

WOOD FUELS CONSUMPTION IN HOUSEHOLDS IN BOSNIA AND HERZEGOVINA

by

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The paper shows research results for the consumption of all types of wood fuels in the households in Bosnia and Herzegovina and its entities in 2015. The research was conducted in the period from March 15th to August 26th, 2016 in 109 cities/municipalities in the entire Bosnia and Herzegovina.

Complex methodological approach was used for conducting the research, which required field research on the sample of 8,602 households on the entire territory of Bosnia and Herzegovina as well as adequate statistical processing of the obtained data pursuant to the high statistical standards. Research results show that in 2015, 5.4 million m³ of firewood, 81,656 tones of wood pellets, and 6,780 tones of wood briquettes were consumed in the households in Bosnia and Herzegovina. Total expenses of households necessary for the supply of wood fuels in Bosnia and Herzegovina in 2015 were 239.8 M€, with the largest share of firewood (226.8 M€), followed by wood pellets (11.6 M€), and wood briquettes (720.9 thousand €).

Average firewood consumption per household in Bosnia and Herzegovina is 6.43 m³. Compared to the surrounding countries it is on the level of Slovenia (6.5 m³ per household), less than in Serbia (7.3 m³ per household) and more than in Montenegro (5.49 m³ per household).

Average consumption of energy from firewood expressed in kWh/m² of the heated surface was 252.7 kWh, which is significantly higher than the average in the EU. One of the reasons for such high consumption of wood energy per 1 m² of the heated surface is the fact that only 36.1% of the households using solid fuels have thermal insulation on their residential facilities.

Key words: wood fuels, consumption, households, energy

Introduction

In spite of a strong culture of energetic use of wood in Bosnia and Herzegovina, the country relies heavily on importation of fossil fuels at high costs to meet their total primary energy needs. The lack of national sector policies and action plans supporting the use of renewable energy sources including wood fuels for heat generation further contributes to the increased dependence on importation of fossil fuels. Some heating systems using fossil fuels (district heating systems, heating of public institutions) have been modernized, involving change in boilers and installations, but without giving consideration to switch to renewable energy.

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On the other hand, national and foreign investment groups have introduced wood fuel systems in their recently established plants and factories making use of the available woody biomass in Bosnia and Herzegovina. However, as wood demand is rising fast in other regions and national markets for wood fuels are underdeveloped, huge amounts of wood fuels are exported from Bosnia and Herzegovina primarily to Italy and Slovenia.

In this way, a CO₂ neutral source of energy is exported from this country and fossil fuels are imported which not only poses a problem for the environment but also for the foreign trade balance of this country.

Various actors conducted wood fuels utilization studies in Bosnia and Herzegovina in the past. However, these studies were limited, both in terms of scale and methodology, using incomplete and only partially suited, highly aggregated national statistical data, and personal assessments. Therefore, the values for wood energy in collective national energy balance have almost been derived from official statistical data which cover only one category of wood fuels, namely firewood. There is not reliable statistical data on the production and consumption of firewood, nor on illegal logging or on import and consumption of other wood fuels.

Such a situation is not typical for Bosnia and Herzegovina only, it is also typical for most other countries in the region. Thus in the period 2010-2014, similar research was conducted in most western Balkan countries as it is done now for Bosnia and Herzegovina. The objective of such research was to obtain relevant data about actual consumption, production and foreign trade of wood fuels and wood energy by using internationally acknowledged methodology and comprehensive research. Based on such obtained data, new energy balances were made and the policy for using renewable energy sources was redefined.

First such research was conducted in Serbia in the period 2009-2010. Research results showed that actual consumption of firewood in the households in Serbia in 2010 was 4.9 times higher than the statistically registered consumption [1]. After Serbia, research of wood fuels consumption was carried out in Montenegro in the period 2011-2012. This research also showed that actual consumption of wood fuels was significantly higher than the officially registered consumption. According to [2] actual consumption of firewood in households in Montenegro was 5.1 times higher than the officially recorded consumption in 2011. During 2014, research of wood fuels consumption was conducted on Kosovo as well. According to [3], total consumption of firewood on Kosovo is about 2.05 million m³.

The issue of balancing the consumption of woody biomass and its potentials has been dealt with other authors in Europe as well. According to [4] biomass and renewable waste, with a share of 64.2% of primary renewable energy production, is the most important energy source in the EU. However, utilization of renewables in energy production and consumption differs across EU countries and is significantly influenced by various factors. Using Slovakia as an example, almost 83% of all resources used in Slovakia originated in forest biomass, 16.1% were from industry waste, and only 1% came from used paper. On the other hand, over 84% of resources were used industrially, while nearly 16% were used for energy purposes [5].

