Polimac Company d.o.o.
Sarajevo, Bosna i Hercegovina

WASTEWATER PROJECTS - REGIONAL OVERVIEW

Sarajevo, 2021

No	PROJECT	PROJECT STATUS	MODEL OF FINANCING	LOAN	TOTAL PROJECT VALUE

Polimac Company LTD

Bosna & Hercegovina

2021

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	BOSNIA AND HERZEGOVINA - OVERVIEW				
1.	**SARAJEVO WATER**[1]	Tendering expected on 31th May 2019	Loan from EBRD	25 mil (EBRD) 5 mil (B&H)	30 mil €
2.	**REGIONAL WATER SUPPLY PROJECT „BLUE WATER“**	- Preparation for the project realization	Loan from EBRD, grant from international institutions and own funds	11 mill € (EBRD), rest own funds	22 mill €
3.	**WASTEWATER TREATMENT ZENICA**[2]	Preparation of the technical documentation – tendering expecting in 2019	Grant from KfW, SECO, JKP VIK Zenica and City of Zenica	20 mil (KfW)	20 mill €
4.	**CONSTRUCTION OF A JOINT WATER PURIFIER AND COLLECTOR NETWORK OF WASTE WATER IN THE AREA OF VOGOSCA, ILIJAS AND BREZA MUNICIPALITIES**	Preparation for the project realization	Federal Ministry of Agriculture, Water Management and Forestry		68 mil €
	MONTENEGRO – OVERVIEW				
1.	**WASTEWATER TREATMENT PLANTS WITH ASSOCIATED COLLECTOR NETWORK**[3]	Preparation for tendering - 2019	Loan from KfW, WBIF, city of Podgorica	10,15 mill € (WBIF); 35 mill € (kfW); Rest city of Podgorica	50 mil €

[1] **Rehabilitation of water infrastructure in Sarajevo includes:**
— reconstruction of pumping stations including equipment for power supply, chlorination and control,
— reconstruction of bulk water pipelines (both pressure and gravitational),
— replacement of obsolete water mains in selected parts of the distribution network,
— installation of meters (individual, bulk water flow meters, telemetry etc.), and
— supervision services.

[2] http://energis.ba/zenica-receives-20-million-grant-for-the-rehabilitation-of-wastewater-treatment-the-project-involves-arcelormittal-and-coal-mine/.XLWm5OgzaUk#.XLW9LegzaUk

[3] http://podgorica.me/2019/02/05/potpisan-ugovor-za-podrsku-u-pripremi-glavnog-projekta-postrojenja-za-preciscavanje-otpadnih-voda-sa-pripadajucom-kolektorskom-mrezom/

2.	**WATER SUPPLY AND WASTEWATER DISPOSAL AT THE ADRIATIC COAST III – BAR** (phase –construction of sewerage network, pumping stations, submarine outfalls, water supply network, storm water drainage system and reservoirs in Sutomore and Bar)	Preparation for the project realization	Loan from KfW		19.110.000 €
3.	**WATER SUPPLY AND WASTEWATER DISPOSAL AT THE ADRIATIC COAST V – ULCINJ** (construction of water and sewage infrastructure and wastewater treatment plant)	Preparation for the project realization	Loan from KfW and own funds	20 mill € (KfW)	30 mil €
4.	**WATER SUPPLY AND WASTEWATER DISPOSAL AT THE ADRIATIC COAST III –HERCEG NOVI** (Phase Construction of sewerage network, pumping stations, submarine outfall and water supply network)	Preparation for the project realization	Loan from KfW, Government of Montenegro and local muncipalities		18,522,000 €
5.	**WATER SUPPLY AND WASTEWATER DISPOSAL AT THE ADRIATIC COAST III – BAR** (Phase – Preparation of the location for WWTP,construction of the Wastewater Treatment Plant in Bar and the main pumping station,	Preparation for the project realization	Loan from Kfw bank and local Muncipalites		16,201,000 €
CROATIA					
1.	**ZAGREB COUNTY WATER PROJECT**[4]	Preparation for the project realization	Loan from EIB and EBRD		111 mil €
2.	**CONSTRUCTING AND UPGRADIG WWTP- WASTE WATER ISLAND KRK**[5]	Preparation for the project realization	EBRD, EIB		25 mil €
3.	**CONSTRUCTION, RECONSTRUCTION AND REHABILITATION OF THE DRAINAGE SYSTEM AND WATER SUPPLY "WATER WASTE SYSTEMS - NOVI VINODOLSKI, CRIKVENICA AND SELCE" (III)**	Preparation for the project realization	EBRD, EIB		23 mil €

[4] 91 000 000 EUR investments into construction and upgrade of water-supply system in the Zagreb County, and — 20 000 000 EUR investments into construction and upgrade of wastewater infrastructure in the City of Vrbovec including construction of a wastewater treatment plant.
https://ted.europa.eu/udl?uri=TED:NOTICE:99478-2019:TEXT:EN:HTML&src=0

[5] https://eojn.nn.hr/SPIN/APPLICATION/IPN/DocumentManagement/DokumentPodaciFrm.aspx?id=2490653

4.	**CONSTRUCTION OF WASTE WATER TREATMENT PLANT FOR AGGLOMERATION RIJEKA**	Preparation for the project realization			72 mil €
KOSOVO					
1.	**GJILAN WASTEWATER DEVELOPMENT PROJECT**[6]	Tendering expected to begin on 01th May 2019	EBRD, EIB, WBIF,other donors and Govrenment of Kosovo	10 mil € EBRD 10 mil € EIB 0,4 mil € WBIF 0,3 mil € other donors Rest from Government	20.700.000,00 €
NORTH MACEDONIA					
1.	**CONSTRUCTION OF WWTP AND REHABILITATION AND UPGRADING OF THE SEWERAGE NETWORK IN THE MUNICIPALITY OF TETOVO**[7]	Tendering expecting in April/May 2019	IPA FUNDS		review

[6] https://ecepp.ebrd.com/delta/viewNotice.html?displayNoticeId=8487926
[7] https://webgate.ec.europa.eu/europeaid/online-services/index.cfm?ADSSChck=1555495593033&do=publi.detPUB&searchtype=AS&zgeo=35506&aoet=36538%2C36539&debpub=&orderby=upd&orderbyad=Desc&nbPubliList=25&page=1&aoref=139966

Polimac Company d.o.o.
Sarajevo, Bosna i Hercegovina

RAILWAYS OF BOSNIA AND HERZEGOVINA

Sarajevo, 2018

Polimac Company LTD

Bosnia & Hercegovina

2018

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BOSNIA AND HERZEGOVINA RAILWAYS PUBLIC CORPORATION

With Annex 9. of the General Framework Agreement for Peace in Bosnia and Herzegovina, signed in Paris on 14. December 1995, since that within the transportation sector railways constitute a specific matter and need to have their own specific structure, Federation of BiH and the Republic of Srpska have established Bosnia and Herzegovina Railways Public Corporation, abbreviated name BHRPC.

In accordance with Art. 8. of Agreement the parties shall take whatever measures are necessary so that the railway companies of the Federation of Bosnia and Herzegovina and of Republica Srpska and particulaily the infrastructure managers:

1. Act in conformity with the decisions taken by the BHRPC

2. Keep the responsibility of maintaining the railway infrastructure up to the standards required by the regulations issued by the Institutions of Bosnia and Herzegovina

3. Abstain from taking any action which may be detrimental to railway traffic between the Entities

BHRPC is established for the mutual benefit of the Federation of BiH and the Republic of Srpska and its purpose is to establish an institutionalized cooperation between the Entities and to facilitate decision-making so that a smooth, safe and regular inter-Entity and international rail traffic takes place.

BHRPC consider and make decisions on:

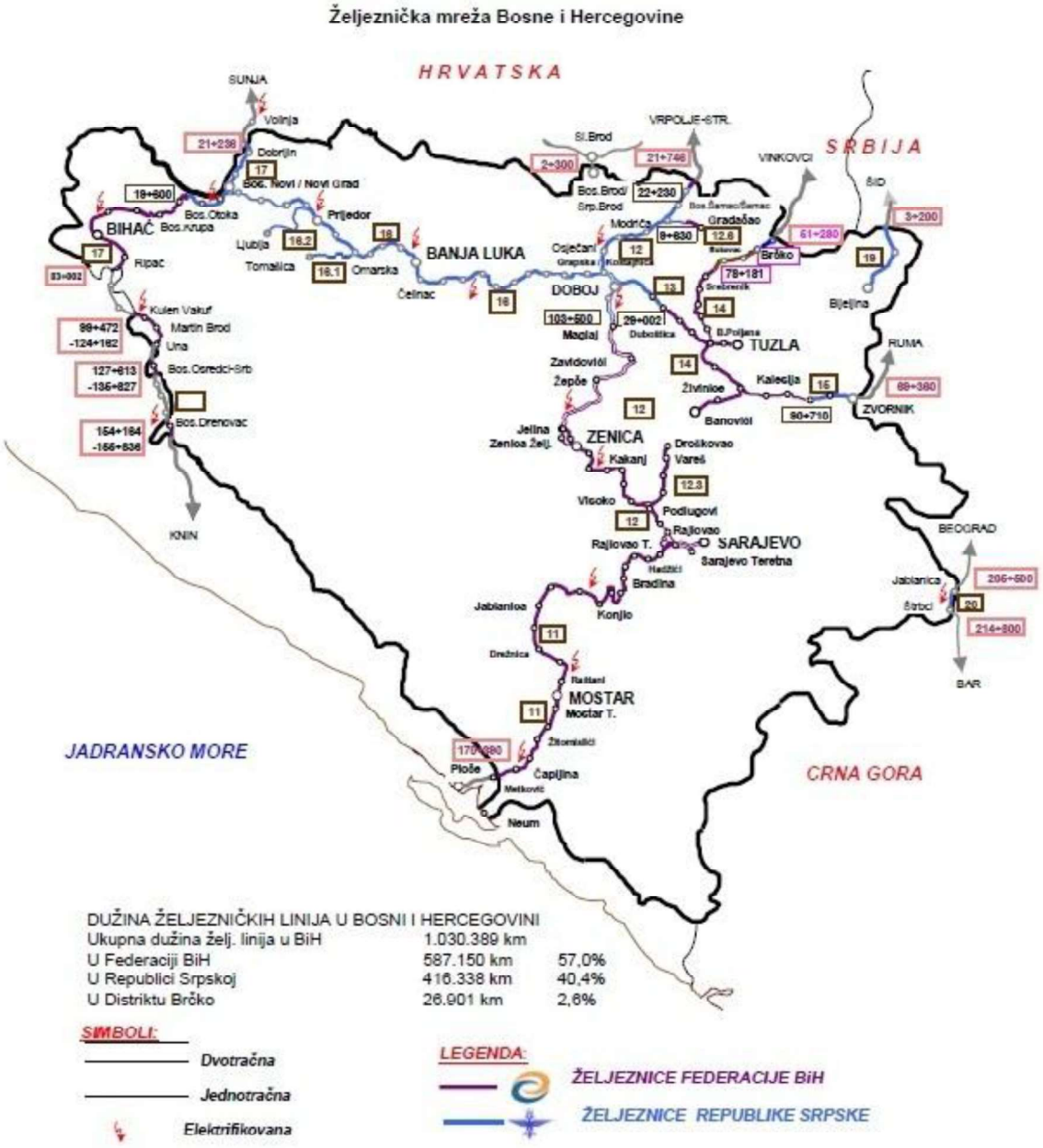
- The allocation of train paths for inter-entity and international traffic, in a non-discriminatory manner

