Energy Efficiency Finance II

Task 1 Energy Efficiency Potential

FINAL Country Report: Bosnia and Herzegovina

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Abbreviations

BDBiH	Brcko District in Bosnia and Herzegovina
BHAS	Agency for Statistics of Bosnia and Herzegovina
BiH	Bosnia and Herzegovina
CHP	Combined Heat and Power
CRES	Centre for Renewable Energy Sources
EE	Energy Efficiency
EnC	Energy Community
EPC	Energy Performance Contract
ESCO	Energy Service Company
EU	European Union
FBiH	Federation of Bosnia and Herzegovina (Entity in Bosnia and Herzegovina)
FMERI	Ministry of Energy, Mining, and Industry of the Federation of BiH
GHG	Green House Gasses
ha	hectare
HPP	Hydro power plant
KM	Convertible Mark
MOFTER	Ministry of Foreign Trade and Economic Relations of BiH
MW	Megawatt
NEEAP	National Energy Efficiency Action Plan
ORC	Organic Rankine Cycle
PJ	Petajoule
RES	Renewable Energy Sources
RS	Republika Srpska (Entity in Bosnia and Herzegovina)
SHPP	Small hydro power plant
UNDP	United Nations Development Programme

General Remarks

Most financial values mentioned in the available studies were provided in Convertible Mark (KM). For this report the exchange rate used to convert the local currency Convertible Mark to EUR is:
1 EUR =1.95583 KM.

Figure 1: Map of Bosnia and Herzegovina
Source: UNDP, 2013

1 Executive Summary

Coal and hydropower are the main sources of energy generation and of emissions in BiH. About 70% of electricity in BiH is generated in thermal power plants using local coal. The remainder of electricity is produced mostly by large hydropower plants, and a fraction comes from small hydropower plants. Natural gas and oil imports are also an important source of energy, but so far these fuels are not used for electricity generation on a relevant scale.

Total energy consumption in BiH in 2005 was based on the following sources: 45.3% coal, 9.6% hydro 21.1% liquid fuel, 3.5% natural gas, and 20.5% wood. Liquid fuel and natural gas are 100% imported, showing that BiH is highly dependent on imports. Regardless of the type of energy resource, BiH has very low energy efficiency, resulting in **high energy consumption relative to its GDP**. Biomass from wood is also a significant source of energy, and wood fuel continues to be the primary source of heating in smaller towns and rural areas.

Primary energy supply in 2010 was 249 PJ, while in 2012 it increased to **279.5 PJ.** Consumption of final energy **(TFC)** in 2010 amounted to approximately 138 PJ and to **134 PJ in 2012**. From these figures, it can be concluded that energy supply has increased in the period under consideration, but final energy consumption stayed at almost the same level.

Energy consumption statistics for the country are given in the **National Energy Efficiency Action Plan** (NEEAP) which was prepared during 2011 and 2012 for the Energy Community. This document is considered the most reliable source for energy demand statistics. All data given in the NEEAP refers to 2010 figures. The NEEAP is used for energy planning in lower level authorities. The building sector, including households and the service industry, is the single most important energy consumer with two thirds of final energy consumption in 2010 (the residential sector accounts for more than 56%). The industrial sector is second most important energy consumer with 20 % of final energy consumption in 2010, followed by the transportation sector with 15 % of final energy consumption in 2010 (NEEAP, 2012).

BiH has established the necessary institutions at **State and Entity level (RS and FBiH)** to affect and oversee energy market reforms in accordance with the aquis communitaire of the EU. Regulatory authorities exist at State and Entity levels and certain responsibilities for tariff setting and energy efficiency have been assigned to the energy regulators within the Entities. There are strategies that deal with this issue and provide guidelines for the development of EE, but these guidelines have not been made into legislation, and therefore established institutions have not implemented them.

In the **Federation of BiH, there is a legal framework for energy efficiency** in buildings stipulating that every new building has to have an energy performance certificate (EPC) when applying for the final permit. EPCs are the most visible aspect of the new regulation concerning the energy performance of buildings. This document assigns an energy performance label to residential and non-residential buildings or building units. For existing buildings, EPCs contain cost-effective measures for improving their energy performance. Existing buildings are obliged to get energy certificates in the case of renovations, rental, or sale/purchase. An owner must give a valid certificate to a buyer when the deed is established. In the case of rental, a renter must get a copy of the certificate. The minimum energy performance of the existing building after renovations is class B (which stipulates that the maximum energy consumption for heating is 95 kWh/m^2 annually). A similar framework is **under development in Republika Srpska**. Both Entities have incentives, in the form of feed-in tariffs, to generate electricity from renewable energy sources. However, due to low markup on the electricity price paid by final consumers for feed-in tariff, the available funding for feed-in tariffs is very limited.

Energy efficiency in generation, transmission and distribution, and end use is low in BiH relative to developed economies. Energy production in BiH is based on technologies developed more than thirty years ago. The average energy efficiency of existing thermal power plants is around 30% (JP Elektroprivreda BiH, 2015). The only modern coal thermal power plant, which is under construction (expected to be in operation in 2016) is a private investment.

On the demand side, the highest potentials for energy efficiency improvements are expected in the field of **thermal insulation**. In the industrial sector, major savings potentials and replication potentials are

expected for **metal production and processing, food, and the textile industry**. Economic savings potentials for both the residential sector and the industrial sector are in the range of **5 PJ** each.

Regarding the technical framework in BiH, the **market for energy efficient equipment and material is developed** and, in the case of some equipment and material, mature. However, some new technologies such as small scale CHP and some types of heat pumps are not used on a relevant scale yet.

The **most affordable source of energy is coal**, especially in the central part of the country where coal mines with an average retail price of 4.6 EUR/GJ are located. In rural areas, the most affordable fuel is biomass (wood logs). Electricity prices in BiH, compared to EU levels, are low and this poses problems for new investments in energy efficiency and renewable energy sources. Electricity and natural gas prices for households and the public sector are subsidised. The paradox is that **electricity prices in BiH are among the lowest in Europe**, while the price of natural gas (especially for industry) is one of the highest in Europe. The high price of natural gas is a consequence of demand variation during the year since natural gas is mainly used to heat buildings (district heating and individual heating). On the other hand, the low price of electricity is a consequence of numerous hidden subsidies in the power generation sector.

2 Aim and Scope of this Report

The Development Bank of Austria (OeEB) aims to increase its activities in the field of energy efficiency in selected countries. This can be carried out via dedicated credit lines or via supportive programmes for selected financial institutions and project developers. OeEB is also analysing options for direct financing. The present study is part of the overall study, analysing the status of energy efficiency in the countries of Serbia, Bosnia and Herzegovina, Albania, Montenegro, and Georgia.

The Study is carried out in cooperation with ALLPLAN GmbH and the Frankfurt School, and is based on the latest available information collected directly in the country by local experts in March, 2015.

This report focuses on Task 1, “Potential of the Energy Efficiency Market” in Bosnia and Herzegovina, analysing the following questions:

- What is the Status of Energy Efficiency in each economic sector?
- In which sectors the efficiency potential is highest, and which companies are active in these sectors?
- What is the country’s framework for energy efficiency - in terms of legal, economic, and technical aspects?

3 Studies Available

3.1 Overview

There is large number of studies published by international and national institutions about the energy sector. The problem is the difference in some data from one study to another, because there is no specific institution which collects energy data. The most relevant studies, which are referred to in this study, are presented in Table 1. The available studies put the focus on energy efficiency in the energy industry sector (power generation and district heating) and buildings.

Table 1: Overview of available reports

Name/Author/Date/Link	Purpose/Scope	Brief description
Second national communication of Bosnia and Herzegovina under the united nations framework convention on climate change Author: UNDP, 2013, link	The report was prepared according to the requirements of UNFCCC.	The following issues are discussed: ■ Energy efficiency by sector ■ Emissions of GHG by sector ■ Analysis of GHG mitigation measures by sector ■ Adaptation for climate change
EUbuild energy efficiency Author: Chamber of Commerce of Sarajevo Canton, 2012 link	The report was prepared within the EU project EUBUILD – finance of energy efficiency in buildings.	The following issues are discussed: ■ Current state of energy efficiency in buildings ■ Legal framework for energy efficiency in buildings ■ Financial mechanisms available for energy efficiency
First national Energy efficiency Action plan (NEEAP) Author: MOFTER, 2011	The report was prepared as an obligation of BiH according to the Energy Community Treaty.	The following issues are discussed: ■ Energy consumption by sector ■ Analysis of energy efficiency measures needed to meet objectives from EnC by sector ■ Proposal of financial and fiscal mechanisms for energy efficiency
Heating Sector Background Analysis in Bosnia and Herzegovina Author: World Bank 2014, link	The report was prepared within the regional (Western Balkan) project of the World Bank, focusing on district heating with biomass.	The following issues are discussed: ■ Review of the current state of the district heating sector ■ Analysis of biomass potential for district heating ■ Creation of pipeline of biomass based district heating projects
In-Depth Review of Energy Efficiency Policies and Programmes Author: Energy Charter Secretariat 2012 link	Bosnia and Herzegovina ratified the Energy Charter Treaty and the Protocol on Energy Efficiency and Related Environmental Aspects in 2001. The report reviews implementation of energy efficiency policy.	The following issues are discussed: ■ Energy efficiency policy ■ Renewable energy policy ■ Energy pricing and market ■ Energy efficiency funding ■ Energy efficiency programmes
Study of Energy Sector in BiH Author: MOFTER 2008 link	The study was done as input for the development of the energy strategy of BiH. However, for political reasons, the strategy was made on the Entity level, not the State level. Reference year of the study is 2005.	The following issues are discussed: ■ Energy demand and supply ■ Scenarios of energy demand ■ Energy resources ■ Emission of pollutants ■ Renewable energy potential

3.2 Main results of existing studies

Major energy sources in BiH are domestic coal and biomass. Except for buildings connected to the district heating system, buildings are heated mainly by individual boilers and stoves. Characteristic of these technologies for both coal and biomass is very low energy efficiency—less than 60%.

