

Renewable Energy Country Profile Version 0.6b

These profiles are a work in progress. They are presented to the international community for review and comment. The profiles are undergoing continual updating for technical content, formatting, grammar, and other issues. Each country profile will be modified on a continuous basis as new information is made available.

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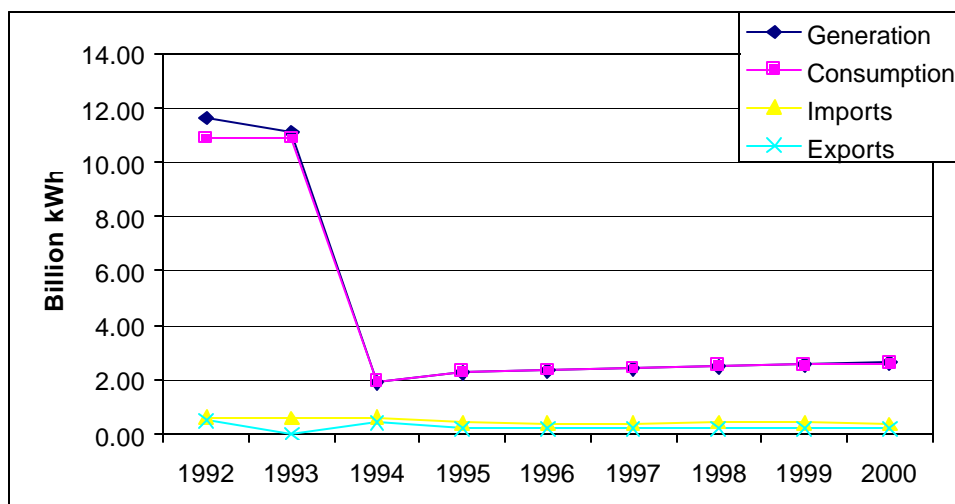
5.0 Bosnia & Herzegovina

5.1 Overview of Electricity Supply

Electricity generation is entirely made up with coal fired base-load units and hydroelectric generation. The average age of the generating facilities is 23 and 22 years for the coal and hydroelectric units, respectively. There has been a significant amount of refurbishment and reconstruction following the war in the 1990's to bring electric generation back to operability.

Fuel	Number of Units	Capacity (MWe)	Percent of Capacity
Nuclear	--	--	--
Coal	4	1,957	49%
Natural Gas	--	--	--
Hydro	13	2,034	51%
Other Renewables	--	--	--
Total	17	3,991	100%

In 2000, 10,429 GWh of electricity was produced domestically, while the consumption of electricity was only 9,365, making Bosnia & Herzegovina a net exporter of electricity.



The transmission system sustained significant damage during the war, and is still in the process of rebuilding. The former primary transmission line was a 400 kV network

spanning 800 km. This network had two primary interconnections, the Adriatic Line connecting to Croatia, Montenegro, Serbia, and Greece, and the Northeast Line via Ernestinovo in Croatia, which is part of the former central Yugoslavian transmission line. At the present time neither of these interconnections is in operation, however, the system is connected to Croatia, Montenegro, and Serbia via 220 kV lines. A considerable amount of investment in reconstruction is required to bring the entire system back to operational status.

(Privatization)

1.1.1 Wind Resources

Current Status of Wind Energy

No wind turbines operate in Bosnia/Herzegovina.

No other information on wind energy development was available.

A countrywide wind-atlas is not available.

No industry association or manufacturer was identified.

No other projects were identified.

There is not sufficient information to make a statement on the technical potential for wind energy development.

Wind Energy Resource Potential

The only neighboring country, with some wind energy information available is Croatia. Since the Southwest corner of the country is only some 10 - 20 kilometers away from the Dalmatian Coast, the wind energy resources are certainly similar to the resources right across the border. This does not exclude the possibility of finding favorable wind conditions inland, particularly in the northeast.

Other than this, it is not possible to rate the technical wind energy resource potential of Bosnia/Herzegovina.

Therefore it seems that a country wide resource assessment would be one of the first priorities.

Identification of Areas/Projects with High Potential for Wind Energy

Judging by the wind resources of Croatia, the most promising areas would be in the southeast of the country.

Table 1-2 Bosnia/Herzegovina Areas/Projects with High Potential for Wind Energy..

Project Name and Location	Size (MW)	Description
Southeast region of the country		Hills and ridges close to the Adrian Coast.

Barriers/Incentives for Wind Energy

Specific incentives for the implementation of wind projects in Bosnia/Herzegovina are not known:

The most important barrier to the implementation of wind projects in Bosnia/Herzegovina is the lack of knowledge on wind resources

Table 1-3. Bosnia/Herzegovina Wind Energy Profile.

