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THE VALUE OF BIOMASS ENERGY – THE CASE STUDY OF “CRNI VRH-DEŽEVSKI” IN THE GORNJEIBARSKO FOREST AREA

*Sabahudin HADROVIĆ, Ljubinko RAKONJAC, Tatjana ĆIRKOVIĆ-MITROVIĆ,
Miroslava MARKOVIĆ, Đorđe JOVIĆ¹*

Abstract: *Of all terrestrial ecosystems, forests are the most important carbon reservoirs. Therefore they deserve special care and protection. They are also an irreplaceable source of biomass for energy. Forest biomass has been used as a fuel since the earliest times, and since the late twentieth century, there has been a renewed interest in its use for the production of heat and electricity. Forest biomass has become interesting as a source of energy due to some of its characteristics, above all its availability and uniformity around the world, which implies that both developing and less developed countries can use biomass as a renewable source of energy. Furthermore, biomass fuel is considered to be CO₂ neutral. However, its use is not risk-free. The risks are mainly related to the sustainability of forest systems and their productivity. Therefore, the forestry profession must be extremely cautious in using forest biomass and follow the prescribed allowable cut.*

This paper deals with the current state of biomass for energy, its estimates and properties as fuel. It studies the sustainability of biomass through the preservation of forest ecosystems and all multipurpose benefits of forests.

Keywords: biomass, energy, allowable cut, volume, silviculture, estimation, heat power, renewable sources of energy

ENERGETSKA VREDNOST BIOMASE NA PRIMERU GJ „CRNI VRH-DEŽEVSKI” U GORNJEIBARSKOM ŠUMSKOM PODRUČJU

Izvod: *Od svih kopnenih ekosistemima, šume su najvažniji rezervari skladišta ugljenika, pa samim tim zaslužuju posebnu negu i zaštitu. Shodno tome, oni su i nezamenljiv izvor biomase za energiju. Šumska biomasa je korišćena kao gorivo iz ranih vremena, a od kraja dvadesetog veka nadalje, došlo je do obnavljanja interesa za njegovu upotrebu za*

¹ Institute of Forestry, Belgrade, Serbia

proizvodnju toplote i električne energije. Interesovanje šumske biomase kao izvora energije odnosi se na neke od njegovih karakteristika, kao što su relativna brojnost i ujednačenost širom sveta te tako i zemlje u razvoju i manje razvijene zemlje imaju pristup biomasi kao obnovljivom izvoru energije. Takođe se biomasa smatra kao neutralno gorivo u emisiji SO₂. Ipak, njegova upotreba nije bez rizika, uglavnom vezana za održivost šumskih sistema i njihove proizvodnje, što šumarsku struku dovodi u poziciju da strogo mora voditi računa o pravilnom korišćenju biomase i poštovanju definisanog sećivog etata.

Ovaj rad razmatra stanje u oblasti biomase za energiju, njihovu procenu svojstava kao goriva, očuvanje trajnosti prirasta biomase kroz očuvanje šumskih ekosistema i svih pozitivnih funkcija šume kao opšte korisnih dobara.

Ključne reči: biomasa, energija, etat, zapremina, uzgoj, procena, toplotna moć, obnovljivi izvori energije

1. INTRODUCTION

Energy has been obtained from forests for thousands of years. Forests have been one of the most important contributors to biomass production (The WBA Global Bioenergy Statistics Stockholm, 2017). Most of today's production of solid biomass for energy occurs in non-OECD countries (83.7% in 2015) where it is widely used for traditional heating and cooking. The traditional use of biomass is not efficient and it can have serious adverse effects on human health caused by combustion smoke (Hanna, R. et al, 2016). Excessive use of biomass is often associated with local deforestation and degradation of high forests into devastated forests, which consequently leads to soil erosion and endangerment of entire forest ecosystems. The modern use of biomass in the twenty-first century is characterized by cleaner and more efficient heating technologies.

The use of biomass is also associated with some controversy over the sustainability issues. In developed countries, the reason for the increasing interest in bioenergy lies in the necessity to pursue greenhouse gas mitigation policies. Wood biomass is a renewable source of energy which is considered to decrease the anthropogenic CO₂ emissions.