The markets for boilers and stoves are not well regulated. For example, some of the manufacturers present on the market do not have appropriate certificates for the performance of their boilers and stoves. Moreover, domestic coal is partly used in imported boilers despite their not being designed for such coal (regarding contents and heating value). This causes lower energy efficiency rates and an increase in air pollution.

Energy efficiency in generation, transmission and distribution, and end use, is low in Bosnia and Herzegovina in comparison to developed economies, and the highest potential for energy efficiency is expected in end use sectors.

Electricity production in BiH is based on technologies developed more than thirty years ago. In the case of new plant construction and in major reconstructions of existing facilities, new technologies should be introduced whenever possible. Generally, awareness needs to be increased about the savings that could be achieved by increasing energy efficiency.

The energy sector in BiH is one of the sectors with the most prospects in the country, it has a long history, vast potentials and many possibilities for further development and investment. This sector is currently subject to reform, reconstruction, and privatisation, with the aim of inclusion into the European energy markets and the European community.

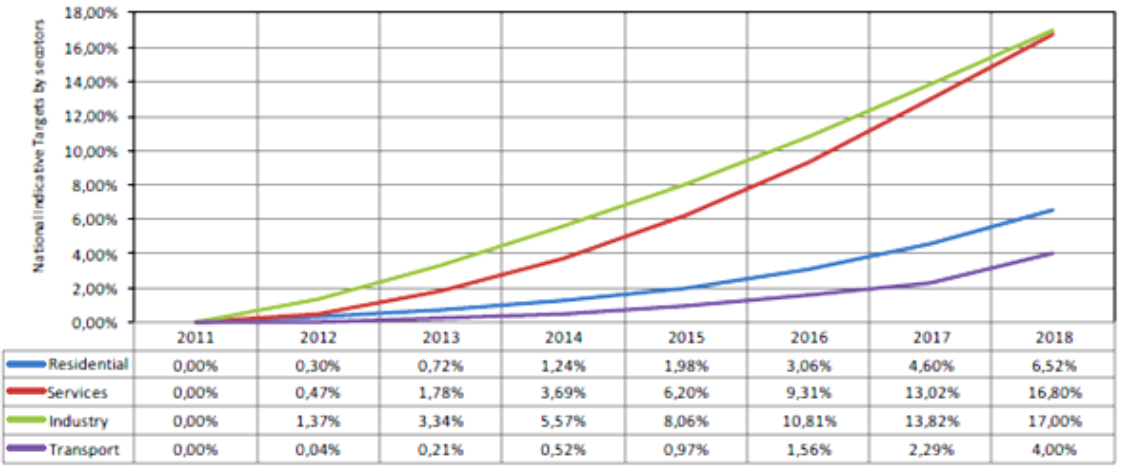
There are no available studies on the energy efficiency potential in industry. Within NEEAP, a review of existing energy consumption per manufacturing sector is given. In the same document, targets for energy efficiency is defined for the period 2009 – 2018, but measures are described very generally, and not for specific manufacturing sectors.

The value of the energy market in 2006 amounted to approximately 2.5 billion Euro (source: Institute Hrvoje Pozar, 2008) and GDP was about 9 billion Euro. Therefore, the ratio of energy costs to GDP was about 28%. In developed countries the ratio is about 6-7%. The conclusion is that in BiH there are considerable possibilities to improve energy efficiency.

The main document for energy efficiency analysis is the **NEEAP**. Due to lack of political will, NEEAP was not adopted as state level document, but as separate documents on entity level. Federation of BiH - since this entity wants to have state level NEEAP - did not call the NEEAP “entity document”, but “Energy Efficiency Action Plan of Federation of BiH”. Republika Srpska, being against state level NEEAP, called their document NEEAP. However, contents did not change in comparison to overall document.
Figures cited in this report are taken from the final version of NEEAP. This version was sent to the state parliament for adoption, but never was adopted on state level.

4 Status of Energy Efficiency

According to NEEAP, BiH has adopted a national indicative energy savings target of not less than 9% of the final energy consumption for 9 years by 2018. Compared to current average savings of 1.1% annually, this target has to be considered quite ambitious. Taking into account total final energy consumption in 2009, it means that the **country should save energy 12.47 PJ until 2018**. The highest target is set for the industrial sector and amounts to 17% for the **period 2009 – 2018.** Highest potential in absolute terms, however, can be identified in the buildings sector, given the dominant share of energy consumption in buildings for both the residential and the service sector.



	2011	2012	2013	2014	2015	2016	2017	2018
Residential	0,00%	0,30%	0,72%	1,24%	1,98%	3,06%	4,60%	6,52%
Services	0,00%	0,47%	1,78%	3,69%	6,20%	9,31%	13,02%	16,80%
Industry	0,00%	1,37%	3,34%	5,57%	8,06%	10,81%	13,82%	17,00%
Transport	0,00%	0,04%	0,21%	0,52%	0,97%	1,56%	2,29%	4,00%

Figure 2: Energy saving potential targets (NEEAP, 2012)

4.1 Energy supply

The International Energy Agency's latest data (2012) for the energy balance of BiH are given in Figure 3.

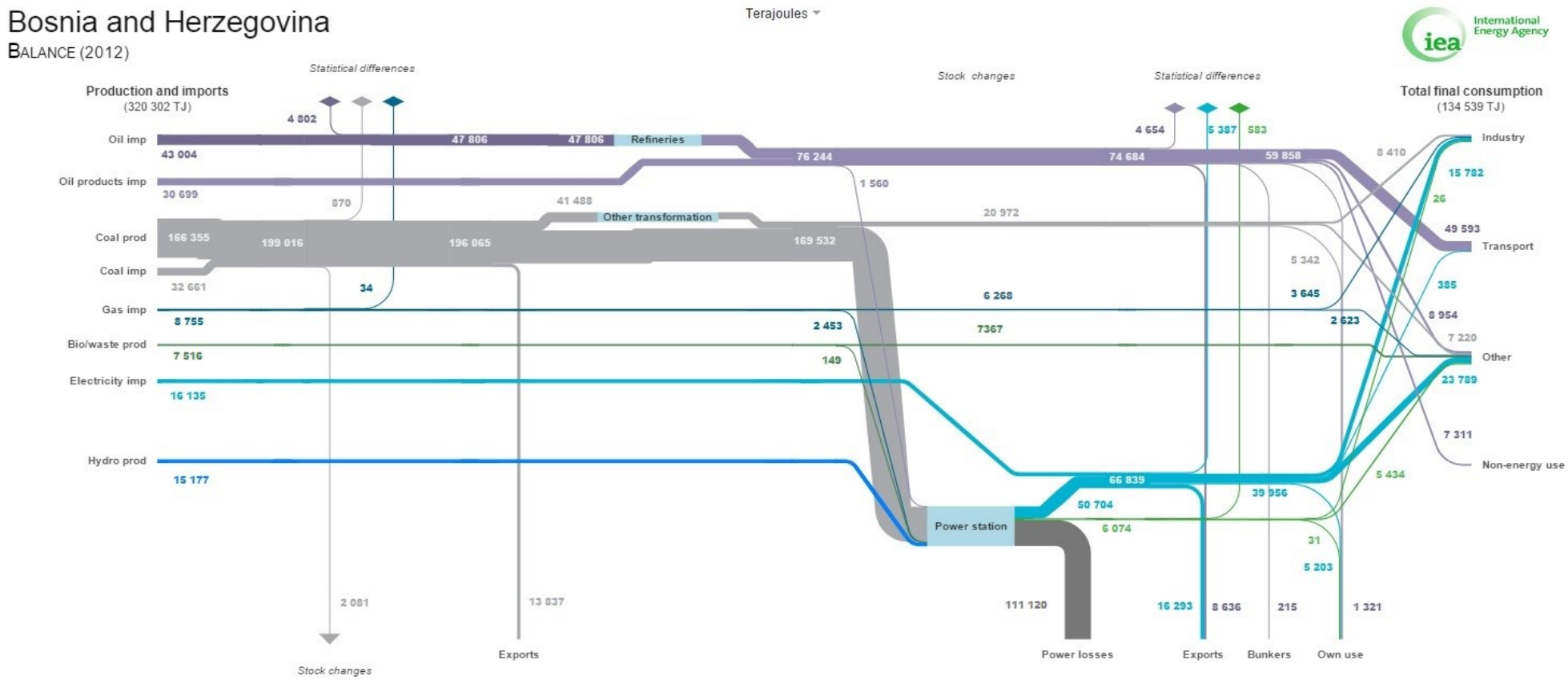


Figure 3: Energy balance of Bosnia and Herzegovina (IEA, 2012, figures inserted by ALLPLAN)

From the 2012 energy balance, which shows about **279 PJ of primary energy consumption**, the following conclusions can be drawn:

- Taking into account that all liquid fuel and natural gas are imported, BiH is highly dependent on energy imports.
- Coal and hydro (big hydro power plants) are the main sources of electricity generation.
- Biomass is mainly utilised in the residential sector for heating and cooking purposes, but with very low efficiency.
- The share of industry in the final energy consumption is about 20%, which is considerably lower than in 1990.
- Renewable energy makes up almost 17% of the final energy consumption according to the 2012 energy balance report. However, data from EnC show that the share of renewable energy in final energy consumption was as high as 34% in 2010. The difference is because of different data on biomass consumption. The share of biomass in final energy consumption varies from 6% to 20% depending on the source of data. The CRES study indicates the total use of biomass in energy generation at 32.7 PJ in 2010.

