



Mediterranean and National Strategies for Sustainable
Development
Priority Field of Action 2: Energy and Climate Change

Energy Efficiency and Renewable Energy
Bosnia and Herzegovina - National study

Mrs Semra Fejzibegovic, Hydro-Engineering Institute Sarajevo

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**Mediterranean and National Strategies for
Sustainable Development
Priority Field of Action 2: Energy and Climate Change,
Energy Efficiency and Renewable Energy**

**Final Draft of the National Study
for Bosnia and Herzegovina
WORKING DOCUMENT**



January, 2007

INTRODUCTION- SHORT SUMMARY of the situation in Bosnia and Herzegovina in energy sector

Bosnia and Herzegovina (BiH) has experienced massive economic and political changes since the collapse of the former Yugoslavia in 1992. Currently, the country is largely decentralized and consists of two state-like entities, the Federation of BiH (Federation), and the Republika Srpska (RS) and District Brčko. The Federation is further decentralized and made of ten cantons.

The complexity of political and organizational structures extends to the energy sector where the state-like entities own and oversee three electric power companies, an oil refinery, natural gas transmission and distribution utilities, and coal mines. District heating facilities fall under the responsibility of municipal (RS) and cantonal governments (Federation). This is a unique arrangement that has emerged as a consequence of the complex political situation.

Some of the major problems facing the energy sector in BiH today include an unclear authority over energy issues, the absence of a long-term energy strategy on the state level, and the absence of energy statistics and laws. BiH is lacking the legal and political basis for efficient decision-making and for delegation of responsibilities for energy and energy efficiency to different levels of government.

According to available data, production and consumption of energy and the condition of energy infrastructure have not yet reached the pre-war level. With the existing level of energy intensity, more than 20 percent of national GDP is spent on energy, a clear indicator that significantly more attention has to be paid to energy efficiency.

BiH satisfies its electric power needs in total with the production of electricity from its own power stations (10.8 TWh in 2002), using for that its available hydro potential and coal resources. The situation of domestic consumption enables also the export of part of generated electricity, which in 2002 was 1.1 TWh. About 60% of electricity has been generated in thermo power plants, and the other 40% in hydro power plants. The available hydro potentials have been estimated to possible annual production of approx. 22,000 GWh, while the coal reserves are over four billions of tons. The production of electric energy on today's level is sufficient for satisfying B&H own needs in short-term time period.

The overall power production system is in the process of separating on production, transmission and distribution of electricity, in accordance with the European standards. By adoption of the Law on establishment of the Independent System Operator for transmission system in BiH and by adoption of the Law on establishment of the Electricity Transmission Company in BiH, the legal framework on State level has been realized for the regulation of the transmission segment. These laws have enabled the establishment of non-profit and independent system operator for the management of power transmission system operation in BiH (NOS), as well as the establishment of the Electricity Transmission Company ('Elektroprijenos BiH'). Regarding the work of the regulatory body, there is State Power Regulatory Commission in B&H (DERK), with the head office in Tuzla, and the Entity Power Regulatory Commissions with the head office in Mostar (FBiH) and Trebinje (RS). Also, the activities on preparation of the Energy Strategy in BiH have been started, and The Council of Ministers has already adopted the Terms of Reference for the Strategy of BiH.

In coalmines in BiH, about nine millions of tons of brown coal and lignite has been produced, what is less then 60% of prewar production. The coal has been used in greatest extent (over 70%) for the needs of electricity production in thermo power plants (TPP). We can say that the available coal reserves in BiH are sufficient for the insurance of future needs for electricity generation.

BiH imports the natural gas from Russia, and the postwar level of gas consumption is up to 200 millions of m³.

The natural gas price in BiH on distribution level is the largest in South East Europe. District Heating Companies in BiH are faced with low collection rates due to the great number of consumers who do not pay the heating bills. Low level of payment does not allow for investment in maintenance of or upgrades in the system. A recently adopted Law

on Consumer Protection states that the supplied energy is to be paid in accordance with consumption itself rather than by square meter, which is the present case. As a result, the system must be switched to individual heat metering. It is major priority in terms of better quality of service and better management of district heating system.

According to data from Chamber of Commerce of BiH, from 1997 to 2001, the average oil derivatives consumption in BiH ranged about 1.2 millions of tons annually. The current domestic producer capacities are not sufficient to satisfy the needs of B&H market. That's why currently BiH mainly depends from import of oil derivatives.

Regarding the environment protection, the legal and institutional environment is not strong enough for adequate approach to the environment protection problem. The problem of inexistence of intersectoral approach to this field should be added to this as well. The inexistence of the energy strategy of BiH, as well as the appropriate institutional approach and mechanisms for realization of plans precludes BiH from implementation of the requests of Athena Memorandum and Charter in the part related to the environment protection.

Also, the ratification and implementation of Kyoto Protocol for BiH will be necessary, regarding that it will result with the significant opportunities and profits for the economy, as well as with the benefit in the form of reduction of air pollution. That will ensure the more favourable life environment and sustainable development.

1. PART I – Energy situation in B&H: indicators and basic data

1.1. Share of the Energy Sector and Institutional Specificities

Energy sector economic weight

- Energy share in the GDP (%)

Up to 1991, the annual computation of the social product has been done. The computation of the social product has been performed according to the production method, i.e. the start point of the computation is the production unit. In social product computations each production activities of the social, mixed and private sector of economy were included. Therefore, the computations of social product has been performed for the following production activities: Industry and mining, agriculture, forestry, water management, civil engineering, traffic, commerce, catering and tourism, production part of utility activities (water utility companies, district heating companies etc.). In Statistic Annual of Socialist Republic of B&H from 1992, the prices of the producers from 1972 were taken for the computations of the social product according to the permanent prices. The given data on social product in permanent prices give the information on what the social product would be in the considered period if the prices had been unchanged, i.e. if the structure of prices had been as in 1972.

The computation has been done according to the principle of clear activities applying the unique classification of the activities.

From 1961, in computation of social product per activities and branches, two types of computation have been done: first according to main economic activity of the organization and its head office (organizational principle) and, second one, according to the activities and location of the facility and other units of the working organization (principle of clear activity and territory principle).

The total results of the computation, done according to organizational and according to clear activity principle are not identical. The difference comes from the reason that the computation of the social product according to organizational principle, i.e., according to main economic activity, includes also the part of the organization activity that has not the production character. According to the principle of clear activities in computing the social product, only the results of working units dealing with material production and production services are taken into account [1].

Table 1. Share of energy sector in social product (SP) of B&H for period 1970 –1980-1990 in prices of 1972 in thousand of dinars according to principle of clear activities

	Total SP in B&H	Elektroprivreda (Electricity production)	Coal production	Coal processing	Oil derivatives production	Total SP of energy sector	Share of energy sector in total SP (%)
1970	2,678	82	79	23	22	206	7.69
1972	3,027	96	88	22	24	230	7.59
1974	3,413	114	95	23	27	259	7.58
1976	3,614	127	98	31	32	288	7.33
1978	4,205	145	98	31	37	311	7.39
1980	4,587	163	108	33	39	343	7.47
1982	4,851	158	115	34	39	346	7.13
1984	4,973	180	127	48	41	396	7.96
1986	5,240	205	147	48	38	438	8.35
1988	5,040	218	138	48	42	446	8.84
1990	4,664	210	146	33	42	431	9.24

Source: The data for SP per branches of activities have been taken from Statistical Yearbook of SR B&H of 1992 for period of 1970-1990

In connection with Bosnia and Herzegovina independence, starting process of property realignment on economy and transition to market economy, created a needs for transformation of statistic services. That is why from 1993 and in the work program for a future, the Statistic Institute predicted using SNA methodology (System of National accounts) for calculating a macroeconomic aggregate and for monitoring of development of the entire economy and its factors. SNA methodology is the basic statistic standard that has been recommended by UN, and which has been using in all countries having market economy.

For 1992, 1993 and 1994, neither the computation of social product nor the computation of Gross Domestic product (GDP) has been done due to the war situation in B&H.

For the 1995 and 1996 the Institute of Statistics conducted the statistical researches on the territory of Federation of B&H (FB&H)- one Entity in B&H, by means of that collected elements necessary for calculation of GDP in all area of activities. Data for Republic of Srpska (RS) – the other entity in B&H, are obtained from Institute of Statistics of Republic of Srpska.

All accounts of GDP are now published according to Standard classification of activities, which has been harmonized, with European Classification of activities (NACE). According to that classification all computations were done in USD by rate of exchange 11.35 dinars for 1 USD in 1990. For 1995, the rate of exchange for USD was 141.0 BHD or 2.72 Yugoslav Dinars, and for 1996 1 USD was 151.0 BHD or 4.95 Yugoslav Dinars [2].

Table 2 Share of industry and mining in GDP of B&H for period of 1995 - 1996 in million of USD

Year	Total GDP in B&H	Total GDP of industry and mining	Share of industry and mining in total GDP (%)
1995	2,029	493	24.29
1996	2,778	594	21.38

Source: The data for GDP per branches of activities have been taken from Statistical Yearbook of Federation of B&H of 1993-1998 for period of 1995-1996

Table 3 Share of energy sector for RS for period of 2000 - 2005:

Year	GDP- Structure in % for Electricity, gas and water supply	GDP- Structure in % for Mining and quarrying
2000	9.9	1.3
2001	10.0	0.8
2002	7.5	0.5
2003	8.8	1.7
2004	7.6	1.8
2005	7.6	2.4

Table 4 Share of energy sector for FB&H for period of 2000-2005:

Year	GDP- Structure in % for Electricity, gas and water supply	GDP-Structure in % for Mining
2000	6.04	2.28
2001	6.15	2.09
2002	5.23	2.26
2003	5.46	2.29
2004	n/a	n/a
2005	n/a	n/a

Source: For period of 2000-2005 only separate data per Entity (RS and FB&H) are available within the national accounts (SNA methodology) from Institute of Statistics of RS and FB&H.

- *Energy shares in export and import (absolute value and percentage of total) per type of energy (oil, gas, coal, electricity, other)*

Table 5 Share of energy sector in export in thousands of dinars for period 1970 –1982

Year	Total export in B&H	Electricity (Absolute value)	Share (%)	Coal and derivatives (Absolute value)	Share (%)	Oil and derivatives (Absolute value)	Share (%)
1970	3, 026, 391	-	-	102,189	3.37	28, 489	0.94
1972	3, 767,163	20, 798	0.55	42, 148	1.11	18, 715	0.49
1974	7, 841, 232	-	-	115, 127	1.46	54, 153	0.69
1976	11, 628, 911	39, 623	0.34	198, 492	1.7	739	0.006
1978	13, 003,875	54, 752	0.42	460, 568	3.54	7, 720	0.059
1980	52, 076, 087	254,767	0.48	827, 380	1.58	29, 826	0.057
1982	62, 713,170	-	-	1, 183, 775	1.88	58, 861	0.09

Note: According to parity 1 USD = 41.80 dinars for period 1980-1982

Table 6 Share of energy sector in import in thousands of dinars for period 1970 –1982

Year	Total import in B&H	Electricity (Absolute value)	Share (%)	Coal and derivatives (Absolute value)	Share (%)	Oil and derivatives (Absolute value)	Share (%)
1970	3, 755, 964	-	-	383, 622	10.21	343, 358	9.14
1972	4, 644, 440	-	-	620, 919	13.36	455, 962	9.81
1974	11, 236, 446	-	-	962, 640	8.56	2, 349, 727	20.91
1976	15, 705, 786	11, 735	0.07	2, 524, 342	16.07	2, 924, 787	18.62
1978	20, 011, 715	1, 368	0.006	2, 355, 403	11.77	3, 633, 215	18.15
1980	78, 469, 465	-	-	5, 888, 229	7.50	21, 748, 424	27.71
1982	76, 461, 661	575, 029	0.75	7, 232, 409	9.45	23, 306, 060	30.48

Source: The data for export and import per branches of activities have been taken from Statistical Yearbooks of SR B&H of 1975 and of 1979 and of 1983, for period 1970 - 1982

Table 7 Share of the energy sector in export in million of dinars for period 1983 –1985

Year	Total export in B&H	Electricity	Share (%)	Coal and derivatives	Share (%)	Oil and derivatives	Share (%)
1983	267, 444	-	-	3, 076	1.15	521	0.19
1984	279, 083	1, 022	0.36	2, 594	0.92	1, 254	0.45
1985	279 ,678	-	-	3, 130	1.119	3, 014	1.07

Note: 1 USD = 185.70 dinars

Table 8 Share of the energy sector in import in million of dinars for period 1983 –1985

Year	Total import in B&H	Electricity	Share (%)	Coal and derivatives	Share (%)	Oil and derivatives	Share (%)
1983	304, 578	2, 230	0.73	34, 521	11.33	90, 483	29.7
1984	311, 032	6, 449	2.07	31, 517	10.13	101, 690	32.69
1985	306, 169	4, 682	1.52	35, 411	11.56	81, 234	26.53

Source: The data for export and import per branches of activities have been taken from Statistical Yearbook of SR B&H of 1986, for period 1983 –1985.

Table 9 Share of the energy sector in export in thousands dinars for period 1988 –1991

Year	Total export in B&H	Electricity	Share (%)	Coal and derivatives	Share (%)	Oil and derivatives	Share (%)
1988	455, 463	-	-	4,559	1.00	2,389	0.52
1990	23, 271, 331	-	-	117,403	0.50	159, 502	0.68
1991	40, 093, 370	44, 194	0.11	46,000	0.115	189, 436	4.72

Note: current rate of exchange

Table 10 Share of the energy sector in import in thousands dinars for period 1988 – 1991

Year	Total import in B&H	Electricity	Share (%)	Coal and derivatives	Share (%)	Oil and derivatives	Share (%)
1988	378,410	1,265	0.33	47,115	12.45	67,663	17.88
1990	21,130,488	104,225	0.49	1,635,773	7.74	4,974,558	23.54
1991	32,371,081	324,258	1.00	1,177,416	3.63	3,323,896	10.26

Source: The data for export and import per branches of activities have been taken from Statistical Yearbook of SR B&H of 1992, for 1988 –1991.

The following data are only for Federation of B&H.

