

ENERGY UTILIZATION OF BIOMASS IN THE REGION OF EAST SLOVAKIA

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ABSTRACT

This paper deals about energy utilization of biomass. Biomass is an important renewable energy source and has potential to cover part of the electricity production. The aim of the paper is analysis of wood biomass for energy utilization in region of east Slovakia.

1. INTRODUCTION

In the present it is a very lively debate about the efficient use of energy because the requirements for new energy resources are still increasing. European Commission (EC) therefore conducted a thorough reassessment of its energy policy. In the context of the faster economic growth among the main priorities of the energy policy include reducing energy demand, increase reliance on renewable energy sources, diversification of energy sources and increase international cooperation. To strengthen energy independence, it is put increasing emphasis on increasing the efficiency of energy facilities and the use of renewable energy sources (RES).

One of the fundamental objectives of energy policy in Slovakia is using RES. One of very important type of RES is a biomass. It is possible to use almost any material of biological origin to generate the heat and also electricity. Clean biomass combustion has the advantage that it does not pollute the environment, whereas the amount of CO₂ generated by the combustion is equal to the amount of CO₂ consumed by the mass during its live.

European Commission Action Plan sets out measures to increase the development of biomass energy from wood, wastes and agricultural crops by creating market-based incentives and removing barriers to market development. The use of biomass is expected mainly for the production of heat, electricity and transport fuels. Purposely grown energy crops in many areas can replace conventional fuels. It is estimated that biomass has the potential to contribute on global scale energy of one quarter of the total consumption.

2. THE ENERGY USE OF BIOMASS

Recently, there has been progress in technology through which energy from biomass is obtained (biomass chemical treatments, new facilities for energy recovery of biomass, the impact of breeding and genetic engineering) which make it possible to achieve higher yield of energy crops and more efficient energy conversion.

Among the so-called alternative energy sources, biomass can be a relatively stable source of energy (electricity) - not so "sensitive" to fluctuations in weather or for other environmental changes such as wind, photovoltaic energy or power plants using sea tides. Ways of using biomass for energy purposes are largely predetermined by physical and chemical properties of biomass.

Biomass used for energy purposes can be divided into:

- biomass with a high content of lignocellulose (wood, straw, cereals),
- phytomass rich in starch and sugar (potato, sugar beet),
- phytomass oil crops (sunflower, rapeseed),
- organic wastes and by-products of animal origin (manure, dairy wastes),

- mixtures of various organic wastes.

Energy crops involve also some grass; in their case, as in the case of other biomaterials, which have a low bulk density, can be a problem with their transport over long distances. It can be uneconomic; biomass power plant in such case must be located in the territory where it is sufficient amount of biomass.

Wood substance is characterized by relatively slow growth, whereby the cellulose fibres are in it rather closely bounded, as opposed to herbaceous species, respectively grassland perennials where the fibres are cellulose looser bound and the proportion of lignin is lower. The mutual ratio of lignin and cellulose is important for the appropriate modes of energy use. A very important parameter of biomass quality is the biomass moisture, respectively the dry matter content in the biomass. Wood biomass except firewood consists of residues after timber production and by-products from the production of products of mechanical and chemical processing of wood. The main sources of biomass for energy use from forestry may be considered forest biomass and biomass from energy forests.

Currently, as the most suitable technique for production of electricity from biomass seems to be biomass gasification followed by combustion of gas in a gas turbine. For the maximum utilization of the energy contained in biofuel are currently used so-called cogeneration units. These are able to provide a combined production of heat and power. [1], [3], [5]