- The harmonization of signaling, safety, telecommunications and other systems on the railway network of the two Entities

- The setting of accounts between railway companies

- Allocation and managing with donations that are donated or borrowed

THE RAILWAY NETWORK OF BOSNIA AND HERZEGOVINA

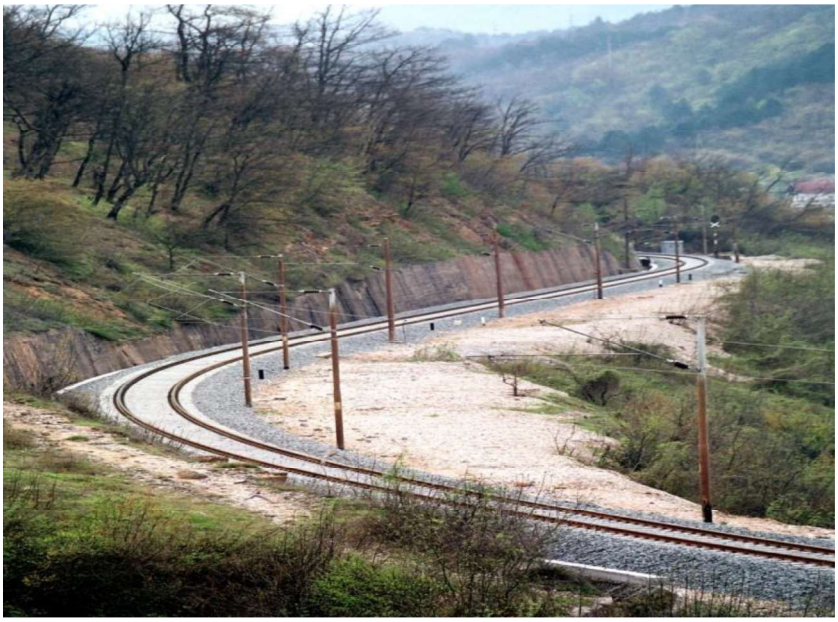


CHARACTERISTICS OF THE RAILWAY NETWORK OF B&H

- Network length in BiH: 1032, 76 km
- Track gauge
- Length Networks ŽFBiH, 608.45 km
- Double track, 68.453 km
- Electrified network 398 km
- Voltage of 25 kV, 25Hz
- Regulation of train movement is done in cell spacing
- Systems for centralized management of traffic does not exist
- Speeds are between 50 and 70 km/h
- Most networks require renewal
- Partially restored about 30 km
- Rebuilding underway at 100 km
- Funds for the reconstruction provided for another 40 km

- **Large slope Nival, to 25%**

- **Small radius of curvature 25 and 30 m**



- **Large number of facilities, bridges 233 - length of 11.4km**
- **Tunnel 163 - length of 55.2 km**

INTER-ENTITY AND INTERNATIONAL RAIL TRAFFIC

M A P
OF NEW RAILWAY LINES

Legend: *new railway lines in BiH*

- *Čapljina – Trebinje – Nikšić with branches to Neum and Dubrovnik,*
- *Čapljina – Imotski – Split or Knin,*
- *Koprivna – Brod,*
- *Šamac – Brčko – Bijeljina-Lešnica,*
- *Zvornik – Višegrad - Trebinje*
- *Vareš - Banovići*

The railway network comprises two main strategic lines, which are also the main railway lines for cargo. The two include: (i) The North-South Bos.Šamac-Doboj-Zenica; Sarajevo-Mostar-Čapljina line located on Corridor Vc (which connects Budapest in Hungary to Ploce in Croatia);

and (ii) the West-East Dobrjlin–Bos.Novi-Banja Luka-Doboj-Tuzla-Zvornik line which is the railway line parallel to Corridor X.

The rehabilitation of the core railway network, in particular Pan-European Corridor Vc and the east-west line parallel to Corridor X are deemed to be critical first steps. In 2005, the EBRD approved euro 70 million (US$102 million) for a program of track renewal on key sections of both corridors, together with rehabilitation of the station signaling system and purchase of track machinery.

The overall condition of the railway network in Bosnia and Herzegovina remains poor, with operational weaknesses reducing line capacity markedly.

Despite extensive rehabilitation, overall operational speeds remain low, due to the following:

(i) temporary speed restrictions arising from the condition of some tunnels (notably Tunnel Ivan south of Sarajevo where there is a speed restriction of 40 km/hour);

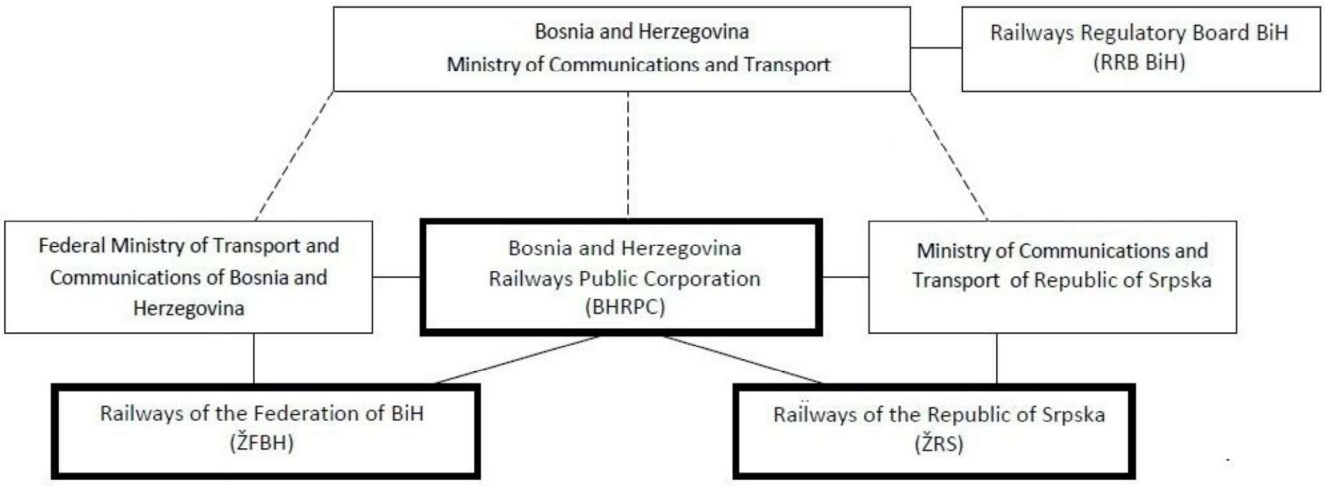
(ii) poor track alignment (due to topography and gradient) and condition; and

(iii) the number and functioning of crossings. On around 80 percent of the railway lines on Corridor Vc, train speed is limited to a range of between 30 km/hour and 70 km/hour, depending upon the conditions of the track.

In addition, there are limitations in ballast in the curves, weak sleepers, and inadequate fastenings. Another significant problem is the length of the crossing sidings in stations (with a usable length of 570 meters), leading to restrictions on train length (550 meters) and train weight (1,500 tons).

THE STRUCTURE OF THE RAILWAYS IN BIH

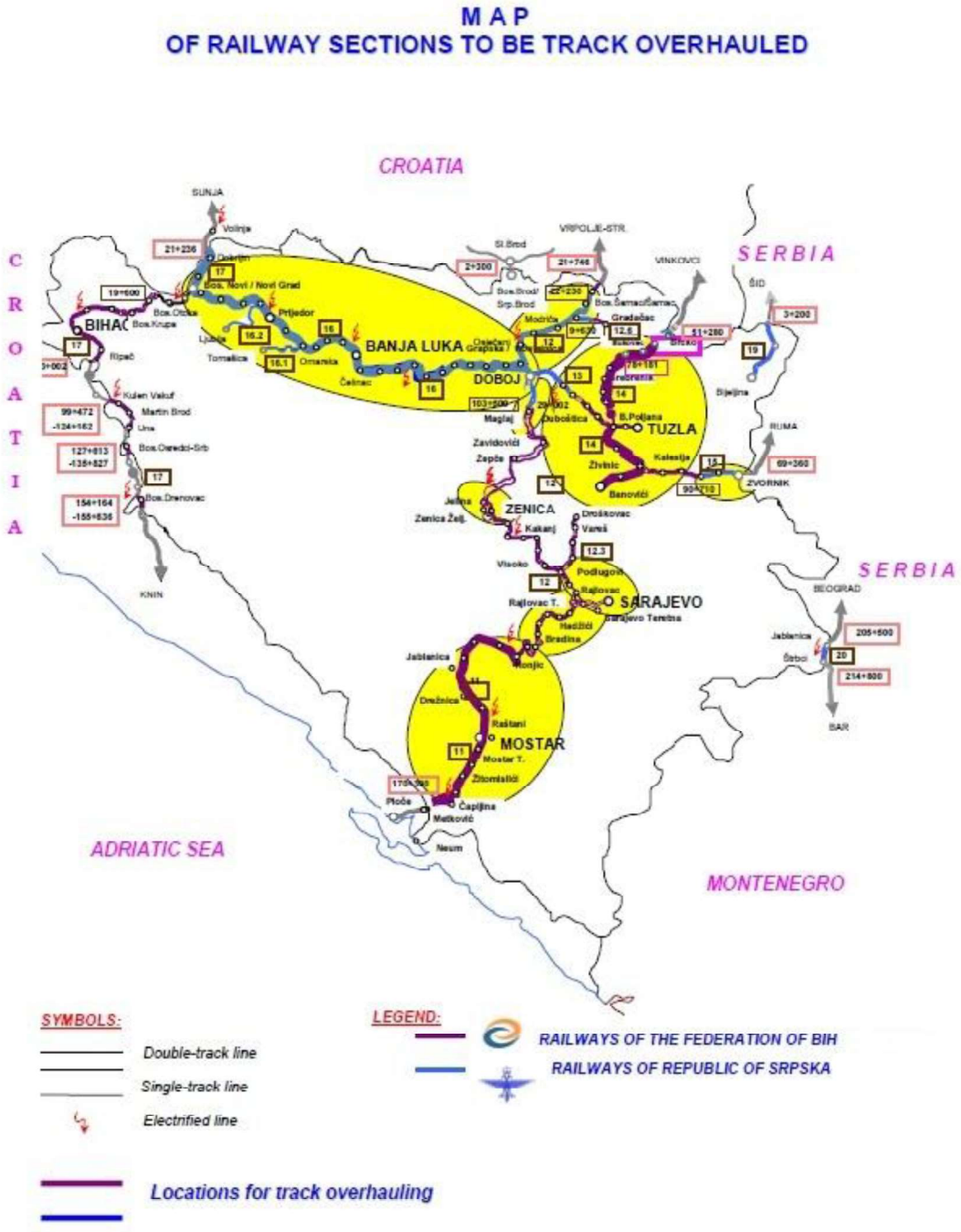
The basic structure of the railway sector in Bosnia and Herzegovina



