

ANALYSIS OF ENERGY WOOD CHIPS PRODUCTION IN SLOVAKIA

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Abstract

The aim of this study is to evaluate the wood chips production as fuel for energy sector in the State Forests Enterprise of Slovak Republic logging conditions. Working operations of primary transport are analyzed – ground-based skidding systems that drag or carry logs from stump to landing, transportation of energy wood chips in containers. The main result of the research is the possibility to optimize the energy wood chips transportation methods from environmental and economical point of view. The paper deals with the knowledge and experience of increasing the value of less valuable wood from thinnings.

Key words: energy wood chips, wood chipper, primary transport, transportation, thinning.

Introduction

Biomass means dendro-, phyto- and zoo-material suitable for industrial and energy utilization. Biomass means also residue and by-products from silviculture biomass and its processing as well as usable part of household organic residue. Biomass, as one of the sustainable energy carrier, is being the resource with the highest potential in Slovakia.

The forest land area in Slovakia continually increases. Since 1950 the forest land area has increased with about

234,840 ha (11.8%). The area of forest land for regeneration has also increased with about 168,993 ha (9.6%) since 1950. The area usable for wood production is nowadays 1,751,200 ha, which is 90.7% from the whole forest land area. The biomass as raw material for the energy sector is supplied from forest stands as fire wood or chips. At present we are using more wood due to the higher energy consumption. Since 2007 the forest land area has increased with about 840 ha and the forest land area for regeneration with about 649 ha

and has reached 1,946 thousand hectares (Ministry... 2009).

The need of biomass increased in 1980s and forestry practice was oriented especially towards processing of crown parts throughout the whole-tree cutting method. The development of suitable machines was closely connected with these trends. Produced wood chips were used for production of wood pulp, agglomerated materials and in metallurgy. In the second half of 1980s processing started with leftovers after delimbing of coniferous trees using multipurpose machines at landings. The result was a complex utilization of the biomass, where green parts of trees were used for animal feeding and wooden part for energy purposes.

Nowadays, there is a visible increase of interest in the utilisation of less valuable wood, logging residue from final cuts and thinnings for energy production in Slovakia. There is a specialized forest enterprise, which produces biomass for energy purposes in Slovakia. Its name is Forest Enterprise "Biomasa" in Levice, and it belongs directly to the State Enterprise Forests of the Slovak Republic in Banská Bystrica. It has been working since 2004. It produced 120,000 tons of wood chips in 2008 and 122,000 tons in 2009. This enterprise with seven regional centres covers 90% of the Slovak energy demands.

In 2004 only one regional project really was working for supplying SES Tlmače with energy wood chips. A project for heating the Nová Dubnica town 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.

On the 1st of January 2005 a "Biomasa" Centre was established consisting of the regional centres Levice, Rimavská Sobota, Trenčín, Revúca, Čadca, Palárikovo, Vranov nad Topľou. The Regional centre Rimavská Sobota was divided into Beňuš and Revúca in 2008. In the same year 2005 the "Biomasa" Forest Enterprise (OZ Biomasa) was established (Olajec 2005).

Material and Methods

Basic information comes from foreign and Slovak literature, Green Reports – data from the internet and from unpublished materials from the State Enterprise Forests of the Slovak Republic in Banská Bystrica (Riško 2009). Original data has also been obtained from the Levice "Biomasa" Forest Enterprise and from field measurements in Regional centre Levice. The data obtained has been processed, analysed and presented in the following chapter.

Results

Technology for preparing the wood for chipping

Storage of material for chipping is space demanding, because a work with whole trees, or with their crown parts is necessary. The whole tree method is to be used – from the place of cutting up to landing place. Nowadays it has become a common practice to forward crown

parts from the forest stands to the landing site. Skyline systems, adapted tractors, skidders and harvesters are mostly used for preparation of wood for biomass using forwarders for transportation of topwood and wood with diameter under 7 cm (Slugeň 2009). For a successful production of energy chips the good synchronization is important between their production and their transportation.

If there are trees with stumps of better quality at the landing, it is necessary to pick them up and to store them at special landing sites. The chips from chipper are loaded directly into containers on trucks and thus the following turns out to be effective:

- to use a truck with load capacity of 10–12 tons for transportation of the chips up to 50 km;
- to use a truck with a trailer with load capacity of 20–25 tonnes for transportation of the chips on distances over 50 km.

Amounts of the chips produced at OZ Biomasa in 7 regional centres

As it was mentioned above, there are seven regional biomass centres in Slovakia: Levice, Trenčín, Revúca, Palárikovo, Beňuš, Vranov and Čadca. Each of them produces biomass on the area of assigned Forest Enterprises. The amounts of biomass produced for each Regional “Biomasa” Centre are presented in Table 1.

The table shows that the highest volume of wood chips was produced in 2007, followed by 2008 and 2009. It is necessary to state, that the differences are not significant.

Costs, prices, sales

The costs for production of 1 t of wood chips are as follows:

- 10–12 €·t⁻¹ – fuels, wages of workers;

Table 1. Production of energy wood chips in the regional centres in the period 2007–2009.

Activity	Centre	Amount of biomass produced, t		
		2007	2008	2009
Biomass production	RC Levice	20,731.38	17,659.78	17,156.50
	RC Trenčín	15,145.76	14,921.29	16,545.74
	RC Beňuš	19,153.79	20,378.90	17,540.44
	RC Revúca	21,484.71	20,378.05	18,002.13
	RC Vranov	16,378.90	16,507.53	20,340.87
	RC Čadca	20,228.20	14,151.88	17,664.34
	RC Palárikovo	17,166.18	18,211.81	15,765.52
	Total	130,288.92	122,209.34	123,015.64

- 5 €.t⁻¹ – overhead costs (wages of the managers);
- 18 €.t⁻¹ – average price for purchasing wood for chipping.