Table 11 Share of the energy sector in export in thousands dinars for period 1999- 2003 for FB&H

In

thousands of KM

Year	Total export in B&H	Electricity, gas, steam and hot water supply	Share (%)	Coal and peat mining	Share (%)	Petroleum and natural gas extraction	Share (%)
1999	950,213	44,274	4.65	4,891	0.51	31	0.003
2000	1,429,561	74,566	5.21	6,504	0.45	-	-
2001	1,644,576	77,554	4.71	10,326	0.62	56	0.003
2002	1,513,957	102,270	6.75	18,203	1.20	-	-
2003	1,720,185	81,254	4.72	22,647	1.31	-	-

Table 12 Share of the energy sector in import in thousands dinars for period 1999- 2003 for FB&H

In thousands of KM

Year	Total import in B&H	Electricity, gas, steam and hot water supply	Share (%)	Coal and peat mining	Share (%)	Petroleum and natural gas extraction	Share (%)
1999	4,458,976	23,125	0.51	3,292	0.07	36	8.07
2000	4,852,232	59,482	1.225	4,812	0.99	593	0.01
2001	5,382,633	44,431	0.82	6,716	0.12	85	0.001
2002	5,609,956	38,523	0.68	2,767	0.05	12	2.14
2003	5,705,517	57,624	1.01	12,429	0.217	4	7.01

Source: The data for export and import per branches of activities have been taken from from Statistical Yearbook of Federation B&H of 2004 for 1999-2003.

Data for energy share in export and import for period of 1999-2003 in RS are not available.

The status of consumption within the country enables also the export of part of generated electricity, which in 2002 was 1.1 TWh for the entire B&H. [11].

- *Number of jobs in the energy sector absolute value and percentage of the total)*

Table 13 Share of jobs in energy sector in total number of jobs in SRB&H for period of 1970-1980 in thousands

Year	Total number of employees B&H	Electricity	Share (%)	Coal and derivatives	Share (%)	Oil and derivatives	Share (%)
1970	511.4	6.3	1.23	24.5	4.79	1.5	0.29
1973	581.4	7.6	1.31	26.1	4.49	1.8	0.31
1975	668.4	9.2	1.37	24.7	3.69	1.9	0.28
1978	754.0	9.5	1.26	25.8	3.42	1.4	0.18
1980	820.8	11.3	1.38	25.9	3.15	1.3	0.16

Source: Number of employees per branches of activities in social sector according to Statistical Yearbook of SRB&H of 1979 and of 1986

Table 14 Share of jobs in energy sector in total number of jobs in SRB&H for period of 1983-1991 in thousands

	Total number of employees B&H	Electricity	Share (%)	Coal and derivatives	Share (%)	Oil, gas and derivatives	Share (%)
1983	926.0	13.5	1.46	28.9	3.12	1.4	0.15
1985	989.7	14.9	1.50	32.0	3.23	1.9	0.19
1988	1,061.2	16.9	1.59	30.4	2.86	1.4	0.13
1990	1,026.2	16.3	1.58	32.4	3.16	1.6	0.15
1991	945.9	16.1	1.70	29.9	3.16	1.5	0.16

Source: Number of employees per branches of activities in social sector according to Statistical Yearbook of SRB&H of 1992

Table 15 Share of jobs in energy sector in total number of jobs in Federation of B&H for period of

1999-2005 in thousands

	Total number of employees B&H	Electricity, gas, steam and hot water supply	Share (%)	Mining of coal and peat	Share (%)	Manufacturing of coke, petroleum products and nuclear fuel	Share (%)
1999	407,754	11,563	2.83	14,528	3.56	1,333	0.32
2000	410,808	11,237	2.73	14,500	3.53	1,283	0.31
2001	407,199	10,536	2.58	14,401	3.54	1,183	0.29
2002	394,132	10,098	2.56	13,781	3.49	1,124	0.28
2003	387,381	9,799	2.53	13,526	3.49	1,083	0.28

Source: Statistical Yearbook of FB&H for 2004

Data for energy sector for 2003 taken from Chamber of Commerce of Republic of Srpska is the following:

The total number of employees in energy sector is 10,039 or 4.27% comparing to total number of employees in RS, or 12.77% comparing to total number of employees in industrial sector.

- *Relative importance of the energy sector within the State budget*

Energy sector played an important role in the development of Bosnia and Herzegovina. Energy share in the industry production structure of Bosnia and Herzegovina during 1990 was over 15 %, and was officially lower only from the industry processing of metal. The total level of energy consumption in Bosnia and Herzegovina before the war (data from 1991) was 324×10^{15} J, i.e. about 73 GJ per inhabitant annually. That was more than the world average (about 69 GJ per inhabitant annually). In developing countries, the level of energy consumption was 25.6 GJ per inhabitant annually.

Coal, including the coal for coke production insured the largest share of primary energy in Bosnia and Herzegovina in 1991. Coal was provided 59 % of primary energy. Share of the liquid fuels was 26 %. Hydroenergy, the only one ecologically acceptable source of energy in Bosnia and Herzegovina participated with 7% in providing the primary energy. In the world, in 2000, 10.41 GJ of energy in average was used for the insurance of 1,000 US\$ of GDP. In the same year, the developing countries used 22.57 GJ for 1,000 US\$ and in Bosnia and Herzegovina for the same amount of GDP, the energy of 30.1 GJ was consumed.

In Bosnia and Herzegovina, the final energy consumption was far below average level of consumption in the world. This data shows the energy unfavorable economy structure, but also the inefficient and irrational production and consumption of energy. The ratio of total consumption of final energy and total consumption of primary energy was 0.35 in 1991 in Bosnia and Herzegovina, while in the world it was 0.70.

In Bosnia and Herzegovina as well as in other countries having the planning economy, the energy had systematically lower price comparing to the prices in other parts of the world. [6]

- *Fiscal revenue linked to energy taxation (percentage and total fiscal revenue)*

Data on percentage of energy taxation to the total fiscal revenue are not available. Fiscal planning and management is difficult due to decentralized government structure: 94% of total budget consumption goes to entity and lower levels, while in Federation of B&H 55% of budget consumption goes to Cantonal and municipality levels, and in RS 22% of the consumption goes to the municipality level. Entity governments adopted mid-term framework of expenditures for period 2004 - 2006. The Program of Fiscal Reform in BiH in total is basically consistent with the mid-term framework of expenditures of each of Entity.

From the document Strategy of industrial policy of REPUBLIC of SRPSKA issued by Ministry of industry and technology of RS in Banja Luka, in September 2000, we can find out the following:

The stable fiscal system and the budget balance have positively influenced the industry development in Republic of Srpska. Entities have the source revenue (taxes, fees, custom duties and excise) and take over also the obligations on basis of public revenues. However, the filling out of budget does not satisfy the needs of budget users. Also, many economy stakeholders for current activities ask for assistance from the budget. The stability of fiscal policy and balance of tax basis will contribute to the faster development of industry in entire B&H. In that sense, the introduction of VAT can positively influence the situation (the way that tax has been calculated in the most of European countries).

For example, total public expenditures in Federation of B&H in 2005 was 1,031.9 millions of KM (BAM).

Only 4.4% of budget expenditures relate to incentives for agriculture, industry, mining and veterinary, what is somewhat more then in 2000.

With the aim to creating a model of future cooperation with the EU in the field of fiscal policy in B&H, the economy fiscal programs for B&H should be prepared in 2006.

- *Share of the total investment in the country, and of the total industrial investment*

Table 16 Share of energy sector in total investment according to the nature of construction technical structure and purpose in million dinars

	Total investments in B&H	Investment in industry and mining	Investment in energy sector	Share in total investment in the country	Share in industry investment
1970	6, 312	2, 528	770	12.19	30.45
1978	44, 179	22, 088	8, 903	20.15	40.30
1984	190, 782	105, 360	38, 093	19.96	36.15

Source: Statistical Yearbook of SR B&H for 1985

Table 17 Share of energy sector in total investment in 1990 according to the nature of construction technical structure and purpose in thousands of dinars :

	Total investments in B&H	Investment in industry and mining	Investment in energy sector	Share in total investment in the country	Share in industry investment
1990	14, 562, 845	5, 173, 353	2, 090, 697	14.35	40.41

Source: Statistical Yearbook of SR B&H for 1992

There are no statistical data for the investments in postwar period. There are only data of given international donations and credits for the reconstruction of energy sector.

The main objective of the Electric power reconstruction project «Power III» for B&H is continuation of the Program of postwar reconstruction of energy sector of B&H, enabling of continuously supply of electricity with lower prices, reducing negative impacts on environment, as well as whole reform of the power sector.

Led by the World Bank, Power III involves total financing of about US\$ 234 million and includes contributions from the World Bank, the EBRD, the European Investment Bank, the European Commission, and bilateral donor countries including the US, Switzerland, Norway, Spain, the UK and Italy. Power III is project that is also known under the name of Third Electric Power Reconstruction Project, which is being implemented under the Stability Pact's "Quick Start" programme.

Electric Power Reconstruction Project of EBRD has aim of Supply and installation of a SCADA/EMS system for the electricity transmission network in the Federation of Bosnia and Herzegovina and Republika Srpska. Following the signing of this loan in November 2000, a further loan of €20 million for environmental investments at four thermal power plants (Tuzla, Kakanj, Gacko and Ugljevik) is being considered. The project will re-establish Bosnia and Herzegovina's interconnection with the Union for the Coordination of Transmission in Europe (UCTE), thereby increasing and facilitating power trade in the region. It will also help reduce environmental pollution in the region through investments in four power plants.

Currently, the realization of all components of Project III is intensively ongoing within the RS and Elektroprivreda RS. Total estimate value of Project III for all three Elektroprivredas (electricity management companies) in B&H is 231 million of US\$, out of what more than 1/3 is for Elektroprivreda of RS.

EBRD has provided a €50 million sovereign loan to improve and integrate the country's electricity network. The loan is a continuation of the EBRD's Emergency Power System Rehabilitation Project, which supplied essential power to the country's big cities, as well as small and remote villages, following the end of the war. It is also part of the Power III.

Power Distribution Reconstruction Project of EBRD is aiming at modernising the electricity distribution systems of three regional utilities in Bosnia & Herzegovina, enabling the three local power utilities (or "Elektroprivredas") to improve the reliability of electricity supply and to increase energy efficiency by minimising losses of electricity. The Borrower, the State of BiH will on-lend to the three Elektroprivredas that will implement the project on their own territories. Bank's funding will be used for the supply and installation of new metering equipment, protective cables and for the rehabilitation of substations [7].

In RS, in the period of postwar reconstruction and reconstruction of power structures, the implementation of donations and credits for restoration and reconstruction of power energy structures including the end of 2002 was 174,136,395 KM in total, out of what 32,511,443 were credit funds, and the rest are the funds from different donators in the amount of 141,624,952 KM [8].

- *Infrastructures: number of refineries, of power stations, length of the electricity network...*

Coalmines and Power stations: There is only exploitation of brown coal and lignite. In Tuzla basin (Kreka, Banovići and Đurđevik), Central Bosnia basin (Kakanj, Zenica and Breza), and Ugljevik and Gatački basin, more than 80% of coal has been produced in B&H, on which basis the large thermo power systems have been constructed. Presently, there are approximately 30 coalmines in operation. Thermal power plants have been built in the direct or close proximity to those areas in Gacko, Ugljevik, Tuzla and Kakanj. The mines are dependent on power plants as the only consumers of coal. In return, the power plants supply the coalmines with electricity.

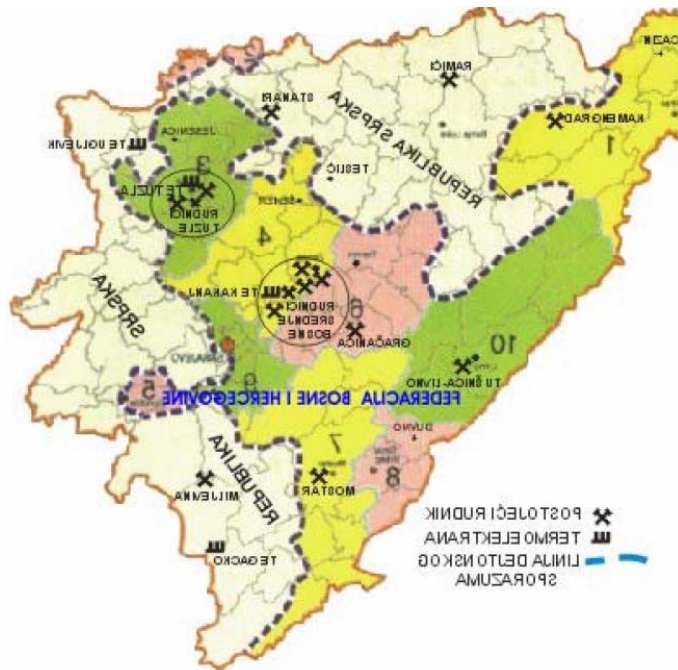


Figure 1 The mines and thermopower plants in B&H

Today, in B&H there are three separated vertically organized companies that are in charge for production, transmission and distribution of electricity.

- Elektroprivreda B&H with head office in Sarajevo (EPB&H)
- Elektroprivreda of Croatian Community of Herceg Bosna with head office in Mostar (EPCCHB)
- Elektroprivreda of Republic of Srpska with head office in Trebinje (EPRS)

Besides, there are also newly established state level Transmission Company Transco in Banja Luka, then newly established Independent System Operator (ISO) and also State Regulatory Power Commission (SRPC) in Tuzla. The production capacities per companies in B&H are the following: [4]

Table 18 The electricity production capacities per companies in B&H

	EPB&H	EPCCHB	EPRS	TOTAL
Total capacity in MW	1,849 or 47% of B&H total	762 or 19% of B&H total	1,346 or 34% of B&H total	3,957
HPP (without small HPP)	492 or 26%	762 or 100%	746 or 55%	2,000 or 51%
TPP	1,357 or 74%	0 or 0%	600 or 45%	1,957 or 49%

Source: Plan for construction of new power production capacities in FB&H

Length of electricity network: The B&H high-voltage system consists of 992km of 400kV transmission line, 1,691km of 220kV transmission line, and 3,680km of 110kV transmission line. Total transforming capacity in 134 high-voltage substations is 12,013 MVA. [7].