Scope and objective of the work

The main scope of researches is wood fuels consumption for energy purposes of households in Bosnia and Herzegovina which include heating, food preparation, hot water, brandy distilling, meat smoking, and other purposes.

Research objective is to identify the consumption level of all wood fuel types which are used in the households in Bosnia and Herzegovina by applying internationally recognized methodology. Based on such obtained results, consumption of wood energy per 1 m² of the

heated surface will be calculated in order to make adequate conclusions and give recommendations to the decision makers in order to adopt measures for increasing the efficiency of wood fuels use in the households in Bosnia and Herzegovina.

Used methodology

Considering the fact that Bosnia and Herzegovina does not have reliable statistical data on the production and consumption of wood fuels and that numerous studies and papers with the topic of woody biomass were based on the assessment of experts based on official statistical and other data published by certain institutions and organizations, the need to conduct a comprehensive research emerged with the purpose to observe actual consumption and thus participation of wood based energy in the total balance of final energy consumption. The paper used WISDOM methodology defined by the FAO organization [6].

As the basis for determining the sample for interviewing of households were used the preliminary results from the census conducted in 2013. This sample could include only those households that use solid fuels for heating. In this regard, it was necessary to do the research and collect data on the number of households in all cantons and mesoregions that use other fuels for heating, such as: electricity, gas, and fuel oil, and the number of households that use district heating systems. For those purposes, data from all relevant fuel suppliers in Bosnia and Herzegovina were collected through questionnaires. On the basis of thus collected data on the total number of households in Bosnia and Herzegovina in accordance with the census (1,163,387 households), those households that use other fuels for heating were deducted in order to obtain the number of households that use solid fuels such as wood, coal, briquettes, pellets, or combined fuels, fig. 1. The same methodological approach was used in the research of wood fuels consumption in Serbia in 2010, in Montenegro in 2013, and in Macedonia in 2016.

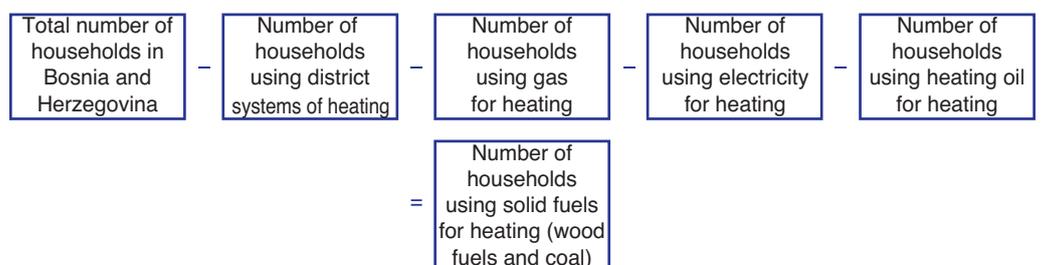


Figure 1. Methodology for determining the number of households which use solid fuels for heating purposes in Bosnia and Herzegovina [1]

Number of households which used the stated fuels was obtained from the district heating plants [7], electric power industry [8, 9], gas distributors [10], and petroleum distributors in Bosnia and Herzegovina [11] representing the number of active households which used the stated fuel forms in the period in which the research was conducted.

Using the previously mentioned methodological approach, fig. 1, the total number of households which used solid fuels (wood fuels and coal) for heating in Bosnia and Herzegovina in 2015 was calculated to 860,228.

Thus defined sample was a starting point for defining the size of the sample for interviewing of households. The sample was 1% of the total number of households which use solid fuels, *i. e.* 8,602 households. After determining the sample, the following methodological steps were made:

- to determine the sample size in some cantons, mezoregions and the District of Brcko, was used the same percentage as each canton/mezoregion/District of Brcko had in the total number of households according to the last census in Bosnia and Herzegovina; the total number of 8,602 households in the sample was multiplied by that percentage and so the sample for each canton/mezoregion/district was obtained,
- sampling of the number of households in particular towns/municipalities within the cantons/mezoregions/district was done in the same way; number of households in the sample in certain towns/municipalities within cantons/mezoregions/district was determined based on a percentage share of the number of households in that town/municipality in the number of households at the level of a canton/mezoregion/district, and
- division of such sampled households into *urban households* and *other households* was based on a share of those two categories (urban and other) in the total number of households at the level of town/municipality.

For conducting the field research, 33 interviewers were selected for the entire Bosnia and Herzegovina. For the Republic of Srpska, which is divided into six mezoregions (Prijedor, Banja Luka, Doboj, Bijeljina, East Sarajevo, and Trebinje), twelve interviewers were selected. In the Federation of Bosnia and Herzegovina, which is divided into ten cantons, 21 interviewer was selected, and one in the District of Brcko.