The sector now includes two vertically integrated railway companies (Željeznice Federacije Bosne i Herzegovine (ŽFBH) and Željeznice Republike Srpske (ŽRS),), and a state level coordinating body, Bosanskohercegovačka Željeznička

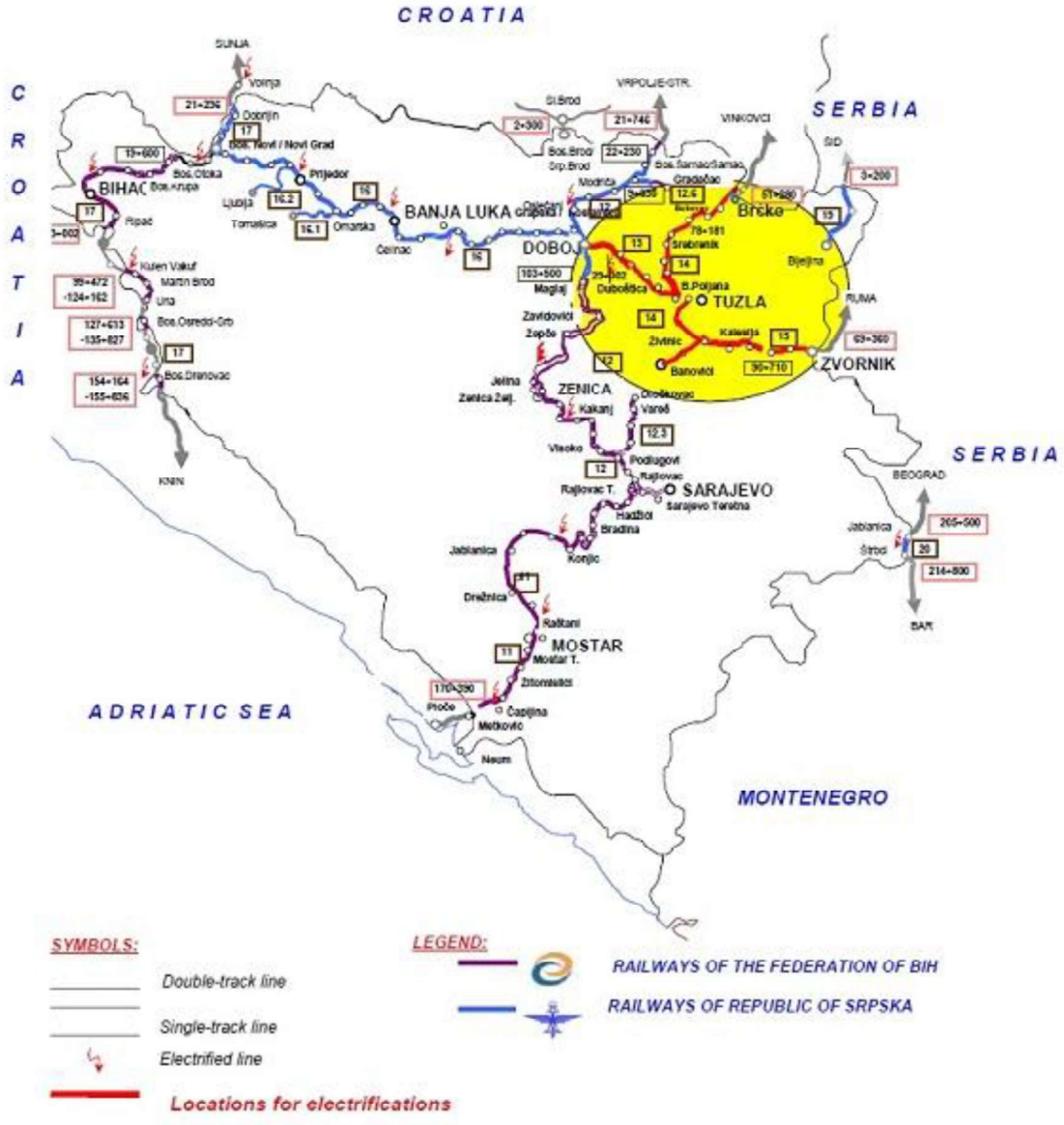
Javna Korporacija (BHŽJK).