Due to the shrinkage of forest areas and the shortage of timber products, as well as the increasing inability to ensure forest and ecosystem sustainability, monitoring, estimation and regulation of forests have become a pressing need, all with the aim to determine the biomass volume, its increment within a given forest area or in a given period of time. This is important if we want to determine the allowable cut which will guarantee the sustainable growth of forest stands. In this sense, the forest inventory of the MU "Crni Vrh-Deževski" provided data on the biomass volume classified by tree species. Combined with the data on the allowable cut, they reveal the total energy value of the management unit, its energy value by tree species, as well as the energy value of the allowable cut in the course of a ten-year-long forest management plan.

The obtained data prove that the volume of the biomass harvested in a given stand in a defined study period should not be greater than the biomass produced in the same area in the same period. This is the only way to achieve sustainable forest management for biomass.

The forest biomass should be clearly distinguished from the agricultural biomass. The major difference lies in the time of biomass collection. Agricultural biomass is generated annually as a by-product of harvesting, while it takes much longer for the forest biomass to be collected in natural forest stands. Sometimes it can take more than 100 years to collect all the biomass present in a stand. Meanwhile, through thinnings, we harvest only as much biomass as can be produced, following the allowable cut prescribed for each management unit.

One of the advantages of biomass compared to other renewable energy sources is its versatility. Biomass in general, and forest biomass in particular can be converted into electricity, heat or transportation fuels. In practice, though, forest biomass is mainly used for the production of heat and electricity (Ge, X. et al., 2016). The conversion of forest biomass into biofuels that can be used in the transport sector still faces various challenges which have impeded its commercialization (Brown, R.C., 2011). Despite its advantages, and despite the fact that biomass is the most commonly used renewable energy source, the current share of bio-energy in the world is still limited. In 2015, bioenergy and renewable waste accounted for 9.4% of the world's energy supply (Hanna, R. et al, 2016). Of the various sources of biomass, solid biofuels accounted for 63.7% of the global supply of renewable sources (liquid biofuels, biogas and renewable municipal waste amounted to 4.3, 1.7 and 0.9% respectively, while other renewable energy sources accounted for the rest of the percentage). In OECD countries, biomass is mainly used in modern systems. Therefore the share of biomass and renewable waste is even lower. There the fuels accounted for 5.2% of total primary energy in 2015, while solid biomass accounted for 36.1% of the renewable energy supply. Solid biofuels, which are almost entirely composed of wood, wood residues and wood fuels, are used to generate electricity and heat. Direct heat is undoubtedly the most common application of solid biomass. In this case, biomass is used directly by end users (e.g. residential, industrial, commercial or agricultural users) rather than by the energy transformation sector (e.g. power plants, combined heat and power plants or heat plants). The prevailing use of solid biomass for heating purposes is largely justified by its traditional use for heating and cooking in African and Asian countries (WBA Global Bioenergy Statistics Stockholm, 2017).

The situation in Europe is different. Here, solid biomass has a higher energy value in the energy transformation sector due to the modern methods of biomass utilization (<http://ec.europa.eu/eurostat/data/database>). In total, the European energy transformation sector accounts for 30% of the solid biomass consumption while the global average, on the other hand, amounts to 9%.

In order to make the use of biomass economically justified and acceptable, it is necessary to use biomass with as low moisture content as possible. It is well-known that the drying and combustion processes, as well as the heat value of wood, depend on the density of wood. Hard and dense woods have higher calorific values and burn more slowly and thus produce a higher amount of heat. We cannot directly change wood density, but we can certainly change the percentage of moisture content in biomass.

It is best to harvest biomass during the resting period and taking into account the effects of climate factors to choose the period when the humidity is as low as possible.

2. MATERIJAL AND METHODS

This paper studies the state of the forest biomass potential in the MU “Crni Vrh Deževski” for the 2004-2014 forest management plan period. The total felling volume projected to be harvested over the period of ten years was smaller than the total tree increment assessed in the area of the MU “Crni Vrh Deževski”, which indicates that this management unit had been properly managed taking into account its sustainability. This data was obtained in the new forest inventory of the management unit, designed for the period 2015-2024.

Our goal is to show the energy value of biomass as a renewable energy source and to point out that although it is renewable it is still a limited resource. Therefore, the amount of biomass harvested must not be larger than the projected biomass. The amount of biomass should not be increased by cutting trees for energy, but by increasing the area under forest. These new areas should be established by taking into account their ecological characteristics and selecting those tree species that are valuable for energy production.

We started from the assumption that the entire allowable cut is intended for biomass, although in practice, this is often not the case, because part of it is always used for timber which is more commercial than biomass.