Households were interviewed between March 15th and April 22nd 2016 in 109 cities/municipalities in the entire Bosnia and Herzegovina, *i. e.* in its two entities, the Republic of Srpska and the Federation of Bosnia and Herzegovina, and the District of Brcko. Interviewing was conducted in urban settlements, and in at least two larger other settlements in every city/municipality. Survey was conducted in such a manner that interviewers visited households and applied the method of direct interviews (face-to-face). A total of 8,500 households were interviewed for the entire Bosnia and Herzegovina, households in urban settlements 3,912 and households in other settlements 4,588.

Compared to the defined sample, there were 102 interviewed households less. The main reason was the lack of co-operation in some cities. However, despite of this, the number of 8,500 interviewed households is fully representative for conducting the analyses on wood fuels consumption in households in Bosnia and Herzegovina since it represents nearly 1% (0.99%) compared to the number of households that use solid fuels.*

Spatial distribution and size of strata for interviewed households by some mezoregions/cantons/district are given in fig. 2.

After interviewing and entering the data into the web application, the entered data were checked, logical control of consumption in physical measurement units per m² of heating surface was conducted, and then the data were processed, systematized, and calculated from the level of a sample to the level of a whole.

Data obtained using the previously described methodologies are used for creation of wood fuel energy balance for 2015 for Bosnia and Herzegovina. Data obtained for some types of fuels needed to be calculated into cubic meters of the compact wood volume, while some other fuels needed no further calculation. Wood fuels for which the data on production and consumption were obtained in stacked m³ or bulk cubic meters, were converted into solid m³ using conversion factor 0.69.

* Sample and its scope are statistically representative for the conducted research in households using only solid fuels for heating purposes (860,228). In 2015, Agency of Statistics of Bosnia and Herzegovina conducted the research on consumption of all types of energy in households at the level of B&H (1,163,387) on a sample of 7,083 households.

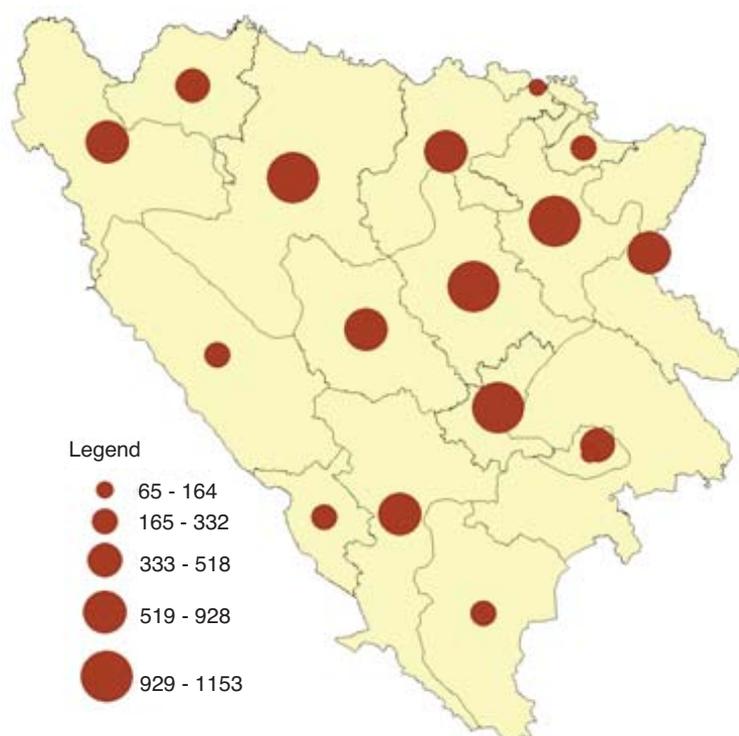


Figure 2. Spatial distribution and size of strata for interviewed households by mezoregions, cantons, and district in Bosnia and Herzegovina

Research results and discussion

Current situation on wood fuels market in Bosnia and Herzegovina is characterized by the fact that the following types of wood fuels are used for the purpose of heating households: firewood, wood pellets, wood briquettes, logging residues, and residues from sawmills.

Consumption of wood fuels in households in Bosnia and Herzegovina

The stated statistical indicators of the number and structure of households are significant for the analysis of fuel consumption for own purposes (heating, food preparation, etc.).

Results of the survey showed that 11% of the total number of households in Bosnia and Herzegovina used district heating system, 9% used electricity, 5% used gas, and 1% used heating oil for heating purposes in 2015. The largest number of households (74%) used solid fuels such as firewood, coal, wood briquettes, wood pellets, logging residues, residues from sawmills, and combinations of solid and other fuels, fig. 3.

Participation of certain fuel types for the purpose of heating households varies in different regions in Bosnia and Herzegovina. Results of the questionnaires [12] indicate that the households in 2015 year used 27 different combinations of fuels for heating purposes. Figure 4 shows the share of households with particular fuel combinations on the level of the region in Bosnia and Herzegovina.