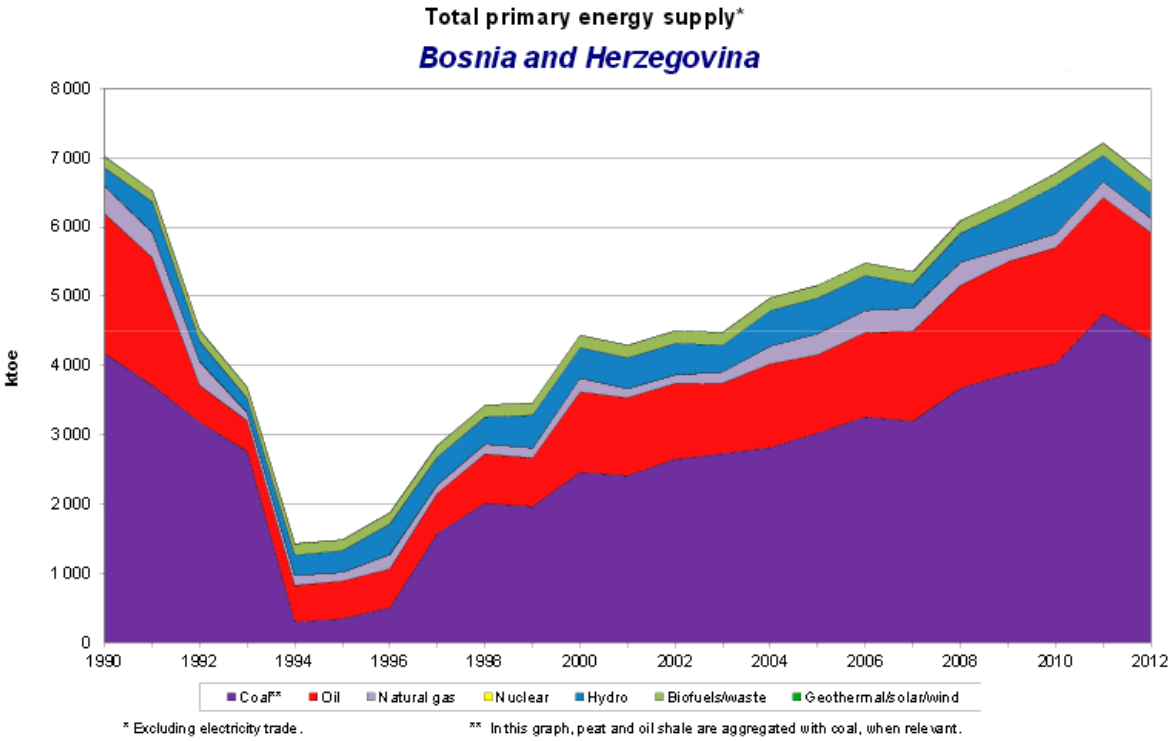


Figure 4: Total primary energy supply trends (IEA, 2012)

The total electricity generation of BiH amounted to 50.5 PJ (around 14,000 GWh) in the year 2012 (IEA, 2012).

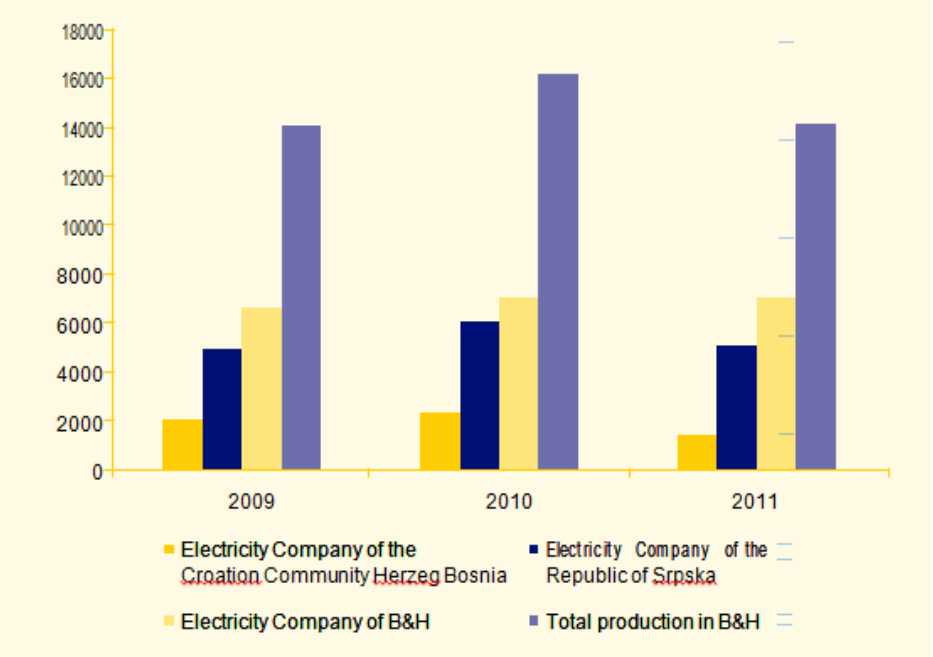


Figure 5: Electricity generation in BiH, in GWh
(The State Electricity Regulatory Commission of BiH)

Power generation in BiH is carried out by three electricity companies, Elektropriveda (EP) BiH, Mixed Holding Company Electropriveda Republike Srpske (EP RS), and EP Hrvatske Zajednice Herceg Bosne d.d. Mostar (EPHZHB), which are independent in decision making, especially on the construction of new power plants, and they are responsible for customer supply in their respective areas of operation. All three electricity companies are majority-owned by the Entities (FBiH and RS). In addition, there are other privately-owned companies and initiatives to construct new generation capacities.

The majority of electricity generation in BiH is by coal thermal power plants. The total installed capacity in BiH amounts to 3,656 MW; 2,100 MW of which are HPP, the rest being coal and lignite power units. Most of the facilities were put into operation between 1955 and 1989 during a period of intensive power facility construction in BiH. All thermal power plant units are dimensioned to operate with domestic coal with an energy value of 8-12 MJ/kg (lignite) and 14-17 MJ/kg (brown coal). The energy efficiency of the existing thermal power plants is very low, estimated at 30.5%. In addition, levels of acid gas emissions are very high, for instance, the concentration of sulphur dioxide in flue gasses in the Ugljevik thermal power plant is about 15,000 mg/m^3, while the EU limit value is 150 mg/m^3. The operation of existing thermal power plants after 2018 will be very restricted due to these high emissions. This is because BiH's obligation to the EnC is to reduce acid emissions in order to be in compliance with the EU Directive on Large Combustion Plants.

Apart from large HPP, there are currently 13 SHPP with a total capacity of 31 MW, and a large number of new SHPP projects at various stages of development.

BiH is a net electricity exporter – according to data from the State Electricity Regulatory Commission (SERC) it exported 17.6 PJ in 2010.

About 12% of all households in BiH are connected to the district heating system. About 20% of households have central heating (individual central boiler heating where one boiler heats water to heat the whole household). The rest of households are heated by stoves (UNDP, 2013). The total production of heat in the district heating system is 6.1 PJ (IEA 2012), and the total consumption of energy for heating is 64.9 PJ (World Bank, 2014).

4.2 Energy demand

The overall **Final Energy Consumption** for 2010 for BiH amounted to **137.7 PJ**, including 42.9 PJ for Republika Srpska and 94.8 PJ for the Federation of BiH; more than half of TFC is consumed by the residential sector.

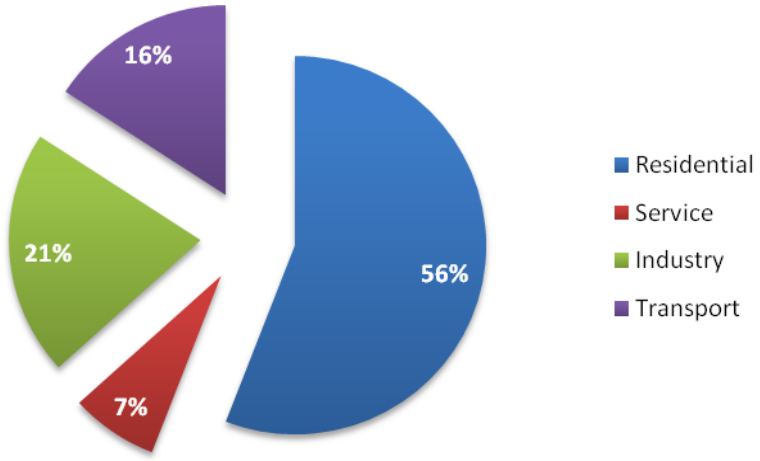


Figure 6: Shares of energy consumption in BiH by sector for 2010 (NEEAP, 2012)

In most of the towns with a population of more than 25,000, there exist district heating systems. In 1991, these systems supplied heat energy for about 10% of the population (about 450,000). Recently, systems have operated in Sarajevo (with about 45,000 dwellings, and a capacity of 485 MW), Banja Luka, Tuzla, Kakanj, Zenica, Travnik and other towns. Total heat consumption in 2010 was divided among households (74.6%) and industry and other consumers (25.4%).

Table 2: Indicators of energy use in Bosnia and Herzegovina (FMERI, 2009)

Indicator	BiH	Southeast Europe	EU 25	World
consumption of energy (GJ/per capita annually)	50.2	76.6	166	74.1
energy intensity (toe per 1000 USD of GDP)	0.86	0.86	0.18	0.32

From Table 2, the following can be concluded:

- BiH consumes around 40% less energy than the average consumption of the countries in Southeast Europe, three times less than EU countries, and almost 40% less than the world average.
- BiH, like other countries in Southeast Europe, consumes a lot of energy per unit of GDP, almost five times more than EU countries and 2.5 times more than the world average.

Total electricity consumption in BiH in the year 2010 amounted to 37.2 PJ, and has shown an upward trend since then. In 2010, electricity consumption shares amounted to: households (43.9%), industry (35.7%), and other consumers, including the public sector, transportation and agriculture (20.4%).

In the industrial sector, electricity is the dominant energy carrier with a share of the total baseline consumption of 41.8%. Shares of Industrial energy consumption in BiH by fuel type in 2010 is given in Figure 7.