Transportation costs:

- up to 50 km, the costs are 0.22 €.km⁻¹.t⁻¹ (usually Tatra 6x6 chiptruck, with capacity 10 t of chips);
- over 50 km, the costs are 0.084 €.km⁻¹.t⁻¹ (transportation with trucks equipped with chiptrailers, 20–25 t of chips).

Average costs for production of 1 t of wood chips are about 35–40 €, according to conditions.

Raw wood for chipping is purchased from the State Forest Enterprise, based in Banská Bystrica (98% of volume), and from the private sector (2%). The price of the chips depends on their state, moisture content (dry wood biomass, warm wood biomass and partially dried) and on their quality (the amount of smallwood in the prepared wood).

The chips of the best quality are produced from wood biomass with smallwood content up to 40% and they have also the best prices on the market. If the smallwood content is between 41–60%, the produced chips are of medium quality and finally, the chips from wood with smallwood content over 61% are of the worst quality and they have the lowest price on the market. A summary of the total revenues and costs in OZ Biomasa can be seen in Fig. 1.

Perspectives of development and processing of the biomass

Wood biomass is a valuable raw material of environmental friendly energy. The biomass energy comes from the sun and the world production is around 2.10^{14} kg, what represent 90 TW of energy. Biomass means mainly wood, but also hedgeways and energy plantations. Biomass has been used as a

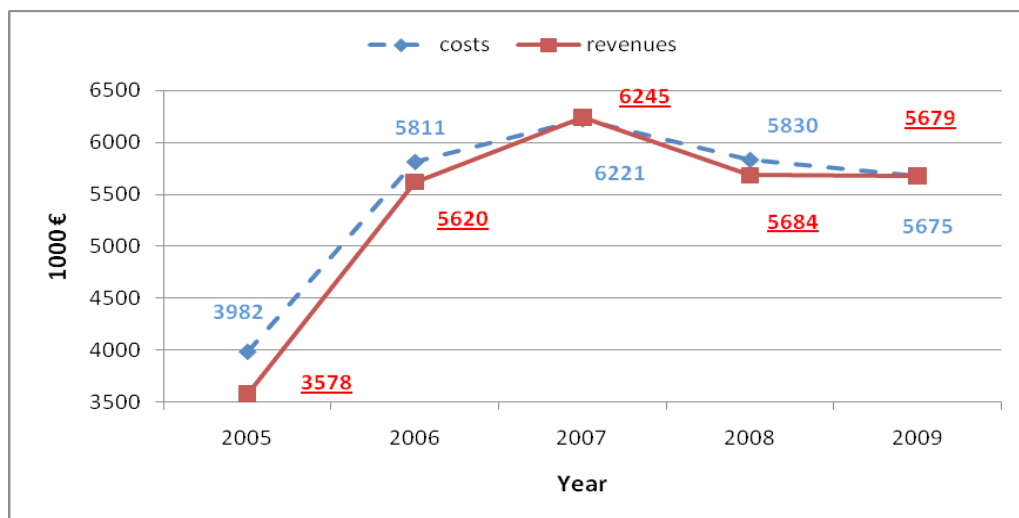


Fig. 1. Development of the total revenues and costs in the branch Company "OZ Biomasa" in the period 2005–2009 (Riško 2009).

fuel for thousands of years worldwide. However, present technologies allow us to use biomass a lot more effectively and in larger volumes.

The utilization of wood biomass is perspective in Slovakia because in many cases (e.g. the woody debris) is used as an energy raw material, which would otherwise be valueless. There are hectares of useless and abandoned agricultural land, where a local carrier of energy could be grown. This resource does not pollute the air or increase the global warming and its transportation would be cheaper, because this source is local.

Strengths and weaknesses of biomass utilization:

- a local source of energy: does not require inefficient transport, the price does not depend on the supplier monopoly, the international market trends and it is easier predictable;
- money stays at the regional level and this means a local economy stimulation, creating new work opportunities (in general rural development);
- it is a sustainable carrier of energy;
- forest debris utilization;
- biomass decreases CO₂ production;
- biomass utilization contributes to a decentralization.

Biomass utilization has also some weaknesses, for example the energy plantations (short-rotation forests), which could be established as monocultures, could have negative impact to the environment. From an economical point of view, an analysis has to be made whether the outputs are higher than the inputs in Slovakia.

Biomass is a valuable substitution of fossil fuels. Dried wood is compara-

ble to the calorific value of brown coal, which has been the basic energy carrier source in Slovakia but it is sulphur free.

Biogas contains approximately 70% natural gas energy.

Biomass is a key sustainable energy carrier for both small and large technological units. Nowadays 14% of the world energy requirements are covered by biomass energy. However, for three quarters of the world population, which is primary from the third world countries, biomass is the main fuel source. On average, the percentage of biomass energy consumption is about 38% (in some countries 90%). Therefore we can suppose the world population will increase and the fossil fuel reserves will decrease, the significance of biomass will become more important and demanded (Chovan 2010).

Biomass is also a valuable energy carrier in the developed countries. In Sweden (27%), Latvia (26%), Finland (25%) or Austria the percentage of biomass energy consumption is more than 15%, in Slovakia is less than 10% (European... 2010). There are plans to marginally increase the percentage of biomass utilization in Sweden in order to substitute nuclear energy. In USA the percentage of biomass utilization as a primary energy source is about 4% (the same as for the nuclear energy). The biomass which would be produced on agricultural land could substitute nuclear energy in the future, without consequences for the price of agricultural plants. The biomass used for ethanol production could substitute 50% of the imported oil.

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