

Biomass Residues And Energy Crops Availability And Use

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Abstract

One of the main goals of the energy policy and climate change mitigation policies in Latvia is the promotion of the development of renewable sources of energy - biomass energy, hydro-, wind- and geothermal energy. Biomass fuel is the most important domestic fuel and widely used already in Latvia and it is determined in Energy Program as well as in other official documents that the biomass fuel part will be significant in future also. The National Development Plan for 2007-2013 stresses the importance of renewable energy, including biomass, in the effort to ensure sustainable development. It provides for promotion of the use of renewable natural resources and alternative energy sources in the production of energy (heat and power), including the use of biomass in CHP, maintaining agricultural land for the production of agricultural products, and increasing the contribution of the agricultural sector in the production of raw materials for heating and transport fuel.

Keywords: biomass, biomass by-products, energy crops, biomass use

1. Biomass availability at national & regional level

The main type of biomass resources that considered in the paper are: industrial by-products from wood industry, wood wastes, forest residues (woodchips), sugar beet, starch crops (corn, barley), oil crops (rape seed), agricultural by-products (BP) and residues.

The territorial distribution of woodlands in Latvia is not even. Forests are most common in the central part of the country the south east area and in the West. The forest land area has been partly privatized. From an environmental point of view the new organization into private, state and other ownership may influence some administration problems concerning the controlling of the forest utilization. The forests ownership is shown in Figure 1.

It should be pointed out that until now the attention has not been paid to cultivation of rapid growing tree plantations for energy industry purposes in Latvia. It is possible to have such plantations, as there are areas of unused land in Latvia. Within some years when full cycle of wood waste usage is mastered, it could be topical to have rapid-growing tree plantations for wood biomass.

The potential volume from crop residues is estimated up to 50 thsd.tons per year only from plant-growing products in Latvia but taking in account the rather big volume of imported crops, technical crops which are this volume could be bigger.

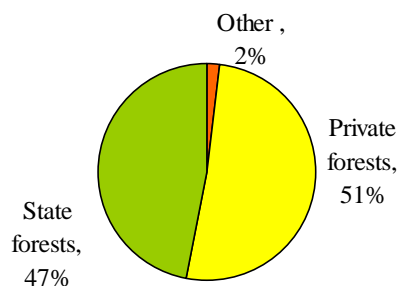


Figure 1. The structure of the forest ownership (%), 2007.

From the products cultivated in Latvia only rape is a real product for energy use in Latvia now and in nearest future too because by-products from rape production are significant residues from agriculture. Straw availability on the regional level is presented in Figure 2, from which it is possible to define the most prospective regions in Latvia.

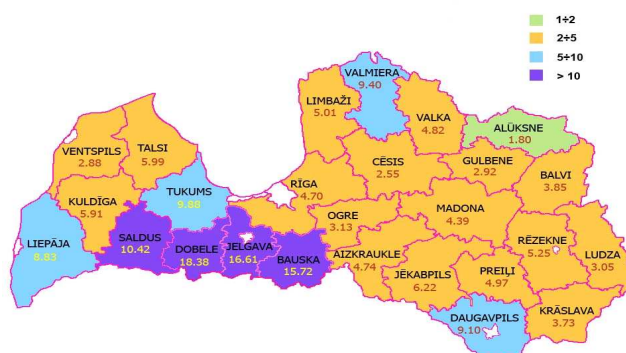


Figure 2. Straw availability by regions in thsd.tons.

The total annual amount of excess straw in Latvia is between 150 and 570 thousand tons and has a distinctly regional character. The forecast for the year 2010 is 276 th. tons and 3,015 PJ. Analyzing the structure of Latvian agriculture and the objectives of agricultural policy, we can forecast that grain crop growing will not significantly increase over the next few years. The advisable production and consumption amount is 0.2 PJ. As the straw resources are produced in the countryside, they should be utilized in small village or rural boiler houses, their capacity not exceeding 2 MW.