Since we know the quantities (allowable cut) that can be harvested this MU by tree species, we used data on the density of wood for each tree species, as well as the energy value of raw and dried wood to determine the differences between different tree species.

3. DISCUSSION

According Forest management plan for the Gornjeibarsko forest area, “Crni Vrh-Deževski” management unit occupies an area of 2805.74 ha, a large part of which is under forest (2206.99 ha). Forest plantations occupies 123.02 ha, forest unstocked land 401.84 ha, barrens 44.35 ha and the rest 29.54 ha. There is evidently a lot of forest land that is suitable for afforestation which should be done as soon as possible. A total of 401.84 hectares (14.32%) should be successfully restocked so that this area can be used for biomass production.

The total volume of this MU is 233621 m³. Broadleaved species account for 222159 m³ or 95.10% of it. The most common tree species are beech, sessile oak, Turkey oak and hornbeam, while other broadleaves have an insignificant share. Coniferous species that make 4.90% include Norway spruce, Scots pine and Austrian pine. The total biomass accounts for 15% of the allowable cut and it is harvested in approximately equal quantities over a period of ten years through care and thinning measures.

Table 1. The state of biomass in the MU “Crni Vrh-Deževski” in the 2004-2014 forest management plan period (Data on the weight of wood and the combustion heat were obtained from the following source – Vojcijehovski, 1961, Nikolić, 1990)

Tree species	Volume m ³	Wood weight kg/m ³	Allowable cut m ³	Combustion heat kj/kg		Total kj/m ³ Oven-dry	Total kj/m ³ Dried
				Oven- dry	Dried		
Beech	183292.0	680	27493.8	18816	14843	12794.88	10093.24
Sessile oak	20772.8	660	3115.92	18381	14455		9540.30
Turkey oak	10610.2	670	1591.53	18381	14455	12315.27	9684.85
Hornbeam	3343.1	690	501.465	17008	13315	11735.52	9187.35
Other hard broad.sp.	1572.3	675	235.845	17996	14098	12147.3	9516.15
Maple	1282.9	590	192.435	17996	14098	10617.64	8317.82
Field maple	547.0	590	82.05	17996	14098	10617.64	8317.82
Hop hornbeam	356.3	690	53445	17008	13315	11735.52	9187.35
Aspen	230.9	410	34635	17996	14098	7378.36	5780.18
Birch	58.7	610	8.805	1949	15429	11888.9	9411.69
Flowering ash	61.2	650	9.18	17816	13984	11580.4	9163.70
Other soft broad. sp.	33.9	630	5.085	17996	14098	11337.48	8881.74
Oriental hornbeam	4.5	690	0.675	17008	13315	11735.52	9187.35
Total broadleaves	222159.0		33323.85				
Norway spruce	7507.9	430	1126.185	19662	15596	8454.66	6706.28
Scots pine	2274.3	490	341.115	21211	16957	10393.39	8308.93
Austrian pine	1679.8	580	251.97	21211	16957	12302.38	9857.1
Total conifers	11462.0		1719.255				
Total for the MU	233621.0		35043.15				

There is a clear difference in the energy value between oven-dry and partially dried wood in all tree species. The difference is so significant that it is recommended to oven-dry biomass before it is used for heating purposes. The allowable cut of this management unit is 35043.15 m³, which is the amount of biomass that can be harvested from the forest in a period of 10 years, i.e., the annual allowable cut is about 3500 m³. From the records of the FMP for the MU “Crni Vrh-Deževski”, we can see the trends in the allowable cut by study year. The data are presented in Table 2.

Table 2. Allowable cut by study year

year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Vol. ³	3189,1	3285,1	3417,2	3080,1	3396,2	3658	3850.15	3698.2	3655.10	3814

The data are used to present the linear regression of the biomass use.

Graph 1. Linear regression of the biomass use in the observed period

The annual felled volume of oven-dry biomass has a 21% higher energy value. For instance, the felled volume of 3500 m³ of oven-dry biomass has an energy value that equals 4235 m³ of partially dry biomass. It follows that the process of biomass drying increases energy efficiency and thus reduces tree cutting.

This proves again that wood biomass should be used in a dry state.

The differences in the energy value between tree species are clear. In the future, certain tree species are expected to be favoured in the afforestation of barren land and establishment of plantations for energy purposes due to their high energy value.