System of gas supply: The main features of the gas system in BiH are: length of 191 km and the projected annual capacities of 1 billion m³. The existing leased transport capacities to BiH

are 750 million m³/year, and the takeover pressure of incoming natural gas from receiving-distribution gas station in Zvornik is 26 bars.



Figure 2 The gas supply system in B&H

Rafineries: The first basic capacity is Petroleum refinery in Bosanski - Srpski Brod, which processes the import raw petroleum into the derivatives – engine fuels, LPG and numerous other products, especially for needs of civil engineering and road construction. Capacity of Petroleum refinery is approx. 3 millions of tons per year. The second capacity is Refinery of engine oils and lubricants in Modriča, which is technological continuation of processing and refinement of products from Petroleum Refinery in Brod. Installed capacity of Oil refinery in Modriča is 80, 000 tons of engine oil and 50, 000 tons of lubricants [9].

National energy resources and potential saving

Fossil energy resources:

Coal

It has been estimated that total coal reserves in Bosnia and Herzegovina are:

- a) Brown coal 1,886 millions of tons
- b) Lignite 3,578 millions of tons

What gives total of 5,464 millions of tons. [4].

Oil and gas

Preliminary research surveys of oil and gas, which were interrupted by the war, had indicated the presence of promising deposits on a number of sites in certain areas of BiH. Information about this research is not publicly available (although the off-balance sheet reserves are estimated at about 50 million tons of oil, and less than 10 percent of potential deposits has been surveyed) and it is not known what the future plans are regarding exploration of oil deposits. Depending on the results of the preliminary research, these should continue, but, for now, liquid fuels and natural gas need to be imported [3].

Potentials of renewable energies

Potential for exploitation of geo-thermal energy, wind energy, solar energy and bio-mass energy have not been sufficiently explored, but the share of these energy sources in the overall consumption will certainly remain modest, as is the case in the world, where it is projected that in 2020 the share of all renewable sources (including hydro-power, which holds the most significant share) will amount to about 7,7 percent. However, the increased use of renewable sources of energy in the world is significant and their potential and feasibility of their use is going to be analyzed in B&H within the document of national strategy which is being drafted within EU CARDS program called “Technical assistance for strengthening of energy sector within Ministra of Foereign Trade and Economic Relations of B&H”.

Further in text the data can be found that are available in this moment at the level of B&H from the available sources. [5]

Wind potential

Due to insufficient measurements it is impossible to estimate the energy potential of wind in B&H in this moment. In a preliminary study carried out on behalf of the GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) from Germany it was established that there is an economic potential of approx. 600 MW that could be developed by 2010, on the assumption that an appropriate incentive system to build wind power installation is set up. There are promising wind values shown by measurements taken before the war for the region of Trebinje through Mostar to Bugojno, and more up-to-date measurements in Kupres and Podveležje, with average speed of 10 m/s.

Solar energy

The annual average of daily-allocated Sun energy on horizontal surface of B&H is 3.4-4.4 kWh/m². At 1 m² of horizontal surface, the Sun radiates to about 1,240 kWh/year of energy in the north of B&H and about 1,600 kWh/year in the south of B&H. Theoretical potential of solar energy in territory of B&H is 74.65 PWh per year and technical potential is 685 PJ. [5]

Hydroenergy

Economic hydro energy potential of large watercourses in B&H according to Study "Current knowledges of hydro energy potential of SRB&H" done by Institute of energy management Sarajevo in 1986, is approx. 18,600 GWh/year. Total usage of that potential is about 40% or 7,182 GWh/year.

However, a large part of this hydro energy potential is permanently lost due to spatial, ecological and economic limitations, which were result of the past period.

Besides hydro energy potential of large watercourses, B&H also abounds with hydro energy potential of smaller watercourses on which large number of small hydro power plants could be built. It has been estimated that such potential is 12% of total hydro energy potential of large watercourses [4].

The latest report of EBRD [2] states that theoretical hydro potential in B&H is 99,256 GWh/year and technical hydro potential is 23,395 GWh/year out of what 2,599 GWh/year is in small HPP.

Biomass

There is considerable potential for the use of biomass for energy generation in the forestry sector (roughly 50% of the land area of B&H is wooded) and in the agriculture. According to a study conducted by INNotech HT GmbH, Berlin, Germany in 2003 on behalf of the GTZ, there is an unexploited potential of approx. 1 million m³/a of residual wood, wood waste etc. which could be used to provide heat to 130,000 residences or 300,000 inhabitants.

There is ongoing project within FP6 program of EU where Mechanical Faculty of Sarajevo participates (together with partners from Greece, Germany, Portugal, Croatia and Serbia), within which the potential of biomass would be estimated.

Geothermal energy

Hydrothermal deposits of low enthalpy were located in 9 hydrothermal regions in B&H. Utilization and usage is about 5% [5].

According to some studies geothermal potential is 33 MW_{th}. It must be said though, that the temperature at three known locations in Bosanski Šamac (85°C), Kakanj (54°C) and Sarajevo (58°C) is too low for electricity generation, which is why the reserves are currently only under the consideration for thermal exploitation. [10].

Estimate of the potential energy saving

According to the estimates for 2000, the households and the commercial sector in BiH accounted for 50 percent, the industry for 25 percent and the transport for 25 percent of the total energy consumption. Therefore, the share of households and the commercial sector in the consumption of energy is the highest. The energy consumed by the households and the commercial sector is used (predominantly) for heating (water heating and treatment, cooking, illumination and electrical appliances and equipment.

The reduced energy consumption in this segment can be partly achieved by introduction of district heating. Most of the current systems do not achieve the satisfactory effects, partly due to inadequate maintenance, and partly because there are no instruments for measuring individual heat consumption of consumers. The possibilities of combined production of heat and electric power, an option that is convenient for larger buildings or groups of buildings, are also underutilized. Because of its efficiency, the district heating saves fuel, and also contributes to reduced emission of CO₂. The district heating systems can be used in hospitals, hotels, recreational and trade centers, and other larger public facilities, particularly those where the natural gas can be used as a fuel.

In addition, taking into account that the largest share of energy is used for heating, and that the relative consumption of energy for heating in BiH is much higher than in the EU countries (according to the assessments made in the EU countries, at least one fifth of the energy consumed in households and commercial sectors is "easily savable"), and, obviously, there is a lot of room to reduce the energy consumption in this area. The methodology for designing energy performance indicators in buildings, used in Bosnia and Herzegovina, is mostly outdated and the revision of methodology would assist in both achieving energy savings in the buildings and reducing the investments for energy infrastructure in newly constructed buildings. This could also have an important role in the reconstruction, i.e. restoration of buildings.

In the transport sector, significant changes need to be made with respect to energy demand, especially taking into account that the primary source of energy used is imported oil, i.e. petroleum products. For this reason, ways to increase the share of rail transport relative to road transport, which would allow for a greater use of domestic energy sources, should be considered.

The possibilities for energy savings in the industry sector are also considerable. Most industries treat energy as tangible cost and include the energy cost in the final price of the product, which does not promote energy savings. The cost of energy should be registered separately, compared with the energy costs in the same activities in the developed economies, and measures should be taken to rationalize the consumption. Subsidies could present an effective solution for such measures. Generally, the awareness about the savings that could be achieved with the increased energy consumption efficiency should be raised. Energy savings require investments, but these investments pay off quickly [3].

The existing legislation and tax policy do not stimulate the energy saving (e.g. more rational construction of heating and cooling systems, greater use of construction insulation materials etc.).

Institutional specificities and energy policies

On the state level there is no Ministry for energy but the necessity to have some competence on the state level regarding energy sector was recognized and now Ministry of Foreign Trade and International Relations is responsible for energy at the state level. Special energy department is in establishing phase in the scope of this Ministry. Ministry of Foreign Trade and Economic Relations is responsible for policy formulation and for the international policy of Bosnia and Herzegovina in the energy sector. The Department for Energy within this Ministry is responsible for preparation of national energy strategy and policy. The role of this sector is to maintain contacts with all energy stakeholders in the country, including also the international community.

Also, this department has a role of coordinator between Entity ministries responsible for energy and State Government and between international donors and institutions giving loans and its Consultants working in B&H.

In Federation of BiH Ministry of Energy, Mining and Industry is responsible for energy. All ten cantons have some ministries responsible for energy.

In Republic of Srpska Ministry of Energy and Mining is responsible for energy in the Republic of Srpska.

The Law on Electric Power Transmission, System Regulator and Operator of B&H (Of. Gazette of B&H, No.7/02, 13/03) entered into force on 18 April 2002 and represents the first step in realization of aims of energy sector reform. The idea of this Law is to make conditions for unlimited and free trade and continuously supply of electricity according to defined standard for quality. The intention of this Law and also Entity Laws on Electricity (Law on electricity in FB&H – Of. Gazette of FB&H 41/02,24/05,38/05,as well as Law on Electricity of RS- Of. Gazette of RS 66/02, 29/03, 86/03,111/04 and law on Electricity of Brčko District-Of. Gazette

of BD, No.36/04) is to enable and speed the establishment of electricity market in B&H, integration into the regional market, introduction of the competition and strengthening the buyer protection.

The Law on Electric Power Transmission, System Regulator and Operator specifies the institutions of Bosnia and Herzegovina in charge of electricity transmission:

- **State Electricity Regulatory Commission** (Državna regulatorna komisija za električnu energiju - DERK), has jurisdiction over and is responsible for power transmission, transmission system operations and international trading in electric power. DERK is to be an independent and non-profit institution, which will operate on the basis of principles of objectivity, transparency and equality.
- **Independent System Operator** -ISO (Neovisni operator sistema - NOS), is responsible for the management of the transmission network operating and dispatching in Bosnia and Herzegovina and for the governing, maintenance planning and coordination, network construction and expansion in cooperation with the elektroprivredas. NOS will be a non-profit agency, independent from any individual the market participant and from electricity production, distribution and supply activities. ISO shall not venture into trading with electricity, keeping its independence and authority, and the owners of the Electricity Transmission Company will devolve all relevant responsibilities for the management of the system to ISO. ISO will operate in line with objectivity, transparency and equality principles and will have full authority to coordinate the electric power transmission system.
- **Single Power Transmission Company** is responsible for the transmission, maintenance, construction, expansions and the management of the electricity transmission network. With the new Law on establishment of Power Transmission Company in B&H (Of. gazette B&H No. 35/04) the conditions were created from 1 February 2006 for the entire asset of high-voltage transmission power network to be transferred to the single newly established Power Transmission Company (Transco) with the head office in Banja Luka. However, the production and distribution stayed in the competency of electric power enterprises described below.

Electric Power has been produced in B&H in hydro and thermo power plants.

In BiH, there are at present three vertically integrated electricity monopolies in charge of the generation, transmission and distribution:

- Elektroprivreda BiH (Electric Power Enterprise) of Bosnia and Herzegovina (EPBiH);
- Elektroprivreda (Electric Power Enterprise) of the Croatian Community Herzeg-Bosnia (EPHZHB); and
- Elektroprivreda (Electric Power Enterprise) of the Republika Srpska (EPRS).

For the market to become functional gradually and for the competition to be introduced, electric power suppliers' freedom of choice will be limited to qualified consumers and independent electric power traders, who will be able to purchase power directly from production or trading companies. There will be three categories of qualified consumers:

- **Qualified Consumers (QC):** In the beginning, this category will include major industrial consumers, who will have a right to a free selection of their power supplier. While the qualified consumers purchase power directly from the producers, the role of transmission and distribution will include only the delivery of the purchased power;
- **Regional Electricity Traders (RET):** RETs are fully separate trading operations of the distribution companies, empowered to purchase power from anyone. A RET will be able to purchase power from the production company or to contract a delivery from another RET or from independent traders.
- **Independent Retail Traders** will be companies with the exclusive function of buying and selling electric power to the qualified consumers and other power traders.

Coal sector

The coal sector comprises 15 separate organizational units, many of which manage several separate mines. There are not either forms of horizontal or vertical integration between the mines, or any shared infrastructure, market or any other links.

In BiH there are two types of mines:

- Mines supplying coal for thermal power plants

- Mines working for the general market (market competition).

In both entities, the competences for the mines lie with the line ministries

- the FBiH Ministry of Energy, Mining and Industry and
- RS Ministry of Economy, Energy and Development.

The Federation of B&H and Republika Srpska own the coalmines. In Republika Srpska, the mines are embedded in the power plant operation while in the Federation they are separate companies yet closely operating with the power plants.

Natural Gas sector

All natural gas is imported from the Russian Federation and is transported to BiH via the gas transport systems in Ukraine, Hungary and Serbia and Montenegro.

The legal and institutional framework in this sector is still non-existent, which prevents any foreign investment and any development of gas sector.

Just like the entire energy complex in the post-war BiH, the gas sector is also in the competence of the entities and this structure is at the root of all problems in the sector. It could be said that, out of the three predominant segments of the energy sector (electric power, liquid fuels and gas), the gas sector is the least developed. The existing gas sector of BiH comprises four companies, two in each entity:

In RS:

- **Gaspromet Pale** (manages the transmission line Karakaj - Zvornik - approximately 20 km)
- **Sarajevogas Lukavica** (transmission line Zvornik - Kladanj and distribution in the municipality of Srpsko Sarajevo)

In FBiH:

- **BH Gas - Sarajevo** (transmission lines Kladanj - Sarajevo - Zenica, the biggest post-conflict supplier and gas wholesaler in Bosnia and Herzegovina)
- **Sarajevogas - Sarajevo** (gas distribution in Sarajevo)

Although it no longer formally conducts the transport and distribution of gas, the **Energoinvest Sarajevo** needs to be added to the above list of entities (until the outbreak of the war, Energoinvest Sarajevo managed the entire gas system in BiH and was the exclusive gas supplier for the territory of BiH). Because of outstanding debts from the period before and during the war, and the obligations under long-term contracts with Russian suppliers, this company continues to be a major player on the complicated BiH gas market.

The international processes where B&H is actively participating, first of all the process of establishment of Energy Community of South East Europe, will have great impact on the gas sector organization as well as on the development of gas infrastructure in B&H.