Current status of wind energy	
Installed capacity	None
Projects under construction	None
Supporting regulations?	None
Industry association?	No
Wind energy resource potential	
Level of information available	Poor
Highest wind class	Class 5 (~500 W/m ² estimated from Croatia data)
Country-level wind atlas available?	Yes.
Estimated potential	Insufficient data
Estimated potential (Interwind)	100 MW
Target established?	No
High wind speed locations	Southeast, possibly north
Identification of areas/projects with high potential for wind energy	
Recommended strategic assessments	Study 1 : Country wide appraisal of wind resources, by state of the art wind measurements at 50 m Study 2 : an appraisal of legal and economical frame work
Identified areas/projects	None
Incentives/barriers for wind energy	
Significant incentives	None known
Significant barriers	<ul style="list-style-type: none"> • Wind energy resources not known
Overall Prospects	<p>Poor</p> <p>The overall prospects are rated as poor due to lack of information, and do not necessarily imply that this country has no potential for wind energy development</p>

ENERGY COUNTRY RENEWABLE PROFILES

COUNTRY: BOSNIA HERZEGOVINA

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RENEWABLE ENERGY PROFILE OF BOSNIA HERZEGOVINA

1. GENERAL INFORMATION ON THE COUNTRY

Bosnia Herzegovina has also been a victim of the ethnic conflict. Although it did exist before as a state entity member of the Former Republic of Yugoslavia, it is now under U.N. Administration, led by the High Representative.

Difficulties have in consequence been met in obtaining information from various Ministries that the Office of the U.N. High Representative introduced to us – presumably because their priorities lie in reconstructing its infrastructure and economy. Hence some of the information reported here might be somewhat out of date.

Its population is about 4,0 million – 3,98 million in the Year 2000, according to the IMF – International Financial Statistics. Its GDP in 2000 amounted to 8.323 millions mark. Earlier statistics suggested that per capita GNP in 1995 amounted to US\$199.

Its size in physical terms is 51.129 km. Its capital is Sarajevo.

2. ENERGY OVERVIEW OF BOSNIA HERZEGOVINA

2.1 Economic Reforms and Energy Policy

Like all other former member states of the Yugoslav Federation, Bosnia Herzegovina has initiated programmes of economic and energy reforms: Liberalisation, privatization etc. It has also announced policies of encouraging energy conservation and alternative sources of energy, particularly renewables.

Quite a few of the changes relating to the energy sector, which are under way, are either lagging behind or have not been realized yet, because of the ethnic conflict in the 1990's.

The current organizational structure of the Energy Authority involves unified generation, transmission and distribution. The Government still owns and operates all power plants, and controls the electricity market.

2.2 Energy Summary: Sources, production, consumption etc.

The main sources of energy are coal, hydro power and gas. The main sources of electricity production in 1998 were hydro power (5100GWh) and thermal plants (543° GWh). The total electricity consumption was 10.530 GWh, representing a per capita consumption of 2130k=kwh/yr. In 1998, 1210 GWh of electricity was exported from the country.

Energy consumption is expected to increase by 8% per year over the next ten years and electricity demand also by 8% a year.

In 1998, the average electricity price before tax was US\$0.7/kWh. The cost of producing a kWh of electricity in the country was US\$0.04 for both operational hydro plants and other types of power plants. The mean cost of new hydro capacity is US\$1290/kW.

Companies that generate more than 5% of national hydro power generation are Elektroprivreda BiH, Elektroprivreda Mostar and Elektroprivreda Srpska.

Available information on electricity portray the following levels and structure (Table 1):

Table 1 Production of Electricity in Bosnia Herzegovina

SOURCE	1994		2000	
	GWh	%	GWh	%
1. Fossil fuels	671	34,9		
2. Nuclear	-	-		
3. Geothermal	-	-		
4. Wind	-	-		
5. Hydro	1 250	65,1		
TOTAL	1 921	100,0		

2.3 Renewable Energy Installed Capacity

Bosnia's main renewable energy capacity and production at present is based on hydro power plants, whose capacity at present is 1624 MW. It also has ten small, mini or micro hydro plants in operation with a total capacity of 31 MW.

3. THE RENEWABLE ENERGY SOURCES (RES) AND RESOURCES OF BOSNIA HERZEGOVINA

3.1 Wind Energy

No information is available on the wind resources in Bosnia Herzegovina.

An assessment is reported as taking place.