Graph 2. Differences in the energy value of oven-dry and partially dry wood

Underused and unstocked areas should be afforested and if the conditions allow, fast-growing tree species should be introduced (i.e., plantations for energy purposes should be established). They will increase the allowable cut of this management unit and help derive other multiple forest benefits (Hadrović S, 2015).

The total energy value of biomass should be reduced by the fraction of the fossil fuel energy used in cutting, wood assortment production, skidding of biomass from the felling site to the haul road, and transporting it to the place of use.

Biomass should certainly be used as a renewable energy source, but not at the expense of other forest benefits. Clear-cutting should not be allowed on large surface areas as it can cause soil removal and erosion (Hadrović, S, Stevović, S., 2017, Brašanac-Bosanac, Lj. et al., 2018).

Forest biomass is mostly used as raw material and it is rarely subjected to the upgrading processes. However, the use of upgraded biomass has been growing in importance. For instance, pellets are one of the fastest-growing bioenergy carriers. One of the benefits of upgraded forest biomass over raw biomass is the fact that it is more uniform and convenient to be used, particularly when it is used at a site away from the production site. A disadvantage is its higher cost compared to the correspondent raw biomass fuel. Untreated wood is characterized by low carbon content and high content of volatile matter and oxygen compared to solid fossil fuels. This leads to the lower heating values of wood, which combined with its low density results in low values of energy density. In practice, wood is often not oven-dried and contains a certain amount of water. The moisture content of green timber typically ranges from 50 to 60%, while the timber stored for summer or several years has the moisture content of 15-25%. The lower heating value of wood fuels is largely due to the content of water in the fuel. The higher the content of water in wood, the lower is its energy content. Another convenient characteristic of biomass is the low content of ash. However, it can be significantly higher in the bark, especially of oak trees.

4. CONCLUSIONS

The production of energy in the world has been increasingly focusing on renewable sources. Biomass is one of the major renewable sources. The most important reasons for its use lie in the fact that fossil fuels are exhaustible and the emissions from their combustion contribute to the global warming of the Earth. Therefore, the laws of most countries require a constant increase in primary energy production from renewable energy sources. The modern way of life is a dangerous "pollutant". Therefore, it is necessary to raise environmental awareness and develop new cleaner methods and technologies. It should be noted that biomass has its shortcomings. First of all, it can be a pollutant. Certain amounts of carbon dioxide and other gases are certain to be released into the atmosphere. It can also be unprofitable for an area. Therefore, when selecting the source of energy to be used, it is necessary to consider all the circumstances and to choose the most appropriate solution. The production of energy from biomass has the following advantages: we can store energy sources so that there is no need for energy reserves, which is a significant advantage over all other renewable energy sources. The optimum use of biomass promotes regional development and creates new job opportunities in the domestic industry, forestry and agriculture, which is of particular importance to the community.

Every year, power plants and cars burn an amount of fossil fuel that took about 500000 years to produce. This produces 24 billion tons of carbon dioxide (CO₂) which is assumed to have increased the CO₂ levels by 27% over the past 100

years. Combustion of wood doesn't contribute to this increase because the same amount of CO₂ would be produced if the wood was left to decompose in the soil. However, as trees grow, they bind carbon and thus stop their contribution to the negative effects of CO₂ that would otherwise arise. Therefore, the environment can be significantly improved with greater afforestation and the use of wood in the construction of residential and commercial buildings or as an environmentally-friendly packaging material to substitute for the synthetic ones. A particularly large contribution to the environment can be given by using wood instead of other types of fuel because it is carbon-neutral fuel, unlike oil and coal. The wood is also a renewable material, and unlike fossil fuels, it is a renewable fuel as well. The following facts best illustrate the role and importance of wood in the efforts to preserve the environment and mitigate climate change in the world:

- to produce 1 m³ of wood, trees require 1 ton of CO₂ which they take from the atmosphere;
- 1 m³ of wood volume of a standing tree contains about 250 kg of carbon stored in wood fibers and about 750 kg of oxygen released into the atmosphere during the process of photosynthesis;
- European forests absorb about 140 million tons of carbon a year from the atmosphere during the process of photosynthesis;
- An area of 150 m² of forests releases an annual amount of oxygen that meets the needs of one person;
- a sixty-year-old beech tree provides oxygen for more than 10 people;
- a sixty-year-old beech tree can absorb CO₂ released into the atmosphere by 6 people.