Oil sector

In the existing BiH economic structure, the oil industry sector encompasses imports and refining of imported crude oil and production of petroleum products.

The BiH oil sector developed production and transport capacities.

The production segment comprises production organized in two refineries within the "NIRS" (Naftna industrija RS – RS Oil Industry) Company. The first, basic capacity is the oil refinery in Bosanski - Srpski Brod, where imported crude oil is refined into various products - motor fuels, liquid petroleum gas and a range of others, especially those for the needs of construction and road construction. The second of these capacities is the Refinery of Motor Oils and Lubricants in Modriča, which is essentially the next technological stage in the processing and refining of the Brod refinery products. This refinery produces high-quality motor oils, as well as various special purpose technical oils for the industry and for other industrial and commercial purposes, paraffin and various motor and other lubricants for industry, and especially transport, as well as for households.

The installed production capacities are used at the level of around 25 percent of the pre-war production. **The commercial sphere** in Bosnia and Herzegovina comprises the oil products distribution capacities, especially for motor fuels, oils and lubricants. In both entities, there are two major state-owned distributors, but small private distributors cover the greatest share of the market.

After the war, the oil sector legislation was passed neither at entity nor at BiH levels. The Yugoslav regulations dating back to the 1980s on transport and management of fuels, gas and inflammable substances, as well as the applicable rule books on storage and transfer of highly inflammable substances are still in force. In regulating the rights of the production in the oil industry and in performing other related activities, the entity ministries of energy and their inspectorates have the main role.

Recent evolution in energy strategy

B&H signed the Treaty on establishment of Energy Community of South East Europe on 25 October 2005 in Athens, Greece. Treaty already should have been entered into force in June 2006 after the ratification process by 6 signatory countries. After the ratification process which is soon expected, B&H will be obliged to, inter alia, implement Acquis Communautaire of EU on energy, environment, competition and renewables.

BiH is a member of the Energy Charter Conference and signatory of the Energy Charter Treaty (ECT) and the Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA), which was signed in London in December 1994 along with the Treaty. B&H participated in the Review of the Energy Charter Process, which was concluded in December 2004, and its implementation thereafter.

As already mentioned above regarding the preparation of national energy strategy, there is ongoing the EC CARDS Project "Technical assistance for strengthening of energy sector within Ministry of Foreign Trade and Economic Relations of B&H" which started 6 February 2006 and is planned to be finished on 5 February 2008.

Within the document of National energy Strategy that will be prepared within this project, also the strategies for each energy subsector will be prepared separately (coal mining, petroleum, natural gas, electric power sector, district heating sector, renewable energy sector and energy efficiency and energy conservation issue).

Parallely with this project, there is also ongoing the preparation of detailed energy study analysis in B&H by World Bank as assistance to B&H according to the plans of the signed Treaty on energy community of SEE countries which results will help in preparation of the national strategy. The preparation of the study started 1 July 2006, and foreseen completion is 30 June 2007.

1.2 Energy Supply, Demand and Production: evolution and structure

Electricity access

Production of the electricity in **1990 in B&H** was 12,613 GWh. **The consumption was 11,535 GWh.** The system was consisted of 13 hydro power plants with total capacity of 2,034 MW and annual production of about 5,500 GWh per year and of 4 thermo power plants with total of 15 blocks with the capacity of 1,957 MW and with production of 9,678 GWh in 1990. All power energy system capacities were part of one company Elektroprivreda B&H which also was operating with the system.

The restoration of the power energy system after the war enables the achievement of the total production in B&H in 2003 of 11,257 GWh per year (89% from the 1990 level), and **the consumption in 2003 was 10,407 GWh** (90% compared to 1990).[3]

The drop is attributed mainly to the sharp decline in industrial output and in general economic activity.

Data on electricity access of the population in rural areas are not available for period of 1990.

Objective of indicator: halving the proportion of the populations with no access to electricity in the concerned rural areas up to 2015 (comparing to 1990).

In 1999, the three statistical organizations in B&H (State Agency for Statistics for B&H, the RS Institute of Statistics-RSIS, and the FB&H Institute of Statistics-FIS) began work on the design of a Living Standards Measurement Study Survey (LSMS) to collect data needed for assessing the living standards of the population and for providing the key indicators needed for social and

economic policy formulation. The LSMS survey collected data from households and individuals concerning their overall welfare levels, including their access to electricity.

Therefore, the 2001 Bosnia and Herzegovina Living Standards Measurement Study (LSMS) survey provides individual level and household level socio-economic data from 5,402 households drawn from urban and rural areas in the two entities of Bosnia and Herzegovina, the Federation of Bosnia and Herzegovina and the Republic of Srpska.

A probability sample of 5,400 households was selected and interviewed throughout the country: 2,400 in the RS and 3000 in the FB&H. The resulting data are representative at the state and entity level as well as by type of municipality: urban, rural, semi urban. To ensure the highest quality data, direct informants were used.

Table 19 1999 data for the purpose of Indicator ENE_C10

Indicator	Source	National level Rural areas (households)	National level Rural areas (population)
Share of the population with no access to electrification	LSMS Survey Module 2- done by three statistical organizations in B&H	0,65 %	0,47 %

Evolution and structure of the energy demand

- Coal

The authors of various studies offered different projections of the potential demand for coal in BiH by 2015. These projections range from 5 to 8.6 million tons for the FBiH, and from 3.2 to 4 million tons for the RS, i.e. from 8.2 to 12.6 million tons for BiH. The coal demand of four thermal power plants is satisfied from the mines in their immediate vicinity. The thermal plants Kakanj and Tuzla are supplied by railway, trucks and transporters from several mines, and the thermal plants Gacko and Ugljevik are supplied by continuous conveyor, so that, besides economic links, there are also physical links between the mines and the thermal power plants. In all other mines, the production plan is based on the coal demand of the traditional long-term consumers, with individual market offer and creation of competition in the market. [3]

- Natural gas

With respect to the long-term projected gas needs, previous studies (as early as 1999, the World Bank financed the preparation of two studies on the reform and the development of the gas sector in BiH: Study on Natural Gas Sector Reconstruction (NERA) and Study on Natural Gas Sector Development (RAMBOLL) analysed three different scenarios (high, low and basic) by comparing economic indicators with other countries and conducting separate analysis across all consumption sectors. The demand projections for all three scenarios are similar for both methods, and amount to 3 billion m³ for the high scenario, 2 billion m³ for the basic scenario and around 1.5 billion m³ for the low scenario, until 2020. In the case of low growth scenario, the energy policy would be based on the use of national energy sources, with partial use of gas where the domestic energy sources are thought non-competitive or technologically inappropriate. From the aspect of this study, this is what makes this particular scenario realistic and conceptually acceptable.

- Oil

The demand for motor fuels on the domestic market in the present conditions is approximately 1.5 million tons annually. The oil refinery delivers around 500,000 tons to the market, and the rest is imported. Considering that the number of private petrol stations is on the increase and has reached approximately 300 stations, objective estimates suggest that the commercial capacities in BiH market are already oversized. The present state on the BiH oil products market suggests not only inadequate usage of own production capacities, and large imports of such products, but also the problems of the frequent imports of cheap low-quality products,

especially motor fuels. This situation needs to be urgently addressed and the relations on the market improved.

- Non commercial energy demand data

During the war, there was a chaotic forest situation. Local experts evaluated the cutting and production range in forest industry in this period about 10 - 20% out of total prewar planned production.

Table 20 Cutting and processing of forest products in Bosnia and Herzegovina in 1990

	m ³	%
Total	4,310,000	100.0
Industrial wood	3,167,000	73.5
Technological wood	265,000	6.1
Fuelwood	878,000	20.4

Source: GTZ Study for forestry sector in B&H

During the war, wood was primarily used for heating as fuelwood. And also after the war such use is significant, but presents the great danger due to large number of mines. Additionally, the illegal cutting of wood has been reported as well as related sale and uncontrolled export of wood of good quality abroad, because of what the supply of wood for private plants in Bosnia and Herzegovina has been difficult and opportunities for usage of value transferred abroad. Although the forest and wood industry are not in State jurisdiction, the actual legislation does not permit the log export [13]. It was possible to find statistics data only for the below given period.

Table 21 Fuelwood consumption in industry in stacked cubic meter

	1970	1972	1974
Fuelwood	8,586	173,908	84,007

Source: Statistical Yearbook of SRB&H of 1975 and

- Demand for electricity

Before the war, the power sector organization in Bosnia and Herzegovina was related to only one company and that is Elektroprivreda B&H.

Table 22 Total demand for the period 1990-2005 of Elektroprivreda BiH

Year	Total demand of Elektroprivreda B&H in GWh	Total demand of Elektroprivreda B&H in TWh
1990	7,490	7.49
1991	7,466	7.47
1992	3,264	3.26
1993	1,235	1.23
1994	1,552	1.55
1995	1,788	1.79
1996	2,831	2.83
1997	4,299	4.30
1998	5,222	5.22
1999	5,258	5.26
2000	6,069	6.07
2001	5,427	5.43
2002	5,919	5.92
2003	5,701	5.70
2004	6,618	6.62
2005	6,237	6.24

Source: Elektroprivreda B&H

Today we have two more electricity companies in the territory of Bosnia and Herzegovina and those are:

-Elektroprivreda (Electric Power Enterprise) of the Croatian Community Herzeg-Bosnia (EPHZHB)

Electricity demand data of EPHZHB is not available.

and

-Elektroprivreda (Electric Power Enterprise) of the Republika Srpska (ERS), established on 2nd of June

1992, for production, transmission and distribution of electricity and coal, as well as for the management

for the electric power system in Republika Srpska.

Elektroprivreda of Republika Srpska gives the information that the production of electricity currently satisfies the demand in Republic of Srpska, and part of the electricity has been exported.

- The final relative consumption percentage per sector in GWh

Table 23 Final relative electricity consumption per sector in GWh

	1971	1975	1981	1985	1986	1987	1988	1989	1990	1991
Industry and mining	2,332	2,929	5,062	6,927	7,286	7,203	6,928	7,523	6,657	6,314
Households	740	1,357	2,239	2,570	2,743	2,950	2,897	2,980	3,187	3,120
Electrical and rail traction	-	108	145	163	171	177	195	189	170	179
Trams	14	-	19	28	29	31	32	32	37	39

Source: Statistical Yearbook for 1993-1998, Federal Institute for Statistics

Table 24 Final relative electricity consumption percentage per sector

	1971	1975	1981	1985	1986	1987	1988	1989	1990	1991
Industry and mining	68.9	61.7	62.0	66.2	66.6	61.8	55.7	62.3	53.0	49.3
Households	21.9	28.6	27.4	24.6	25.1	25.3	23.3	24.7	25.3	24.4
Electrical and rail traction	-	2.3	1.8	1.6	1.6	1.5	1.6	1.6	1.3	1.4
Trams	0.4	-	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.3

Source: Statistical Yearbook for 1993-1998, Federal Institute for Statistics

Table 25 Consumption of coal in industry in SR B&H in thousands of tons

Year	Brown coal	Lignite	Stonecoal	Coke	Anthracite
1970	2,086	1,904	1,720	793	8
1972	1,967	2,772	1,706	792	42
1974	2,317	3,704	1,744	720	67
1978	435	238	-	27	17
1982	875	491	-	36	0.439
1991	119	49	-	30	-

Source: Statistical Yearbook of SRB&H for 1975, 1983 and 1992

Table 26 Consumption of oil derivatives for industry purpose in SRB&H

Year	Liquid fuels in tons	Fuel oil in thousands of tons
1970	29,584	180
1972	32,030	301
1974	44,175	361
1978	72,426	520
1982	242,217	411
1991	138,020	174

Source: Statistical Yearbook of 1975, 1983 and 1992

The estimated consumption of crude oil and products in B&H in 2005 is about 25,000 barrels per day.

Table 27 Consumption of gas for industry purpose in SRB&H

Year	Natural gas in m ³	Liquid gas in tons
1970	-	-
1972	-	-
1974	-	-
1978	80,000	58,226
1982	255,777,000	34,272
1991	287,587,000	36,933

Source: Statistical Yearbook of 1979, 1983 and 1992

The overall gas consumption in B&H ranged on the level of approx. 400 millions of m³ in 1979 ÷ 1984, and the peak consumption was in 1990, when it was 610 millions of m³. In the period 1992 - 1999 the natural gas consumption has been reduced. In the last few years the natural gas consumption has been gradually increasing, primarily thanks to the increasing of the consumption in industrial sector, as well as extension of the distribution network.

Table 28 Energy consumption per inhabitant on Level of Bosnia and Herzegovina

	Annual energy consumption per inhabitant	Total primary energy supply	Population
Units	Mtoe/inhabitant	Mtoe	million
1996	0,550	1,72	3,13
1998	0,517	1,95	3,77
1999	0,518	2,01	3,88

Sources: **International Energy Agency**

Postwar consumption of gas for B&H is at level of up to 200 millions m³. There is no data for consumption of gas per sector.

According to data of Chamber of Commerce of B&H, from 1997 to 2001, the average consumption of oil derivates in B&H ranges about 1.2 millions of tons /year.

The main consumers of the final forms of energy are households and the commercial sector (often considered as one consumer category), the industry and the transport sector. The share of individual consumer groups varies depending on a number of factors, climate being one of the most important.

According to the estimates for 2000, the households and the commercial sector in BiH accounted for 50 percent, the industry for 25 percent and the transport for 25 percent of the total energy consumption. Therefore, the share of households and the commercial sector in the consumption of energy is the highest. The energy consumed by the households and the commercial sector is used (predominantly) for heating (water heating and treatment, cooking, illumination and electrical appliances and equipment.

Evolution and structure of production

- Primary energy production per source

The basic identified sources of primary energy in B&H are coal and hydropower.

The coal, including coal for coking insured the greatest share of primary energy in Bosnia and Herzegovina in 1991. The coal insured 59% of primary energy, the liquid fuels share was 26% and hydroenergy participated 7% in insurance of primary energy.

Coal

In 1990, the production in the mines in FB&H totalled approximately 12 million tons of coal, with approximately 27,000 workers. Two-thirds of the coal was produced in strip mines and one-third in subsurface mines. In the mines on the territory of the RS, the production in the same year was approximately 4 million tons of coal, and with over 95 percent of the coal produced in strip mines. In the post-war period (2001), the annual production of coal in FB&H was 5.5 million tons, and 3.3 million tons in RS. [3]

There is more data available from other sources [9].

