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POTENTIAL FOR THE USE OF BIOMASS AS A PROSPECTIVE RENEWABLE ENERGY SOURCE

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Abstract

This article defines biomass as a prospective renewable energy source, defining the main arguments of this claim. The potential for the use of biomass as an energy source is examined on the basis of calculations of cost analysis, analysis of availability of this energy source and its applicability under SR conditions.

Key words

biomass, renewable energy, effectiveness of energy

Directive of the European Parliament and of the Council No. 2009/28 / EC defines biomass as biodegradable parts of products, waste and residues of biological origin from agriculture, including plant and animal substances, forestry and related industries, including fisheries and aquaculture, as well as biodegradable parts of industrial and municipal waste (1). Biomass is seen as a renewable energy source, but to the certain extent can be seen as anomalous, since it is obtained from the products of a raw material basis. However, the period of regeneration of used stocks is relatively short. There is the possibility to produce heat, electricity, combined heat and electricity and various gaseous and liquid fuels for transport, made of biomass.

Sources of biomass are very large worldwide, but the views and estimates of the bioenergy production potential vary widely amongst the professional public. An empirical contribution within this theme was the analysis made by Bernes (2003). This was a thorough analysis and comparison of seventeen studies on the global biomass production potential. Bernes identified the main cause of the difference in estimates, which is focus of the research on either the demand side or on biomass as a source, with no attention paid to the mutual interaction of demand and supply. Based on this finding, Vries et al. (2007) summarized the factors influencing the production potential of biomass. These are geographic factors (land use), technological and economic factors (labor costs, resource use) and institutional factors (legislation), which at the same time separately assesses the mutual interaction of demand and

supply for the assessment of possible availability of energy from biomass to global level for the period 2000 to 2050 (2).

Table 1: The real development of the renewable energy market (capacity development)

Kind of RES		**Real development of market**					
		2004	2005	2006	2007	2008	2009
solar photovoltaic	MW/year	1 052	1 320	1 467	2 392	6 090	7 203
solar concentrated	MW/year	0	13	0	75	55	119
wind	MW/year	8 207	11 531	15 245	19 866	26 721	38 708
biomass	**MW/year**	**1 244**	**1 557**	**1 974**	**2 527**	**806**	**4 861**
geothermal	MW/year	13	165	408	340	280	200
water	MW/year	19 490	16 057	17 367	25 925	17 082	9 473
IN SUM	**MW/year**	**30 006**	**30 643**	**36 461**	**51 125**	**51 034**	**60 564**
		2010	2011	2012	2013	2014	2015
solar photovoltaic	MW/year	16 817	29 665	29 400	39 000	39 000	50 000
solar concentrated	MW/year	595	500	1 034	885	1 000	400
wind	MW/year	38 850	40 629	44 711	35 467	51 000	63 000
biomass	**MW/year**	**7 850**	**1 069**	**245**	**5 000**	**5 000**	**5 000**
geothermal	MW/year	200	200	301	500	641	300
water	MW/year	23 359	25 000	27 070	40 000	18 000	28 000
IN SUM	**MW/year**	**87 671**	**97 063**	**102 761**	**120 852**	**114 641**	**146 700**

Source: own processing based on REN21 data

The potential of using biomass as a renewable energy source can be derived from a study by Strattford University, prepared by prof. Jacobson in collaboration with Mark Delucchi from the University of Berkeley (3). Based on the conclusions of this analysis, it can be stated that RES can be used as a substitute for fossil fuels to full extent by 2050. In the medium term, the available energy output of these energy sources is approximately at the level of global demand for energy, so as at 17 trillion watts.

Table 2: Capital costs of fossil and renewable energy sources

	Current costs per KW	**Yield**	**Expected costs per KW**
natural gas	917 USD	90%	1 019 USD
coal	3 246 USD	90%	3 607 USD
nuclear energy	5 530 USD	90%	6 144 USD
biomass	8 180 USD	90%	9 089 USD

Source: own processing based on Stratford University study

The problem is their yield. Fossil fuels represent a concentrated energy source capable of delivering high volumes of fast-use energy at low operational and procurement costs. Renewable energy sources, including the use of biomass, suffer from underdeveloped technology, which affects a significantly low yield and a relatively high acquisition cost.