LOCATIONS PROVIDED FOR OVERHAUL

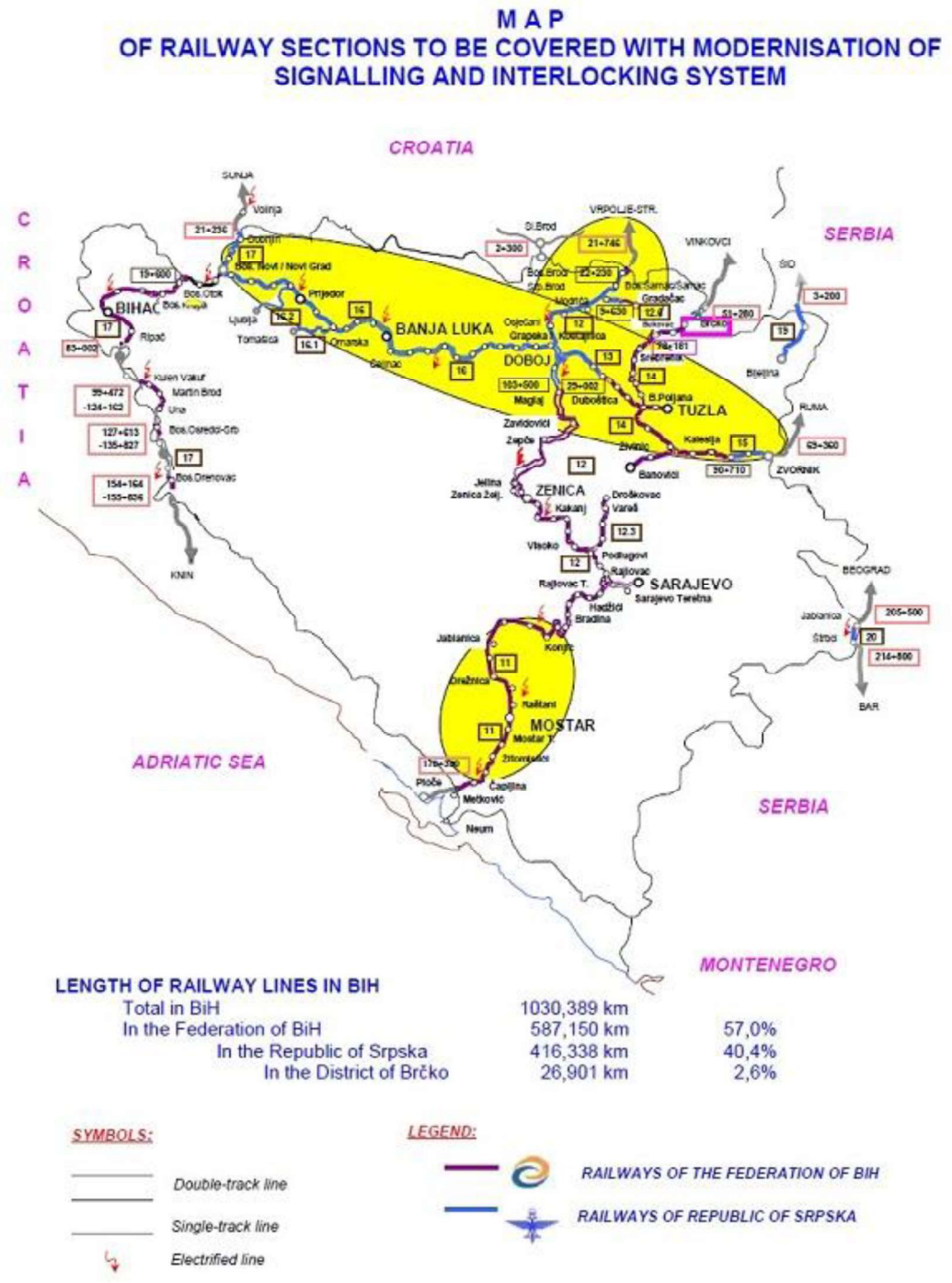


LOCATIONS PROVIDED FOR ELECTRIFICATION

MAP
OF RAILWAY SECTIONS TO BE ELECTRIFIED

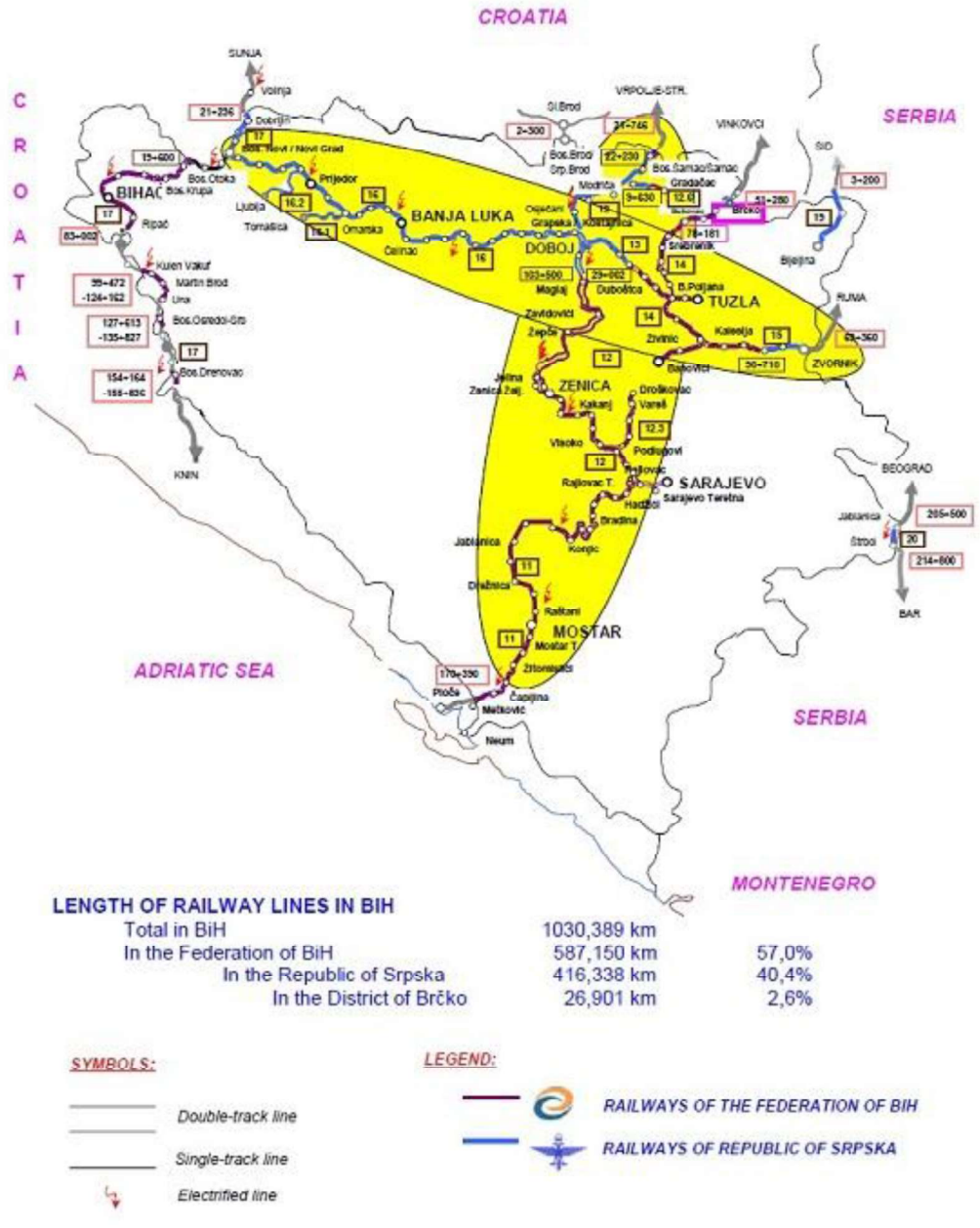


LOCATIONS PROVIDED FOR SS



LOCATIONS PROVIDED FOR TT

M A P
OF RAILWAY SECTIONS TO BE COVERED WITH MODERNISATION OF TELECOMMUNICATIONS SYSTEM, FIBBER – OPTICAL, TRANSMISSION AND TELECOMMUNICATIONS KNOTS



LENGTH OF RAILWAY LINES IN BIH

Total in BiH	1030,389 km	
In the Federation of BiH	587,150 km	57,0%
In the Republic of Srpska	416,338 km	40,4%
In the District of Brčko	26,901 km	2,6%

SYMBOLS:

Double-track line

Single-track line

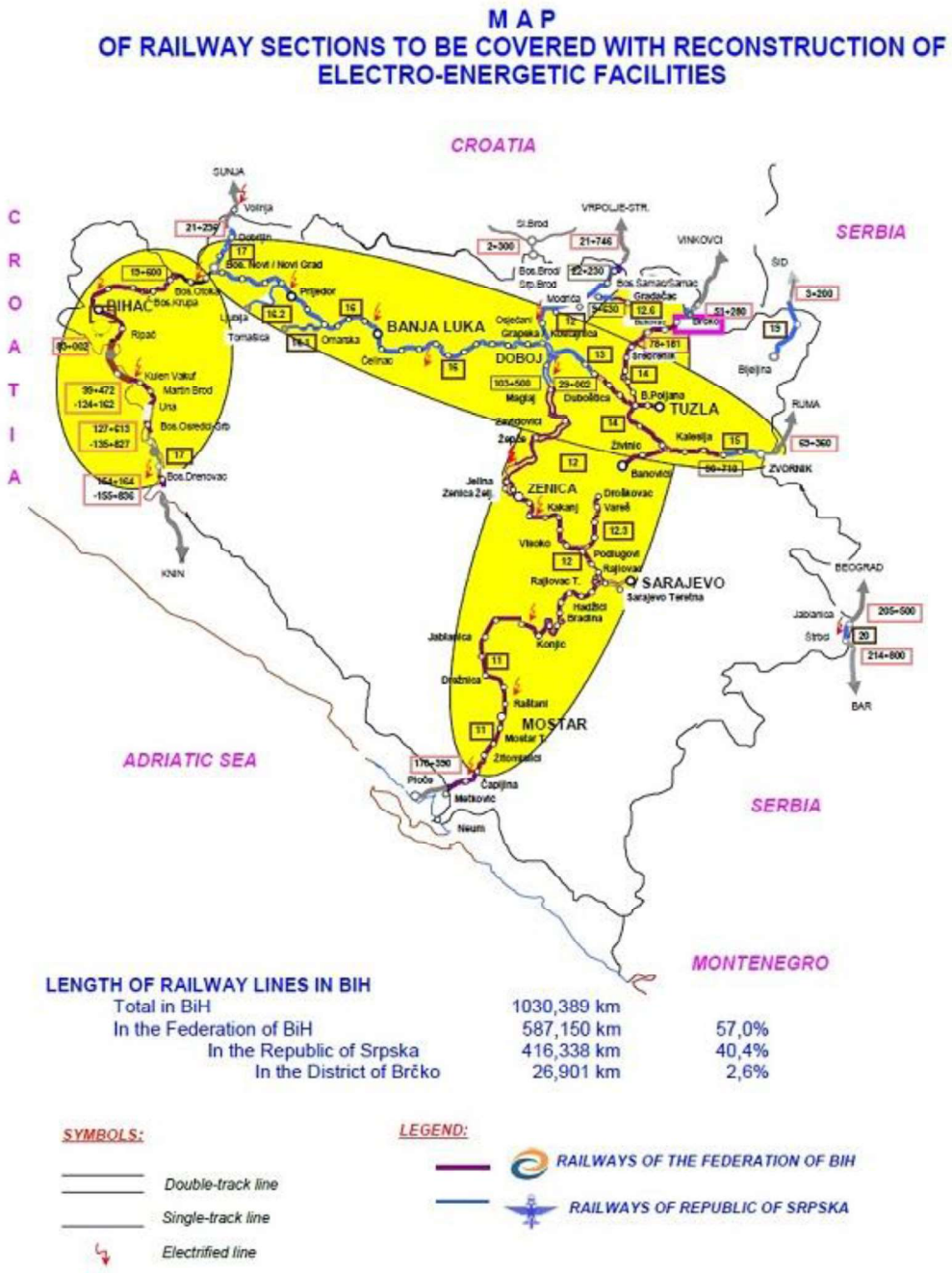
Electrified line

LEGEND:

RAILWAYS OF THE FEDERATION OF BIH

RAILWAYS OF REPUBLIC OF SRPSKA

LOCATIONS PROVIDED FOR EE



PLANNED INVESTMENTS

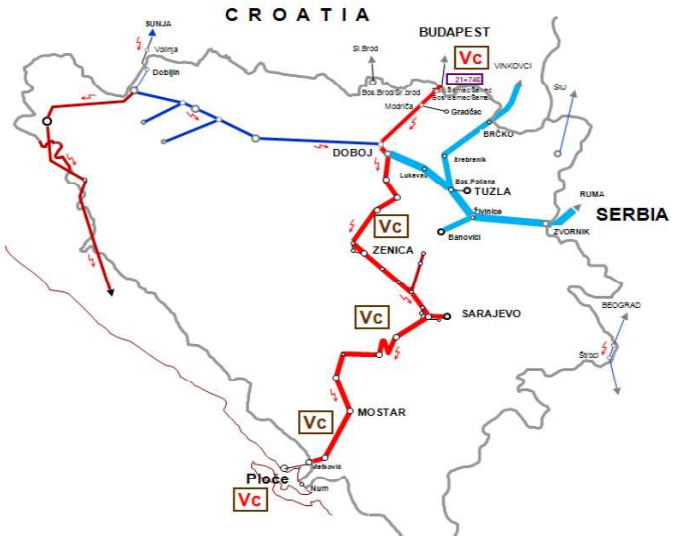
NO.	PROJECT	PROJECT VALUE (in mil KM)	YEAR OF BEGINNING
1.	Regional project of reconstruction of railways in Bosnia and Herzegovina (FBiH): The main railway repair Podlugovi - Sarajevo	44,01	2018
2.	Regional Rehabilitation Project of BiH Railway (FBIH): Main line of Doboj railway, km 103 + 500 Maglaj I Jelina - Zenica	31,29	2020
3.	Regional Project of reconstruction of railways in Bosnia and Herzegovina (FBiH): Preparation of a feasibility study and project documentation for the construction of the railway Vareš - Banovići	19,50	2018
4.	Regional Railway Reconstruction Project in BiH (FBIH): Preparation of the main project of repair of railway Zenica - Podlugovi I Maglaj - Jelina	19,56	2018
5.	Regional project for reconstruction of railways in BiH (FBIH): Preparation of the main project of repair of railroads Tuzla-Doboj, Brčko-Banovići, S.Kostajnica-Doboj	19,56	2018
6.	Regional Railway Project in BiH (FBIH): the elaboration of the main project for removing the "bottleneck" by railway traffic at the tunnel Ivan - st. Bradina	19,56	2018

Priority projects:

- **Laying fiber optic cable along the network of railway of B&H**

- **Electrification**

  Doboj –Tuzla –Zvornik
  Brčko - Banovići



- **Continued repair line on Corridor Vc parameters to improve existing route**
- **Procurement track mechanization with high performance**

Priority should be given to improving the quality of service and increasing capacity, rather than introducing higher line speeds.

The proposed investments prioritize projects to rehabilitate track on the key lines to meet the 22.5 ton axle load, as required by the TER standards—improving signaling, and upgrading line speeds to 120 km/hour.

A recent study noted that if this rehabilitation were implemented and current bottlenecks were addressed, together with other necessary operational improvements (level crossings, signaling, and operational practices), then the capacity of the railway network would be sufficient to meet projected demand until 2030.

It is important to place emphasis on the capacity of the current network, primarily on the key lines on Corridor Vc, and the quality of service for existing customers, before ambitious and probably unviable projects to introduce even higher line speeds, or high speed passenger services. The latter seem difficult to defend given the current traffic mix on the railways.