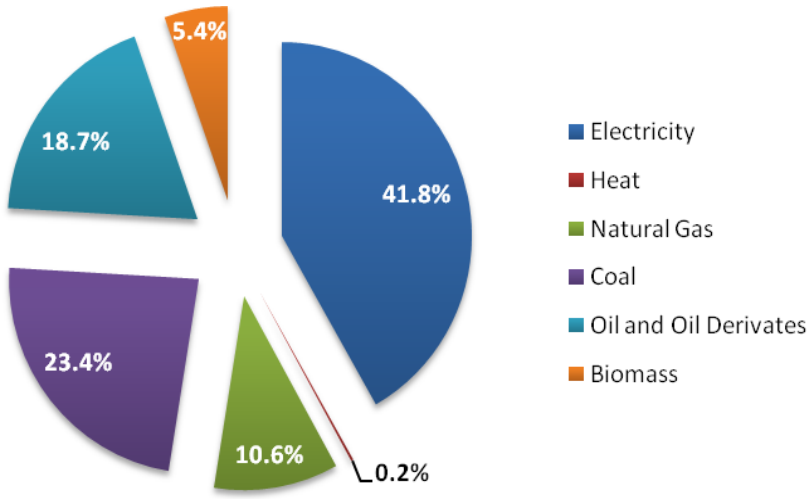


Figure 7: Shares of energy consumption in industry in BiH by fuel type (NEEAP, 2012)

According to BHAS, consumption of electricity in the industrial sector shows an upward trend and amounted to 14.7 PJ in 2013. Data on electricity consumption by industry branch in 2013 is given in Table 3.

Table 3: Consumption of electricity in industry in BiH in 2013 (BHAS, 2014)

Electricity Consumption	PJ
Industry	14.7
Iron and steel	2.9
Chemical (incl. Petrochemical)	0.4
Non-Ferrous Metals	7.1
Non-Metallic Minerals	0.6
Transport Equipment	0.1
Machinery	0.8
Mining and Quarrying	0.3
Food, Beverages, and Tobacco	0.7
Paper, Pulp, and Printing	0.7
Wood and Wood Products	0.6
Textiles and Leather	0.3
Non-Specified	0.4

The largest share of final electricity consumption in industry in 2013 was Non-Ferrous Metals with 48.1%, while the Iron and Steel Industry contributed with a share of 19.4%.The biggest consumer of electricity in BiH is the aluminium factory Aluminij dd Mostar. Two main consumers of natural gas in industry are the steel factory in Zenica and the aluminium factory in Zvornik.

According to the Study of the Energy Sector of BiH published in 2008, an increase of EE and implementation of RES is foreseen in the country. The highest potentials for energy savings are attributed to insulation, which would be carried out with strict regulations and by establishing a set of controls for new buildings. High potentials also exist by implementing other measures of decreasing heat losses in existing buildings such as the installation of thermostatic valves, measurement of heat delivered, balancing heating systems, improvement of the sealing of windows etc. By 2020, the predicted final energy consumption in BiH will have increased by 20% in comparison to 2010. Consumption of fuel wood and fossil fuels for heating purposes should decrease. The result of this decrease will be the decreasing share of energy consumption in buildings, coming closer to its share in European countries (approximately 40%). Energy consumption in industry will increase.

4.3 Greenhouse gas emissions

The main source of GHG is the energy production sector, which contributes more than 70% of total carbon dioxide emissions. Two of the most carbon-intensive energy sub-sectors are energy conversion (thermal power plants, heating plants, and transportation) and industrial fuel combustion. Most of the carbon dioxide emissions in energy conversion are from fuel combustion in thermal power plants.

Emissions of carbon dioxide from the electricity production sector in 2010 were 11.11 million tons, with a grid coefficient of 750 kgCO_2/MWh. Total emissions amounted to 21.249 million Gg CO_2eq for 2010. Sink capacities, amounting to 7.327 million Gg CO_2eq, are not incorporated in the stated value.

Figure 8 shows CO_2eq emissions for the period 1990 to 2001. It is evident that the analysis in this chart deviates from charts from most other countries, since instead of a normal increase in emissions of CO_2e it shows a decrease of GHG emission during the war (12% in 1993 compared to the base year of 1990).

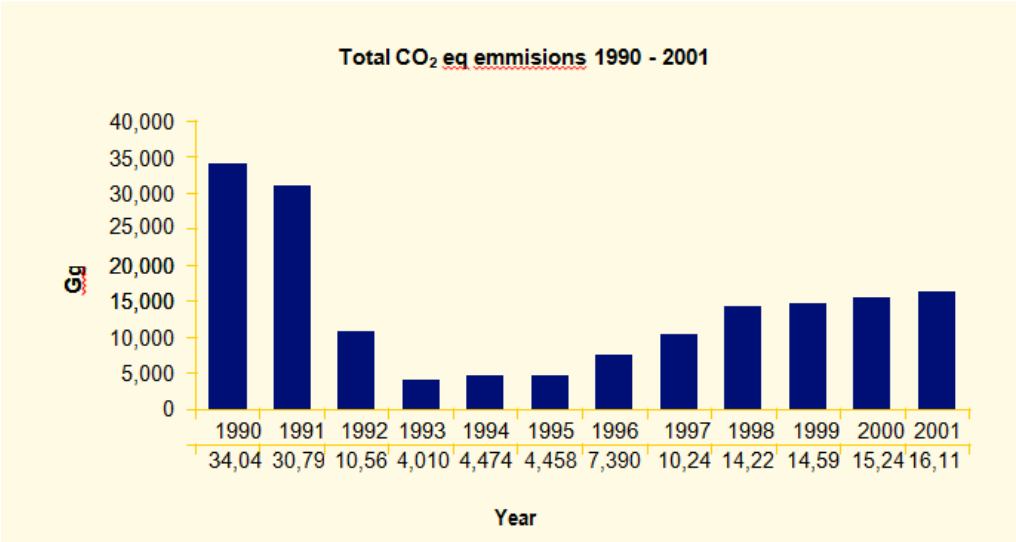


Figure 8: GHG emissions in BiH, 1990 – 2001 (UNDP, 2013)

4.4 Energy efficiency in the industrial sector

Analysis of energy efficiency measures in BiH are mainly focused on buildings and housing, less on transportation, while there is no clear strategy regarding the introduction of energy efficiency in industry. However, the manufacturing industry shows great potential for increasing energy efficiency (Kapetanovic and Curkovic, 2012).

Production is mostly based on technologies that are several decades old. A large part of the current industrial capacity was built at a time when the choice of technology was based only on the criterion of minimum investment, but with little attention to energy and environmental-related matters. The utilisation factor, calculated as the ratio of useful energy to final energy, amounts to 0.62 for the industrial sector as a whole, 0.65 for ferrous metallurgy, 0.60 for coloured metallurgy, to 0.50 for non-metal industry, 0.85 for the chemical industry, and 0.71 for other industries. On average, the foundries need around 2 MWh of electricity to produce one ton of casting (Sehic-Music et. all, 2013).

The last comprehensive study on energy savings potential in industry dates back to 2010. The company CETEOR carried out energy audits of selected industrial facilities within a project financed by EBRD. The estimated energy savings potential in Table 4 is based on the conclusion of these energy audits. The percentage of industrial energy consumption per sub sector is based on NEEAP.

Table 4: Industrial sectors with greatest energy saving potentials

Industrial Sub Sector	Percentage of Industrial Energy Consumption (%)	Estimated Energy Saving (technical potential) (%)	Energy Saving Potential on whole Industrial Energy Consumption (%)
Iron and steel, aluminum, basic metals	37.65	15	5.65
Non–metallic minerals (cement, ceramic, salt…)	49.34	20	9.87
Food	6.36	23	1.46
Textile, clothing, leather	2.84	20	0.57

The **target for energy efficiency in industry** for the period 2009 – 2018 is an energy savings of 4.82 PJ, or **17%** compared to the energy consumption in 2010. The total required investment to fulfil the criteria of the energy consumption reduction target for BiH by the end of 2018 is 438 million EUR (NEEAP, 2012).

The Metal production and processing industry (aluminium and steel) is of great importance for the economy of BiH. There are more than 130 companies in the metal processing industry in BiH, 80% of which are small enterprises, 15% medium sized enterprises, and 5% large enterprises. There is only one steel production facility, in Zenica, with an annual production as large as 720,000 tons of steel. In 2013, 58% of produced steel was exported. The factory uses natural gas and coal in its operations. Moreover, there are dozens of foundries and forging facilities in the country. Many of them face the problem of overcapacity because the capacities were designed for the market of ex-Yugoslavia. Recently, many of them have operated at 30-50% of designed capacity. In the group of non-ferrous metals, the biggest energy consumer is the aluminium factory in Mostar with a correspondingly high consumption of electricity. The estimated potential for energy savings is 1.62 PJ, mainly in electricity and natural gas. Energy savings measures with the highest savings potentials are the replacement of old equipment, the addition of heat recovery, and the rearrangement of equipment within factories (due to the lower current capacity and change of final products).

There are two **cement factories** in BiH, and both are owned by companies from the EU (Germany and Austria). Several EE measures have already been implemented. Both factories are currently working to introduce alternative fuels in their production processes. A higher potential for energy savings can be found in the sectors that produce asphalt, stones, ceramic materials, sand, etc. The estimated potential for energy savings is estimated at 2.84 PJ (NEEAP, 2012).

There is a long tradition of **textile and garment manufacturing** in BiH. Before the war (1992), this primarily SME-based industry was one of the pillars of light industry. Bosnian garment manufacturers were viewed as the market leaders in final processing and were a top choice for western European customers seeking quality, reliability, and productivity.

Recently, the textile industry has employed up to 30-35,000 workers in BiH. The number of employees in the manufacturing of leather, leather products, and footwear has consistently grown year to year.

The main energy carriers used in the textile industry are coal, natural gas, and electricity. The increase in electricity consumption can be taken as an illustration of the growth in the textile industry. In 2013, consumption of electricity was 2.27 times higher than in 2010. The estimated potential for energy savings is 0.16 PJ.