The main conclusion that can be drawn based on this overview in fig. 4 is that firewood individually or combined with coal is dominantly present in all the regions in Bosnia and

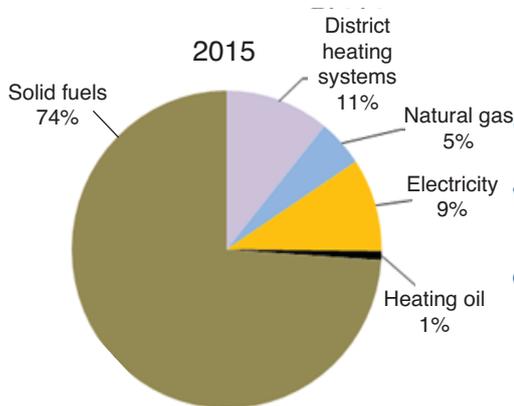


Figure 3. Share of certain fuel types for heating households in Bosnia and Herzegovina in 2015, [7-11]

Herzegovina. Combinations of firewood with other fuels (gas, electricity, heating oil, briquettes, etc.) are present in practice, however, with a small share of such households in the total number of households in Bosnia and Herzegovina.

Results of the participation of certain types of solid fuels on the level of Bosnia and Herzegovina are presented in fig. 5. Data from fig. 5 show that 70.3% of households, which used solid fuels for heating, use firewood, while the combination wood/coal is present in 23.2% of households.

Total consumption of wood fuels in households in Bosnia and Herzegovina in 2015 is given in tab. 1. Data in tab. 1 are structured

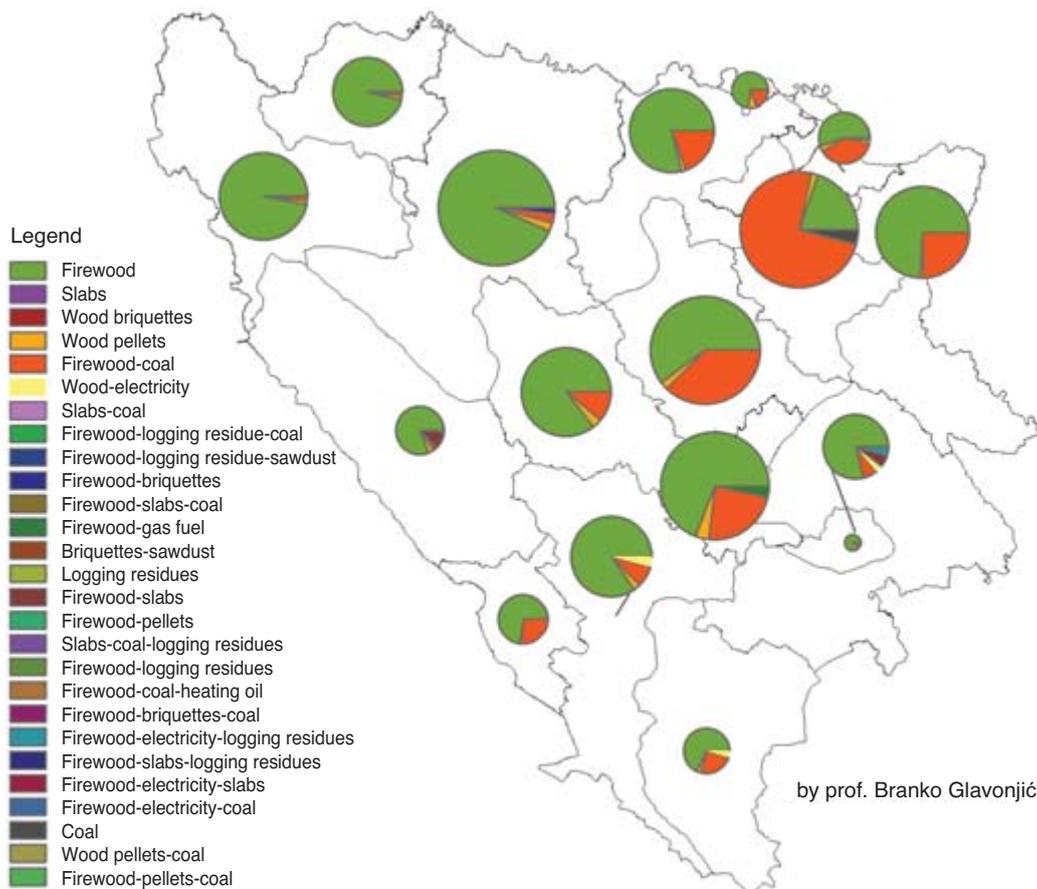


Figure 4. Presence of certain fuel types for heating households in Bosnia and Herzegovina in 2015 [12] (for color image see journal web site)

as to show consumption of certain wood fuels in households at the level of Bosnia and Herzegovina and its entities.

