



WOODY BIOMASS UTILIZATION IN BULGARIA AND SLOVAKIA*

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Abstract

This report examines the current state of the use of woody biomass for energy production in Bulgaria and the Republic of Slovakia, development possibility, advantages and disadvantages of woody biomass utilization in both countries.

Key words: wooden biomass, firewood, waste, energy, forestry

1. INTRODUCTION

Woody biomass is one of the most effective renewable energy source (RES), with highest potential for future. In Bulgaria and Slovakia, where forested lands are respectively more than 34% and 40% from the country territories, woody biomass is an important part of the infrastructure for waste management. It can be used to produce energy at different scales - energy for industrial use, thermal power plants or small projects for thermal heating for domestic and public needs. The widespread use of RES and the induction of energy efficiency criterions are among the priorities in the country's energy policy objectives and correspond to a new Energy Policy for Europe.

The distribution of RES in Bulgaria is as follows: biomass – 36%, hydro energy – 31%, wind energy – 7,5%, etc. Both countries are also extremely dependent on the import of fossil fuels out of European Union (EU) and had serious problems with regular natural gas supplies from Russia.

According to EU Action Plan in field of energy and climate changes mitigation (Directive 2009/28/EU) is foreseen in 2020 the share of RES in energy consumption has to reach 20%, particularly for Bulgaria at least 16%. One of the particular aims in White book for RES is construction and installation of biomass thermal plants with capacity of 10 000 MWh. Among all RES wooden biomass residue characterizes with highest potential.

The annual technical potential of Bulgarian woody biomass estimates at 48 PJ or 1,15 Mt o.e., incl. logging residue 44,4 PJ or 1,064 Mt o.e. and wood processing residue 3,6 PJ or 0,086 Mt o.e. (Stoilov et al., 2008). Total annual potential of the exploitable forest biomass of Slovakia is 1,81 Mt (16,9 PJ), which includes 0,13 Mt, (1,1 PJ) of wood processing residues and also 0,95 Mt (9 PJ) of biomass from woodmills. (CHOVAN, 2010).

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One of the greatest challenges facing the foresters and forest managers in Europe is regenerating, maintaining, and improving the health and flexibility of forest ecosystems. In many cases, there is currently no commercial effect of the removal of large quantities of small-diameter and low-quality wood. These logging residues, consisted by woody plants, limbs, tops, needles, and leaves, are often byproducts of forest management activities. At present this biomass has little commercial value and removing it requires large expenditures with little or no economic return in the long or even short distances. Many forest managers cannot afford this sort of large-scale economic investment, therefore far fewer forest stands are being treated than needed.

Bulgaria has 4,077 million hectares of forested lands. This corresponds to 34% or over one third of its total territory, while forest fund includes 37% of Country. The forested lands are almost equal to the area of agricultural lands. Slovakia has ca. 2 million ha of forested lands (41 % of the Slovak territory). In Slovakia the area usable for the wood production is nowadays 1 751 200 ha, which is 90,7 % from the whole forest land area (GREEN REPORT 2009).

The State Forest Fund (SFF) in Bulgaria is 77% from the Country's forest fund, including the forests and lands from the forest fund, which are managed mostly by Executive Forest Agency (EFA) at Ministry of Agriculture and Foods. The rest 23% are owned by municipalities, physical and legal persons, religious communities and others. The logging and wood processing industries in Bulgaria are close to 100% private and the wood processing industry has 2,2% from the GDP and 18 000 employees.

In Slovakia the state forests, managed by State Enterprise Forests of the Slovak Republic, Banská Bystrica, are 43%, cooperative forests – 25%, private forests – 15%, municipal forests – 10%, forests of religious communities and unknown owner – 7%.

The total timber supply in Bulgarian forests amounts to around 643 013 812 cubic meters (i.e. 158 m³/ha). The mean annual increment of around 14,4 million m³ of timber contrasts with annual roundwood production for 2011 of around 7 414 215 m³ (90,4% from planned in forest management projects 8 203 119 m³), from which 72% are from commercial logging and 28% for local household at stumpage price. The mentioned volume is significantly under annual increment of Bulgarian forests.

Major wood processors in Bulgaria are represented by the sawmill industry, the fiber board and particle board industry, which process around 1,6 million cubic meters annually. The total timber supply in Slovak forests amounts to around 428,2 million cubic meters (i.e. 223 m³/ha). The mean annual increment of Slovak forests is around 6,5 million cubic meters of timber, 35÷50% of them from regenerative cuts and 33-36% coming from thinnings.

The strategic goals, which have to be reached in the forest-based sector in both countries, are focused to the achievement of balance between the economic, ecological and social functions. One of the main priorities that are pointed is increasing the woody biomass for energy.

2. CURRENT STATE ANALYSIS

Woody biomass for energy purpose in Bulgaria and Slovakia provides both logging and wood processing industries.