Significant changes could be expected in rapeseed residues use. In the same time it should be pointed that the rapeseed residues could be used in future not only for energy, but also as a marketable fodder and for bioethanol or biogas production.

The “Biofuel Production and Use in Latvia for 2003-2010” programme serves as a framework document for forecasting biofuel use and the related production and trade issues. A biofuel share of 5.75% of total consumption in 2010 will require the consumption of 75 thousand tons of biofuel, i.e. 32 thousand tons of bioethanol and 43 thousand tons of biodiesel.

2. Biomass use in Latvia for energy production

Biomass of fuel wood occupies the most important place among domestic energy resources and the share of forestry and its associated industries in GDP has increased remarkably in last years. Conversion of the existing boiler houses from heavy fuel oil and coal into energy worthy wood fired ones takes place. The most common form of energy worthy wood is either firewood or wood chips. Forecast of use of wood depends on the availability to change from

extensive to rational use of wood in regions. If these conditions develop favorably the share of biomass might be estimated around 25-30% in the total fuel consumption in Latvia.

The prospective fuelwood volume totally will be approximately the same as in last years in accordance with the Forest Law and the State regulation for wood cutting.

The greatest assessment differences are related to timber and wood felling residues as well as to wood processing waste. The lowest assessment mark of the potential is lower than the annual consumption amount of wood resources, excluding the exported wood resources. Obviously, the potential of timber and wood felling residues and wood processing wastes have to be related to the development of technologies (since they determine the efficiency of fuel use) and the price level of woodfuel in comparison with other energy resources. The current tendency to raise prices of fossil fuel resources may foster the development of the potential of wood resources of little value.

2.1 Biomass from forests

The biomass market is well developed because the forests are the most important nature wealth in Latvia. In Latvia, the total forest-covered area is 2950,3 thousand ha and covered 46% of its territory.

In Latvia owing to natural factors (soils, climate) and the management practice (less need for farmlands) the forest cover has nearly doubled over the period between 1930 (25 %) and 2007 (55 %). Because of natural overgrowing of abandoned farmlands and also afforestations, the increase in forest cover is expected to continue.

Each year a definite amount of wood is removed by way of main felling, thinning and sanitary cutting. In 2007 the total volume of felling was 11, 3 million m³. The fuel wood logs are sold at road side or transported by track to the end consumer and sold free delivered at the energy plant.

A number of factors determine the total volume of felling – the overall economic situation, the timber prices on the market, the legal framework, etc. Over the past three years, the average felling intensity is 3, 82 m³/ha/year.

Part of the wood wastes (wood chips, other wood wastes) are using directly in the wood-processing and furniture enterprises as a fuel for their own boiler houses.

Wood waste from sawmills, when not directly used as fuel at the sawmill, is chipped at the sawmill and transported and sold as fuel chips to either district heating (DH) plants, or to the harbor bin Riga for export. The wastes can also be transported and sold to the DH plant without any processing at sawmills. In this case the waste is stored at the DH plant for some time, after them it is chipped.

The wood for heat production in Latvia is used in the form of: firewood, wood BP, and wood from energy wood plantations. The wood granules and briquettes (a highly valuable fuel) as well as firewood are mainly utilized for individual heating and in households. For district heating there are used: firewood, hog fuel, wood processing remainders and sawdust; the utilization of granules is also under use now. Taking into account the yearly volumes of Latvian forestry products and well-developed their processing, the level of wood biomass utilization for heat production is insufficient.

The wood fuel potential by 2020 has been evaluated: the maximum potential of 14-37 PJ is to be that of woodworking residue; for forestry by-products this value is 12-18 PJ, and for firewood – 12-16 PJ.

At processing, biomass can be accompanied by such timber products (BP) as bark, roots, branches, sawdust, greenery, and others. The forest exploitation and plant growing BP structure in Latvia in 2006 is shown in Figure 3. The yearly produced wood BP biomass is sufficiently well calculated, and is partially utilized in the form of hog fuel, sawdust and as granules or briquettes.