The main products of the **food industry** are milk, fruit juices, flour, processed fruits/vegetables, processed meat, wine, beer, sugar, and animal fodder. Based on energy audits performed within different projects, the estimated energy savings potential is 0.42 PJ.

4.5 Energy efficiency in the residential sector

According to the state Agency for Statistics, in 2010 BiH had 3,843,126 inhabitants, meaning a decrease of 500,000 since 1991. Population density is 71 inhabitants per km². The population growth rate in 2010 was -0.41%.

The building sector, including households, is the single most important energy consumer, with 58.44% of final energy consumption in 2010 (see Table 5). Final energy consumption in residential buildings in 2010 amounted to 77.07 PJ, in the services sector this indicator was 10.17 PJ. Total housing facilities in 2005 are estimated to number 1,097,200 units, which is approximately 97.8 million m² of housing area (a population census was not carried out after the war so there is no precise data). Family houses account for 70% and flats account for 30% of the total housing facilities.

It is predicted that by 2020 there will be 1,292,600 housing units making up 121.20 million m² of housing footprint.

The average annual energy consumption for heating in residential buildings is 200 kWh/ m², which shows considerable room for improvement. The average heating surface per household is 55.72 m².

In 2005, the service sector accounted for only 15% of the total building sector, whereas in 2020 it is expected to account for approximately 20%. Energy demand is predicted to double by 2020 with the rapid growth in energy needed for space cooling (MOFTER, 2008).

Heating accounts for almost 63% of the energy used in residential buildings and 36% in public buildings as can be derived from the below tables. The primary energy source for heating in rural areas is biomass, while in urban areas there are district heating systems which use natural gas, heavy liquid oil, biomass, coal, and heat from thermal power plants. The heating season lasts 6 months.

Table 5: Energy consumption in residential buildings in 2010 (NEEAP, 2012)

		PJ/a	%
1.	Cooling (air conditioning)	1.35	1.75%
2.	Heating of sanitary water	6.30	8.17%
3.	Lighting	2.70	3.51%
4.	Household appliances	7.19	9.32%
6.	Cooking	11.03	14.31%
7.	Heating	48.50	62.94%
	Total	**77.07**	**100.00%**

Table 6: Energy consumption in public buildings and public lighting in 2010 (NEEAP, 2012)

		PJ/a	%
1.	Heating	3.64	35.76%
2.	Cooling	0.61	6.02%
3.	Heating of sanitary water	0.80	7.86%
4.	Lightning	0.94	9.22%
5.	Electrical appliances	3.58	35.23%
6.	Public lighting	0.60	5.91%
	Total	**10.17**	**100.00%**

The total investment costs of implementing energy efficiency measures to reduce heating demand towards the 60% by 2020 savings target are estimated at 30 EUR per m² of housing area on average. This would correspond to a total investment of about 2.9 billion EUR (MOFTER, 2008).[1]

[1] This value has to be contrasted with the NEEAP target, which is about ten times lower. NEEAP target is an obligation emanating from the Energy Community. The figure stated here is a more ambitious estimation of potentials and not a binding target.

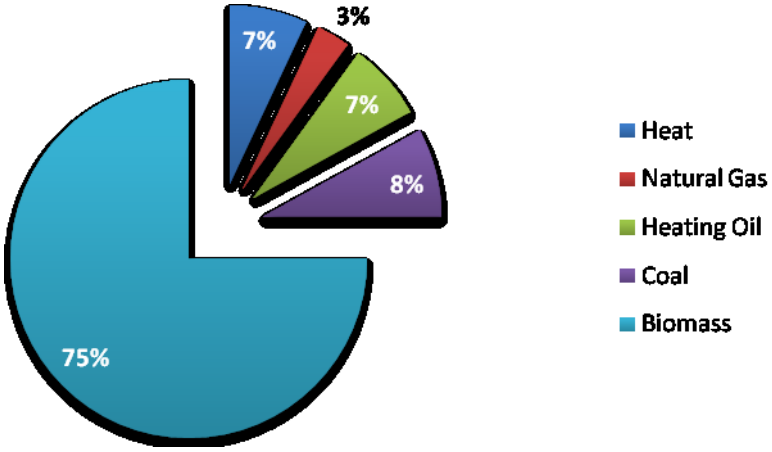


Figure 9: Share of fuel used to heat households (World Bank 2014)

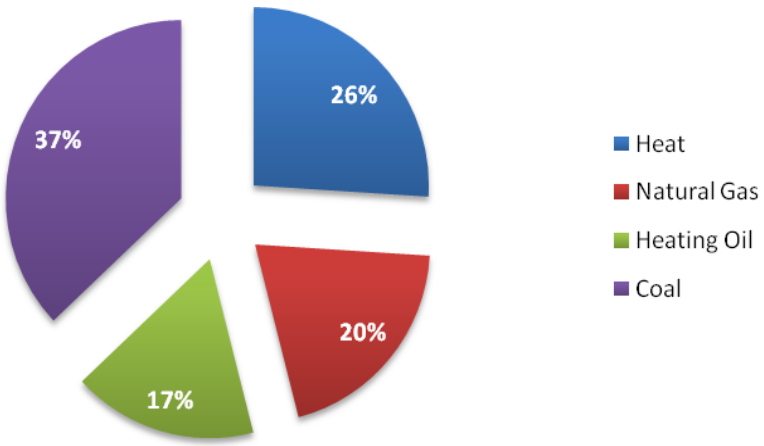


Figure 10: Share of fuel used to heat service buildings (World Bank 2014)

Modern appliances, such as refrigerators, freezers, ovens, stoves, washing machines, etc., use significantly less energy than older models. However, due to low prices of electricity, EE is not the primary driving force for people to replace existing electric appliances, but functionality and design instead.

There is no official assessment on the rate of construction of new buildings. Taking into account the actual growth rate of the population (negative) and the existing, relatively-high specific footprint of dwellings (m^2 per capita), new buildings will be constructed only to replace the old ones. EE is not such a strong driving force to significantly influence the rate of new building construction. According to the official statistical data in 2010, 568,033 m^2 of new buildings were constructed in both the residential and commercial sectors. In order to reach the NEEAP targets, a large portion of residential buildings built before 1960 (approximately 10% of the current building stock) must be replaced. 10 million m^2 of new construction would be needed to reach this target. In order to achieve this by 2020, construction of one million m^2 annually is needed, which is double the figure in 2010 (EUBUILD, 2012).

According to legislation in FBiH, every new building has to have an energy performance certificate (EPC) when applying for a building permit. New buildings must achieve at least a class B rating (a maximum heating need of 95 kWh/m^2 annually). EPCs are the most visible aspect of the new regulation concerning the energy performance of buildings. These documents assign an energy performance label to residential and non-residential buildings or building units. For existing buildings, an EPC contains cost-effective

measures for improving their energy performance. Existing buildings are obliged to get energy certificates in the event of renovation, rental, and sale/purchase.

4.6 Energy efficiency in the agricultural sector

The share of agriculture in the gross national income of BiH has been reduced in the past dozen years from about 14% to about 8% as a result of its stagnation relative to other industries.

Another important indicator is the use of agricultural resources — land, and particularly land of the highest quality, such as arable land. In BiH, only about 53% of arable land is used (in FBiH below 50% and in RS 55%). In RS, the rate of arable land use has increased during the last 15 years by about 35,000 ha, whereas in the FBiH this trend is negative. In addition, the number of livestock — cattle per ha of arable land — is under 0.5 which is 4-5 times lower than in countries with developed agriculture. The portion of livestock production in total agricultural production is below 40%, which is a synthetic indicator of the general underdevelopment of agriculture.

The share of agriculture in the total consumption of final energy in 2010 was about 2.0% or 2.92 PJ (NEEAP, 2012).

According to the Ministry of Agriculture, Forestry and Water Management of RS, 50% of existing tractors in BiH experience the problem of incomplete combustion due to badly-adjusted fuel injectors. The solution is to optimize the high pressure pump and fuel injectors in these machines. Badly-adjusted fuel injectors inject fuel at varying pressures, resulting in incomplete fuel combustion, unstable engine operation, and loss of engine power.

4.7 Energy Efficiency of SMEs

The weight of SMEs in the economy of BiH can be characterized as follows:

- SMEs account for more than 99% of the total number of companies,
- Share of the SME sector in GDP is 60%

The number of active companies in BiH is given in Table 7.

Table 7: Number of active companies in BiH (BHAS, 2014)

Classes of employees		total	RS	FBiH	BDBiH[2]
1 (0 – 9 employees)	Micro enterprises	23,332	6,996	15,030	1,306
2 (10 – 19 employees)	Small enterprises	3,227	1,030	2,111	86
3 (20 – 49 employees)	Small enterprises	2,669	850	1,767	52
4 (50 – 249 employees)	Medium enterprises	1,906	639	1,239	28
5 (250 and more)	Large enterprises	301	96	199	6
		31,435	**9,611**	**20,346**	**1,478**

There is no available study on specific energy efficiency potentials in SMEs. However, all companies in the food industry belong to SMEs. In the textile industry, there is only one large company, while all others are SMEs. All foundries and forges are also SMEs. Therefore, the energy efficiency potential by sector, estimated in chapter 4.4, mainly refers to SMEs.

[2] BDBiH is Brcko District in Bosnia and Herzegovina. It is a municipality in BiH, but it does not belong to any of the two entities.

4.8 Summary of energy efficiency potential

Residential buildings have the highest energy efficiency potential in BiH due to their high baseline energy consumption. However, the economic viability of EE measures in buildings depends on type of fuel used for heating as it is described above.

The 1st NEEAP for BiH has set the percentage and absolute values of targets for energy efficiency by sector until 2018, both at the State and Entity level. These targets can be considered as economic energy efficiency potential since the payback time of the measures considered to reach the target is up to 7 years. **The technical potential for energy efficiency is much higher**. For instance, the technical potential in residential buildings amounts to 60% of the baseline energy consumption. However, it would require 30 EUR/m^2 of the investment, depending on the baseline consumption and payback time could be even longer than 10 years. Economic energy efficiency potential by sector in BiH is given in Table 8.