Project	Cost (BAM Mill)	Period	Description
Completing rehabilitation of southern section of Corridor Vc between Sarajevo and Gabela (Croatian border) Total length covered by the project is 73 km (100 km of the 173 km long line is covered by the EBRD- EIB loan).	76.2	Short - Medium term.	The line is completely electrified and connects to the line Metković - Ploče in Croatia. The rehabilitation of the section Čelebić – Mostar – Čapljina – Croatian border is part of the EIB-EBRD plan. The section Bradina – Konjic, part of this proposal, has a very complex set of tunnels and turns over a 25 km distance.
Completing rehabilitation of northern section of Corridor Vc between Samac and Sarajevo. Total length covered by the project is 235 km.	245.6	Medium – Long term.	The medium term requirements to implement the project includes completing the feasibility and technical studies and determining the further funding needs on the basis of the available EBRD- EIB loans. The project focuses the sections not covered prior by EBRD-EIB or other investments.
Completing Rehabilitation of Sections Novi Grad – Doboj and Doboj – Tuzla (Line parallel to Corridor X). Total length covered by the project is 190 km: 125 km (section 1) + 65 km (section 2).	198.6	Medium – Long term.	The medium term requirements to implement the project includes completing the feasibility and technical studies and determine further funding arrangements on the basis of the available EBRD-EIB loans. The project focuses the sections not covered by the EBRD-EIB investment.
Rehabilitation and electrification of the railway line Brcko – Tuzla. Total length covered by the project is 75 km.	78.4	Long term.	With the expected growth of river transport via Brcko port, Improved railway interconnectivity linking the port with the BiH railway network and Corridor Vc will create opportunities for intermodal transport linking river and railway.

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RENEWABLE SOURCES OF ENERGY IN BOSNIA AND HERZEGOVINA

Sarajevo, 2021.

Polimac Company LTD

Bosna & Hercegovina

2021

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Sarajevo, Bosna i Hercegovina

BIOMASS, POTENTIAL TO BUILD BIOMASS POWER AND COGENERATION PLANTS IN BOSNIA AND HERZEGOVINA

Sarajevo, April 2020

Polimac Company LTD.

BosnaiHercegovina

2020

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INTRODUCTION

Bosnia and Herzegovina (B&H) is a country in southeastern Europe, on the western part of the Balkan Peninsula. B&H covers a total area of 51.129 km^2. Bosnia and Herzegovina is a transition country in the process of European integrations.

This paper gives the analysis of the potential connections between renewable energy sources (RES), particularly biomass, potential to build biomass power and cogeneration plants in B&H, taking into consideration specific political structure of the state.

The process of European integrations and international signed agreements represent a chance for Bosnia and Herzegovina to follow the current trends of the European Union and thus embrace the opportunity to administer reforms which will guarantee sustainable development.

SITUATION ANALYSIS

Energy is of vital importance for the development of any country in the world and Bosnia and Herzegovina as well. Without adequate policies in the energy sector business, industrial and economic progress is not possible either.

However, regardless of how important energy is for development, it is still only a mechanism for achieving the ultimate goals – sustainable economy, clean environment, high living standards, prosperity and health of population.

The current EU trends regarding investments in renewable sources of energy are essentially complementary with sustainable development. The investment in energy efficiency in Bosnia and Herzegovina has a potential of bringing multiple profits having in mind the actual situation, and securing big revenues in a relatively short time period.

Bosnia and Herzegovina belongs to a group of countries which have a large percentage of territory covered by forest resources, which indicates a certain potential for energy production based on sustainable use of forest biomass.

In Bosnia and Herzegovina, coal has the most dominant place in the structure of the energy consumption with about 45,3%, followed by fluid fuels with about 21% and wood mass with about 20,5%. Other forms of energy (hydro energy, natural gas, and imported electrical energy) participate with about 13,1% in the total energy consumption (METROPOLI, 2012).

The process of generating, distribution and consumption of energy in Bosnia and Herzegovina is characterized by big losses. The same quantity of energy yields four times lower gross domestic product compared to any other average European Union country, and at **the same time causes twice as high pollution. Chances are that this is the right time to change the existing paradigm in the energy sector.**

BIOMASS AS A SUSTAINABLE DEVELOPMENT DRIVER

Biomass is a source of energy made from renewable organic materials, such as wood, agricultural crops or waste, and biodegradable municipal or industrial waste. Biomass can be burned directly or processed into biofuels.

The main advantage of use of biomass as a source of energy is in abundant potentials of not just purposefully cultivated plants but also waste materials in agricultural and food industry. Gases produced while using biomass can also be used in generation of energy.

Production of biomass for the purpose of energy generation implies the use of large areas, which, combined with the usual manner of farming creates, significant influence on biodiversity and the way of its production. Therefore, the use of plant remainings for the generation of electrical energy, heat and biodisel, no matter whether it is from sugar cane, rice husk, or hay or similar crops waste, waste from forest activities or plant oils production, etc., is one of the best ways to generate sustainable energy, to the extent that it does not prevent other significant ways of using agricultural waste, such as, for example, conservation of soil.

As already mentioned above bioenergy interest has been greatly increased in last period.

Thus, at present factors may influence the prospects for bioenergy:

- increases in crude oil prices,
- concerns for enhancing energy security matters, by creating de-centralized solutions for energy generation,
- concerns for climate change and global warming, but also to
- preserve non-renewable resources,
- promotion of regional development and rural diversification by creating jobs and income in usually underdeveloped rural areas,

For the developing and transition countries as Bosnia and Herzegovina, the increased deployment of modern biomass based systems, as a reliable and affordable source of energy could be part of the solution to overcoming their current constraints concerning GDP growth.

In any case, production and use of biomass should be sustainable in terms of the social, environmental and economic perspectives.

POTENTIAL OF BIOMASS ENERGY IN BOSNIA AND HERZEGOVINA

Considering that forests and forest land cover more than 50% of the territory of Bosnia and Herzegovina, they represent arguably one of the most important natural resources of this state. Regardless of the significant resource base, there is no strategic commitment in Bosnia and Herzegovina for production of fuel and energy from biomass.

Therefore, the most widespread use of wood biomass is in the form of firewood for production of heat energy, although modern technologies offer possibilities for processing wood into various products which have better energy efficiency than firewood. Biomass in the form of fuel wood and charcoal is currently a growing source of energy in Bosnia and Herzegovina the consumption of which is estimated at 1.464.400 tons in 2003.

Since consumption of fossil fuels has an adverse effect on the environment and the fact is that prices of other energy sources are on the constant rise, use of wood biomass for production of energy is expected to intensify in Bosnia and Herzegovina

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Chart 1. Biomass Potential Mapping in FB&H and Brčko District

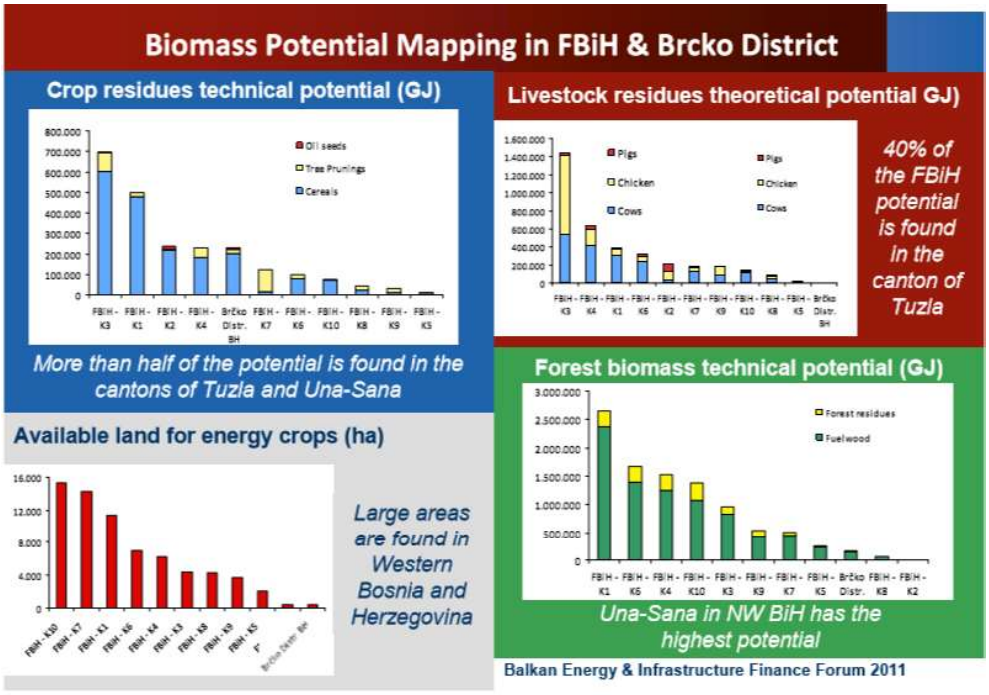


Chart 2. Biomass potential of B&H in percentage

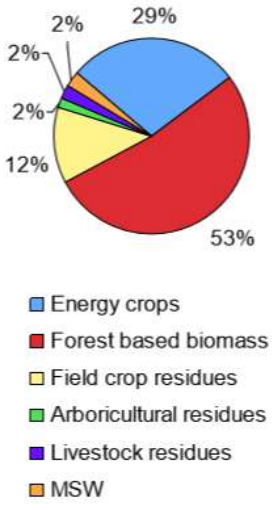


Table 1.

Estimated technical biomass primary energy potential in Bosnia and Herzegovina in 2008[2]

Biomass type	Technical Potential (PJ)	Technical Potential (GWh)
Energy crops	15.33	4258.3
Forest-based biomass	28.04	7788.9
Field crop residues	6.63	1841.7
Arboricultural residues	0.84	233.3
Livestock residues	1.3	361.1
Municipal Solid Waste	4.28	1188.9
TOTAL	**56.41**	**15672.2**

*Energy crops are crops grown specifically for the use as fuel and offer high output per hectare with low inputs.

The results showed that a very significant energy source would be available (29% of the total biomass potential), even if only small portions of the land are used to cultivate energy crops. Although this assumption may be sensible, the fact that these types of crops are not cultivated in B&H can lead to an overestimate of the biomass potential. Therefore, energy crops are not considered in this report.

Arboricultural residues (fruits, vine) are also not considered, since their potential is only about one eighth of the potential of field crops.

In the following sections, an analysis of the biomass potential relevant to wood processing and agricultural sectors in BiH in 2015 is conducted.

Biomass potential of the wood processing and forest-based biomass

Forests and forest lands are very abundant in BIH, covering more than 50% of the territory, and are one of the most important natural resources. Despite being an excellent resource, so far there is no strategic plan to significantly increase the use of biomass for energy generation or for the production of biofuels.