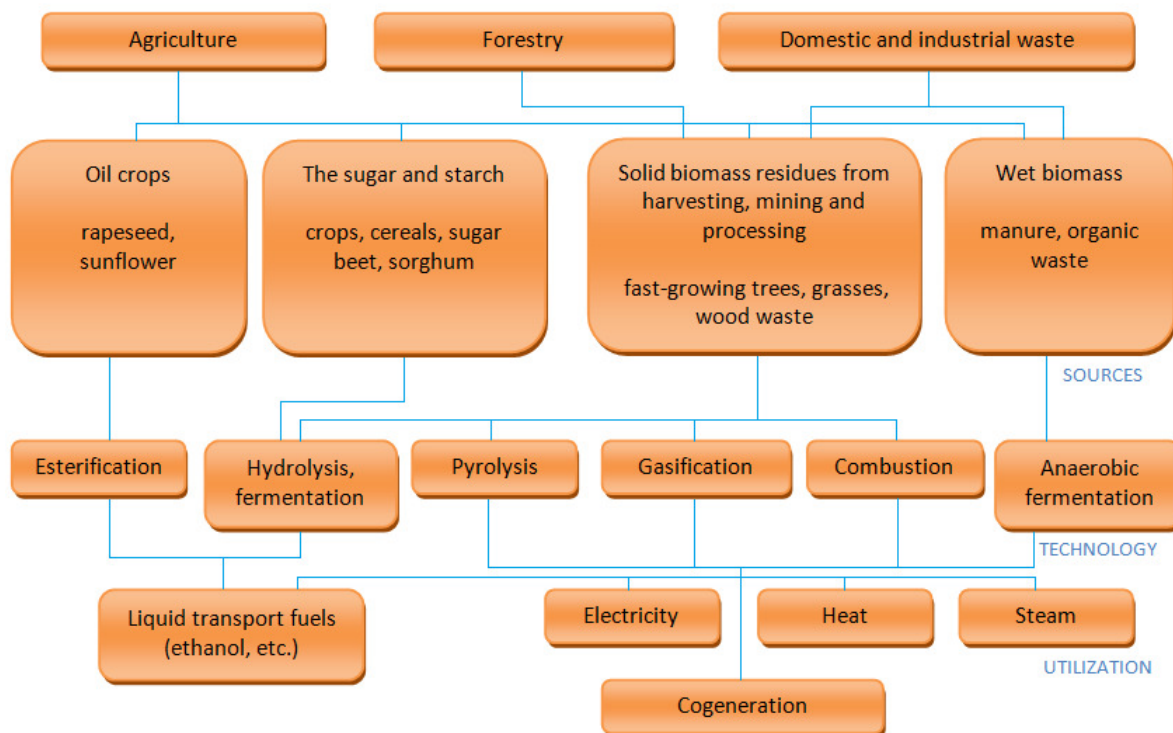


Figure 1 - Methods of energy use of biomass [3]

3. ANALYSIS OF BIOMAS IN THE REGION OF EAST SLOVAKIA

The current use of RES in Slovakia represents only 2.6 % of the total consumption of primary energy sources. It is used only about 17 % of the technically usable potential of RES in Slovakia, so it still remains unused huge amounts of renewable energy. The biomass is potential source of the greatest usability. The biomass has the largest share - up to 42 % (40453 TJ) from the total technically exploitable potential of renewable energy sources (87753 TJ / year) in the Slovak Republic [2]. Potential of forest and woody biomass is 25 %; the remaining 17 % are other types of non-wood biomass and municipal waste. Energy potential of forest and woody biomass from domestic sources should grow by the year 2020 and should reach 28357 TJ per year. [1], [3]

It is expected that in the Slovakia it could be covered by bio energy approx. 30% of total energy consumption till the year 2050. The uses of wood chips and straw have a perspective in centralized heating systems, briquettes and pellets in households. The so-called purpose-grown biomass has the greatest potential. However, in the present, the most used is a wood biomass. [3]