Table 8: Economic energy efficiency potential by sector in BiH (NEEAP, 2012)

Sector – final energy users	Economic potential PJ	Share of the potential index %
Households – residential buildings	5.25	42.08
Commercial and services	1.62	13.00
Industry	4.79	38.42
Transportation	0.81	6.50
Total	12.47	100.00

The total financing needed to fulfil the requirements of the energy consumption reduction target for residential buildings by the end of 2018 is 216 million EUR. 87% of this investment is predicted to be soft loans and the rest tax incentives.

The total required investment to fulfil the energy consumption reduction target in the commercial and service sectors by the end of 2018 s 142 million EUR. 67% of this investment is predicted to be soft loans, 13% tax incentives, and 20% subsidies from an energy efficiency fund. The total required investment to fulfil the energy consumption reduction target in industry by the end of 2018 is 438 million EUR. 60% of this investment is predicted to be soft loans and the rest should be self-financed (NEEAP, 2012).

5 Framework for Energy Efficiency

5.1 Legal and policy framework

The following table provides an overview of the current energy and EE policies in BiH.

Table 10: Energy and EE laws and policies

Year	Name of Legislation
2000	Statements of the Entity governments on electricity policy
2002	Act on Transmission of Electric Power, Regulator and System Operator of Bosnia and Herzegovina
	Law on Transmission of Electric Power, Regulator and System Operator of Bosnia and Herzegovina (Official Gazette Bosnia and Herzegovina 7/02)
2003	The Action plan for Restructuring the Power Sector of RS (Official Gazette 69/03)
2004	Law Establishing the Company for Transmission of Electric Power in Bosnia and Herzegovina (Official Gazette Bosnia and Herzegovina 35/04),
	Law Establishing an Independent System Operator for the Transmission System (Official Gazette Bosnia and Herzegovina 35/04)
	Medium-Term Development Strategy (2004-2007)
	The Action plan for Restructuring the Power Sector of FBiH
2005	Plan for Power Capacities Development on new electricity generation plants
	Federation of Bosnia and Herzegovina Law on Electricity (Official Gazette Bosnia and Herzegovina 38/05)
2006	Energy Community Agreement for South East Europe
	Market Rules (Official Gazette Bosnia and Herzegovina 48/06)
	Grid Code (Official Gazette Bosnia and Herzegovina 48/06)
	The Law on Gas in Republika Srpska
2007	Decree on Organization and Regulation of the Gas Sector in the Federation of Bosnia and Herzegovina
2008	Agreement on principles of energy policy
	Study of energy sector of BiH
	Task Force on Energy Efficiency
	Bases of Energy Policy of Republika Srpska (Official Gazette RS No. 117/08)
2009	**Strategic plan for development of energy sector in FBiH**
	Republika Srpska Law on Energy (Official Gazette RS No. 49/09)
	Republika Srpska Law on Electricity (Official Gazette RS 92/09)
2010	The first national communication on climate change for BiH
2012	Strategy of development of energy sector of RS
2013	The second national communication on climate change for BiH
	Low Emission Development Strategy of BiH
	Law on energy efficiency of RS (01-1518/13)
	Law on Renewable energy and Cogeneration in FBiH (70/13)
	Law on Renewable energy and Cogeneration in RS (39/13)
2014	**Action Plan for Energy efficiency of FBiH**

* The bold lines are of significant importance in terms of EE.

Study of Energy Sector in BiH (MOFTER, 2008) puts an emphasis on the need to provide the institutional and legislative framework at State and Entity levels. This was seen as one of the essential prerequisites to implement energy efficiency measures and the use of renewable energy sources

By signing the Energy Community Treaty (EnC), BiH committed itself, inter alia, to transpose EU directives related to EE into national legislation. All EnC member states, including BiH, are obliged to make reductions in final energy consumption by 9% compared to the baseline in 2010, in the period 2011 -2018. In accordance with the requirements of the EE Directive 2006/32/EC, BiH prepared the First National Energy Efficiency Action Plan (NEEAP), but for political reasons NEEAP has not been adopted yet. Despite this, the NEEAP has been used to draft Entity-level action plans for energy efficiency.

BiH does not have a law on energy efficiency at the State level. RS adopted the Energy Efficiency Law in 2013. A draft of the law was developed within the EU project. In FBiH the law has not been adopted yet but the draft is under public discussion.

FBiH has recently adopted the changes of the Law on Construction which contain some relevant transpositions of the EU directive 2010/31/EU and has published a new set of regulations covering some parts of the directive 2006/32/EC but only in the building sector. Some segments of the building construction regulations are longer in force in FBiH. Drafts of the secondary legislation on EE in RS have been prepared and have recently been under public discussion.

Laws on renewable energy and cogeneration adopted at the Entity level are the main laws governing the use of renewable energy. Their purpose and scope is to ensure the widespread use of renewable energy sources in order to meet the target for the share of renewable energy in final consumption — 41% by 2020 defined within the EnC. The financial instrument adopted by the laws are the feed-in tariffs for electricity produced by renewable energy sources.

In both Entities, the funds for environmental protection and energy efficiency are established and EE measures are eligibile to be co-financed from these funds. The maximum support for energy efficiency projects in public buildings is 50% of the total investment. EE in industry is not eligibile yet and neither are residential buildings. .

Table 11. Public support systems (incentives)

Title / Organisation	Available Support	Description
Fund for environmental protection and energy efficiency in FBiH	Up to 50% of the investment, there is no defined maximum amount of investment	Sector: Public buildings Project components: ▪ Replacement of boilers ▪ Replacement of windows ▪ Thermal insulation of façade ▪ Installation of solar collectors
EBRD BAS programme	Up to 70% incentive for energy efficiency.	Sector: Industry Support is provided for audits, consultancy projects, and preliminary design in private industrial companies.

5.2 Technical framework

The market in BiH in terms of energy efficiency related equipment and material is well developed and relatively mature with the exception of a few technologies. Due to BiH's close trade relations with Western Balkan countries and the EU, a wide variety of products from these countries are easily available. This leads to a wide variety of equipment and materials (and also a very high variation of models and efficiencies as well as prices) available to consumers, who often need support in selecting the "best" equipment due to the large number of types available.

One category of equipment that is very new and largely unavailable in the market is different types of biomass cogeneration technologies, such as ORC units and technologies with biomass gasification. Small scale absorption chillers, small scale CHP units, small scale biogas systems, and PV systems are also relatively new to the market.

There are dozens of companies in BiH dealing with production and installation of solar water heaters. They produce flat panel units, often used for hot water heaters, and in some cases, as an additional source for space heating. Domestically produced solar water heaters are installed mainly in BiH because

the majority of producers do not have all the certificates needed for export. There is no data about the quantity of production. Prices of these solar water heaters is up to 50% less in comparison to Western European producers.

There are plenty of companies producing windows from PVC frames imported from the EU and Turkey. The market is well developed, with a large number of installers. The coefficient of heat transfer of the windows ranges from 1.1 to 1.5 W/m^{2}K.

There are several companies that produce insulation materials for building façades. There is one producer which uses only natural materials, such as wool and wood.

There are several producers of efficient biomass boilers and stoves (for pellets and wood chips). The quality is very high and recognised at an international level. A certain amount of these boilers and stoves are exported.

There is one producer of LEDs.

There are no producers of heat pumps, although the growth of the application of this technology in BiH is quite high (especially water-to-water, and air-to-water types).

Table 9: Companies in BiH

Company info/ address	Main Company/ Mother company	Remarks
UGARAK d.o.o. Dobrinje bb 71300 Visoko http://www.ugarak.ba/	domestic company	One of the biggest companies dealing with manufacturing of PVC and ALU windows.
FRAGMAT IZLORIKA, d.o.o. Branilaca grada bb 75320 Gracanica http://dev.fragmat.info/Kontakt.aspx	FRAGMAT TIM SLOVENIA, www.fragmat.si	Manufacturing of different kinds of thermal insulation materials
KOVAN M.I. d.o.o. Grabovac bb 75320 Gracanica http://www.kovan.ba/index.php/en/kontakt-2	domestic company	Manufacturing of efficient pellet boilers, capacity from several kW to 600 kW, certified efficiency 90%. The company exports boilers to EU and has own pellet production facility.
TOPLING d.o.o. Vojvode Stepe 6 78430 Prnjavor http://topling.com/	domestic company	Manufacturing of efficient hot water and steam biomass boilers (wood chips, heating wood, pellets), capacity from several kW to several MW.
ENECO d.o.o. Petrova Gora 10 76300 Bijeljina http://www.en-eco.net/	domestic company	Assembly and installation of heat pump systems. The company imports parts of heat pumps and provides assembling and installation.
BEKTO PRECISA d.o.o. Ibrahima Popovica bb 73000 Gorazde http://www.bekto.com/V2/product-housing3.htm	domestic company	Manufacturing of LED bulbs.

Regarding the agricultural sector the following facts are important:

- More than 95% of existing tractors have manual gearboxes and outdated engines (pump – nozzles).
- These tractors have outdated engines (no common rail engines) which are in compliance with Euro 3 standards at a maximum.
- There are no tractors with continuously variable transmissions (CVT) on the common market (at dealers in BiH).

- On the new tractor market, there are only tractors with pump-nozzle engines, manual gearboxes, and without electronic control unit. Catalogues of the new tractors do not contain any information on energy consumption.

5.3 Economic framework

There are no publicly available studies on the economic viability of energy efficiency investments apart from the assumptions in the NEEAP. The economic viability values provided below are estimations by the local expert which are based on the performance of more than 50 energy audits in buildings and industry.