2.1. Woody biomass from logging

In Bulgaria the area of forests for timber is 65,9 %. During last 50 years 1,5 million ha of new forests was planted. Since 1989 the afforestation and reforestation have been decreasing and ranged 5000-7000 ha/year with priority of natural regeneration. Key goals are increasing forested areas and increment, as well as reduction of erosion risk. The afforestation is carried out mostly in SFF.

Woody biomass from forests suitable for energy production can be differentiated as logging residue and fuelwood, estimated in Bulgaria for 2011 to 3,2 million m³ over bark. Logging residue, consisted of branches, tops and other wood wastes, is a byproduct of conventional logging operations and its advantage is that the extraction costs usually are covered by roundwood production. The volume of logging residue relative to the volume of timber harvested is very variable.

At present the basic product for energy purpose in Bulgaria is fuelwood and there is a significant increase in its utilization of 3 times in last 10 years. That phenomenon occurs due to attractive regulated prices in comparison with other fuels. For fuel wood combustion and converting into thermal energy mainly low-budget conventional heating systems with overall efficiency not more than 40% have been used. Generally, household sector is main consumer of fuelwood with 40-45 % of Bulgaria's total population and similar situation is in Slovakia. Biomass from fuel wood is 3,6 % from primary energy consumption and 7,4% from final energy consumption. At present in Bulgaria fuel wood is with the highest contribution to energy balance from all Renewable Energy Sources (RES). Ratio of biomass energy to total energy consumption in Slovakia is 4%.

The annual volume of fuel wood harvested in Bulgaria is estimated ca. 3,539 million m³, which means ca. 760 305 t.o.e. During last decades the share of fuel wood varies between 55-64% of timber harvested. The total volume of fuel wood and technological timber (1,754 million m³) for 2011 in Bulgaria amounts to 4,596 million m³, which is about 74% of the total timber harvested in Bulgaria (Trichkov, 2012).

The volume of fuel wood harvested in Slovakia in 2008 (GREEN REPORT 2009) was 0,42 million m³ (0,19 million m³ of deciduous and 0,23 million m³ of coniferous). Woody biomass utilization in both countries is insufficient due to difficulties during collecting, prime processing and transportation. Currently only at the rate of 45% of total logging residue at stump and landing are economic accessible resources and can be used for energy production. According to data of EFA, during last several years only average volume of 50 000 m³ of logging residue have utilized annually in Bulgaria.

Increasing demand of biomass source for energy purpose in Bulgaria may be obtained additionally by replacing crops with Short-Rotation Forests (SRF). A key factor for economic feasibility is mechanization know-how. Protective poplar, black locust, willow and sycamore plantations there are long tradition in Bulgaria and were very popular in the past especially along rivers and in the Northern Bulgaria. The plantations were progressively abandoned, but there is a revival in recent years. EFA and 35 communities have started a joint project to afforest 3100 ha abandoned and non-forested lands in order to decrease 1 715 000 t CO₂ within the period of 2008-2027. SRF are an opportunity both to energy recovery and to meet needs of wood processing industry with an yield of 0,7-0,9 m³ per tree. From tops, branches and slash can be obtained approx. 15 gt/ha.

Other volumes of woody biomass may come from biologically and destroyed by fire forests..

2.2. Sawmill and furniture industry residue

The annual volume of the harvested sawlogs during the years is 1,4 million m³, from which coniferous are 920 000 m³ and deciduous sawlogs are 447 000 m³. The total volume of the technological timber for production of wood plates and pulpwood harvested is 1 754 million m³ annually, from which 943 000 m³ is coniferous and 780 000 m³ deciduous. During the last few years Bulgaria exports bigger volumes of engineering timber, around 350 000 m³ annually (130 000 m³ is coniferous and 220 000 m³ deciduous).

The total volume of the produced sawnwood is increasing around 1,3 million m³, from which 260 000 m³ is exported. From the produced timber 65% is coniferous timber. Relevant large is the exported part from the deciduous sawmill timber – around 27% is exported. The total volume of the produced plywood is relevant the same during the last few years and is 50 000 m³ (Strategic plan for development of forest sector 2007–2011).

As a result from new investment projects provided in Bulgarian sawmill and furniture industry the capacity of renewal plants reaches respectively 1 million m³ for coniferous and 600 000 m³ for deciduous timber for technological processing.

Wood processing provides different kind of residue, mostly suitable for energy purpose. In sawmill and veneer production the rates of residue are 28–46% and 52–62% respectively and they depend on the size of processed wood materials. In furniture production wooden residue varies between 7 and 23%.

Generally, it can be concluded that nowadays in Bulgaria solid residue of wood processing is used for energy purpose in the same plants and as residential fuel wood as well. At present only soft residue (slash, sawdust, etc.) do not be used widely. They are real reserve for effective energy utilization, mainly for briquettes and pellets production.