Wood is the cleanest and safest fuel available today, especially compared to petroleum products and nuclear fuel. It is also the fuel with low nitrogen and sulfur content. The use of wood for heating, instead of oil, coal and natural gas, surely entails greenhouse gas emissions, but sustainable forestry can compensate for these emissions by planting new forests. Planting a large number of trees in deserts could yield excellent results. German experts conducted experiments with a special tree species (*Jatropha curcas* L.) which they planted in trial plots in Egypt and the Negev Desert. This tree species can survive adverse conditions and a hectare of this plant absorbs about 25 tons of carbon dioxide. It further increases biomass as a renewable energy source.

The same amount of felled volume has a 21% higher energy value if it is in a dry state. For instance, the felled volume of 3500 m³ of oven-dry biomass has an energy value that equals 4235 m³ of partially dry biomass. It follows that the process of biomass drying increases energy efficiency and thus reduces tree cutting. This proves again that wood biomass should be used in a dry state.

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Summary

Of all terrestrial ecosystems, forests are the most important carbon reservoirs. Therefore they deserve special care and protection. They are also an irreplaceable source of biomass for energy. Forest biomass has been used as a fuel since the earliest times, and since the late twentieth century, there has been a renewed interest in its use for the production of heat and electricity. Forest biomass has become interesting as a source of energy due to some of its characteristics, above all its availability and uniformity around the world, which implies that both developing and less developed countries can use biomass as a renewable source of energy. Furthermore, biomass fuel is considered to be CO₂ neutral. However, its use is not risk-free. The risks are mainly related to the sustainability of forest systems and their productivity. Therefore, the forestry profession must be extremely cautious in using forest biomass and follow the prescribed allowable cut.

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The situation in Europe is different. Here, solid biomass has a higher energy value in the energy transformation sector due to the modern methods of biomass utilization (<http://ec.europa.eu/eurostat/data/database>). In total, the European energy transformation sector accounts for 30% of the solid biomass consumption while the global average, on the other hand, amounts to 9%.

In order to make the use of biomass economically justified and acceptable, it is necessary to use biomass with as low moisture content as possible. It is well-known that the drying and combustion processes, as well as the heat value of wood, depend on the density of wood. Hard and dense woods have higher calorific values and burn more slowly and thus produce a higher amount of heat. We cannot directly change wood density, but we can certainly change the percentage of moisture content in biomass.

It is best to harvest biomass during the resting period and taking into account the effects of climate factors to choose the period when the humidity is as low as possible.

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Rezime

Od svih kopnenih ekosistemima, šume su najvažniji rezervari skladišta ugljenika, pa samim tim zaslužuju posebnu negu i zaštitu. Shodno tome, oni su i nezamenljiv izvor biomase za energiju. Šumska biomasa je korišćena kao gorivo iz ranih vremena, a od kraja dvadesetog veka nadalje, došlo je do obnavljanja interesa za njegovu upotrebu za proizvodnju toplote i električne energije. Interesovanje šumske biomase kao izvora energije odnosi se na neke od njegovih karakteristika, kao što su relativna brojnost i ujednačenost širom sveta te tako i zemlje u razvoju i manje razvijene zemlje imaju pristup biomasi kao obnovljivom izvoru energije. Takođe se biomasa smatra kao neutralno gorivo u emisiji SO₂. Ipak, njegova upotreba nije bez rizika, uglavnom vezana za održivost šumskih sistema i njihove proizvodnje, što šumarsku struku dovodi u poziciju da strogo mora voditi računa o pravilnom korišćenju biomase i poštovanju definisanog sećivog etata.

Energija je dobijena iz šuma hiljadama godina, šume su najveći doprinos dale između ostalog u proizvodnji (WBA Global Bioenergy Statistics Stockholm, 2017). Većina današnje proizvodnje čvrste biomase za energiju javlja se u zemljama koje nisu članice Organizacija za ekonomsku saradnju i razvoj (OECD) (u 2015. godini 83,7%) i široko se koristi za tradicionalno grijanje i kuvanje. Tradicionalna upotreba biomase je neefikasna i karakteriše je ozbiljan negativan uticaj na ljudsko zdravlje usled dimnog sagorevanja (Hanna, R. et al, 2016). Preterana upotreba biomase je povezana sa lokalnim krčenjem šuma i prevođenja visokih šuma u devastirane i izraubovane šume gde posle toga dolazi do spiranja erozije zemljišta i ugrožava se celokupni šumski ekosistem.