Table 29 Coal production in B&H in thousands of tons

Year	Brown coal	Lignite	Total
1972	5,741	5,250	10,991
1978	6,433	5,613	12,046
1980	7,221	6,104	13,324
1981	8,099	5,781	13,880
1982	8,117	6,277	14,394
1985	9,820	7,989	17,809
1987	9,476	8,892	18,368
1989	9,615	8,359	17,974
1991	6,663	7,450	14,113
1992	2,402	1,628	4,030
1993	763	607	1,370
1994	925	676	1,601
1995	1,112	663	1,775

Source: Statistical Yearbook of FB&H of 1993-1998 and of SRB&H of 1992

Table 30 Coal production in FB&H in tons

Year	Brown coal	Lignite	Total
1996	1,414,963	772,259	2,187,222
1997	1,942,573	1,318,004	3,260,577
1998	2,392,379	1,720,028	4,112,407
1999	2,414,913	1,409,516	3,824,429
2000	2,759,212	1,590,074	4,349,286
2001	2,762,962	1,666,484	4,429,446
2002	3,246,119	1,826,663	5,072,782
2003	3,295,517	2,123,542	5,419,059

Source: Chamber of Commerce of FB&H

Table 31 Coal production in RS in tons

Year	TPP Gacko	TPP Ugljevik	Total
1998	1,412,425	1,816,675	3,229,100
1999	1,719,776	1,538,977	3,384,169
2000	1,738,874	1,224,613	2,963,487
2001	1,745,089	1,174,746	2,919,835
2002	1,305,648	2,444,171	3,749,819

Source: Chamber of Commerce of RS

- Electricity production per source

Following the post-war reconstruction projects, total electricity production has been restored to 84 per cent of pre-war level. The sources of power are balanced between hydro and thermal (52 and 48 per cent respectively)[8].

Table 32 Electricity production in B&H in power plants (1970-1996)

Year	Total in GWh	In TWh
1971	6,374	6.37
1975	8,241	8.24
1977	9,604	9.60
1979	10,556	10.55
1981	11,299	11.29
1983	11,252	11.25
1985	11,991	11.99
1987	13,387	13.38
1990	14,632	14.63
1991	15,031	15.03
1992	4,097	4.09
1993	3,035	3.03
1994	3,663	3.66
1995	3,881	3.88

Source: Statistical Yearbook of FB&H of 1993-1998 and of SRB&H of 1992

Table 33 Electricity production in FB&H (1993-2002)

Year	HPP	TPP	Total in GWh	In TWh
1996	2,652	1,301	3,953	3.95
1997	3,090	1,955	5,045	5.04
1998	3,124	2,509	5,633	5.63
1999	2,893	2,990	5,884	5.88
2000	2,614	3,895	6,509	6.50
2001	3,191	4,062	7,253	7.25
2002	2,427	4,844	7,272	7.27
2003	2,508	4,648	7,156	7.15

Source: Statistical Yearbook of FB&H of 2004

Table 34 Electricity production in RS (1993-2002)

	HPP	TPP	Total in GWh	In TWh
1993	1,318.9	276.3	1,595.2	1.59
1994	2,299.2	163.7	2,462.9	2.46
1995	2,340.7	14.1	2,354.8	2.35
1996	2,892.8	1,076.7	3,969.5	3.96
1997	2,372.0	1,708.7	4,080.6	4.08
1998	2,026.4	2,290.5	4,316.8	4.31
1999	2,629.8	2,374.9	5,004.7	5.00
2000	2,212.7	2,181.5	4,394.1	4.39
2001	2,625.47	2,050.58	4,676.0	4.67
2002	1,870.42	2,206.24	4,076.66	4.07

Source: Chamber of Commerce of Republic of Srpska

Table 35 Production of oil derivatives in B&H in thousands of tons

Year	Petrol	White spirit	Diesel fuel	Lubricants oils	Fuel oil	Bitumen
1972	225	1,260	355	25	412	171
1978	335	1,929	387	39	836	242
1979	378	3,378	513	36	714	294
1981	312	4,789	475	34	718	216
1982	355	3,306	530	31	645	210

1985	328	2,884	384	46	598	140
1987	364	2,315	399	43	615	104
1989	361	3,979	434	46	718	149
1990	396	2,703	477	42	832	121
1991	210	2,100	393	37	512	88
1993	-	No data	-	2	No data	No data
1994	-	No data	-	2	No data	No data
1995	-	No data	-	1	No data	No data

Source: Statistical Yearbook of SRB&H of 1983 and 1992

The actual production in 2005 in Bosanski Brod refinery was just 135,349 tonnes per year, equivalent to about 2,800 barrels per day. That is only 3% of the refinery's theoretical capacity, which is obviously a good indicator of Bosanski Brod's financial problem. The Modriča lubricants refinery, produced just 11,127 tonnes in 2005, compared with 107,726 tonnes in 1990.

1.3. Impacts and risks of the observed and forecast evolutions

Energy dependence and Energy bill, reduction in exports capacities

The basic identified sources of primary energy in BiH are coal and hydropower. In 2001, annual production of energy from those sources in BiH amounted to about 62 percent of the total consumption of primary energy, which indicates that BiH is dependent on the imports of energy, as certain energy sources, for now, can not be replaced with domestic energy sources.

Electric power generation accounts for three-quarters of coal demand. The remainder is delivered for the industrial and district heat generation purposes, sold on the general market or exported.

The bulk of coal (about 70% in 1990, more than 90% in 1997 and about 78% in 2001) is used for power production. Taking into account the economy of coal exploitation, as well as the existing efficiency of the transformation of coal energy into other forms of energy, a part of coal used in the production of electricity could be reduced in comparison with the existing situation. The present level of consumption of oil and gas is significantly lower than the pre-war consumption. The liquid fuels and natural gas, for now, need to be imported.

The consumption of oil and gas should rise once the economy revives. It will remain necessary to import oil in the coming years. The imports of petroleum products and the processing of oil will depend on the resolution of political issues in BiH, as the processing capacities in the country are sufficient for virtually the total of consumption of petroleum products in the country.

Current gas consumption is significantly lower than in 1990, again due to the poor conditions in the industrial sector. Due to the unfavorable natural gas consumption mix (relatively high share of heating and household consumption), the dynamics of consumption are also unfavorable (winter consumption is considerably higher), resulting in increased prices of natural gas. In addition, gas is procured over only one pipeline and from one supplier only, which makes supply stability an issue.

The problem of storing oil and, possibly, natural gas, has not been resolved, although some solutions for gas storage facilities exist. [3]

Electricity

Table 36 Indicator Electricity dependency rate of B&H for period of 1970-1996

Year	Export electricity GWh	of in	Import of electricity in GWh	Net electricity import	Export/production
1971	2,499		141	-2,358	2,358/6,374=0.37
1981	1,889		-	-1,889	1,889/11,299=0.16
1991	3,150		1,580	-1,570	1,570/15,031=0.10
1994	283		17	-266	266/3,663=0.07
1996	-		-	-	-

Source: Statistical Yearbook of FB&H of 1993-1998

This indicator shows that B&H is net electricity exporter.

B&H satisfies its power needs in total by generation of electricity in its own power stations (10.8 TWh in 2002), using for that the available hydro potential and domestic coal. The status of domestic consumption enables also the export of part of generated electricity, which in 2002 was 1.1 TWh.

Also, small quantities of coal have been exported.

Table 37 Indicator: Electricity dependency rate of B&H for 2002

Year	Export of electricity in TWh	Production of electricity in TWh	Export/production
2002	1.1	10.8	0.10

For the calculation of this indicator for coal, oil and gas, there were no data of energy balance for B&H, so that it was impossible to calculate that without the data of export and import in tons. There are only export and import in dinars (the currency of ex-Yugoslavia).

Natural gas

All natural gas is imported from the Russian Federation and is transported to BiH via the gas transport systems in Ukraine, Hungary and Serbia. Due to the above mentioned post-war dissolution of the energy system, BiH is facing an absurd situation – in the entire gas transport (over 5,000 km) from the gas wells in Siberia to Sarajevo (which is the main consumer in BiH) the intermediaries involved in the internal transport of gas in BiH outnumber the transport intermediaries up to the BiH border.

Oil

The current processing capacities of oil are not enough to satisfy the needs of B&H market. Because of that, B&H currently mainly depends on import of oil derivatives; hence the market is very sensitive to each disturbance in supply of this strategic energy source. The oil market in B&H is completely liberalized and it has been supplied from import mostly from refineries in Croatia, Hungary, Serbia and Montenegro.

The imported quantities of mineral fuel in B&H for period 2000 – 2004 was 1,108,495.217 tons. In import of oil derivatives, the largest share has Croatia with 63.09%, Hungary with 17.42%, Serbia and Montenegro with 10.86%. These three countries participate in supply of B&H with oil derivatives with 91.37%. Currently the largest export of mineral fuels is in Serbia and Montenegro with 96.89%.

With regard to the estimated consumption of crude oil and products in B&H, which is in 2005 about 25,000 barrels per day, these estimates suggests that Bosanski Brod is only supplying approximately 10% of the domestic market. By subtraction, imported products must account for about 90%.

Greenhouse gas effect

Bosnia and Herzegovina ratified the UN Framework Convention on Climate change on September 7, 2000, and the UNFCCC entered into force on December 6, 2000.

Bosnia and Herzegovina has not ratified yet the Kyoto Protocol on the Greenhouse Gases Reduction, but it is currently in the process of ratification.

The National Focal Point for UNFCCC is the Ministry of Physical Planning, Civil Engineering and Ecology of Republic of Srpska, while the operating unit is the Institute for Urbanism of the Republic of Srpska (IURS) in Banja Luka.

Bosnia and Herzegovina under the assistance of UNDP, as the selected Implementation Agency, has prepared the Project proposal for the First National Assessment and Inventory of Greenhouse Gases, and submitted to the Convention Secretariat in July 2002. The project is still in the phase of approval within the Convention Secretariat. Under the technical assistance and financial support of the Government of Greece, Bosnia and Herzegovina participated in the implementation of the project "Capacity Building in Balkans in order to deal with the Climate Changes Problem" which was completed in October 2002. The Sub-Committee for supervision of the UNFCCC implementation was appointed by the National Steering Committee for Environment and Sustainable Development in September 2002.

At the beginning of 2004, the most important institutions in Bosnia and Herzegovina related to climate protection and participation of B&H as a Non-Annex I Party in the UN Framework Convention on Climate Change negotiation process were:

- National Focal Point B&H to the UNFCCC-Ministry of Physical Planning, Civil Engineering and Ecology of the Republic of Srpska;
- B&H Committee for Climate Changes and Sub-Committees for Climate Changes;
- GEF Political and Operational Focal Point for climate changes;
- Administrative Committee for Sustainable Development.

The Ministry of Physical Planning, Civil Engineering and Ecology of the Republic of Srpska and the Federal Ministry of Physical Planning and Environment of the Federation of Bosnia and Herzegovina (recently changed into Ministry of Environment and Tourism) are responsible for the management of the environment and should provide legislation and administrative management bases for implementation of international conventions, such as UNFCCC.

As defined by the B&H Law on Ministries, the relevant authority at the State level remains with the Ministry of Foreign Trade and Economic Relations (MOFTER). More specifically, this Ministry is responsible for carrying out tasks related to defining policies and basic principles, coordinating activities and harmonizing plans of the Entity authorities and bodies at the international level for, among other topics, protection of the environment, development and use of natural resources.

In accordance with the national law requirements, the IURS produced a long-term Physical Plan for the Republic of Srpska in 1996. The Physical Plan includes elements related to climate data and monitoring, climate applications and climate change impact studies. This sub-program has two components: the long-term strategic plan (for 1996-2015) and the implementation plan and set up of the climate monitoring system. These actions are aimed at supporting and further development of national meteorological and hydrological observing networks in order to ensure participation in the Global Climate Observing System and the implementation of other climaterelated UNFCCC commitments.

In accordance with the Law on meteorological and hydrological activities of Republic of Srpska (Official Gazette of the Republic of Srpska, 20/2000), the Republic Hydrometeorological Institute of the Republic of Srpska, as the governmental organization, is responsible, among other, for climate change monitoring, climate data exchange and data base management, application study and climate predictions in the framework of the various scientific and technical programs of the World Meteorological Organization.

The Law on Hydro-Meteorological affairs, being of interest to the Republic Bosnia and Herzegovina (R BiH 10/76), also presents a legal basis for the work of FBiH Institute for Meteorology (the law is inherited from R BiH/SFRY). This law describes in detail the tasks of the Institute in the field of hydrology and meteorology. Considering the Institute an active partner in communication with the World Meteorological Organization (WMO), whose member is also Bosnia and Herzegovina, the Institute follows in its work various WMO Guidelines in the field of meteorology and hydrology.

It is expected that the adoption of the new legal regulation on environment shall unavoidably lead to organizational restructuring of authorities per sectors and administrative bodies both in FB&H and RS. This means that it will be necessary to reinforce institutionally the proficiency and capabilities of the existing resource ministries (more space, equipment and employees), and to clearly define competences and authorities related to environmental issues, as well as to improve compatibility and coordination of relevant bodies in assigning or even overlapping responsibilities in the field of environmental protection.

Through the efforts undertaken by BiH National Focal Point to UNFCCC and other responsible institutions, the climate change issues were addressed in identifying the various environmental problems and challenges facing BiH. Hence economic Development Strategy of BiH (DSPRSP) for the realization of the national sustainable development and poverty reduction for the period 2003-2007 based on Millennium Development Goals underlines climate change consequences and sets

up a several priority actions with respect to climate protection. The National Environmental Action Plan (NEAP) has been developed with the assistance of the World Bank and it was adopted in 2003 by the Entities. BiH NEAP based on national sustainable development priorities, Rio Agenda 21 and objectives and priorities of The Sixth European Community Environment Action Program 2001-2010, also considers climate change issues (NEAP BiH, 2003). It contains a concrete list of main existing problems and provides measures for their solutions. In Chapter 3 on the Environmental Management in BiH, the NEAP recognizes the necessity to establish an Environmental Information System.