The main source of biomass in Slovakia is wood-processing industry, more precisely the waste generated by wood-working activities. However, from the point of view of the development of biomass use in the world, it is necessary to say that thin and roughly from fields, pitches and roots, chips, sawdust and shavings are only a marginal resource.

Energy crops are the primary source of forest biomass. The energy crops are divided according to the length of the rubble period to crops with very short rubble period - from 3 to 4 years, crops with short rubble period - from 5 to 8 years and crops with shortened rubble period from 10 to 20 years. The greatest practical significance is given to crops with shortened rubbing time. They can be used to house and climb up clones of poplars, recognized clones of tree molds, seed progeny derived from the seed of recognized stands as well as recognized white agate populations. The production of wood, depending on the site conditions, ranges from 90 to 340 m^3/ha at a 15-year rubbing time. The production of fuel dendromasis and also of wood pulp can be increased in the shortest period of time in the growing area of the fast-growing woods by shortening the length of the rubble, especially in the less productive stands and in the areas with a low proportion of round assortments. Sustainable growth of dendromasse production can be achieved by changing the way of management of the stands of fast growing woods and, in justified cases, also by their inclusion in energy crops. The transport distance has a significant influence on the efficiency of the production of the chips, while the distance can be considered to be within 40-50 km (4).

The second major source of biomass is animal production. The predominant source of biomass is mainly manure. Additionally, it can be assessed as dominant sources of biomass also flotation sludge from waste water treatment, fats, blood, intestines and soft parts of the animal. Apart from these sources, however, it is possible to use all clean bio-waste (5). Potential gas production in Slovakia is estimated at 15 PJ, of which 10 PJ comes from the use of agricultural primary resources and 5 PJ from other sources of organic waste (6). Taking into account the number of livestock kept in Slovakia, the volume of primary biomass from livestock production is at the level of 10 million tons. This volume might cover electricity consumption in 300,000 households and heat supply up to 60,000 households (7).

Another option for obtaining biomass is the use of municipal and agricultural waste. About 1.5 million tonnes of municipal waste are produced annually in Slovakia, of which some 400,000 tonnes are organic waste that can be used to produce biogas.

Biogas has a potential of 0,3 TWh of electricity, equivalent to about 10% of annual consumption in Slovak households and 0,6 TWh of thermal energy, which is an annual heat consumption for about 30,000 households. The third high potential source is straw as a common by-product in agriculture. In Slovakia, we have about 900,000 ha of land on which cereals are grown. Every year, about 2 million tons of excess straw could be obtained. From this amount of biomass, it would be possible to obtain 2.8 TWh of electricity, representing about 6% of annual consumption and 4.8 TWh of thermal energy, which represents coverage of annual consumption in 300.000 households (8). The total biomass energy potential is 147 PJ. The greatest potential in terms of the energy potential of the energy source biomass has, dedicated biomass for energy production, including white areas, up to 27.62% of the total energy potential.

Other important types of biomass within the energy potential are forest dendromass with 18.23%, woodworking with 14.97%, biomass for biofuels with 7%, municipal wood waste with 3.6%, moldings and burns in the production of biofuels with 5.71%, excrements Livestock with 6.8%, dedicated biomass for energy production, including white areas with 27.62% and agricultural biomass for combustion with 19.46% of total energy potential.

In terms of the technically feasible potential (i.e. the potential that can be utilized after the introduction of available technology and is limited by administrative, legislative and environmental barriers and not just by economic obstacles), biomass clearly accounts for the

largest share of RES (almost 60%). The technically feasible biomass potential represents, in theory, up to 15% of the gross domestic energy consumption in Slovakia (7). It can be said that, in the case of biomass, it is a renewable energy source that is the most accessible in the Slovak Republic, and belongs to a source with the greatest potential for use in manufacturing.

By analyzing usability and energy efficiency calculations, we have come to the conclusion that biomass energy is the most promising renewable resource that is applicable in Slovakia for the needs of the manufacturing company. It is an energy source that is relatively evenly accessible throughout Slovakia, whether it is agricultural biomass, forest biomass or waste biomass. Its potential is relatively high, since the area of arable land in Slovakia is about 1,884 mil. ha and the area of forest land about 2,05 mil. ha.

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