Jedna od bitnih karakteristika biomase u dvadesetiprvom veku je čistija i efikasnija tehnologija za grijanje. Drvena biomasa je obnovljivi izvor energije i smatra se da doprinosi smanjenju antropogenih emisija CO₂. Zbog smanjenja šumskih površina i nedostatka drvnih proizvoda, kao i garantovanja održivosti šuma i ekosistema, javila se potreba procene, praćenja i regulacije šuma kako bi se znala zapremina biomase, prirast na odreženoj površini i u određenom vremenskom periodu da bi na osnovu toga mogli da odredimo sećivi etat uz garanciju trajne održivosti sastojine. Tako smo na osnovu podataka o inventuri šuma došli do količine zapremina za GJ „Crni Vrh- Deževski“ razvrstanih po zastupljenim vrstama drveća, i uz podatak o sećivom etatu možemo uporediti ukupnu energetsku vrednost

gazdinske jedinice, kao i vrednost za svaku vrstu drveta kao i energetska vrednost za godišnji sečivi etat u periodu važenja osnove od deset godina.

Na ovaj način dokazujemo da količina zapremine koja se kroz proces seče uzme iz jedne sastojine za posmatrani period ne sme da bude veća od prirasta biomase na istoj površini za isti posmatrani period. Samo kroz tako gazdovanje možemo obezbediti trajnost biomase. Jedna od prednosti biomase u odnosu na druge obnovljive izvore energije je njegoa svestranost. Biomasa uopšte, a posebno šumska biomasa, može se pretvoriti u električnu, toplotnu ili transportnu energiju. U praksi, međutim, šumska biomasa se uglavnom koristi za proizvodnju toplotne i električne energije (Ge, X. et al., 2016). Transformacija šumske biomase u biogoriva koja se mogu koristiti u sektoru transporta i dalje se suočava sa različitim izazovima, koji su ometali njegu komercijalizaciju (Brown, R.C., 2011). Uprkos svojim prednostima i uprkos tome što je najčešće korišćeni obnovljivi izvor energije, sadašnji udeo bioenergije u svetu je još uvek vrlo ograničen. U 2015. godini bioenergija i obnovljivi otpad činili su 9,4% svjetske energetske ponude (Hanna, R. et al, 2016). Među različitim izvorima biomase, čvrsta biogoriva su činila 63,7% globalnog snabdevanja obnovljivim izvorima (tečna biogoriva, biogas i obnovljivi komunalni otpad su iznosili 4,3, 1,7 i 0,9%, a ostali obnovljivi izvori energije za ostatak) U zemljama OECD-a, gdje se biomasa uglavnom koristi u modernim sistemima, udio biomase i obnovljivog otpada je još niži, s tim da ta goriva čine 5,2% ukupne primarne energije u 2015. godini, a čvrsta biomasa čini 36,1% obnovljive energije snabdevanje . Čvrsta biogoriva, koja se gotovo u potpunosti sastoje od drveta, drvnih ostataka i drvnih goriva, koriste se za proizvodnju električne energije i topline. Direktna toplota je daleko najčešća primena čvrste biomase. U ovom slučaju, biomasa se koristi direktno od strane krajnjih korisnika (npr. Stambenih, industrijskih, komercijalnih, poljoprivrednih), a ne od strane sektora za transformaciju energije (npr. Elektrane, postrojenja za kombinovanu proizvodnju toplotne i električne energije ili toplane). Dominacija upotrebe čvrste biomase za potrebe grejanja uglavnom je opravdana tradicionalnom upotrebom u zemljama Afrike i Azije za grejanje i kuvanje (WBA Global Bioenergy Statistics Stockholm, 2017).

Da bi biomasa bila ekonomski opravdana i prihvatljiva za upotrebu , neophodno je da se ista koristi sa što manjim sadržajem vlage. Poznato je da proces sušenja ,kao i proces sagorevanja i toplotna vrednost drveta zavise od gustine drveta. Tvrdá drva sa većom gustinom imaju veću kalorisku vrednost, sporije sagorevaju te će na taj način proizvesti i veću količinu toplotne energije.Na gustinu drveta nemožemo direktno da utičemo, ali svakako možemo da utičemo na procenat sadržaja vode u biomasi.

Potrebno je da se biomasa priprema tako što će se seći u periodu mirovanja vegetacije,potom da se vodi računa i o uticaju klimatskih faktora da seča bude u periodu kada je vlažnost vazduha što niža.