>

Production of electrical energy in Bosnia and Herzegovina in 1990 was 12.613 GWh. Consumption was 11.535 GWh. System was nude from 13 hydropower facilities with total capacity of 2.034 MW and average production of 5.500 GWh per year, and 4 thermo facilities with total 15 blocks with capacity of 1.957 MW and production around 9.678 GWh in 1990. Rehabilitation in few last years made it possible to achieve total production of 11.257 GWh in 2003 (89% from the level in1990), and consumption has reached 10.407 GWh (90% into the level in 1990).<sup>[8]</sup>

Today in Bosnia and Herzegovina 3 separate vertically organized companies exist that produces, transmit, distribute:

- Elektroprivreda Bosnia and Herzegovina with its main office in Sarajevo;
- Elektroprivreda HZHB with its main office in Mostar;
- Elektroprivreda republic of Serbs with its main office in Trebinje;
- Join electro energy coordinating center (ZEKC) which will be transformed in independent system operator.

Table 1. Basic information on production capacities in companies<sup>[8]</sup>

		EP BiH		EPHZHB		ERS		UKUPNO
<b>Ukupni kapacitet</b>	MW	<b>1849</b>	47%	<b>762</b>	19%	<b>1346</b>	34%	<b>3957</b>
HE (bez MHE)		492	26%	762	100%	746	55%	2000
TE		1357	74%	0	0%	600	45%	1957
<b>Ukupna proizvodnja 2003</b>	GWh	<b>5362</b>	48%	<b>1238</b>	11%	<b>4657</b>	41%	<b>11257</b>
HE		1248	23%	1238	100%	2142	46%	4717
TE		4114	77%	0	0%	2515	54%	5612

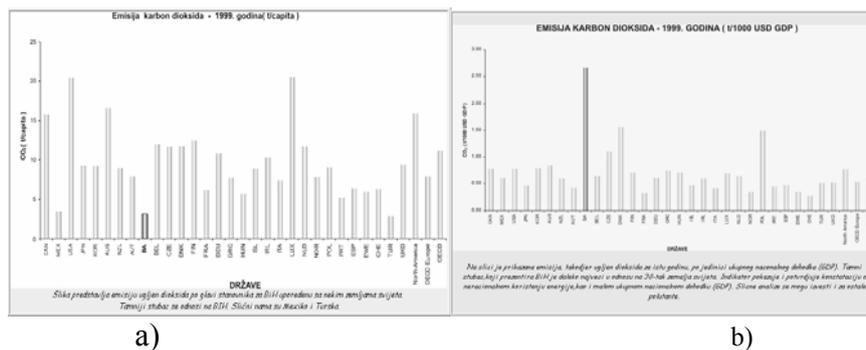


Figure 2. a) Dark column represent emission of coal dioxide in Bosnia and Herzegovina per inhabitant compared to some other countries... b) Dark column represent emission of coal dioxide in Bosnia and Herzegovina per GDP unit compared to other countries.<sup>[8]</sup>

River pollution in Bosnia and Herzegovina are mainly caused by communal waste waters specially in cases when sewer system doesn't work properly, and waste waters from agricultures industry. Other major polluters of water are industry and production of energy. Industries cause heavy metal pollution and production of energy often causes thermal pollution.<sup>[8]</sup>

#### 4. SUGGESTION

Picture 2 shows that level of air pollution caused by heavy industries (power station) per habitant is low, and per GDP is high. By replacing thermo power facilities with some other “healthy” sources of energy situation in picture (2) will be even better and production of electrical energy will be accepted in same level. These steps would create image of Bosnia and Herzegovina as environment of healthy living, which would be very profitable tourisms arrangements. Picture 2 (b) is more pessimistic then picture 2 (a), but if the all of the upper quoted is realized, then condition on picture 2 (b) would be improved significantly. Table that follows are result of visit to company “INTRADE Sarajevo” which made it possible insight in some technical information needed for construction of power producing facilities on “healthy” way.

Table 2: Building cost, power and production per year of some types of power stations. [9]

Ordinal number	Type of power station	Power in kW	Product per year in GWh	Price construction and price installation in KM	Relation KM/kW
1	MHI X	1.100	5,2	3.600.000	3.273
2	MHI Y	2.800	11	4.600.000	1.643
3	MHI Z	20.000	100	96.000.000	4.800
4	Accumulation	165.000	295	310.000.000	1.879
5	Wind power station	1.000	5	3.000.000	3.000

MHI x, MHI y, MHI z, are 3 types of mini hydropower stations, for whose installation is not necessary to build accumulation, can have negative influence on natural beauties of country side, and it can be very harmful to public health. MHI z and accumulation power plants are not substitute for thermal power station, because MHI z is very big investment with lower effects in production (compared to second two mini hydro power station), and accumulation is price satisfactory but it is negative because of destruction of big area can be used example production of healthy food, tourism purpose, and so far...., It is also negative because of catastrophe which can occur during inconsiderate handling. It takes only few square meters of accumulation for MHI. In Bosnia and Herzegovina exists ten localities suitable for construction of windmill, which have around 270 days wind per year. For wind generator necessary area is from 500 to 1000 square meter, while foundation has at most 15 x 15 meter, rest of surface is suitable for cultivation. MHI x, MHI y and wind generators are not the cheapest option but they are popular option because they don't have any or very small negative impact on health of habitants and they give pretty good results in production and protection of environment and health.

## 5. CONCLUSION

Based on economical and other pointers, reduction of CO<sub>2</sub> emission is possible by replacing remaining thermal power station with hydroelectric power station type MHI x, MHI y and wind power station. Of course it is possible to replace harmful energy sources with some other more acceptable energy sources, not just these mentioned. Big funds are needed in order to realize such program, funds that Bosnia and Herzegovina can't provide. It is desirable to use all natural wealth on best way, and by that not disturbing natural balance.

Southern Herzegovina and north Bosnia are plains regions with wind map suitable for building wind generators. River basin of Bosnia and Neretva are rich with regions suitable for installing mini hydro plants. Renewable energy sources should replace old and environmentally harmful thermal power station, and to stop buildings of new accumulation power plants in our country. In this way, balance would be made between energy need in and out of Bosnia and Herzegovina and preservation of natural wealth.

## 6. REFERENCE

- [1] International Energy Agency (IEA), World Energy Outlook, 2001 Insights: Assessing Today's Supplies to Fuel Tomorrow's growth (Paris IEA, 2001)
- [2] Annual investments in energy infrastructure from UNDP, UN-DESA, and WEC, 9. October 2002.
- [3] IEA, The Evolving Renewable Energy Market (Paris: 1999)
- [4] Christopher Flavin, Discussion with author, 11. October 2002.
- [5] Intergovernmental Panel on Climate Change (IPCC), Climate Change 2001: The scientific Basis (Cambridge, UK: Cambridge University Press, 2001)
- [6] California Public Interest Research Group, "Developing Renewable Energy could mean more jobs", KTVU News, 25. June 2002.
- [7] Vijeće ministara, Jedinica za ekonomsko planiranje i implementaciju srednjoročne razvojne strategije BiH, Ured za ekonomsko planiranje i istraživanje (www.eppu.ba)
- [8] Government Federation Bosnia and Herzegovina – *Plan behind construct new production capacity Electrical energetic facilities*, Januar 2005.
- [9] Podaci preuzeti od kompanije INTRADE energija.