Total consumption of wood fuels for energy purposes in households in Bosnia and Herzegovina in 2015 was: firewood 5.4 millions m³, wood pellets 81,656 tones, wood briquettes 6,780 tones, slabs from sawmills 29,918 m³, sawdust from industry 1,098 tones and logging residues 9,050 m³.

Total expenses of households necessary for supply of wood fuels in Bosnia and Herzegovina in 2015 were 239.8 M€, including the largest share of firewood (226.8 M€), and then follow wood pellets (11.6 M€) and wood briquettes (720.9 thousand €).

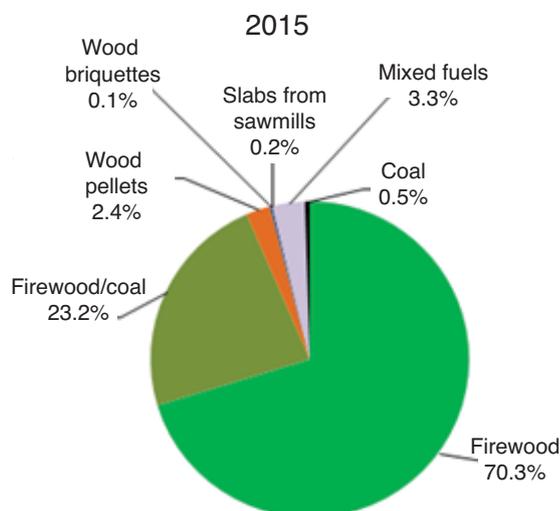


Figure 5. Participation of certain types of solid fuels for heating households in 2015 in Bosnia and Herzegovina [12]

Table 1. Wood fuel consumption in households in Bosnia and Herzegovina in 2015

	Urban/ other settlements	Type of wood fuel	Number of households that use wood fuels	Measurement unit	Total consumption of wood fuel in households (measurement unit)	Total expenses of households for supply of wood fuels (€)
Bosnia and Herzegovina	Total	Firewood	839,296	m ³	5,398,022	226,822,003
		Slabs from sawmills	9,602	m ³	29,918	603,524
		Wood pellets	17,363	tones	81,656	11,559,347
		Wood briquettes	3,014	tones	6,780	720,890
		Logging residues	4,072	m ³	9,050	115,185
		Sawdust	1,425	tones	1,098	21,316
Republic of Srpska	Total	Firewood	319,285	m ³	2,317,308	88,730,477
		Slabs from sawmills	3,751	m ³	16,152	295,765
		Wood pellets	4,094	tones	22,217	3,090,210
		Wood briquettes	2,750	tones	6,323	674,854
		Logging residues	3,188	m ³	6,083	29,826
		Sawdust	1,321	tones	1,087	20,889
Federation of Bosnia and Herzegovina	Total	Firewood	497,139	m ³	2,937,340	133,153,512
		Slabs from sawmills	5,693	m ³	12,339	285,220
		Wood pellets	12,383	tones	55,566	7,903,909
		Wood briquettes	264	tones	457	46,036
		Logging residues	751	m ³	2,834	84,069
		Sawdust	104	tones	11	427
District Brčko	Total	Firewood	22,872	m ³	143,374	4,938,014
		Slabs from sawmills	483	m ³	1,427	22,539
		Wood pellets	886	tones	3,873	565,228
		Logging residues	133	m ³	133	1,290

Source: [12], Calculations: Glavonjić, B. D.

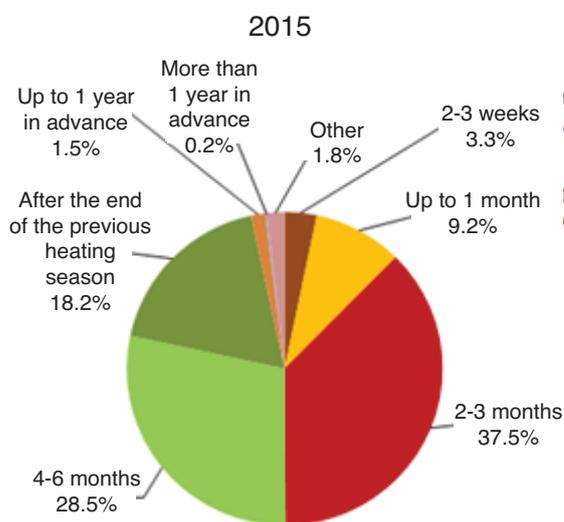


Figure 6. Time period in which households purchased firewood compared to the beginning of the heating season in 2015 [12]

According to the survey results, wood fuels are mostly purchased from timber merchants who represent the main suppliers of all types of wood fuels in Bosnia and Herzegovina. About 75% of the total amount of firewood purchased by households in Bosnia and Herzegovina, the Federation of Bosnia and Herzegovina (74.7%), and the Republic of Srpska (75.0), was purchased from timber merchants, and in the District of Brcko it is 62.9%. Supply of firewood from private or state forests is much lower than the one from merchants, and does not exceed 13.7%. In the District of Brcko, large amounts of firewood are purchased from fuel storages (16.6%).