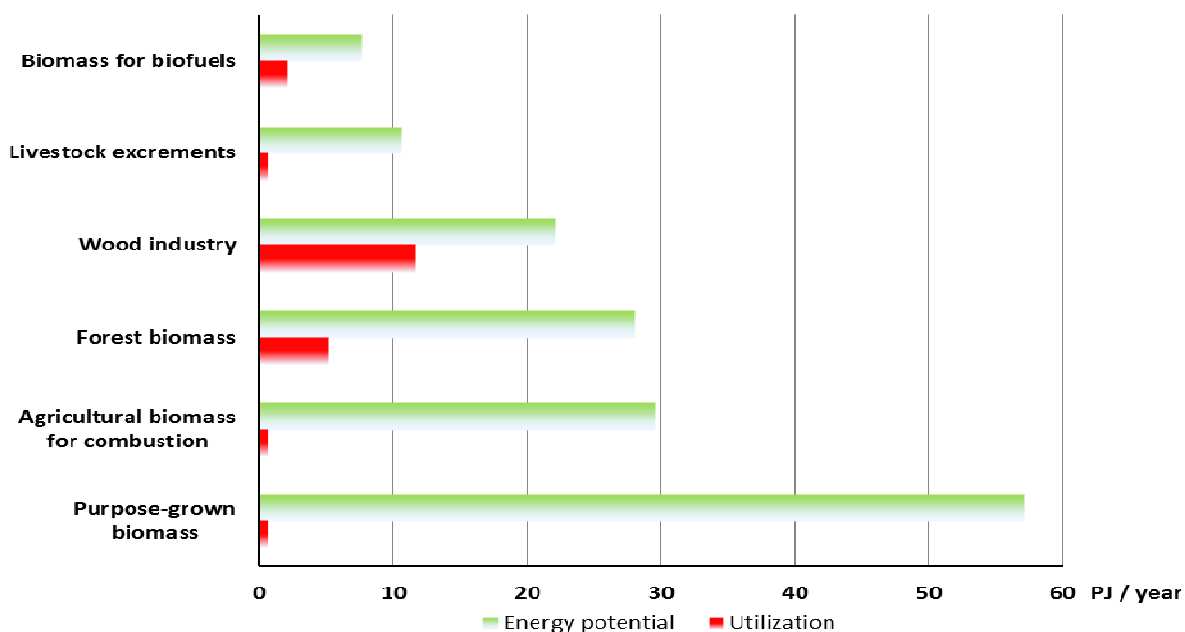


Figure 2 - Energy use of biomass in Slovakia [3]

The area of eastern Slovakia consists of two regions namely Košice and Prešov region and covers an area of 15726.4 km². Based on knowledge from project RobinWood [5] is a useful annual amount of wood biomass from forests in the Prešov and Košice region and wood processing industry follow:

Table 1 – Potential biomass resources and their capacity in the Prešov and Košice region [4]

District	Biomass from the forest [t]	Biomass from wood processing industry [t]	Overall [t]
Prešov region			
Bardejov	11287	23310	34597
Humenné	10347	28320	38667
Kežmarok	3088	12980	16068
Levoča	223	9620	9843
Medzilaborce	7592	10790	18382
Poprad	2426	24670	27096
Prešov	7045	17130	24175
Sabinov	3501	4690	8191
Snina	10791	44850	55641
Stará Ľubovňa	1877	23300	25177
Stropkov	8010	6790	14800
Svidník	6523	8240	14763
Vranov nad Topľou	9773	5240	15013
Overall	82483	219930	302413

Košice region			
Gelnica	1992	18390	20382
Košice a Košice okolie	13521	26840	40361
Michalovce	1103	6140	7243
Rožňava	5419	15610	21029
Sobrance	7318	2100	9418
Spišská Nová Ves	1129	39470	40599
Trebišov	3605	4850	8455
Overall	34087	113400	147487
Prešov and Košice region			
Overall	116570	333330	449900

Above mentioned data (Table 1) also show that the dominant source of woody biomass suitable for energy recovery is the woodworking industry. Wastes from wood processing industry presents even to 74 % in the Prešov and Košice region. The total annual amount of usable wood biomass from forestry and wood processing industry in all forms, i.e. as firewood, wood chips, pellets, briquettes, cuttings, sawdust, wood dust and others is 450000 t in the Prešov and Košice region. [4]