3.2 Solar Energy

The situation regarding solar energy is similar to that applying in other areas of FR Yugoslavia (Slovenia, Croatia, FYR Macedonia). It is amongst the highest in Europe.

The most favourable areas record a large number of sunshine hours, the yearly ratio of actual irradiation to the total possible irradiation, reaching approximately 50%.

The primary form of solar energy and technology used are flat plate collectors for heating houses and some commercial and public premises. But their contribution to the total energy consumption is insignificant, less than 1%. Nor is it expected that this figure will increase substantially in the near future, as new consumption could mainly come from new entrants to the market i.e. of new buildings or installations.

Likewise, electricity production from solar photovoltaic sources will be restricted to research or remote locations, primarily for telecommunications. PV solar energy is still 300-500% more expensive than alternative fossil-fuel derived sources.

3.3 Geothermal Energy:

Before the recent civil war, the first 1 MW pilot plant working on geothermal water was about to be built in Sarajevo. Due to lack of money the project has not been pursued. Its estimated flow rate is 240 l/s at a temperature of 58°C.

The country's geothermal potential for space heating and balneological purposes, based on the existing wells, is about 33 MWt.

3.4 Biomass Energy

3.4.1 Biomass Resources and Energy Use at present

Statistics on potential raw the biomass resources of Bosnia Herzegovina are presented in Table 2.

Statistics on crop and livestock production, as a basis for working out potential energy output, are given in Table 2.

Table 2. Bosnia and Herzegovina Biomass Resource Data (FAO 2002a, FAO 2002b).

Biomass resource type	Total production	Production density
Primary crop production, tonne	(avg. 1999-2001, tonne)	(tonne / 1000 Ha)
Total primary crops (rank among COO)	3,456,033 (25)	678 (21)
Top 10 primary crops		
Maize	699,776	137
Alfalfa for Forage & Silage	580,000	114
Clover for Forage & Silage	500,000	98
Vegetables Fresh (misc)	450,000	88
Potatoes	346,863	68
Wheat	288,465	57
Cabbages	90,017	18
Maize for Forage & Silage	71,300	14
Oats	57,574	11
Barley	54,681	11
Animal units, number	(number)	(number / 1000 Ha)
Cattle	452,232	89
Poultry	3,514,000	689
Pigs	352,500	69
Equivalent animal units	628,372	123
Forest products, cubic meters	(avg 1999-2000, cu meters)	(cubic meters / 1000 Ha)
Wood fuel and charcoal	NA	NA
Wood residues	NA	NA

No information is available on forest resources and output.

Most probably charcoal and wood fuel consumption is similar to that of the remaining inland area of former Yugoslavia.

3.4.2 Biomass energy potential

While it is not expected to increase use of wood as a fire fuel in the traditional form, it does not necessarily mean that there are no margins and prospects for a better utilization of whatever forest output there is for energy purposes. Better forest practices, reforestation, planting of deserted or marginal land could make a contribution, be it relatively small, to the further development of this sector. Moreover, as burning wood in the traditional way is quite polluting, there will be pressures for switching to other cleaner sources of energy, which would release fuel wood resources. This however, will be a slow process.

As far as exploitation of the residues of field crops, fruit tree plantations and livestock activities are concerned, there ought to be a significant potential for their collection and utilization, along with waste (incl. manures from intensive farms).

This could be done through incineration or anaerobic digestion technologies. But special studies and surveys will have to be carried out to determine location, logistics, size of units, economics and viability.

Likewise with MSW (Municipal Solid Waste) and the waste of sewage (sewage sludge).

3.5 Hydroelectric Energy

3.5.1 Existing Capacity, Reconstruction and Development

The country's present total installed capacity is 2300MW, of which 1624MW is hydro capacity.

The hydro plants have an average annual generation of 8900 GWh/yr, although actual generation was only 5100GWh in 1998. Hydro plants provide about 48.4% of national electricity production in an average year (which includes pumped storage). There is 430MW of capacity in operation at pumped storage plants. No more plants are planned.

Five existing hydro plants (totaling 1060MW) are part of multi-purpose developments. There are 13 hydro plants with a capacity greater than 10MW.

Elektroprivreda BiH has been awarded funds from the US Government to study completion of the 126MW Konic plant, now under construction, which will undergo some revisions. A further 9 MW of hydro capacity is also planned. An 87m high dam is under construction for the project. It is an arch dam, with a concrete volume of 103,000 m³, and will impound a reservoir with a volume of 81.5x10⁶m³. The project is due to be completed in 2003.