In Slovak conditions the rate of return of tree cuts is on average 60 - 62% and the rest is waste, of which approximately 65% In Slovak conditions the rate of return of tree cuts is on average 60 - 62% and the rest is waste, of which approximately 65% are splinters and 35% sawdust. If the timber is processed further, for instance, to produce boards and planks more waste is produced consequently and finally the waste amounts up to 70% of original logs.

Using conclusions of the quantitative analysis it is claimed that wood processing companies produce 650 000 tons of splinter and 300 000 tons of sawdust waste every year (Stanovský et al., 2009).

3. DEVELOPMENT POSSIBILITY – ADVANTAGES AND DISADVANTAGES OF WOODY BIOMASS UTILIZATION IN BULGARIA AND SLOVAKIA

3.1. Advantages

Woody biomass is among the biofuel with the greatest potential and possibilities for use in the production of heat and electricity in terms of economic and energy efficiency. The principal advantage of woody biomass is low greenhouse gas emissions. Their use has many advantages such as low ash waste in the absence of sulfur in them, resulting in combustion fumes are low-corrosive, reduce emissions of carbon dioxide and others.

The energy sector in Bulgaria is stable and perspective. The newest legislative and regulations base includes: Energy strategy of Bulgaria, Energy Act (2011), Energy Efficiency Act (2011), Forestry Act (2011), National Long Term Programme for Energy Efficiency (NLTPEE) for the period of 2008-2020 and a number of regulations, directives and others. The vision for the energy efficiency is toward sustainable and multifunctional

management of the forests and the forest territories. The legislatives and regulations definitely give preferences to woody biomass energy production. The introduction of appropriate mechanisms incentives an increase in the interest of finvestors for energy production from biomass. This in turn will ensure sustainable management and improvement of forests and provide employment to rural communities.

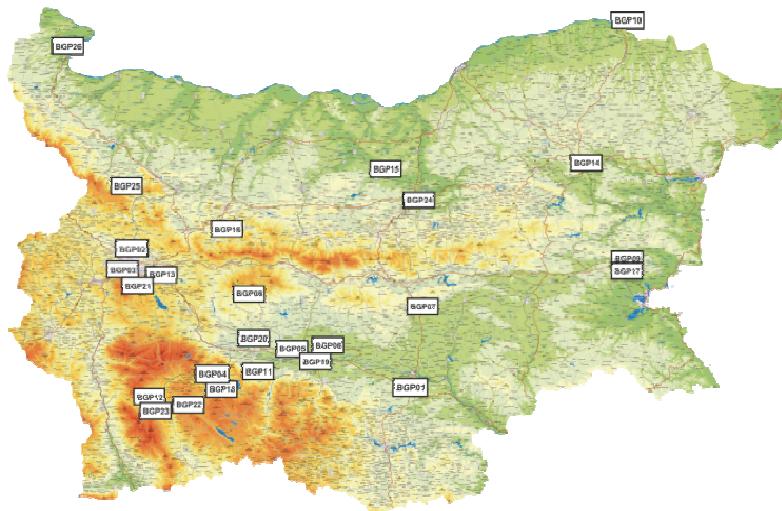


Figure 1 Production of pellets in Bulgaria

Bulgaria is researching and introducing highly efficient energy production systems for utilization of the logging and wood processing residue, and expert assessment is that the useful wood residues are approximately 500 000 m³ annually. Moreover, there are developed agreements and programmes with other Ministries and organizations, with which annually is ensured a certain volume of wood fuel for social programmes. There is a real possibility on the basis of the new Forestry Act, as well as the secondary legislation, to optimize forest policy and strategy related restructuring of the forestry sector, to increase the total timber harvested to 8-10 million m³, and hence to increase the production of woody biomass suitable for energy purpose. There are in Bulgaria more than 30 installations for pellets and briquettes production.

At present in Bulgaria fuel wood is with the highest contribution to energy balance from all Renewable Energy Sources (RES). Generally, household sector is main consumer of fuel wood with 40-45 % of Bulgaria's total population. Bulgarian market offers wide range of furnaces and boilers for direct firing of wooden biomass from 25 to 1100 kW. Logging residue as branches, bark, tops requires preliminary combinations and it is suitable for small local heating installation, small or medium enterprises (SME) or municipal buildings such as schools, hospitals, sport and recreation centers, etc.