The estimate of forest-based biomass shown in the Table 2 is taken from the UNDP Study from October 2014 [3], which is based on the 2012 forest production volume. The forest production volume has not changed much in the last two years so the estimates for forest-based biomass do not need to be updated.

The following percentages of the total amounts of cut wood were used in the UNDP study to assess available quantities of woody biomass in B&H: - Residue after wood cutting and processing of forest wood products – 16.3% for conifers and 11.7% for deciduous trees - Percentage of small branches (residue after wood cutting) - 15%

for conifers and 18% for deciduous trees - Percentage of stumps – 15% of the total quantity of wood - Percentage of residue and waste from production of sawn timber, veneer and furniture – 30% for conifers and 35% for deciduous trees

Table 2 Woody Biomass Theoretical Potential in BiH [3]

Woody Biomass Sources	Conifer trees (m^3)	Deciduous trees (m^3)	Theoretically Available Amount (m^3)
Firewood	1,711	1,228,441	1,230,152
Forest residues	342,181	261,154	603,334
Small branches	314,848	401,432	716,280
Stumps	354,857	200,843	649,375
Residues from wood processing industry	314,848	334,527	555,701
TOTAL	1,328,446	2,426,396	**3,754,842**

Firewood is the single largest source of woody biomass in B&H, as can be clearly seen in Table 2. In 2012, the total quantity of this type of biomass was approximately 1.23 million m^3. Firewood is typically used for the heating of households and is burned in furnaces and stoves with low energy efficiency. Despite the low efficiency, the use of fuel wood to heat households is increasing in urban areas as the prices of other energy sources are increasing. As all of this firewood is currently being used.

Stumps, small branches and other wood residue remain in the forest after wood cutting and processing and are not being collected. This residue represents the largest source of woody biomass potential and combined amounts to more than 1.9 million m^3, as shown in Table 2.

A certain amount of small branches and wood residue must remain on the ground in order to provide nutrients for the soil. Stumps are important for the stability of forest eco-systems and not all of them may be removed from the forest. A minimum amount of investment is needed for the collection of small branches and residue after wood cutting at locations with good accessibility. However, for locations difficult to access with machinery, the cost of wood residue collection can be prohibitive. It is estimated that 1/3 of the stumps, small branches and other wood residue need to be left in the forest; and from the remaining 2/3, only half is accessible for collection. Using this residue for heating, instead of for firewood, would also provide additional quantities of wood for the wood processing industry.

In the wood processing industry there are significant quantities of wood residue from production of veneer, sawn timber and furniture. As shown in Table 2 this wood residue amounts to 0.55 million m3. However, most wood processing companies in B&H use wood residue for heating factory premises and/or to dry wood. If there is any wood residue left, it is sold to companies that produce pellets and briquettes. However, instead of using this residue for production of heat only, or for pellets and briquettes, the residue could be used in CHP plants to generate the necessary heat for the production process, and also to

generate electricity. It is estimated that 80% of this existing residue could be used in CHP plants.

Stumps, small branches and other wood residue is the available unused biomass in the forest. To calculate the lower heating value of forest biomass,3 it is estimated that it has 50% moisture content. Conifer trees with 50% moisture have the density of approximately 810 kg/m3, while deciduous trees with the same moisture content have the density of approximately 1140 kg/m3. Both types of trees have approximately the same lower heating value, and for 50% moisture content the heating value is approximately 8 GJ/t. Although the wood processing residue has less than 50% moisture content, the same value of 8 GJ/t will be used as a conservative estimate. Taking into account the arguments and estimates provided in the previous sections, the available woody biomass amounts to 7.44 PJ as shown in Table 3.

Table 3 Woody Biomass Technical Potential in BiH

Woody Biomass Sources	Conifer trees (m^3)	Conifer trees (PJ)	Deciduous trees (m^3)	Deciduous trees (PJ)	Degree of availability (%)	Technical Potential (PJ)
Firewood	1,711	0.01	1,228,441	11.20	0%	-
Forest residues	342,181	2.22	261,154	2.38	33%	1.53
Small branches	314,848	2.04	401,432	3.66	33%	1.22
Stumps	354,857	2.30	200,843	1.83	33%	0.61
Residues from wood processing industry	314,848	2.04	334,527	3.05	80%	4.07
TOTAL	1,328,445	8.61	2,426,397	22.13		**7.44**

Biomass from agriculture

In the agricultural sector, a small family farm is the most common type of farm, producing mainly for its own consumption. It is estimated that over fifty percent of agricultural farms are less than 2 hectares in size. State farms are larger; but due to the unfinished privatization, they are very restricted in their operational activities.

Biomass potential from agriculture is analyzed in two sections: Biomass from field crop residue and Biomass from animal farming (livestock) residue.

Field crop residues

Two large categories of field agricultural residues can be defined: field crop residue and arboricultural residue. Field crop residue is the residue that remains in the field after the crops are harvested. It includes different parts of the plants (stems, branches, leaves, chaff and pits), varying in composition, moisture content and energy potential. Arboricultural residue is the residue that remains in the field when cultivating perennial crops (i.e., pruning of vineyards and trees). As stated previously, the energy potential of arboricultural residue is much smaller than the energy potential of field crops and will not be considered further.

The data contained in the reports from the B&H Statistical Agency determined that corn, wheat and barley account for over 95% of field crop production in B&H (corn produced for fodder is not included in these values as it is fully harvested and no significant residue remains). Based on this analysis, the estimate of biomass potential from field crop residues in B&H is calculated based on the production of these three main crops.

As can be seen in Table 4 the production of the three main field crops varies significantly from year to year. For that reason, the estimate of biomass potential from field crop residues in B&H is calculated based on the average production over the last five years.

Table 4 Production of main field crops in BiH from 2010 to 2014 [5]

Annual production in tons						
Crop	**2010**	**2011**	**2012**	**2013**	**2014**	**Average**
Corn	853,376	764,119	539,432	798,500	798,487	**750,783**
Wheat	145,412	210,004	225,137	265,152	170,055	**203,152**
Barley	50,183	65,667	65,337	70,844	48,649	**60,136**

The amount of residue was calculated using fixed values of residue production per hectare for every type of crop. In this report the amount of residue will be based on the production value, which should result in a

more accurate estimate. For the three main crops, it is estimated that the ratio of crop to residue production is approximately 1:1, meaning that for one ton of crop harvested, one ton of residue is produced. It can be concluded that from the harvest of these three crops 95% of field crop residue is produced.

It is estimated that about 1/3 of the field crop residue could be used for energy generation (heat and electricity). The other 2/3 of the field crop residue is used in livestock farming as bedding for animals or is left on the land to provide nutrients for the soil. The lower heating value for residues of these three crops is approximately the same, and its value is estimated at 14 GJ/t (15% moisture content).

In Table 5 the technical potential of the most significant crop residue is given. Corn residue accounts for approximately 74% of the energy potential of field crop residues, followed by wheat residue (20%) and barley residue (6%).

As shown in Table 5, it is estimated that 1,014,071 t of field crop residue could be annually used for energy generation. This is equivalent to 4.69 PJ or 1.7 % of the total primary energy supply in 2013.

Table 5 Production and residues of main crops in BiH

Crop	Production (t)	Residue (t)	Degree of Availability (%)	Residues available for energy generation		
				Quantity (t)	Lower heating value (GJ/t)	Technical potential (PJ)
Corn	750,783	750,783	33%	247,758	14	3.47
Wheat	203,152	203,152	33%	67,040	14	0.94
Barley	60,136	60,136	33%	19,845	14	0.28
TOTAL	**1,014,071**	**1,014,071**		**334,643**		**4.69**

Animal farming (livestock) residues

The animal farming sector in B&H has passed through a post-war transition period, resulting in a larger number of small family farms that are mostly focused on satisfying their own needs and keeping the livestock numbers at the biological minimum.

Livestock waste (manure) is an excellent source of energy if it is collected in the appropriate lagoons or large tanks. However, livestock waste can be collected and used only in intensive (stall) livestock feeding, which is used in B&H for cattle, pig and poultry farming. The animal waste can be anaerobically digested in a digester, producing biogas that can be used to generate heat and electricity.

The potential for livestock farming is B&H is excellent, since there are very large areas of suitable land not used or inhabited and close to towns; however, there are a number of market limitations. One of the most important limitations is that a large portion of meat and dairy products consumed in B&H are imported from Serbia and Croatia. Also, agricultural subsidies in B&H are small and not put to the best use as many small family (non-commercial) farms receive subsidies.

Although the number of livestock could be much greater, the energy potential of existing livestock residues is very significant. The number of cattle and pigs does not change much from year to year, as is the case with field crop production; and it is best to use the most recent available data. Larger annual variations occur in the quantity of poultry, but the energy potential from poultry is the smallest and does not affect significantly the total estimate.

The amount of biogas that can be produced from livestock farming waste (manure) varies, depending mainly on the species and weight of the animal. Within one species, the weight varies significantly and that is why a livestock unit (LSU) is used to facilitate the aggregation of livestock. A livestock unit is an animal or a group of animals weighing 500 kg. Livestock unit coefficients for livestock, based on their average weight, are given in Table 6.

Table 6 Livestock unit coefficients (8)

Species	Description	LSU coefficient
Cattle	Under 1 year old	0.4
	Between 1 and 2 years old	0.7
	Male, 2 years old and over	0.8
	Dairy cows	1.00
Pigs	Piglets having a live weight of under 20 kg	0.027
	Breeding sows weighing 50 kg and over	0.5
	Other pigs	0.3
Poultry	Broilers	0.007
	Laying hens	0.014

Biogas yield per animal LSU also varies depending on the breed of animal (for example for cows, Holstein or Guernsey) and the fodder being fed to the animal. The exact values can be determined only by manure analysis. For the purposes of this report the values given in Table 7 will be used. Biogas yield per animal LSU also varies depending on the breed of animal (for example for cows, Holstein or Guernsey) and the fodder being fed to the animal. The exact values can be determined only by manure analysis. For the purposes of this report the values given in Table 7 will be used.

Table 7 Annual biogas yield per animal

Species	LSU coefficient per animal	Annual biogas yield per LSU (Nm^3/LSU)	Annual biogas yield per animal (Nm^3/head)
Cattle	0.8	440	352
Pigs	0.15	700	105
Poultry	0.01	800	8

The number of animals in was taken from reports published by the B&H Agency for Statistics of BiH. According to the official statistics in 2014 there were 444,000 cattle, 53,000 pigs and 20.6 million poultry. The amount of biogas that could be theoretically produced is estimated to be approximately 273 million Nm3. The biogas lower heating value (LHV) estimated at 6 kWh/Nm3 or 21.6 MJ/Nm3 which corresponds to a methane content of approximately 60%.