The relatively low electricity price, due to subsidies, has a negative impact on the economic viability of energy efficiency projects. This factor, combined with limited awareness of the potential savings, reduces consumer interest in energy efficiency investments and activities. However, there are measures, especially in buildings and industry, with very attractive payback times. In buildings, economically viable measures are the replacement of boilers, addition of thermal insulation in building façades, window replacement, thermal insulation of roofs, etc. when the baseline heat source is liquid fuel or natural gas. In industry, attractive measures are waste heat recovery (for instance air compressors) especially in the food industry.

The highest energy savings potential is associated with an increased used of thermal insulation to reduce heat loss. These investments are especially attractive in mountainous areas in the central part of Bosnia and in buildings which use liquid fuel or natural gas for heating. The payback time of EE measures in buildings varies from four years (in cases where the baseline includes light fuel oil or natural gas) to ten years (where the baseline includes coal or biomass). One very profitable measure in locations where underground water is easily accessible is the installation of heat pumps for heating and cooling. Taking into account the cheap electricity needed for the heat pump, payback time can be about three years. However, the most profitable measure in buildings is to switch fuels (from fuel oil and natural gas to modern biomass) with payback times starting at two years.

Energy prices in buildings are slightly lower due to the tariff policy of BiH. Residential users pay 17% of VAT for the energy costs.

Electricity prices in BiH are low compared with the EU, and this poses problems for new investments in energy efficiency and renewable energy sources. Electricity and natural gas prices for households and the public sector are subsidised. The paradox is that electricity prices in BiH are some of the lowest in Europe while the price of natural gas (especially for industry), is one of the highest in Europe. The high price of natural gas is a consequence of demand variation during the year since natural gas is dominantly used to heat buildings (in both district heating and individual heating solutions). On the other hand, the low price of electricity is a consequence of numerous hidden subsidies enjoyed by the power generation sector.

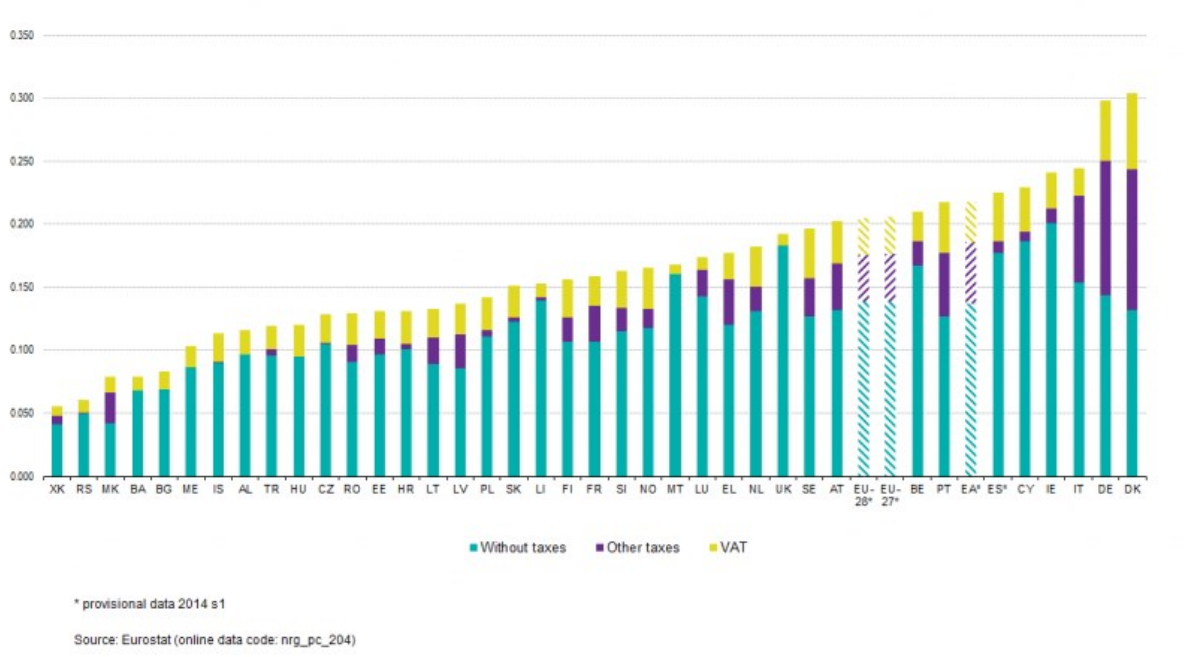


Figure 11: Electricity prices for households in 2014 (EUROSTAT, 2015)
(BiH is BA, 4th from left)

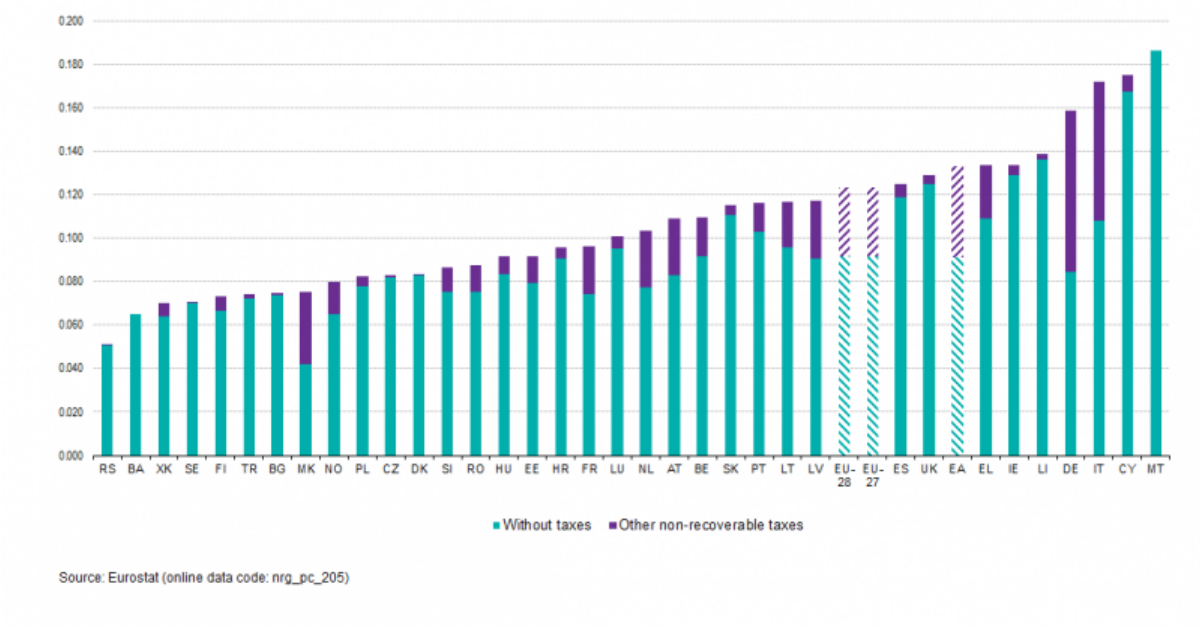
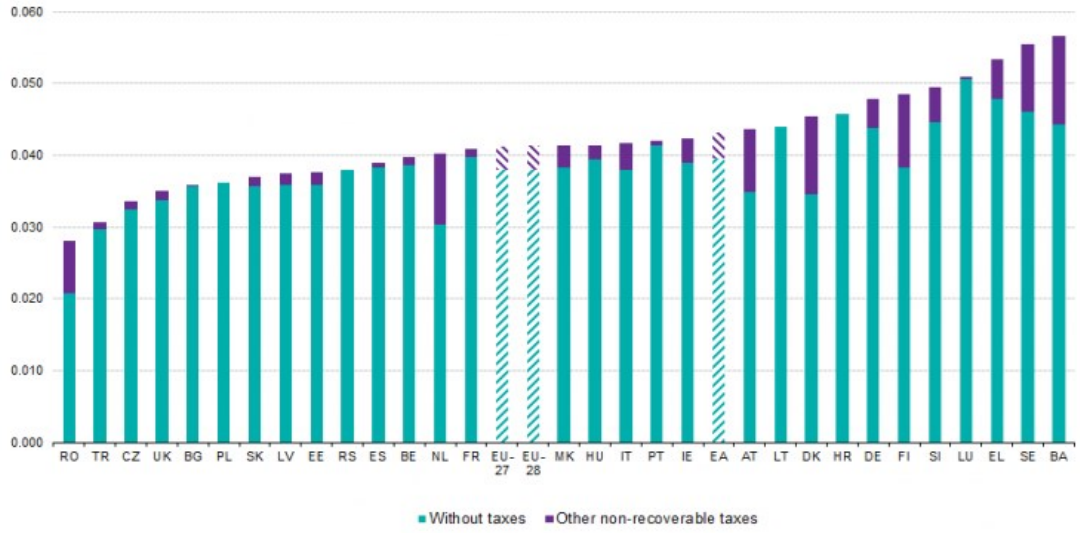


Figure 12: Electricity prices for industry in 2014 (EUROSTAT, 2015)
(BiH is BA, 2nd from left)

Source: Eurostat (online data code: nrg_pc_202)

Figure 13: Natural gas prices for households in 2014 (EUROSTAT, 2015)
(BiH is BA, 11th from left)



Source: Eurostat (online data code: nrg_pc_203)

Figure 14: Natural gas prices for industry in 2014 (EUROSTAT, 2015)
(BiH is BA, first from right)

All **natural gas** is imported and prices are dictated by the contract with the supplier (from the Russian Federation), by transport (through Ukraine, Hungary, and Serbia), and distribution expenses. The main consumer of natural gas is the Canton of Sarajevo. Natural gas is slightly cheaper for households than for large consumers.

The Entity Governments determine the price of **coal** for electric energy generation. According to the FBiH government decision of 2006, the price of coal used for thermal power production was 4.5 KM/GJ (about 2.25 EUR/GJ). The mines in RS are parts of a single company together with the thermal power plants. The price of coal is determined by the energy balance for each year. The price of coal used for other purposes is liberalised and depends on the type of coal and its heating value. The market price of coal in BiH

is about 4.6 EUR/GJ, which is approximately double then the price of coal for electricity generation, but cheaper in comparison to other fuel types.