In 2004 only one regional project really was working for supplying SES – Tlmače with energy wood chips. A project for heating the city of Nová Dubnica with energy wood chips was prepared for the end of the same year. The project was prepared and realized by the Forest Enterprises in Považská Bystrica and Trenčín. Later on in 2005 some other permanent customers have been established in the towns Handlová, Kysucké Nové Mesto, together with some foreign customers. There is a specialized forest enterprise, which

produces biomass for energy purposes in Slovakia – Forest Enterprise “Biomasa” in Levice, and it belongs directly to the Forests of the Slovak Republic, State Enterprise in Banská Bystrica. It has been working since 2004. Production of chips at OZ Biomasa over the years in thousands tonnes is as follows (Psársky 2012):

2005 –	90
2006 –	127
2007 –	130
2008 –	122
2009 –	123
2010 –	160
2011 –	170
2012 –	140.

Nowadays the share of the OZ Biomasa in total production of energy chips in Slovakia is much lower than 50 %. Although that the OZ is still the leader in the process of price creation and in safety of supplying the energy producers with energy chips. New producers of energy chips still appear at the market, which produce the chips in individual regions. Usually they buy pulpwood and process it into chips. Production of the OZ Biomasa is based primarily on processing of residues after timber harvesting, timber from incidental felling and whole trees from energy plantations. OZ Biomasa plans to work in this way and do not increase production of energy chips on the expense of assortments of better quality. The price development of chips at OZ Biomasa is visible in Figure 2.

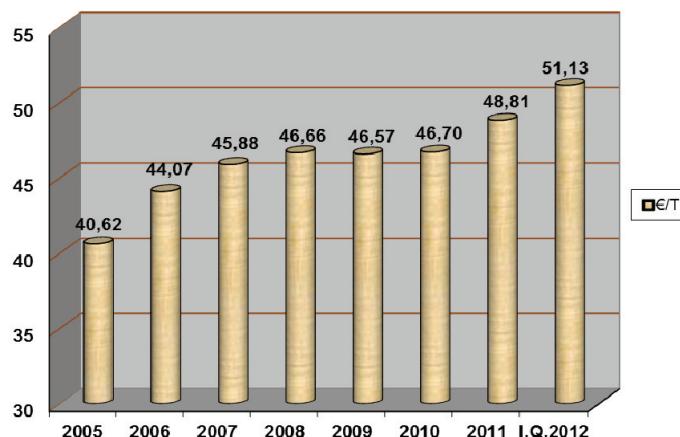


Fig. 2 Trend of energy chips price of OZ Biomasa in EUR/tonnes (Psársky 2012)

3.2. Disadvantages

The main problem of the owners of installations for utilization of biomass is the high cost, the purchase price of the electricity and the reliability of the installation.

Operators of installations for incineration of biomass waste (municipal waste, wood waste, etc.) and produce electricity and steam are often faced with problems of high cost of feedstock. Despite the high efficiency of this type of plants, provision of raw materials at

acceptable prices and transport to the plant could be so expensive as to pointless the whole enterprise.

Installation of operating biomass requires 1,5 to 2 kg biomass for the production of one kilowatt electricity. In most cases the cost of feedstock is not high, but transportation costs are often significantly increasing it cost price. For cost-effective operation of an installation for incineration or gasification of biomass, the price of feedstock should not exceed 60 BGN (30 EUR) per tonne. This is achievable if the raw material comes from no more than 30 km.

Another problem endangers the investment in plant utilization of biomass is the purchase price of electricity after 2012. At the time the purchase price of a kilowatt of electricity generated by wood waste in Bulgaria is 0,226 BGN (ca. 0,113 EUR). Estimates for the cost of this type of power after 2012 ranged from 0,115 BGN (ca. 0,06 EUR) to 0,165 BGN (ca. 0,08 EUR). This fact, especially if not taken into account in preparing a business plan, can lead to bankruptcy of the installation owners.

A problem exists with the reliability of the installation. In most cases, manufacturers of installations for the gasification of biomass are not quite correct with the information about operating costs and reliability of the entire system. According to market research on these plants, in most cases such a system needs a major overhaul every 2 years. Except that it leads to additional costs and to loss of revenue for a period of 2 months. Taking into account the need for at least 30 days annually for current repairs, it significantly reduces the effectiveness of installation

4. CONCLUSION

In Central Europe and Balkans the forests are located mainly in mountains, often on steep slopes. The main problems are both difficult terrain conditions and small harvest volumes due to silvicultural requirements resulting in high biomass production costs.

For fuelwood combustion and converting into thermal energy in Bulgaria mainly low-budget conventional heating systems with overall efficiency not more than 40% have been used.

However, despite relatively huge row base from forest-based sector there is no strong functioning woody biomass supply chain in Bulgaria and large consumers, for example power plants, city heating installations, etc. At present in Bulgaria only a few projects focused towards construction of heating systems based on wooden biomass residue are made in the cities of Bansko and Razlog. The latter is based on specific wood residue. The biggest industrial projects for wooden biomass utilization are installed 11 MW boiler based on wood bark in Svilocell Co. near city of Svishtov and Mondi Stambolijski EAD in city of Stamboliyski.

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