One of the characteristics of wood fuels supply in Bosnia and Herzegovina is the fact that sawmills became sellers of wood briquettes and pellets although they do not produce these types of fuel. This is

the result of various compensation deals, which means that sawmills deliver sawdust and slabs to the factories that produce briquettes and pellets, and in return they receive briquettes and pellets which they further sell to households. In some sawmills, there are small presses where briquette is produced out of sawdust, so such sawmills are producers of wood briquettes at the same time.

Timing of purchase of firewood compared to the beginning of the heating season is an important factor in firewood consumption. Review of households according to the timing of purchase of firewood relative to the beginning of the heating season is given in fig. 6.

The largest number of households in Bosnia and Herzegovina purchased firewood in 2015, 2 to 3 months before the heating season (37.5%), and then follow those households that purchased firewood 4 to 6 months before the heating season (28.5%), and those that purchased it right after the end of the previous heating season (18.2%).

Results of the conducted field research show that in the Federation of Bosnia and Herzegovina, the largest number of households purchased firewood 4 to 6 months before the heating season, then follow households which purchased it 2 to 3 months before the heating season and those which purchased firewood right after the end of the previous heating season. In the Republic of Srpska, the largest number of households purchased firewood 2 to 3 months before the heating season (45.4%), then follow households that purchased it up to 1 month before the heating season (15.8%), and those that purchased firewood 4 to 6 months before the heating season (14.8%). In the District of Brcko, the largest number of households (51.7%) purchased firewood 2 to 3 before the heating season.

Data on attitudes of households in Bosnia and Herzegovina on what type of wood is the best to be used for heating are given in fig. 7.

At the level of Bosnia and Herzegovina, total of 44.8% households, compared to the number of households that use solid fuels, consider dry wood as the best for heating, especially the one that stayed for a year or more. In the Federation of Bosnia and Herzegovina, 47.6% of

households have the same attitude, and in the Republic of Srpska 40.8% households share the same attitude. In the District of Brcko, there are 37.7% of households with this attitude.

Comparative analysis of the data on figs. 6 and 7 shows that households which consider that it is the best to use dry wood for heating (44.8%) purchase the wood at the time with sufficient period for the wood to get air dried, in terms of the beginning of the heating season.

When it comes to the most frequent purposes for which firewood is used in the households in Bosnia and Herzegovina the results of the survey show that firewood is the most frequently used for heating and food preparation, fig. 8.

Results of the field research and the questionnaire have shown that 53.5% of total households which use solid fuels in Bosnia and Herzegovina use firewood for heating and food preparation, in the Federation of Bosnia and Herzegovina 48.7%, in the Republic of Srpska 60.9%, and in the District of Brcko 58.5%.

Types and characteristics of heating appliances that used in the households in Bosnia and Herzegovina have an important role in consumption and efficiency of combustion of firewood. Results of conducted survey show that the most frequent appliance for combustion of wood fuels in Bosnia and Herzegovina in 2015 were wood and coal burning stoves. A 422,799 households or 49.2% of the total number of households using solid fuels used these appliances. In the Federation of Bosnia and Herzegovina, 211,702 households (41.1%) use this appliance, 196,194 households (61.1%) in the Republic of Srpska, and 14,907 households (61.5%) in the District of Brcko.

The second most frequently used appliances were wood burning stoves in all entities except in the District of Brcko, where the second most frequently used appliances are boilers using solid fuels (18.9%). Other types of appliances are used significantly less than the previously mentioned.

Households by the age of the most frequent types of appliances used for wood fuels combustion in households in Bosnia and Herzegovina is given in tab. 2.