Usage of livestock residue for energy production through anaerobic digestion is feasible only for medium to large scale intensive livestock breeding. In the statistical documents there is no data given regarding the size of animal farms so that it could be determined how many of them are large enough for biogas production to be technically feasible. Based on the fact that most animal farms are small, it was estimated that only 20% of farms are large enough and therefore, the technical potential of livestock residues is 20% of its theoretical value. The available livestock residues for energy production amount to 1.18 PJ, or 0.4% of the total primary energy supply in the country in 2013.

Table 8 Energy potential of animal waste in BiH

	Cattle	Pigs	Chicken
Animal heads	444,000	533,000	20,664,000
Biogas annual biogas yield per animal (Nm^3/head)	352	105	8
Biogas potential (million Nm^3)	156.3	55.97	165.3
Theoretical Potential (PJ)	**3.37**	**1.21**	**3.56**
Degree of availability (%)	20	20	20
Technical Potential (PJ)	0.67	0,24	0.71
Total Technical Potential (PJ)		**1.62**	

An estimate of the technical biomass potential to be used for power or CHP generation in the wood processing and agricultural sectors is shown in table below.

Table 9 Estimated technical biomass primary energy potential wood processing and agricultural sectors in BiH in 2014

Biomass type	Technical Potential (PJ)	Technical Potential (GWh)
Woody biomass	7.44	2066.7
Field crop residues	4.69	1302.8
Livestock residues	1.62	450.0
TOTAL	**13.75**	**3819.5**

The technical primary energy potential of 13.75 PJ is equal to about 5.1% of the country's total primary energy supply of 270 PJ in 2013. Woody biomass is the dominant unused biomass resource and it accounts for 56% of the unused technical potential, followed by field crop residues (35%) and livestock residues (9%).

The annual electricity conversion rate for biomass power and CHP plants varies depending on the applied technology used and installed capacity; it ranges from about 12% [10] to 36%.

SWOT ANALYSIS

SWOT analysis in Bosnia & Herzegovina

Strengths	Weaknesses
•Competitive advantages for exploitations of biomass (land, forest, climate, etc) •Pre-war experience in biomass research and exploitation (boilers, combustion research) •A lot of small and similar municipalities with developed wood processing industry (wood residues) •Very close perspective of promotional measures for bioenergy production and use.	•Bad economical and financial situation •Stagnation in further development of new biomass technology •Different competition conditions around the country •Stagnation in education and building of human capacities •No incentives for biomass/waste production and use •Complicated legislative for PPP realization.
Opportunities	**Threats**
•Employment (whole bioenergy chains) •Sustainable exploitation of all biomass sources •Growth in local heat and electricity demands •Possibility of attraction of foreign and private investors •Ecological aspects using biomass/waste •Technological development in the field of biomass/waste use (R&D) •SME industry development •Local development •Potential for EE in wood processing industry as well as agroindustry by using waste biomass from the processes. •Domestic equipment	•Unsystematic and unsustainable exploitation of forests and land, especially forest residues (wastes) •Dependence, to some extent, on imported technology •Low level of R&D and technological development •No new employment in this sector •No further and better local development •No diversification of energy supply side •No foreign investors •Lack of promotional mechanisms for bioenergy production and use •No or bad legislative framework for biomass/waste production and use

HEAT AND ELEKTRICITY MARKET OPPORTUNITIES IN B&H

**Biomass power plants generate electricity from manufacturing waste from various industries (wood processing, agriculture, livestock farming and others).*

Biomass power plants produce only electricity, while cogeneration or CHP plants produce electricity as well as heat.

Biomass energy in Bosnia and Herzegovina has an important role mostly in terms of fuel wood for production of heat energy.

This holds particularly true in the areas where the rural sector has a prominent role in the population structure, since historically the rural population in all areas was using the biomass for heating and/or cooking. Biomass in the form of fuel wood and charcoal is currently an ever increasing source of energy in B&H, whose average consumption is estimated at 1,323,286 m^3 per annum.

However, the degree of efficiency of the energy conversion devices is very low. Unlike in households, biomass consumption is low in other sectors such as, for example, agriculture, trade and industry.

Fuel wood is important mostly in the rural areas and small towns where no public heating network is available. In some areas of Bosnia and Herzegovina, the share of biomass in household heating reaches the level of up to 60% (parts of East Bosnia). As in many cases for development countries, the fuel security and rural development potential of bio fuels that tends to be of most interest.

At this micro scale sustainable development drivers are more social-economic. Strategic approach for the rural areas has to offer new opportunities, in a sense that modern village is not only as food producer, with all difficulties related to competitiveness of its products, but also competitive energy producer, or supplier, which gives new dimension of its sustainability. Most of the cities and rural households have its own heat supply systems, mainly low efficient boilers, which gives a chance to producers of the biomass boilers and HVAC equipment as well as pellet and wood chips producers.

There are some of district heating systems which have problem with sustainability because of low efficiency and use of expensive liquid fossil fuels. The analysis were shown that is possible to reconstruct some of them and switch the fuel to biomass, issuing lower prices of the heat produced as well as CER (Certified Emission Reduction) because such projects can be attractive as CDM.

There are a lot of small municipalities in Bosnia and Herzegovina with large physical potential of biomass and developed forestry and wood processing industry. It is easy to show that small municipalities in Bosnia and Herzegovina (with 10.000 to 20.000 inhabitants) with centralized wood processing industry can satisfy their all energy needs from its own wood waste, but

also start some new business activities based on the available biomass..

Some estimations has shown that 50% of forest biomass this resource could supply medium scale CHP installations (5 MWe +) delivering power to grid and heat to residential/ commercial/ industrial users. The installed capacity would be around 21 MWe and annual output would be 149 GWh and 213 GWh of electricity and heat respectively.

If half of the scenario where potential of 7,66 PJ would be available for bio-energy industry, or mediumscale CHP installations, delivering power to grid and heat to residential / commercial / industrial users, 106 MWe installed capacity that would generate 745 GWh electricity and 1.065 GWh heat annually would be supported.

Modern market opportunities offers many promotional mechanisms for bioenergy based projects. Some of them which are of the high importance has been analyzed: ESCO (Energy Service Companies) and Feed-in tariffs, because they already exists in Bosnia and Herzegovina.

Due to that some of the aspects related to promotional mechanisms will be analyzed. There are no any co-firing biomass based technologies in Bosnia and Herzegovina (except of a small demonstration unit at the Mechanical Engineering Faculty of Sarajevo), but it can became interesting because some analysis shows that use of 50% of estimated forest residues would result in the production of 149 ‘green’ GWh within existing solid fuel power facilities, which are mainly from the seventies and use low rank lignite coal.

Biomass from the wood processing industry and forestry, together with agricultural and other forms of biomass is a significant energy source and due to that deserves careful planning and estimation because it can became one of the important economy drivers.

Production and share in national heating consumption

The forestry and wood processing sector were always very important for the economy of B&H. Wood and wood waste are mostly used for heating in individual housing units. In rural areas it is the major heating fuel. The wood processing waste has never been utilised efficiently. Fossil fuels, which people use for heating in the winter months, and outdated cars on the roads are the primary sources of air pollution in B&H.

It was not possible to find data on energy consumption of heating sector. So, it was decided to use data on household energy consumption, which are presented in table 10.

Table 10. Production and share of renewable energy in national heating consumption (in PJ)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total energy demand in households	67,66	71,36	68,61	73,44	72,77	79,49	82,69	86,02	89,50
Coal	6,78	6,44	8,09	6,72	7,58	9,01	9,46	9,93	10,43
Oil products	5,73	5,74	5,09	4,10	4,16	4,07	4,27	4,49	4,71
Gas	1,41	1,38	1,27	1,55	1,60	1,92	2,04	2,16	2,29
Wood	37,95	41,73	37,64	43,81	41,71	45,84	47,67	49,58	51,56
Electricity	12,72	12,74	13,02	13,56	13,95	14,78	15,22	15,68	16,15
Heat energy	3,07	3,33	3,50	3,70	3,77	3,87	4,02	4,19	4,35
In %									
Wood	56,09	58,48	54,86	59,65	57,32	57,67	57,65	57,64	57,62
Electricity	11,28	10,71	11,39	11,08	11,50	11,16	11,05	10,94	10,83

Source: WB (2008): Energy study in BH; *author approximation on the basis of average increase rate

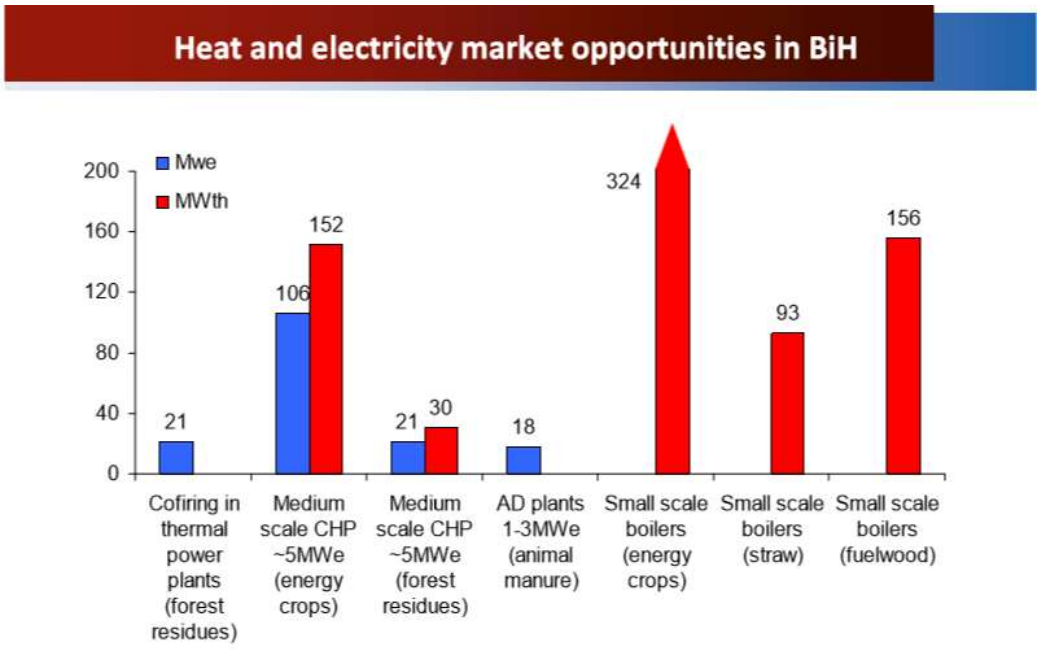
As it can be seen, around 60% of household energy consumption is satisfied by firewood. Generally speaking, the ovens are not modern, well designed and controlled, so there is problem with dust and smell, especially during the wintertime in big cities like Sarajevo, Tuzla etc.