In Bosnia and Herzegovina, there is no institution to be responsible for collection of activity data necessary for GHG inventory emission development, in accordance with UNFCCC guidelines and IPCC methodology. Particular problem is the fact that Bosnia and Herzegovina consists of two entities - FB&H and RS as well as District Brcko, and these activities are carried out on the entity level, so there is an urgent need to promote cooperation in that field between the entities.

Regarding public awareness:

- The Climate change (CC) issues are still not included in the schools' and universities' curricula. During the past period there were no activities in the field of capacity building in the education system.
- There is no department or person within the ministries or public agency working on education on climate change (e.g. development of educational materials, guidelines, or recommendations for curricula, and training materials for teachers)
- The governmental staff of the Ministries responsible for climate change has not been trained on the access and the participation rights of the public; also, the staff responsible for disclosure of information has not been trained on climate change issues.
- Limited public awareness generally on CC related issues, as the CC is not among the priorities of the society;
- Lack of information on issues related to Kyoto mechanisms;
- Lack of support for participation of experts in international workshops;
- Limited number of international workshops in country;
- Lack of financial support for training and certificate programs;
- National Communications and Inventories are not prepared.

Total CO₂ emissions in Bosnia and Herzegovina for the period from 1970 to 2002.

Units: Thousand metric tons of carbon dioxide

Table 38 Indicator ENE_PO3 Greenhouse gas effect emissions

Year	Total CO ₂ emissions
1970	11,284.0
1971	10,694.2
1972	10,771.6
1973	11,578.2
1974	12,472.4
1975	12,607.9
1976	13,181.5
1977	14,019.5
1978	14,838.6
1979	16,616.0
1980	16,528.3
1981	16,757.9
1982	17,400.2
1983	19,011.9
1984	20,576.3
1985	21,229.4
1986	22,038.2
1987	22,245.3
1988	20,775.1
1989	20,402.8
1990	20,922.2

1991	27,055.9
1992	15,735.6
1993	13,275.4
1994	3,431.8
1995	3,642.7
1996	4,455.0
1997	9,360.1
1998	12,130.1
1999	11,540.1
2000	14,270.2
2001	14,870.3
2002	13,960.2

Source – World Resources Institute: <http://earthtrends.wri.org/>

Other impacts on the environment

Table 39 Indicator ENE_CO4 Number of infrastructures on coastal areas

Indicator	Source	
Number of energy infrastructures on coastal areas	NEAP for B&H	Thermal Power Plant Gacko, although it is not located directly in the coastal area, its pollution causes negative impacts in this area, and that is the reason why it was included here.

TPP Gacko is power plant of block type with installed power of 300 MW. As a fuel, it uses lignite from the surface pit of Gračanica, which annual consumption is 1,800,000 tons. The content of the sulphure in the coal is 1.33% and it is specifically used for the TPP boiler combustion in the quantity of 300-350 t/h. By combustion of coal, about 79 t/h of ash and slag in average has been produced what is in total 420,000 per year.

From the start period of TPP operation in 1982 up to 1992, the ash has been transferred by trucks and deposited in the disposal site of Dražljevo, which is 7 km far from the location of TPP. The disposal site of Dražljevo is full and about 3.5 millions of tons of ash has been deposited there. The area of this site is about 18 ha. Currently, the plans are to prepare this site for the permanent conservation although the nature itself partially attributes to it. The erosion canals are noticeable which directs the water from the top to the bottom of the disposal site where the significant layer of the humus has been taken away by those canals.

Thermo power plant is located in the very top of catchment area of Trebišnjica River, so that the polluting products appearing in combustion of coal in the thermopower plant directly threatens the downstream area. Today the solid residues of lignite combustion in the boiler of the thermopower plant – ash and slag, have been deposited in the internal deposit site of the surface pit of Gračanica. This ash is known as hazardous raw material, and its chemical composition is shown in the following table.

Table 40 Chemical composition of ash from TPP Gacko

Parameter	Surface pit Gračanica %
SiO ₂	8.08
Fe ₂ O ₃	2.00
Al ₂ O ₃	6.69
CaO	66.25
MgO	3.50
SO ₃	7.91
P ₂ O ₅	0.37
TiO ₂	0.49

Na ₂ O	0.32
K ₂ O	0.95
	3.17

The ecological problem is evident, taking into consideration that water excess has been discharged into the recipient of Gračanice and Mušnica Rivers, and further into the catchment area of reservoir Bileća of Trebišnjica River. The reservoir Bileća is the largest artificial reservoir on the Balkan, and the Trebišnjica River is the largest sinking river in Europe and that basin is the basic reservoir of drinking water in the region. Currently the ash disposal has been carried out in improvised way, which has not been approved by the B&H institutions and it is necessary to carry out the implementation of the ash disposal project in the form of dense hydromixture that satisfy all legal and technological requirements and by which the requested ecological standards are fully satisfied. It has been assumed that ash transfer by wind leads to endangerment of the area that is 15 times larger than the disposal site.

Table 41 Indicator ENE_C13 Ozone picks frequency

Indicator	Source	
Ozone picks frequency	www.eionet.europa.eu	There is no data showing ozone picks frequency

1.4. Financing and investment needs

There is no national strategy for investments available in this moment. It will be done after the national strategy for energy is adopted.

There are available some studies done by Elektroprivreda B&H. It says in the study: In different studies (foreign and domestic) for restoration of production capacities (technical restoration + environment protection), the different scope of activities has been foreseen, in the sense of amounts and dynamics of investing the necessary resources. The illustration is given on the picture below where the necessary resources and dynamics of investments for restoration of existing TPP of PC Elektroprivreda B&H (TPP Tuzla and TPP Kakanj) are given according to one of the researches (Fichtner Study).

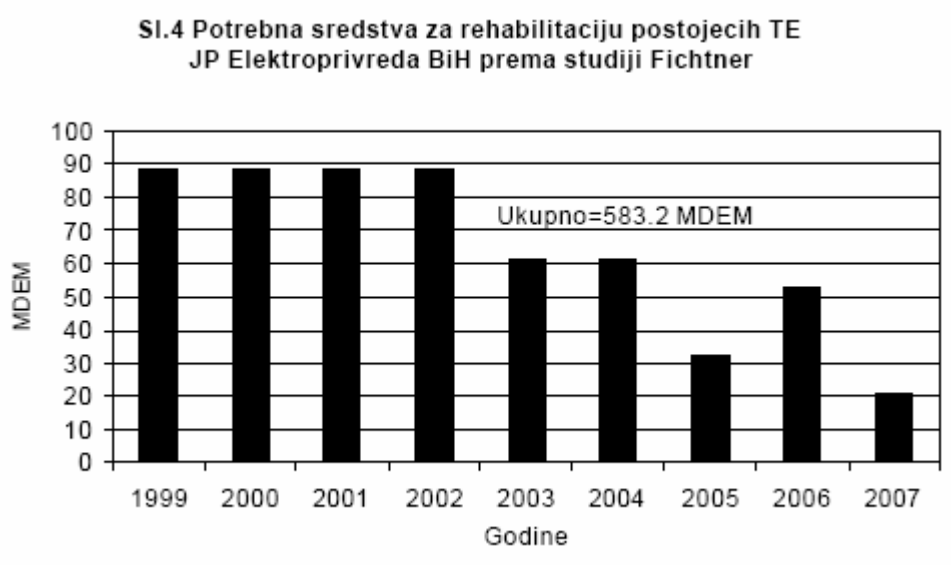


Figure 3 The necessary funds for restoration of existing TPP of PC Elektroprivreda B&H according to Fichtner Study

The power plants, candidates for construction in PC Elektroprivreda B&H up to 2010 for satisfying the higher scenario of development are shown in Table 42.

Table 42 Power plants-candidates for construction in PC Elektroprivreda B&H up to 2010

Elektrana	Instalisana snaga (MW)	Prosječna proizvodnja (GWh)	Invest. ^{xx} troškovi mil. DEM	Elektropriv. preduzeće
HE Konjic	120	284	293	EP BiH
HE Vrhpolje	62	170	110	EP BiH
HE Ustikolina	45	147	137	EP BiH
HE Caplje	12	70	40	EP BiH
HE Glavatičevo	170	305	385	EP BiH
TE-TO Tuzla VI	400	2340	760	EP BiH
TE-TO Kamengrad	60	390	188	EP BiH
TE-TO Kakanj (kombi ciklus)	95	480	110	EP BiH

Source: Bosnia and Herzegovina – Study of electricity tariffs, scheme of social protection and scheme of improvement of payment status, EBRD/Fichtner/ESBI, 1999

2. PART II- Rational Energy Use (RUE)- Renewable Energies (RE): policies, tools, progress, resulting effects, and case studies

2.1. RUE and RE policies

Development and adoption of Energy Strategy for B&H is one of the short-term priorities of Stabilization and Association Agreement (SAA). When doing that, full consideration should be given to envisaged reforms and liberalization of the energy sector in South-East Europe.

B&H will get its Energy Strategy blueprint through the EC CARDS Programme "Technical Assistance to Support the Energy Department of Ministry of Foreign Trade and Economic Relations in B&H". Preparation of a comprehensive background energy sectors study was the first step towards the national energy strategy. That study will be done by World Bank. The duration of implementation of this study is between 12-24 months. The need for such studies was justified because of fundamentally changed energy situation in individual countries after the disintegration of former Yugoslavia, break-up of former economic relations and industrial cooperation, consequences of the war, and intensive activities driven by the EC towards establishment of regional energy markets, particularly in network-based energies (electricity and gas).

The determining factors of decision-making are the following international agreements:

- ECSEE Treaty
- Energy Charter Treaty (ECT) and protocol on Energy Efficiency and Related Environmental Aspects (PEEREA), and
- Stabilization and Association Agreement (SAA).

ECSEE Treaty

Bosnia and Herzegovina signed the ECSEE-Treaty establishing Energy Community in South East Europe (ECSEE) on 25 October 2005 in Athens, Greece. Based on information gathered at the last PHLG meeting in Vienna (8-9 March 2006), the Treaty is likely to enter into force (i.e. become legally binding) by June 2006 after the successful ratification process at least in six signatory countries.

Three main activities of the Energy Community include:

- the extension of the Acquis communautaire
- Mechanism for operation of Network Energy markets
- The creation of a single energy market.

When ratifies this Treaty, B&H will be obliged to implement the Acquis Communautaire on energy, environment, competition and renewables.

Just to mention some particular obligations:

- Implement the EC Directives 2003/54 (on electricity) and 2003/55 (on natural gas) within 12 months of entry into force of the Treaty
- Implement Directive 2001/80/EC on large combustion plants by 31 December 2017
- Make endeavours to accede to Kyoto Protocol
- Within one year of entry into force, to provide to the EC a plan to implement the Directive 2001/77/EC and 2003/30/EC on renewable energy sources.

Chapter VI of the ECSEE Treaty is called The renewable energy sources and energy efficiency and it says in Article 35 that The Energy Community can adopt Measures for development strengthening in the field of RE and EE, with regard to its advantages in relation with supply safety, environment protection, social cohesion and regional development.

ECT and PEEREA

B&H is a member of the Energy Charter conference and signatory of the Energy Charter Treaty (ECT) and the Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA) which was signed in London in December 1994 along with the Treaty. B&H participated in the review of the Energy Charter process, which was concluded in December 2004, and its implementation thereafter. According to the ECT and PEEREA, the main issue areas include:

- Investments

- Trade and Transit
- Energy Efficiency.

ECT requires that all member states strive to minimize, in an economically efficient manner, harmful environmental impacts resulting from energy-related activities (ECT Article 19). PEEREA is designed to reinforce energy efficiency policies and programmes focusing on principles of developing energy efficient strategies, real-costs reflecting prices, transparency of regulatory frameworks, transfer of technologies, establishment of domestic programmes for EE and promotion of investment in EE.

SAA

With respect to Stabilization and Association Agreement, in accordance to Council of the EU Decision on the principles, priorities and conditions in the European Partnership with B&H (Annex to the Annex, B&H: 2005 European Partnership), there are the two following priorities for B&H:

- Chapter 3.1, Short-term priorities (under Sectoral policies, Energy)
 - o Start implementing the commitments undertaken in the framework of the Energy Community Treaty;
 - o Develop and adopt a comprehensive Energy Strategy, pursue reforms and liberalization of the energy sector
 - o Ensure that the Independent System operator (ISO= and the Transmission Company (Transco) become rapidly fully operational, each as a single State-level company.
- Chapter 3.2, Medium-term priorities (under sectoral policies, Energy)
 - o Implement the Entities' Action Plans for the restructuring of the energy sector
 - o Consolidate the State and Entity Energy Regulators
 - o Take steps to achieve concrete progress in relation to the gas sector, inter alia by developing a gas strategy, establishing a system operator and regulator and developing the internal gas market.

There are several Consultants within the MoFTER of B&H who will assist Energy Department of MoFTER in the preparation of progress reports on accomplishment of B&H obligations to SAA and the mentioned agreements in the energy sector and in addressing the mentioned issues.

2.1.1. Rational energy use (RUE) policies

Energy efficiency – energy saving

The level of energy efficiency, i.e. energy intensity in B&H is among the latest in Europe. This means that in this field it is necessary and is possible to do significant improvements. For this field the institutional and legal framework does not exist. [11]

Within the Energy Strategy blueprint for B&H, the Energy Efficiency and Energy conservation sector policy and strategies will be done on the basis of data, knowledge and results obtained both from WB Study and EC CARDS “TASED” Project. The first conclusions from TASED project can be expected at the end of 2007, under the basic assumption that the WB study is implemented in a timely and coordinated manner with the project. For example, should the WB Study be completed by the end of June 2007, as it is currently planned, the draft Blueprint would be ready by the end of September 2007, and the final Blueprint by mid-November 2007.

2.1.2 Renewable energy (RE) development policies

Within the Energy Strategy blueprint for B&H, the Renewable Energy sector policy and strategy will be done on the basis of data, knowledge and results obtained both from WB Study and EC CARDS “TASED” Project.