In Bosnia and Herzegovina and its entities, the Federation of Bosnia and Herzegovina and the Republic of Srpska, the most frequently used appliances are wood and coal burning stoves 6 to 10 years old, households at the level of Bosnia and Herzegovina there

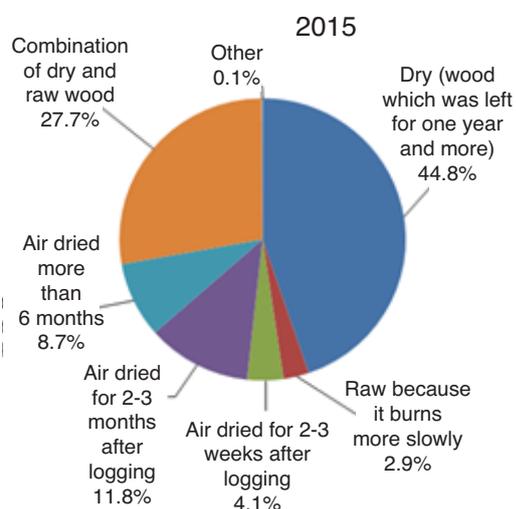


Figure 7. Attitudes of households in Bosnia and Herzegovina on the optimal use of wood for heating (2015) [12]

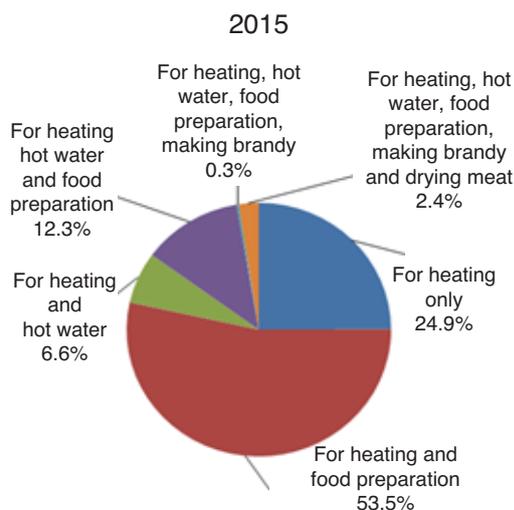


Figure 8. Purposes for which firewood is used in households in Bosnia and Herzegovina [12]

Table 2. Households by the age of the most frequent types of appliances used for wood fuels combustion in households in Bosnia and Herzegovina in 2015

Area	Age in years	Wood and coal burning stove	Wood and coal burning stove, for central heating	Wood burning furnace	Wood and coal burning furnace, for central heating	Boiler using solid fuels (coal, wood, briquette)	Tile stove
Bosnia and Herzegovina	1-5	124,435	23,212	70,580	29,991	28,962	65
	6-10	188,253	28,858	67,823	29,334	28,947	–
	11-15	86,333	5,526	23,452	11,037	10,712	125
	16-20	31,008	1,628	9,308	2,731	3,680	195
	21 and more	18,520	1,394	10,449	3,694	1,829	629

Source [12]

are wood and coal burning stoves while in the District of Brcko the most frequent are those 1 to 5 years old. In 41.9% of 6 to 10 years old, in the Federation of Bosnia and Herzegovina in 47.7%, and in the Republic of Srpska in 36.3% of households. In the District of Brcko, this type of appliance is mostly 1 to 5 years old, in 41.4% of households that use solid fuels for heating.

Graphic presentation of distribution of households depending on the age of wood and coal burning stoves at the level of Bosnia and Herzegovina and its entities is given in fig. 9.

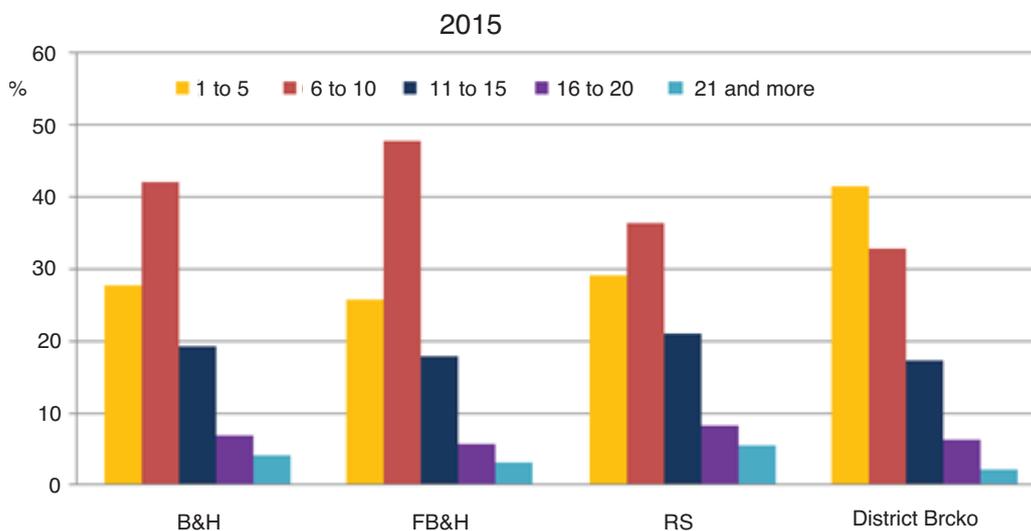


Figure 9. Households by age of wood and coal burning stoves in Bosnia and Herzegovina and its entities in 2015 [12] (B&H – Bosnia and Herzegovina, FB&H – The Federation of B&H, RS – The Republic of Srpska)

In Bosnia and Herzegovina, 41.9% of households use 6 to 10 years old wood and coal burning stoves. In the Federation of Bosnia and Herzegovina, 47.7% of households use this type of appliance 6 to 10 years old, 32.7% of households in the District of Brcko, and 32.3% in the Republic of Srpska.