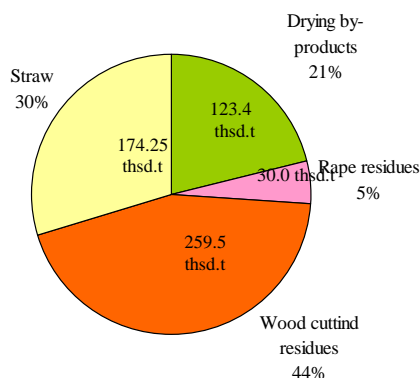


Figure 3. The forest exploitation and plant growing by-products structure in Latvia, 2006

2.2 Biomass from agriculture

The energy crops do not special cultivated in Latvia up to now, only solid waste from traditional agricultural crops are used for energy in our country currently.

The main barriers for the energy crops - for Latvia (rape, etc.) are

- sometimes insufficient knowledge's in energy crops cultivation and non-observance of the agro technical requirements;
- deficiency of the special techniques for the seed preparation and for the growing process;
- disparity of the realization price and the production cost.

The annual straw production as well as straw quality is influenced by the agricultural policy, cereal prices, weather during growing and could be estimated taking in account potential harvest and corresponding coefficients.

The straw market not exists and the major part is used in agriculture's own production as bedding in livestock housing systems etc.

The first Project "Straw Heat Plant" in Latvia was started up in 1997 in Saulaine in Agriculture College. This heat plant was designed as a boiler plant for firing whole bales of straw. Total installed capacity is 1.2 MW. Yearly straw consumption is 1350 t of straw. One more "Straw Boiler House" Project started in January this year in Kurzeme. It is planned to born straw and reed for heat production in this new boiler house.

2.3 Share of biomass in gross energy consumption

Latvia is not rich in natural energy resources. We do not have gas, coal and oil resources of its own. Firewood, peat, and hydro resources are the only significant local energy resources. About 70% of the energy resources are imported; therefore to promote the use of local and renewable energy resources in Latvia is essential.

Both the imported (natural and liquefied gas, oil products, coal) fuel and local (wood and peat) fuel are used in Latvia to provide fuel and energy to sectors of national economy, commercial users and residents (Figure 4).

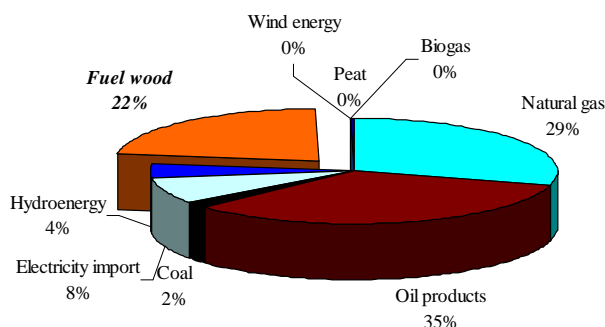


Figure 4. Primary energy resources supply in 2007, % (total 216,9 PJ).

In 2007 the share of biomass in Latvia's primary energy supply was about 48,7 PJ (22%). Taking as a basis the data on the trees felling volumes in Latvian forests, the cutting residue – the cutting BP volumes and their regional distribution have been calculated. The total BP energy potential of plant growing and forest cutting is estimated to be 20%; for comparison, the potential of the main energy biomass product – firewood – is 80%, which provides 24% of heat for DHSs and 57% for local and individual heat supply systems.

Although the present, as well as forecasted price for fuel wood are low in Latvia the higher transportation costs make the present use of wood for energy production profitable in places, where the biomass resource is located not far from the biomass utilisation unit. With the price of oil and gas becoming higher and with more efficient biomass burning equipment using the wood is expected to become more economically attractive (see Figure 5).