2.2. Instruments and measures to be taken in favour of RUE and RE

2.2.1. Tools and measures in favour of RUE

There are still no any RUE policies in the country. There are no economic applicable measures at the state and entity levels (incentives and disincentives relative to the attitude toward RUE). In B&H there is no any energy efficiency and emissions reduction fund. Municipal finance is tightly controlled, with a large proportion of funds being allocated centrally according to costs incurred. Budget periods extend only to one year, so there is little scope for municipal energy managers to take a longer term view.

2.2.2. Tools and measures in favour of RE

Regarding the laws on the entity level in the Federation of BiH there is a law on electricity ("Official Gazette of the Federation of Bosnia and Herzegovina" 41/02) and an action plan of the Federation of Bosnia and Herzegovina on restructuring and privatization of electro-energy sector in Bosnia and Herzegovina ("Official Gazette of the Federation of Bosnia and Herzegovina" 67/02) and Decision on methodology of determination of level of electricity price from renewable energy for plants of 5MW ("Official Gazette of the Federation of Bosnia and Herzegovina" 32/02).

In the Republic of Srpska an existing law on electricity (Official Gazette of RS 66/02) and an action plan of the Republic of Srpska on restructuring and privatization of electro-energy sector in Bosnia and Herzegovina (Official Gazette of RS 66/02).

By this Decision electricity public utilities at the territory of the Federation of Bosnia and Herzegovina (Elektroprivreda BiH and Elektroprivreda HZHB) are obliged to accept electricity from renewable energy sources if producer has the Use Permit for production plant and Work Permit.

Table 43 Indicator ENE_CO8 RUE and RE programmes share in energy investment and R&D investments

Indicator	Number
Expenditures in RE and RUE programmes	0

Table 44 Average Energy Sources Prices in dinars (ex-Yugoslavia currency) in B&H for the period of 1970-1990

	1977	1979	1984	1990
Electricity- higher tariff per kWh	0.66	0.91	4.71	0.84
Lignite per ton	442.16	602	4,463	561.21
Brown coal	-	-	-	861.13
Fuel oil per liter	-	-	-	3.06
Wood per stacked cubic meter	356.45	518	3,241 per m ³	-

Source: Statistical Yearbook of SRB&H for 1980 and 1992

Table 45 Indicator ENE_CO5: Final consumer energy price per fuel in 2003 for F B&H

Indicator	Oil for heating (in Litres)	Electric power (daily tariff) kWh	Electric power (late hours tariff) kWh	Brown coal in tons	Lignite in tons	Central heating per m ²
Average retail price in KM (BAM)	1.02	0.14	0.07	107.08	77.43	1.07

Source: Statistical Yearbook of FB&H of 1993-1998

Table 46 Indicator ENE_C11 Share of fuel and electricity expenditures in household budgets in B&H in percentages (average per member of household)

Year	All households	Agricultural households	Mixed households	Nonagricultural households
1990	7.6	7.7	7.3	7.8

Source: Statistical Yearbook of SRB&H for 1992

Table 47 Indicator ENE_CO6 Existing incentives measures and policies for RE and RUE development at national level

Indicator	Number
Existing incentive measures and policies for RE and RUE developments at national level	0

Table 48 Indicator ENE_CO7 Cities/regions/provinces with an existing energy audit and/or carbon audit and/or with objectives in terms of RE and RUE

Indicator	Number
Cities/regions/provinces with an existing energy audit and/or a carbon audit and/or with objectives in terms of RE and RUE	0

Table 49 Indicator ENE_PO4 total sum of investments made within the Kyoto protocol' Flexibility mechanism

Indicator	Number
Total sum of investments made within the Kyoto protocol's Flexibility Mechanism	0

The Kyoto Protocol has not been ratified yet in B&H. Today, participation in Kyoto CDM mechanism is not possible for B&H, because of the fact that B&H does not have sufficient capacity and does not fulfill other conditions required from host countries for CDM projects development and implementation. B&H, today, does not have any regulations/legal framework, which would able implementation of the Kyoto protocol mechanisms. Committee for Climate Changes, UNFCCC Focal Point, as well as institutions and individuals, tried to initiate ratification of Kyoto Protocol on several occasions, but the official procedure, which should be initiated by the Ministry of Foreign Trade and Economic Relations of B&H, has never been started. Problems are lack of professional institutions, as well as giving low priority to the climate changes issue.

Practical actions taken by some NGOs, associations and international programmes

Energy Efficiency Housing Project of UNDP

This project aims to introduce low cost methods of saving energy when building or reconstructing buildings, thus mitigating the emissions of greenhouse gases while at the same time reducing the operational costs and increasing the comfort level of the buildings.

The project is focused on dissemination of know-how and hands-on experience by training of local municipal officials, representatives from housing maintenance companies and homeowner associations in energy efficiency design, principles, management and planning. Based on the training component, 1-3 buildings will be selected and reconstructed according to an energy efficient plan that is to be developed during the practical part of the training.

The project will also explore through a feasibility study the potential for using individual small biomass-fired boilers for local wood waste in rural households.

Association of small producers of electricity from renewables up to 5MW in Bosnia and Herzegovina has the following main objectives:

- developing, widening and improving activities of the production of electricity from renewables (water, wind, biomass solar).
- establishing the influence on improvement and development of microeconomic and macroeconomic surrounding for this activity
- Giving the expert opinion and support to the members from different fields (taxes, legal aspect, new technologies)

- Improving the competition in domestic and international market
- Defining and giving proposals of legal and regulatory reforms with the aim of improving and development of generation of electricity from RE.
- Engagement the experts for RES development and use policy
- Education of human resources with the aim of elevation of quality of RES use
- Other activities

Website: apeorbih.com.ba

ENERGY SUPPLY AND ENERGY EFFICIENCY done by CETEOR (Center for Economic, Environmental and Technological Development) in Sarajevo

- Study on the energy supply of Central-Bosnia Canton (in the frame of the physical plan for Central-Bosnia Canton) (2001)
- Seminar on energy consumption measuring in central heating systems Travnik (2001)
- Phare program "Promotion of energy cogeneration in low-power plants (1999),
- Concept on energy efficiency in Sarajevo (1997)
- Report on system of payment of natural gas in Sarajevo (1997)

Center for Ecology and Energy from Tuzla - Project: Energy Brigade of B&H

Center for Ecology and Energy from Tuzla is the member of International Energy Brigades – (IEB) from 1 October 2003 and representative of B&H in this network.

- In the first year of project implementation of the Project, the Center have done the insulation of windows and doors in five schools and two NGOs in B&H, and by that the efficient use of energy have been achieved and also the public has been ecologically aware by education and through the media.

There are also some more projects (USAID for example) and more centers dealing with this issue within the Faculties of University in Sarajevo, Banja Luka, Tuzla, and Mostar.

2.3. Energy Efficiency Evolution-decoupling

Table 50 Indicator ENE_P01 Total energy intensity

	Electricity intensity	Final electricity consumption	GDP
Units			
Years	in MWh/000 USD	MWh	000 USD
1995	0.57	788,000	1,392,041
1996	0.82	1,657,000	2,018,912
1997	0.75	2,132,000	2,840,560
1998	1.32	4,196,000	3,183,126
1999	1.46	4,895,000	3,356,220
2000	1.81	5,716,000	3,161,429

Place: Level of Federation of Bosnia and Herzegovina

Sources: Statistical Yearbook of Federation of Bosnia and Herzegovina

The basic characteristic of B&H energy sector is poor efficiency of energy use in the whole life cycle (from the coal extraction or import of fuels up to conversion of energy in money or comfort). The consequence is the very high energy intensity- in 1991, B&H had almost 2.5 times higher energy consumption per GDP unit than it was in some other ex-Yugoslavia republics, such as Croatia and Macedonia. One of the reasons of high-energy intensity in B&H in that time was export of electricity, with low prices in some other republics of ex-Yugoslavia. [15]

2.4. Renewable Energy evolution

Table 51 Indicator ENE_P02 Renewable energy share in total energy

	Share of consumption of renewable energy (electricity) resources	Total production	Hydro power
Units			
Years	%	GWh	GWh
1990	11.39	7,490	853
1991	19.50	7,446	1,452
1992	33.82	3,264	1,104
1993	45.05	1,183	533
1994	57.79	1,303	753
1995	55.55	1,460	811
1996	50.96	2,298	1,171
1997	34.55	3,511	1,213
1998	32.26	4,045	1,305
1999	36.56	4,100	1,499
2000	27.16	4,695	1,275

Place: **Federation of B&H**

Sources: **Annual Report 2000 of Electricity utility "Elektroprivreda B&H"**

2.4. Existing or expected effects and benefits of RE and RUE

There is no activities within the RUE sector or RE sector that would give importance in terms of job creation, international trade, technology transfer, and etc.

Table 52 Indicator ENE_C12 Job creation through the development of RE and RUE

Indicator	Number
Job creation through the development of RE and RUE	0

Table 53 Indicator ENE_C08 Expenditures in RE and RUE: RE and RUE programmes share in energy investments

Indicator	Number
Expenditures in RE and RUE	0

3. PART III- Examples of good practise, case studies

3.1 Content of good practice and case studies

3.1.1. Landfill gas migration and utilization at Sarajevo landfill- Case Study

Today, the landfill gas, produced withih the process of anaerobic degradation of solid waste has been considered as alternative energy source. Sarajevo landfill, where it has been estimated that 3 millions of tons of mainly household waste of organic origin have been deposited from 1963 until today, is related to extremely negative experiences with the uncontrolled explosions and fires of landfill gas. Because of that, in the process of recovery activities which are particularly intensive from 1996 until today, the problem of landfill gas monitoring, and also in the future of its utilization, has been considered with the special attention. The main design for landfill gas migration has been prepared according to which the wells for gas collection have been built. At the temporary sanitary landfill, of area of 1 hectare, the experimental boreholes for landfill gas collection have been constructed. Six boreholes is connected to the torch of the capacity 60-300 m³/h with the aim of experimental insuarance of possibility of utilization of landfill gas, for the electricity generation. In the study, the results of the evaluation of the landfill gas quantity are given for the Sarajevo landfill by application of the multiphase mathematic model, as well as the results of the quality and quantity of the landfill gas from the temporary experimental disposal site.

The technology of the landfill gas utilization is consisted of:

- The evaluation of the quantity and the level of landfill gas production on the basis of the composition and age of deposited solid waste
- Engineering of the collection system for landfill gas which is the most adequate on the selected landfill, as well as the way of the disposal of the waste itself
- Obtaining the most cost-efficient scheme for landfill gas utilization

The priority has been put on the landfill gas monitoring. For that purpose, 14 boreholes of 110mm profile have been performed on the sanitary disposal site at the area of 1 hectare. In the center of the borehole, perforated PE-HD pipes have been put for collection of the landfill biogas. The pipes are buried with pebble of 80-120 mm granulation and with the glass. The distance between the boreholes is 60m. Their purpose was to accept the landfill gas and ventilate it in the atmosphere. In that way, the further accumulation of the gas within the landfill body has been stopped and the probability for repeated fires and explosions have been reduced.

It has been estimated that 3 millions of tons of mainly household waste of organic origin has been deposited from 1963 until today. Considering that gas produced at the landfill is a result of microbiological degradation of organic fracion of the deposited solid waste, it can be concluded that Sarajevo landfill presents the great potential for production of sufficient quantities of landfill gas that can be utilized in cost-efficient way.

Table 54 Composition and quantity of solid waste deposited on Sarajevo landfill

CATEGORY	ANNUAL QUANTITY (TONS)			
	1972	1991	1993	June, 1997/July 1998
Household waste	44,700			119,322
Street waste	4,450			
Mixed industrial waste	9,300			
Foundry sand	5,000			
Coal loess, ash	4,750			
Glass carst	940			
Debris	8,750			57,406
Bulky waste	152			
Soil				176,128
Other				84

TOTAL IN TONS	78,042	165,128	71,442	352,939
TOTAL IN m ³	259,940			
NUMBER OF INHABITANT	280,000	500,000	280,000	
Kg/inhabitant daily	0.76	0.90	0.70	

Source: Strategy for management of solid waste in B&H, October 2000

Table 55 Gas characteristics from Sarajevo landfill

	Methane (%)	Flow speed (m/s)	Gas flow (m ³ /h)	Pressure (mbar)	Combustion temperature(°C)
1999 August	44.83	19.75	297.5	-26.67	948.33
September	50.15	19.63	296.3	-25.84	1,021.5
October	50.1	19.74	297	-27.7	1,036
November	51.6	19.59	295.2	-30.2	1,034
December	56.37	19.15	291.2	-34.37	1,032

Source: Data taken from Public Waste Utility Company RAD, Sarajevo

The results of these measurements show that the methane concentration in the gas of about 55% and the quantity of produced gas of about 300 m³/h are very favourable for further efficient utilisation of landfill gas, as well as that the existing system for gas collection and combustion of collected gas is operating very well. It should be mentioned that because of the limited capacity of the torch, the inflow of gas is reduced almost for one half what shows that the real values of the produced quantity of landfill gas are bigger then the measured one.

3.1.2. Utilization of the geothermal source for district heating system of Gračanica City-Case Study

Instead of the proposed case study of biomass utilization in Konjuh, Živinice furniture factory, the results of case study of prospectives and possibilities of district heating system on the basis of geothermal potential in Gračanica City, B&H are attached here.

The existing way of the heating of the buildings in Gračanica is mainly with the use of individual boiler houses, which significantly pollute the environment. By the construction of buildings-settlements, the individual heating system for these settlements has been designed with the individual boiler houses.

Today those boiler houses are mainly devastated having equipment older then 15 years.

On the basis of the previous studies done in 1980's for possibilities of utilization of thermo mineral waters for district heating system of Gračanica City, the municipality authorities made a decision for preparation of a new study for supply of Gračanica City with the heat energy. For this purpose, one company from Seegen, Austria has been selected which has a significant experiences in designing and implementation of district heating systems of smaller cities in Austria. The objective of this study was to find possibilities of supply of Gračanica City and its outskirts with the heat energy, by which the air quality would be significantly improved, and the ecological, local and favourable supply of heat energy would be offered to citizens. The task of this study was to analyse the feasibility of district heating system of Gračanica, to propose the best solution and the most optimal technical solution and the way of financing for project implementation.