Pellet burning furnaces are appliances of the new generation and therefore they are mainly 1 to 2 years old in households that use these appliances for heating. This refers to the households in all areas in Bosnia and Herzegovina.

Boilers that use solid fuels for central heating are mainly 1 to 5 years old in the Federation of Bosnia and Herzegovina, 41.8%. In the Republic of Srpska, these boilers are mainly 6 to 10 years old (37.1%), and in the District of Brcko 11 to 15 years old (32.0%). At the level of Bosnia and Herzegovina, they are mainly 1 to 5 years old, in 39.7% of households.

Average consumption of energy per 1 m² of the heated surface in households which use firewood in Bosnia and Herzegovina

Average firewood consumption per household in Bosnia and Herzegovina in the amount of 6.43 m³. Compared to the surrounding countries it is on the level of Slovenia (6,5 m³ per households), less than in Serbia (7.3 m³ per households), and more than in Montenegro (5.49 m³ per households) [13].

Average firewood consumption in households depends on several factors, the following of which are highlighted: size of the heated surface, presence of thermal insulation on the heated facilities, age of windows and doors, possession of insulated glazing on the windows, time of wood purchase compared to the beginning of the heating season, and type and age of the appliances.

Concerning households in Bosnia and Herzegovina, results of the calculations of the average consumption of wood energy expressed in kWh per 1 m² of the heated surface are presented in the following text. Size of the heated surface in the households using solid fuels for heating was the starting point in these calculations. Total heated surface in the facilities of the households which used solid fuels for heating in 2015 was 59.6 million m² on the level of Bosnia and Herzegovina [12].

Calculation results show that the average consumption of energy from firewood per 1 m² of the heated surface was 252.7 kWh on the level of Bosnia and Herzegovina in 2015. Having in mind the magnitude of wood energy consumption, it general conclusion can be made that firewood in households is used inefficiently because the average consumption is significantly higher than the average on the level of the EU [14].

One of the reasons for such a high consumption of wood energy per 1 m² of the heated surface is the fact that a small number of households possess thermalinsulation on their facilities. Results of the conducted research show that on the level of Bosnia and Herzegovina, there are 310,731 households or 36.1% that use solid fuels and have thermoinsulation. Among them, 15,575 facilities are up to 5 years old, 43,442 are 6 to 10 years old, 80,910 are 11 to 20 years old, and 170,804 facilities are more than 20 years old.

Of the total number of households that use solid fuels for heating, 549,497 or 63.9% have no thermoinsulation. Among them, 11,798 facilities are up to 5 years old, 39,094 are 6 to 10 years old, 94,150 are 11 to 20 years old, and 404,455 facilities are more than 20 years old.

Based on these data it can be concluded that in Bosnia and Herzegovina and its entities prevail households with no thermoinsulation on their facilities. According to this parameter, the best situation is in the Federation of Bosnia and Herzegovina, where there is 44.1% of households that use solid fuel with thermoinsulation on their facilities. In other entities, situation is significantly worse. In the Republic of Srpska there are 23.4% households with thermo-insulation on their facilities and 35.1% in the District of Brcko.

Conclusions

Results of the conducted research show that firewood individually or combined with other fuels is the main energy generating product used for heating purposes in the households in Bosnia and Herzegovina. Out of the total number of households in Bosnia and Herzegovina, 74% or 860,228 households use solid fuels for heating purposes. Out of this, 70.3% of the households use only firewood, 23.2% use wood combined with coal, and 3.3% use firewood combined with other fuels. Needs of such a high number of households for firewood in 2015 were on the level of 5.4 million m³ or in average 6.43 m³ per household.

Results of the performed calculations show that the consumption of wood energy per 1 m² of the heated surface is 252.7 kWh, which is not satisfactory from the aspect of efficient use of firewood. Since firewood is the wood fuel with the highest share in the consumption of wood energy, one of the reasons for its big consumption is the time of purchase compared to the beginning of the heating season. Research results show that 51.8% of the total number of households using firewood purchase it in the period from 2 weeks to 3 months prior to the beginning of the heating season, which is considered to be inefficient purchase from the aspect of efficient use of firewood. The second reason is the fact that very few households have thermal-insulation on their facilities. Out of the total number of households that use solid fuels for heating, 549,497 or 63.9% have no thermoinsulation.

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