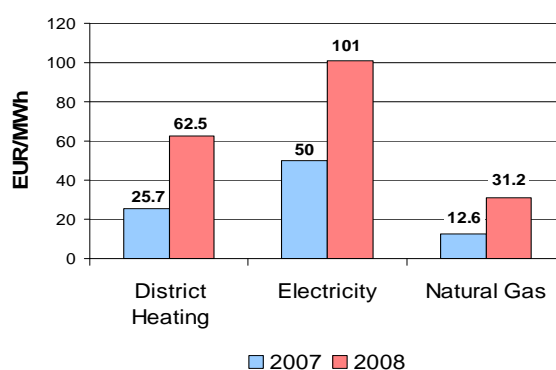


Figure 5. Energy prices increase.

Analysis of Latvian energy sector development in the last years shows that it is a positive tendency - increasing role of the local and renewable energy resources in the energy balance of Latvia. Increasing utilization of biomass, wind energy, energy from small hydro power stations, biogas, etc. was happened in last years. Increased use of biomass for energy production is shown in Figure 6.

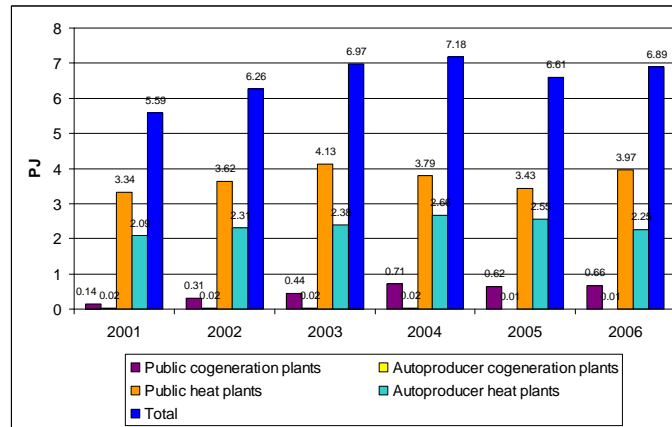


Figure 6. Dynamic of biomass use for energy.

Conclusions

Use of biofuels is exceptionally significant in such a country like Latvia, where there domestic energy resources are scanty, including biomass from agriculture and rapid growing tree plantations despite climate conditions. The prospective fuelwood volume totally will be approximately the same as in last years in accordance with the Forest Law and the State regulation for wood cutting.

Significant changes could be expected in rapeseed residues use. In the same time it should be pointed that the rapeseed residues could be used in future not only for energy, but also as a marketable fodder and for bioethanol or biogas production.

Objectives for biomass use development:

1. Promote the use of wood and wood waste by removing/reducing barriers that currently hamper the substitution of imported heavy fuel oil (mazut) with local, sustainable produced wood waste for municipal heating systems,
2. Promote the development and implementation of an economical and commercially-run municipal heating system that includes generation, transmission and distribution in the municipalities where the similar projects were successfully realized,

Biomass utilization needs some changes in legislation system in Latvia, in technologies of biomass burning, as well as in biomass storage system and activities for biomass effective utilisation should especially be aimed at the: harmonization of the taxes, prices and tariffs; harmonization of the legislation in energy; certification of imported fuels and establishment of fuel quality control mechanism.

References:

1. P.Shipkovs, G.Kashkarova, K.Lebedeva, 2004. Energy from Biomass in Latvia. 2nd International Ukrainian Conference on Biomass for Energy. CD Full Proceedings 6 p., Kyiv, Ukraine.
2. P.Shipkovs, M.Rubina, G.Kashkarova, 2004. Katlu māju konversija uz vietējo kurināmo - koksnes un citu biomasu. ANO & UNDP/PVF, Vides projekti, Riga, 2004, 22-38 lpp. (in Latvian)
3. P.Shipkovs, G.Kashkarova, S.Vrubliauskas, E.Perednis, 2006. Wood fuel consumption for energy production in Latvia and Lithuania. Development of Agricultural Technologies and Technical Means in Ecological and Energetic Aspects. 11th International Conference Raudondvaris, Lithuania, Book of Proceedings 206 – 210 p.