The heat potential which has been obtained by polling of the citizens of Gračanica was 59,418,580 kWh i.e. theoretical power of the connection was 62,545 kW. The calculation of the probability

showed that current amount of 18,512,263 kWh of heat energy is possible to sell. The evaluation has been done on the basis of the criteria from the poll where the potential users answered if they already have the central heating and if they are interested to have connection to district heating station.

As possible energy source for supply of the City with heat energy, the Study elaborated five options.

Option 1- Heating station with the energy from geothermal source, biomass and coal

Option 2- Heating station with the energy from biomass

Option 3- Heating station with the energy from coal

Option 4- Heating station with the energy from geothermal source

Option 5- Heating station with the energy from TPP Tuzla

Total investment of these five studies can be presented as in Table 56. The total investment will influence the price of heating, so there are heating prices each of the five options shown in Table 56.

Table 56 total investments of five options of possible heat energy source

	Option 1	Option 2	Option 3	Option 4	Option 5
EUR					
Heating station	850,000	750,000	750,000	400,000	350,000
Hot water pipeline	2,580,000	2,580,000	2,580,000	2,580,000	12,580,000
Transmission station	710,000	710,000	710,000	710,000	710,000
Technical plants	3,270,000	2,810,000	3,000,000	6,112,308	1,050,000
TOTAL	7,410,000	6,850,000	7,040,000	9,802,308	14,840,000

The result of the study showed that Option 4 (heating station with the energy from geothermal source) is the most favourable. Considering that geothermal source utilization is related to the need for boring a new well up to 1,500 m and with the investment for boreholes, which is estimated on 3,450,000 Euro, it presents a great risk factor in the sense of obtaining new quantities of thermomineral water with the expected characteristics of 100 l/sec and temperature of 100°C. In option 1 (heating station with the energy from geothermal source, biomass and coal), the utilization of geothermal energy has been foreseen from the existing geothermal well PEB-4. The quantities of biomass and coal can be purchased on the regional market.

From the above-mentioned reasons, the option 1 has been chosen as the main option. Option 1 provide the heat energy which would be produced in combined heating station where the basic energy would be produced from geothermal source and biomass, and the rest of energy from biomass and coal (if available biomass quantities are not sufficient).

The technical data of the plant of such option are given in Table 57. The heat from geothermal source would cover up to 30% of annual needs, with the cost and utilization of part of biomass energy. The rest of energy would be covered from biomass.

The Study showed that the sale of heat energy in amount of 18,512 MWh is needed for the start of the project, having in mind that it will increase in coming years. The experiences in similar projects of the Study author show that the other quantity of sale comes after decision for the project and during construction.

Table 57 Technical data of Option 1 of possible heat energy source

Part of the plant	Power in kW
Boiler K1- biomass	3,000
Boiler K2- biomass	6,000
Heat pump of 5,000 kW	2,000
Boiler K3 for maximum load (fuel oil)	8,000
Pipe network-exit	DN 250
Length of the main network	12,500 Trm

Boiler house- fenced area-covered	Approx. 5,500 m ³
Storage-fenced area-covered	Approx. 3,500 m ³
Outside area	Approx. 2,500 m ²

After all, there is a data that is most important for final users, and that is the price for heat that would be offered to the users. Technical solution in the Study foresees the measurement of the heat energy by meters (calorimeters), and that means paying per KJ of the consumed energy.

Why geothermal and biomass: because

- Both are CO₂ neutral
- In B&H 0.7 m³ of wood is growing each second, and currently only 30% of that is used
- From 2006, the CO₂ market will appear
- Possibility for production of bioelectricity.

4. PART IV- Proposals for more sustainable energy development

4.1. Summary of under exploited RE and RUE

The possibilities for energy savings in the industry sector in B&H are very considerable. Most industries treat energy as tangible cost and include the energy cost in the final price of the product, which does not promote energy savings. The cost of energy should be registered separately, compared with the energy costs in the same activities in the developed economies, and measures should be taken to rationalize the consumption. Subsidies could present an effective solution for such measures.

Generally, the awareness about the savings that could be achieved with the increased energy consumption efficiency should be raised. Energy savings require investments, but these investments pay off quickly.

Energy efficiency in Bosnia and Herzegovina, both on the production and transformation side, and on the consumption side, is low, relative to the developed economies. The energy production in BiH is based on technologies developed some thirty years ago, from the period of the construction of a number of blocks in the thermal power plants. In the case of construction of new plants and in major reconstructions of the existing facilities, new technologies should be introduced whenever possible. Renewable energy sources (except hydro-power), at the current level of development and at the current share in the overall energy consumption, could serve as a complement, rather than a replacement for the major plants. However, due to their low environmental impact, these technologies are developing rapidly and their use is increasing and it is for sure that B&H should pay more attention to this field in general.

The reduced energy consumption can be partly achieved by introduction of district heating. Most of the current systems do not achieve the satisfactory effects, partly due to inadequate maintenance, and partly because there are no instruments for measuring individual heat consumption of consumers. The possibilities of combined production of heat and electric power, an option that is convenient for larger buildings or groups of buildings, are also underutilized. Because of its efficiency, the district heating saves fuel, and also contributes to reduced emission of CO₂. The district heating systems can be used in hospitals, hotels, recreational and trade centers, and other larger public facilities, throughout B&H, particularly those where the natural gas can be used as a fuel.

Taking into account that the largest share of energy is used for heating, and that the relative consumption of energy for heating in BiH is much higher than in the EU countries (according to the assessments made in the EU countries, at least one fifth of the energy consumed in households and commercial sectors is "easily savable"), and, obviously, there is a lot of room to reduce the energy consumption in this area. The methodology for designing energy performance indicators in buildings, used in Bosnia and Herzegovina, is mostly outdated and the revision of methodology would assist in both achieving energy savings in the buildings and reducing the investments for energy infrastructure in newly constructed buildings. This could also have an important role in the reconstruction, i.e. restoration of buildings.

In the transport sector, significant changes need to be made with respect to energy demand, especially taking into account that the primary source of energy used is imported oil, i.e. petroleum products.

For this reason, ways to increase the share of rail transport relative to road transport, which would allow for a greater use of domestic energy sources, should be considered.

Priorities for energy sector in general, from the BIH MEDIUM TERM DEVELOPMENT STRATEGY (PRSP) for 2004-2007 will remain the following:

1. Establish, develop and implement clear, well-designed energy policy and appropriate action plans

- Adopt the BiH Energy Development Strategy, in coordination of the BiH Ministry of Foreign Trade and Economic Relations and the competent FBiH and RS ministries, and with cooperation of domestic and international experts,
- Complete the establishment of the Energy Department in the BiH Ministry of Foreign Trade and Economic Relations,
- Develop the methodology for collection of energy statistics.

2. Encourage energy saving in households and industry

- to reduce energy consumption, use existing and available technologies such as heat isolation, more efficient electric appliances etc.
- as a priority, encourage greater use of public transportation and rationalize use of cars in cities
- increase awareness on savings possible through increased energy efficiency.

3. Reform the energy pricing system

- Prices must be based on economic criteria and include costs of environmental protection.

4. Encourage application of renewable and alternative energy sources, research and application of new energy technologies and other technologies increasing energy efficiency

- Intensify construction of planned hydropower plants through a concessionary model, and build small hydro-power plants,
- Install pilot facilities for utilization of wind, solar, geothermal and biomass energy.

For **the electric power sector** the priorities are the reconstruction and privatization program of the separation of three vertically integrated elektroprivredas in BiH into transmission, production and distribution. The newly established transmission company is jointly owned by the two entities, while the production and the distribution will be privatized, to attract investments to BiH, ensure better governance and create efficient competition. The study entitled "BiH: Power Sector Restructuring and Privatization Analysis and Action Plan" done by American consulting firm "PA Consulting Group", December 2001 worked out the sequence, scope and the dynamics of restructuring and privatization of the three elektroprivredas by early 2004, formulated a set of recommendations for the restructuring of the energy sector in BiH and defined the privatization strategy, designed to attract major strategic investors.

The solutions for strategic issues in **the coal sector** should start with the integral approach to coal basins and coal beds and proceed to selection of specific adequate technological processes, taking into account the following elements:

- Demand outlook for energy from coal for the period up to 2015,
- Status and potential total balance and exploitation reserves and possibilities for introduction of new technologies (subsurface gasification, IGCC coal gasification technology and refined processing).

The existing studies and adopted international and national documents contain guidelines for a comprehensive transformation of coalmines into independent for-profit companies. In that context, the action plans have been prepared, with a particular focus on the electric power sector (elektroprivredas) and specifying the required resources. The privatization of the coal sector, following its restructuring, is proposed in principal. In principle, after restructuring, privatization of the coal sector through tenders is envisaged.

The **gas sector** must undergo a process of reform and restructuring. The reform of the gas sector will be implemented in accordance with the BiH Strategy of Energy Sector Development, which is expected to be adopted after the completion of TASED project, according to the agreement between the BiH Ministry of Foreign Trade and Economic Relations and the line ministries in FBiH and RS. The key reform steps in the gas sector are:

1. Transform legislative and institutional framework

- adopt the Gas Sector Development Strategy within the BiH Strategy of Energy Sector Development.
- adopt appropriate legislation and regulations, establish an independent system operator and resolve the regulatory functions by establishing one common regulator for oil and gas,
- create an internal gas market,
- introduce a tariff system.

2. Strengthen capacities and improve efficiency of the gas sector

- build an alternative supply route (When it comes to alternative supply and distribution network development, in addition to the undisputed "northern connection", it will be necessary to determine the "external preconditions" in order for BiH network to develop further – meaning here the final route of the future South-European Gas Ring, as well as the routes of other gas interconnections in the immediate surroundings).
- build underground storages and improve the load factors in the existing gas system,
- diversify the sources of gas supply,
- expand the gas distribution network to include several cities to which gas can be cost-effectively

- supplied through the extensions of the existing system,
- make preparations for attracting strategic partners – prepare the privatization documentation

Ultimately, this means implementation of the EU Gas Directive and liberalization of the market, which is a precondition for integration into the European market.

3. Actively represent BiH interests on the international scene
- Protect BiH interests in planning the regional energy networks;
 - Take part in the establishment of the regional gas market;
 - Strive to have one of the legs of the South-European Gas Ring pass through BiH.

The oil sector can and should be a significant factor for the development of the economy of BiH and both entities. This is why it is considered that the concept of the development of the oil sector in BiH should become an integral part of the Medium-Term Development Strategy for BiH. The initial improvements were already made by the adoption of the Decision on the Quality of Liquid Oil Fuels by the BiH Council of Ministers of in September 2002, stipulating the obligation and the need of importing only the liquid fuels that correspond to the regulations and meet the EU quality standards.

The key tasks in this sector are:

- adopt the BiH oil industry development policy (under the BiH Strategy of Energy Sector Development);
- adopt appropriate legislation and regulations on the basic principles of separation of functions of production, transport, storing, distribution and trade, for the purpose of establishing an open market and secure supply with this fuel;
- set up a single agency to perform the regulatory function in this sector for all energy activities.

The key tasks in **district heating sector** are:

Establish the legislative and regulatory framework

- adopt a strategy for resolving problems in the district heating sector;
- establish a system of regulating the district heating prices at the level of BiH within the framework of a general energy price regulation system.

Improve efficiency and accessibility of district heating

- Improve technical efficiency of the district heating systems – complete the rehabilitation projects and introduce the necessary oversight mechanisms;
- Expand the district heating coverage in cities and towns where the district heating systems have been reconditioned;
- Modernize existing district heating systems and make possible conversions to the heat from thermal power plants where this is possible, or to natural gas in the cities that will be connected to the gas network.

The above considerations clearly indicate that the preparation of the BiH Energy Sector Development Strategy is a precondition for implementing all activities in this area, without which there will be no reduction of poverty, nor any significant economic development. At long last, it should become clear that the strategy must cover the entire BiH, because without the single energy policy, there can be no hope of accession to the EU.

Table 58 Indicators for monitoring the energy sector reforms

Indicator	Source	Estimate for BiH (2000/2001)	2007
Consumption of electric energy/per capita (kwh/pc)	WDI 2002 (World Development Indicators)	540.0	1,050
GDP per unit of consumed energy (economic efficiency indicator)	On the basis of WDI 2002, calculated for IHR MRC Report	47.5	40
Emission of carbon dioxide/per capita (u 1,000 kg)	IHR MRC Report (Human Development Report - Millenium Development Goals – BiH 2003)	3.2	3.5

Source: BiH Medium term Development Strategy (PRSP) (2004-2007)

Although it is very hard to surely foreseen how the energy sector system will look like in the future, in this moment the solution is in establishment of the clear vision of the energy sector system which

will include all dimensions of problem and will be harmonized with the changes in the energy sector of the developed countries, as well as with the solutions that in the best way respond to the interests in the development of Bosnia and Herzegovina. Surely that the limitations in achieving the objectives are very important here, and which first of all comes from the process of transition of Bosnia and Herzegovina, as well as the situation in economy and successfulness of the process of changes in total life of Bosnia and Herzegovina. Taking into consideration the experiences of the countries that are going through or already went through these processes, this is very complex, demanding and by dynamics uncertain process.

Regarding the energy potential of BiH, the issue of energy sector is very important, especially in the context of regional cooperation because Bosnia and Herzegovina is one of the signatory countries of the Athena Memorandum. On the basis of establishment of the Energy Community for the South East Europe, the opportunity is open for BiH for the integration in energy market of EU, regardless of in which phase of the Process of Stabilization and Association the BiH is in. BiH will realize this through taking over the concrete part of acquis, which relates to energy, environment protection, competition and renewable energy resources.

Regardless to these limitations, today we can set out some starting, general characteristics, such as:

- energy system of the future period must suit the needs of the users,
- energy system must be diverse and must use different available sources and technologies,
- energy system should be more and more decentralized,
- energy efficiency and requests for initiating the process of increasing the energy efficiency,
- requests for use of cleaner energy resources and technologies,
- development of energy market with the active policy of state authorities, how in legal sense, so as well in the measures of economy policy,
- researches, development and implementation of the new, clean and efficient technologies.

List of relevant reports

- [1] Statistical Yearbook for SRB&H for 1992. Federal Statistical office, Sarajevo
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