Table 2 – Summary of consumers of wood biomass in the Prešov and Košice region [4]

Consumer	Consumption of woody biomass [t/year]
Slovenské elektrárne a.s., Power plant Vojany	160 000
BUKÓZA ENERGO a.s. a BUKOCEL a.s., Vranov nad Topľou	130 000
BIOENERGY Bardejov s.r.o., Bardejov	100 000
Košická energetická spoločnosť a.s.	50 000
SPRAVBYTKOMFORT, a.s. Prešov	48 000
Energy Snina a.s., Snina	40 000
Tepelné hospodárstvo Moldava, a.s., Moldava nad Bodvou	9 000
SABYT Sabinov, Sabinov	4 000
Belholz s.r.o. Prešov	3 000
Spravbytherm s.r.o., Kežmarok	2 000
Mesto Sobrance	1 000
Lomnická teplárenská, s.r.o., Veľká Lomnica	1 000
Others	27 000
Planned	
Energo Block, s.r.o., operation Stretava (okr. Michalovce)	30 000
Trebišovská energetická, s.r.o.	5 000
Amarco BGS, s.r.o., obec Janík	5 000
Repox, s. r. o., a Biolipany, s. r. o., Lipany	2 000
Spravbytherm s.r.o., Kežmarok	1 000
Group total	620 000
Consumer	
Household of Prešov and Košice regions	400 000
Overall	1 020 000

Important sources of biomass are so-called white areas. These areas are led in the land registry as agricultural land (meadows, pastures, arable land), but in fact are covered with forest, in some cases, 80 years old. According to data [5] in Slovakia growths on white areas, created mainly by succession of plants, are currently located in area of approximately 275000 ha with total resources 36.6 million m³ of wood. The structure of stands on the white areas compared to stands on forest land is characterized by a higher proportion of wood mass suitable for energy production, particularly in parts of the tree crown. In the white areas it is currently about 340000 t of available fuel dendromass. It is assumed that the volume increases to nearly 380000 t by the year 2025. According to [5] the forecast amount of dendromass utilized in 2015 is 165000 t per year. Based on the above data, the estimated annual utilization of fuel dendromass from white areas in the Prešov and Košice region is 53000 t. [4]

Other potential sources of dendromass are windbreaks, riparian stands and municipal green. It is estimated that the annual amount of usable fuel dendromass from windbreaks, riparian stands and communal green areas in the Prešov and Košice region is 30000 t. [4]

The total annual amount of usable wood biomass from all sources (forestry, wood industry, white areas, other woody vegetation outside the forest, municipal green) is 530000 t in Prešov and Košice region. Based on the data in Table 2 it can be stated that the current annual consumption of dendromass in the Prešov and Košice regions is approximately 1 Mt. Overall it can be said that in 2013, the consumption of wood for energy production was 3.8 Mt. [4]

4. CONCLUSIONS

In the present, the European Union declares effort to a twofold increase in the share of RES in total energy consumption. In pursuit of this objective plays an important role the use of biomass. Biomass is one of the main alternatives through which it would help Europe and also Slovakia rid of dependence on fossil fuels. The effective option of electricity production, heat possibly cold processing of organic materials represents for example a biogas plant.

Currently, in Prešov and Košice region is annual deficit of biomass suitable for energy use 470000 t, representing 47 % of consumption. Such disproportionate overrunning of capacities can be caused by uncoordinated procedures for the development of concepts and plans (forestry, energy, economic, development, environmental) at all levels. The result is a reduction of the ecological stability of the landscape, destroying biodiversity and degradation of environment of inhabitants. As shown, the possibilities of using biomass in Slovakia are very broad, but require a complex approach to not only how and in what form it is possible to obtain biomass, but also how it can be further used.

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