Oil and oil products are imported. The market for oil products is fully liberalised and prices reflect the costs of imported oil and oil products. The additional elements in the final import price are custom duties, commercial margins, and taxes. In general, the prices of oil products are slightly lower than in neighbouring countries.

The simple payback period of specific energy efficiency measures are given in Table 10.

Table 10: Simple payback period of specific energy efficiency measures in BiH

Type of project	Simple payback period (years)	Remarks
Thermal insulation of high temperature pipelines (hot water and steam)	1-3	Short payback period due to low investment costs and high operating hours (especially in industry)
Heat recovery in industry (air compressors, flue gasses, boiler blow down etc.)	2-3	Short payback period due to low investment costs, high operating hours, and because saved energy otherwise will be produced from natural gas or light fuel oil, in most cases
Biomass CHP (0.5 – 3 MWe)	5-8	Acceptable payback period due to relatively low price of biomass, feed in tariff
Replacement of electrical equipment (air compressors, pumps, electrical motors)	> 5	Long payback period due to low electricity prices; the main benefit is not energy saving but the decrease of peak power
Building envelope improvements	5 -10	Seven years is the payback period for buildings which are heated 24 hours per day during heating season (hospitals); pay pack is relatively long due of low price of heat from biomass and coal; in general could be shorter than 7 years if natural gas or liquid oil are used for heating.
Solar water heaters	4-8	Four year payback period in south of BiH with higher solar gains
PV systems	5-6	Attractive payback period due to attractive feed-in tariff, but quota for feed-in tariffs for PV is very limited; without feed-in tariff, PV is not economically viable

Source: Estimation of the local expert

5.4 Awareness and information level

Energy efficiency is a frequent topic in legislation and policy, and various awareness raising campaigns have been carried out in the past. Many municipalities raise awareness by organising local energy days through their Sustainable Energy Action Plans.

The leading organisation in this field is the UNDP office in BiH. UNDP implements and supports campaigns for energy efficiency in buildings. Also, GIZ and USAID are very active in this field.

Apart from that, there are several NGOs active in the field of awareness raising and informing the public on energy efficiency. REIC (www.reic.org.ba) is an NGO which holds an annual summer school dedicated to energy efficiency and renewable energy promotion. An intergral part of this programme is energy day, when manufacturers, dealers, and installers present their equipment to improve energy efficiency.

Promotion of energy efficiency is the topic of many EU projects in BiH. In these projects partnership members are organizations from BiH such as chambers of commerce (especially active is Sarajevo Chamber of Commerce) and regional development agencies.

Seminar programmes on the efficient use of energy sources and their environmental impact have been initiated by some consulting companies supported by the UNDP, GIZ, and USAID.

There is a general interest in the public, and among individuals and companies for energy efficiency because of increasing energy prices. The bottleneck is the lack of coordination between different levels of authorities and international organisations, lack of understanding about the technical issues, and confusion about what good practices are.

6 Conclusions

Since 2006, when the Agreement on the Energy Community entered into force, some improvements in the fields of EE and RES in BiH have been achieved. However, these improvements have not been sufficient for BiH to achieve the targets and are smaller than those of neighbouring countries.

BiH has high potentials for improving energy efficiency in all sectors. In recent years, BiH has made significant steps forward when it comes to energy efficiency. Both at the State and Entity levels, many steps were taken to develop a legal framework for energy efficiency, to promote EE, to raise awareness in this filed, and to attract foreign and domestic investors to invest in EE projects. However, comprehensive legislation is not in place yet, mainly for political reasons. According to the constitution of BiH, energy issues are governed by the Entities. Politicians from RS do not want to delegate any issue in the field of energy to be governed at the State level. This is the reason why the Entities have their own energy policies and legislation.

Taking into account the low specific energy consumption in BiH (kWh per capita), growth in energy demand is expected and an increase in energy prices is likely. Regional experience (in Croatia) shows that such a change can dramatically increase interest in energy conservation.

There is high potential for energy efficiency improvement and GHG emission reduction in the electricity production sector since 50 - 70% of electricity is generated in the coal power plants, whose efficiency is 30.5%.

In the energy consumption sector, the highest potential and highest replication potential is in the residential buildings sector, whose share in final energy consumption is about 56 %. The 1st NEEAP defined national energy efficiency targets by sector according to EnC requirements. These targets can be considered the economic energy efficiency potential since payback time of the measures considered to reach the target is up to seven years. The highest potential is in residential buildings and then in industry. The overall target for energy efficiency is 12.47 PJ by 2018.

In industry, the sub sector with the highest replication potential is the food industry (dairies, breweries, meat processing, etc.). There is high EE potential in the iron and steel industry but replication potential is relativelly low because there are only several big facilities in this sub sector.

The total financing needed to achieve the energy consumption reduction target amounts to: 216 million EUR in residential buildings, 142 million EUR in the commercial and services sector, and 438 million EUR in industry.

Regarding ESCOs, in-depth analysis and research on the ESCO market potentials in BiH would be necessary in order to attract ESCOs from other countries, as well as to communicate the rationale for setting up ESCO companies for the SMEs in BiH. In addition, state and local capacity and general awareness raising would be desirable, and banks should be encouraged towards financing also. Capacity building of municipal officials regarding the possibilities of ESCO financing could be especially effective, since a large amount of money is allocated for electricity and heating costs in public buildings. The legal framework for public-private partnerships has been established. There are three ongoing pilot ESCO projects supported by EBRD in hospitals and in the district heating system. These will be implemented according to a public-private partnership model, since there is no law which addresses ESCO businesses specifically.

There are no regular state mechanisms for EE financing. There were specific calls for applications to finance EE in public buildings in the last couple of years on the part of the Federal Ministry of Spatial Planning and the Fund for Environmental Protection and Energy Efficiency. The problem is a lack of documentation needed for applications (energy audits, energy costs records etc.). It is recommended that the development of this documentation be financed as well.

Several banks have dedicated credit lines for EE financing, including lines for individuals (physical persons), but the interest rates are not very attractive. Financing facilities of international development banks implemented through local commercial banks have a certain positive impact. The main barrier to these facilities is that commercial banks give loans only to companies or organisations with excellent financial records. Therefore, companies which are less successful, but have the biggest EE potentials, cannot get such loans.

Pilot projects financed by grants by international organizations (UNDP, USAID, GIZ) are important to demonstrate EEs usefulness. These projects usually focus on EE in buildings.

The pricing policies of heating services are opposite to the policy in EU countries. In most cases, the unit price of heating for public, commercial, and industrial buildings is about two times higher than for residential buildings. This is the wrong signal for end users and acts as an indirect subsidy for inefficiency. Apart from that, the price of heating in some district heating systems does not take into account all the relevant costs.

The state constitution proved to be a barrier for reforms in the energy sector. Entities are responsible for energy policy creation and implementation. From the other side, the Energy Community recognised only the state as its partner for energy policy reforms. Due to the lack of political willingness in Republika Srpska to adopt the Energy Treaty on the State level, some energy reforms are blocked (for instance, in the natural gas sector).

7 Relevant Institutions

The following table provides an overview of institutions relevant for EE in BiH.

Table 11: Institutions relevant for EE in Bosnia and Herzegovina

State bodies	
Name	Description
Ministry of Foreign Trade and Economic Relations (MoFTER)	In accordance with the Law, MoFTER's responsibility is "for activities and tasks within the jurisdictions of Bosnia and Herzegovina and which are related to policy defining, basic principles, coordination of activities and harmonisation of entities' authoritative bodies and institutions on the international level in the field of agriculture, energy, environment protection, development and usage of natural resources and tourism."
Federal Ministry of Energy, Mining and Industry (FMEMI)	The Federal Ministry of Energy, Mining and Industry implements policy and enforces the laws as determined by the legislative body, executes the administrative supervision of implementation of the laws and other regulations, proposes and gives recommendations in the field of legislation, answers to questions of the legislative authorities, and performs tasks of an administrative and professional nature.
Ministry of Industry, Energy and Mining of RS (MEED)	Five sections within the Ministry have energy related responsibilities: the section for energy and energy related power utilities, the section for energy and fuels, the section for development of energy and mining, thermos-energetic inspection, and electric power inspection.
State Electricity Regulatory Commission (SERC)	State Electricity Regulatory Commission responsible for regulating transmission, transmission-related activities, and international trade. Commissioners rotate on an equal basis the position of Chairman each year. As of August 1, 2004, SERC has operated at full capacity, with 17 staff members. The SERC is financed by regulatory fees paid by regulated companies. SERC has its office in Tuzla.
Transmission System Operator (TRANSCO)	Transmission System Operator (TRANSCO) is responsible for transmission, maintenance and construction and was registered and started operating in February 2006.
Independent System Operator (ISO)	Independent System Operator (ISO) is responsible for the management and control of the transmission network, directing, scheduling and coordinating maintenance, planning and development of the grid, development of the indicative generation plan with TRANSCO.
Federal Electricity Regulatory Commission – offices in Mostar	Approval of electricity prices in FBiH
Regulatory Commission for Energy of RS – offices in Trebinje	Approval of electricity prices in FBiH. Feed-in tariffs approval and payment to producers of electricity from renewables
Agency for Renewable Energy in FBiH	Feed-in tariffs approval and payment to producers of electricity from renewables.
International Organisations: EBRD, EU (CARDS, IPA), Federal German Agency GIZ (former GTZ), KfW, Swedish SIDA, UNDP and USAID	There is a wide range of international organisations active in BiH and co-ordination is reported to be increasing with a view to improved targeting and aid efficiency. The principal sources of funds and assistance in implementing reforms of the energy sector include global bodies, the EU and bi-lateral initiatives from many countries.
Other related institution	
Association of Thermal Engineers in Bosnia and Herzegovina	Association founded by Mechanical Engineering Faculty, University of Sarajevo with support of UNDP. Its mission is to promote the sustainable supply and use of energy.
Association of gas in Bosnia and Herzegovina	Founded in 2001. Its mission is the promotion of sustainable use of natural gas.

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