Bosnia and Herzegovina annually is losing 21.5% of its GDP, that is more than 7.2 million dollars (more than 12 million KM), due to the high air pollution, according to the World Health Organization.

Domestic and international environmental organizations for decades warn of an alarming air pollution in B&H, which year after year is a growing problem.

In Sarajevo, then dust concentration exceeded the value of 300 micrograms per square meter, while in Tuzla, near the thermal power plant, measured and more than 1,000 micrograms. According to EU standards, in the cities to tolerate dust concentrations between 25 and 40 micrograms per square meter.

Additionally, around 11% of that need is satisfied by hydro-energy (60% of total electricity). So, the major part of household energy consumption is covered by RE.



Municipal solid waste

Municipal solid waste (MSW) refers to waste collected by or on behalf of municipalities; this mainly originates from households but waste from commerce and trade, offices, institutions and small businesses is also included.

According to the EU legislation (Directive 2001/77/EC) energy produced from the biodegradable fraction of MSW is considered as renewable and therefore organic waste, waste paper and cardboard and textiles are a source of biomass.

Due to lack of data regarding the share of the biodegradable part to the total quantities of MSW in6 iH, the biodegradable fraction of 50% found in neighboring Serbia was employed. Furthermore, a lower heating value of 7,2 GJ/t for the biodegradable part was assumed. Landfill gas. Municipal Solid Waste (MSW) production expected to reach 0,5 t/person/year (the EU 15 average). It is disposed and methane is captured and used to generate power. This assumes that, due to the location of the landfills, there are no local uses for heat.

The theoretical biogas potential estimated in this study is 4,28 PJ. In 2008, 1.367.097 t MSW was generated in Bosnia and Herzegovina, 86% of which (1.181.887 t) was collected. This is equivalent to 308 kg of collected waste per capita per year. Other sources report a higher value of waste generation at around 500 kg/ per capita/ per year. Nevertheless, it was decided to accept the number reported by the Agency for Statistics of Bosnia and Herzegovina, since it is in good agreement with waste generation rates found in other Western Balkan countries.

Table 11 shows estimated total MSW and household waste (HHW) amounts, in accordance with the methodology recommended in the SWMS , and population statistic.

	MSW generated in 1999 [Gg MSW]	MSW generated in 2010 [Gg MSW]	MSW generated in 2020 [Gg MSW]	MSW generated in 2030 [Gg MSW]
MSW in RS	724,269	1002,558	1347,354	1810,731
HHW in RS	362,134	501,278	673,676	905,364
MSW in FB&H	1138,0	1575,258	2117,015	2845,091
HHW in FB&H	569,0	787,629	1058,508	1422,546
Summary MSW	1862,269	2577,812	3469,369	4655,822
Summary HHW	931,134	1288,907	1732,183	2327,911

Taking the above into account the theoretical potential of biomass from MSW can be estimated according to the following equation:

Emsw = PpCoHo (F.5)

P population, p per capita waste generation [t/yr], Co biodegradable waste fraction in MSW [%], Ho biodegradable waste lower heating value [GJ/t].

The estimated theoretical potential amounts to 4,28 PJ or 1,9% of the country's total primary energy supply in 2008. Currently, the main option for disposal of municipal waste is still landfilling, while most of the landfills are not sanitary. Furthermore, it is estimated that there are more than 2.000 open dumps, many located near to small municipalities in rural areas.

Two regional sanitary landfills are anticipated in FBiH for 2010: "Smiljevac"- Sarajevo and "Mošćanica" - Zenica, where 10% and 8% of the total MSW collected in the FB&H would be disposed respectively. For RS, one regional sanitary landfill for MSW disposal "Ramići"- Banja Luka, is anticipated, where 16,7% of the total MSW collected in RS would be disposed.

At the sanitary landfill in Sarajevo, the collected landfill gas is used for electricity generation, while at the Zenica landfill a flare system for the combustion of landfill gas has been constructed. The combustion of landfill gas by flare is also envisaged at the future sanitary landfill in Banja Luka.

In addition to landfills, according to the initial national communication of B&H under the UN framework convention on climate change (UNFCC), incineration of 20% of MSW with energy recovery is anticipated by 2030. It is further foreseen that recycling rates will be 10% of the total household waste (HHW) in 2020 and 20% for 2030. Moreover, 50% of the recycled HHW is foreseen to be biodegradable waste.

NATIONAL POLICY AND CONCEPTS PROMOTING RENEWABLE ENERGIES

Increasing the share of renewables in the energy mix of Bosnia and Herzegovina together with the implementation of energy efficiency measures are also necessary for achieving national objectives on climate change set out in the strategy to adapt to climate change and low-emission development for BiH.

As one of the objectives of the Strategy for the period 2013-2025.is the termination of the use of fuel oil and coal for domestic heating and district heating systems and their replacement energy-efficient systems, biomass, thermal solar and geothermal energy by 2020.

The management of renewable energy sources in Bosnia and Herzegovina is the responsibility of entities (Federation of Bosnia and Herzegovina and the Republic of Serbian) and Brcko District. The National Assembly of the Republic of Serbian and Parliament of the Federation of Bosnia and Herzegovina have adopted separate laws

Analysis of the permitting procedures in Bosnia and Herzegovina (B&H) shows that for a biomass power plant to be considered planned it should have at least the Urban Permit. After a construction permit is obtained and before construction starts, a guarantee for the purchase of electricity can be obtained from the Operator for Renewable Energy Resources and Efficient Cogeneration at set feedin-tariffs.2 Feed-in-tariffs are determined by the Federation Energy Regulatory Commission (FERC) and the RepublikaSrpska Energy (RSERC).

on renewable energy sources in May 2013 and in August 2013. Action plans for the use of renewable energy sources have been adopted in both entities in 2014. 10 At the national level there is still no comprehensive promotion and development of renewable energy, and a national action plan for renewable energy sources, which requires the Energy Community Treaty, has not yet passed.

The key permits needed to be obtained for a construction of the power plant in BiH, listed in order of issuance, are:

- Urban permit
- Energy permit
- Water permit
- Construction permit
- Acquiring status of potentially qualified producer
- Initial agreement for electricity purchase from the Operator for Renewable Energy Sources and Efficient Cogeneration
- Operational license
- Electricity purchase agreement

There are currently no biomass power plants in operation in BiH that supply electricity to the grid. The only biomass power plant in operation is a 37kWe biogas pilot plant at Livac Agricultural Cooperative in the Republic of Srpska (RS), which applied in January 2015 for a license to sell the produced electricity at the prescribed feed-in-tariff (Chapter 1.1), which application was denied in June 2015.

EXISTING BIOMASS POWER PLANTS

“Livac” Agricultural Cooperative – Aleksandrovac, Municipality Laktasi, RS.

Livac Agricultural Cooperative is a dairy farm and is the only biogas-fueled CHP plant in BiH, put into operation in 2011 with installed capacity of 37kWe. The cost of construction was approximately 220,000 EUR (250,000 USD), resulting in a specific investment cost of 5946 EUR/kW. The high specific cost is the result of the fact that this was the first biogas-fueled CHP plant in BiH and even construction of the round digester presented a problem, since BiH companies did not possess the necessary equipment. The produced heat and electricity are consumed at the farm and cheese factory located at the farm. The company does not sell the electricity at the moment; however, in 2014 the Livac Agricultural Cooperative initiated a procedure to become an independent producer of electricity and sell all of the produced electrical energy. In January 2015, it submitted an application to the Regulatory Commission for Energy of the Republic of Srpska (RSERC) for a permit to become a producer of electrical energy. In June 2015, the application was denied on the grounds that the application was incomplete (not containing all required documentation). The EIA project will consider the possibility of providing technical assistance to this company to obtain the necessary documentation and become the first biomass power plant to supply electricity to the grid.

Livno, Esco Eco Energijad.o.o. – In 2012, FERC issued a Preliminary Permit for construction of a biomass CHP plant at the “District Heating Company Livno” to the ESCO Eco Energija Company from Livno. The planned electrical capacity of the plant is 1,250 kW and the estimated annual production of electricity would be cca 10.3 GWh. ESCO Eco Energija Company plans to continue with the construction of the biomass plant in the near future.

MG Gold BH – DonjiZabar, Municipality DonjiZabar, RS.

MG Gold BH is the first biogas power plant in BiH that has received a guarantee for the purchase of electricity at the set feed-intariff after the plant is put into operation (it is under construction at the moment). The power plant will have 989 kWecapacity, with a planned annual production of 8.275 MWh of electricity. The estimated cost of the biogas power plant is 3 million EUR (3.4 million USD), resulting in a specific investment cost of 3033 EUR/kW. This low cost is a result of the fact that the investor did not buy the technology and know-how from a foreign company specializing in biogas, but developed the design on its own in cooperation with local companies. MG GOLD owns a farm with cows, pigs and chickens and over 250 hectares of irrigated land. The feedstock for the biogas plant will be manure from the farm and corn silage. An irrigation system will be used to spread the liquid fertilizer (digestate) produced in the process of biogas production, which greatly reduces the costs of fertilizing the land. The company owns sufficient feedstock to run the plant, making it independent of outside supply.

CONCLUSION

Renewable sources sector in the Bosnia and Herzegovina has good prospects because, as we have already said, Bosnia and Herzegovina has a huge potential that has not been used yet, and as such represents an ideal opportunity for promotion of foreign investment in our country because, as it is well known, the level of utilization of renewable energy sources in individual countries reaches up to 98 % of the total potential both in Europe and worldwide.

With better organization and promotion of renewable energy sources, there are great opportunities for development both in this sector and the entire country.

This sector has a potential to provide a basis for the development of the country for future generations because of the longterm strategic development of the EU, the interest of foreign investors, positive impact on other sectors, such as tourism, environmental protection, improvement of agriculture and energy efficiency (especially heating in households), employment opportunities, importing new technologies, innovative small businesses and the cooperation between the private and public sectors.

Success of biomass based projects depends on the understanding of the stakeholders on the all levels which have to understand biomass resource base, its purposes and potential use in some other competitive branches, benefits and disadvantages of use of such material for energy purposes on sustainable manner. All these aspects point strongly to the importance of coordination and coherence of policies directing the supply and use of biomass for different purposes.

Polimac Company d.o.o.
Sarajevo, Bosna i Hercegovina

HYDRO POWER PLANTS &
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IN BOSNIA AND HERZEGOVINA

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