The state-owned power utility Elektroprivreda Republike Srpske (EPRS) recently confirmed its development strategy, giving priority to the construction of five hydro plants. The company is to move ahead with the development of the 450MW Buk Bijela and Srbinje (Foca) hydro plants, at a total cost of US\$259 million, and commissioning is planned for 2008. These projects are to be followed by two further hydro plants at Krupa and Banja Luka, due for completion in 2010. Longer term, EPRS envisages the construction of a 160 MW hydro station at Dabar.

There is 180MW of capacity at nine units more than 40 years old. It is estimated that 210MW could upgrade the existing hydro plants.

Unit 4 at the 6x25MW Jablanica hydroelectric plant was decommissioned recently and upgrading work took place. This project has increased the capacity of unit 4 to 30MW and should produce an extra 6GWh/year on average. Work on unit 5 at the Jablanica plant is expected to begin this year.

The 58MW Unit 7 at the 308MW Perucica hydro station resumed operation in October 1999, after repairs to the electrical equipment were completed a month ahead of schedule. Perucica generated 603GWh during the first nine months of 1999.

The following dams and hydro projects are at the preliminary design stage:

- Glavaticevo
- Ustikolina
- Vranduk
- Buk Bijela
- Dabar

Other at the preliminary solution stage:

- Vrbpolje
- Unac
- Tihawina
- M Blato

The Ministry for Regional Planning and Environmental Protection is responsible for environmental impact assessment and management. The main domestic civil contractor for dams and hydro projects is G/K Hidrogradnja. The main developer is Energoinvest-Energoinzenjering.

SMALL HYDRO

Bosnia has a small hydro power potential of 2500GWh/yr. There are ten small, mini or micro hydro plants in operation, with a total capacity of 31MW.

Another two plants are under construction (1.8MW) and 20 more are planned, totaling another 28MW. Proposed plans include the installation of ten small hydro plants every year, with an average capacity of 1.5MW each.

Further hydro projects under reconstruction include the Unac project, which will have a capacity of 4x2.2MW.

Swiss company, Geva, signed a US\$3.17 million contract in November 2000 to build and operate a 1.6MW hydro plant in central Bosnia. The mini hydro plant on the Zeljeznica river should start operating by 2003, and produce a total of 9.5GWh/yr.

The contract provides for a 20-year concession on the use of water, in return for building and running the plant, near the town of Fojnica, during that period. Geva has also signed an agreement with the state-owned power company, Elektroprivreda BiH, which will buy the electricity produced by the plant.

Small Hydropower Tyrol of Austria has also announced that it will invest US\$6.03 million to build four mini hydro power plants on the Jezernica and Kozica rivers, near the town of Fojnica, in central Bosnia.

The Austrian company, as part of a consortium with Intrade Sarajevo of Bosnia, signed a 20-year DBOT (design, build, operate, transfer) agreement in July 2000 with the Central Bosnia region as well as a power purchase agreement with power utility Elektroprivreda Bosne i Hercegovine (EPBiH).

Operation and ownership of the future mini hydro plants will revert to the Fojnica municipality and the Srednjobosanski (Mid-Bosnia) Canton at the end of the concession. The Srednjobosanski Canton Authority is the legal entity awarding the concession.

Three of the plants (Prokoska, Jezernica 1 and Mujakovici) will be on the Jezernica river, while the Botun scheme will be on the Kozica river. The total capacity of the four run-of-river plants is 3.8 MW, with expected annual output of 21GWh.

A financial study of the project needs to be completed prior to the start of construction work, with the building of the plants scheduled to begin in early 2001 and to last 16 months.

3.5.2 Hydro Power Potential

The country's gross theoretical hydro power potential is 68,800GWh/yr (equivalent to 8000MW). The technically feasible potential is 24,000GWh/yr (6800MW), and the economically feasible potential is 19,000GWh/yr (5600MW). About 37% of the technically feasible potential has been developed so far.

However, the most urgent task in Bosnia Herzegovina is to rehabilitate and reconstruct power plants and hydro power structures damaged during the war. The rehabilitation of steam-fired and hydro power plants are foreseen up to 2002.

The construction of new hydro plants and reservoirs for water supply is also envisaged.

5. OVERALL ASSESSMENT/CONCLUSIONS

As in the case of FYR Macedonia, Hydropower is playing a major contribution to the energy the needs of Bosnia Herzegovina.

The reconstruction, renewal and development programme of hydropower in Bosnia Herzegovina is proceeding well and should satisfy the country's medium-term needs.

As to other forms of RES, there must be a significant potential for wind, solid and liquid wastes, which should be tapped, as soon as a proper assessment is made.

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