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Assessment of wood fuel use for energy generation in Lithuania

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ABSTRACT

The paper investigates possibilities to use solid biomass (wood) resources. It provides detailed analysis on distribution of Lithuanian wood resources and evaluates possibilities to develop the use of above resources for heat and power generation. European Union as well as Lithuanian legislation declares promotion measures for wood as fuel for energy generation. Legal documents suggest implementation via subsidizing of raw material for production of wood chips for boiler-houses and adopting specific promotion program for the use of forestry biomass for boiler-houses according to which the difference between price and costs should be subsidized for producers of such raw material.

Directive 2009/28/EB obligates separate countries to develop National Renewable Energy Action Plans (NREAP), which would provide specific promotion schemes and target indicators for each year (up to year 2020). According to this Directive the EU RES share in final energy consumption should reach 20%, and for Lithuanian this share should be no less than 23%, while district heating systems should use no less than 70%. At present the total capacity of wood-chip-fueled boilers reached above 476.1 MW. No series obstacles can be seen for extension of wood fuel use. The renewable energy compromise 18.1% of primary energy annual gross inland consumption and cut of the CO_2 emissions about 6% compared with the level on 1990. According to the Kyoto Protocol Lithuania must reduced green gas emissions 8% in the period 2008–2012. These goals can be realised by increasing of the use of biomass as fuel for the energy production.

Contents

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1. Introduction

Promotion of the production and use of biofuel is the priority trend in Lithuania. In 2009 gross inland consumption from biofuel reached 11.5% and solid biomass 10,8% [1]. The use of biomass is recently growing and in district heating (DH) sector. The fuel consumption for thermal centralized energy in year 2009 was 883 ktoe, and 153 ktoe in this using wood fuel [2]. Lithuanian District Heating Association and Lithuanian Biomass Energy Association raise ambitious goal that the share of heat production from RES and other indigenous fuels in fuel balance should reach 70% of total primary energy by year 2020. The installed capacity for biofuel should be approximately 2170 MW to achieve this goal. With regard to increase the share one needs to additionally construct the network of biomass CHP plants with installed capacity approximately 1560 MW, and investment should reach approximately 0.32 billion Euro. EU member states are also increasing the use of biomass to generate clean energy. Regarding ambitious EU energy targets for 2020 (20% of energy from renewable energy sources (RES) in total energy consumption), it appears realistic that biomass will make the major share of RES. According to the NREAPs biomass delivered in 2010 more than 83 Mtoe to the EU's energy consumption, with 12% electricity, 18% as transportation fuels and 70% as heat. Heating will continue being by far the most important sector for bioenergy in 2020. Taking into account that heat covers more than half of the final energy consumption in Europe, biomass should be a key sector for EU members states to meet the 2020 targets. By 2020 the biomass supply in Europe should increase to meet the demand of all sectors of heat, electricity and transport biofuels, rising from 77 Mtoe in 2006 to 122 Mtoe in 2020 [3].

Bioenergy potential in the EU from forestry is also growing. There are 178 million hectares of forests and other wooded land, about 42% of its land area. Over the past 20 years, forests have increased by 5%-approximately 0.3% per year—although the rate varies substantially between countries. The operated forests areas in 27 EU member states should stay unchanged, though politicians in some countries foresee the growth of forest area in some countries. Based on the NREAPs forest biomass potential would make approximately 60 Mtoe in 2015, and increase up to 65 Mtoe in 2020.

Extraction and use of biomass from forests cause many economic problems. Often collection of wood biomass is rather expensive because of large volumes distributed in cutting sites, while traditional wood fuel preparation systems are adjusted to processing of wood with larger measurements. Environmental impact to ecosystems from this activity is also not fully investigated.

In this paper there are represented investigations of the characteristics of Lithuania's forests and wood cutting volumes, wood fuel resources and will highlight wider use of wood cutting residues as well as promotion measures for such resource. It will also assess projections for the use of forest resources as well as fuel consumption for heat and power generation including implemented measures for promotion of this activity.

2. State policy

National Energy Strategy [4], Implementation Measures of the Programme of Lithuanian Government during 2008–2010 [5], Action Plan for National Sustainable Development Strategy [6], international obligation of Lithuanian Republic as well as other related EU and Lithuanian legislation directly regulating development of RES and various studies [7,8] make the background for legal action plan for the use of renewable energy sources (RES) and wood fuel.

Political statements promoting necessary development are necessary to use RES potential, especially for improvement of competitive ability for such energy sources. The main task for RES policy is to find respective equilibrium between possibility to implement wide range of RES capacities today and possibility of waiting till scientific research will reduce the costs of such capacities in future. It is suggested to increase RES share from current level of less than 12.9% to 20% EU energy consumption level by 2020. National Energy Strategy [4] foresees the use of modern technologies and the use of wood fuel more rationally as well as the use of economically viable potential of forest cutting residues, which should be approximately 180 thousand toe (total investment about 34.75 millionion Euro) by year 2025. Bearing in mind current prices for fossil fuel it would be feasible to use the whole potential of forest cutting residues even while mobilization of forest cutting residues is subsidized from national budget.

3. Characteristics of Lithuania's forests

The main Lithuanian legal acts regulating economic activity in forestry are as follows: Forests Law of Lithuanian Republic [9], Economic policy for Lithuania's Forestry and implementation strategy [10], Forests cutting regulations [11]. They regulate reforestation, protection and use in the forests of all types of ownership, as well as management based on uniform sustainability principles via ensuring rational use of forest resources, providing raw material for industry and improving forest productivity. Total consumption of firewood and fuel wood waste was 758 ktoe in 2009 [1]. Installed capacity of biofuel boilers is growing and wood fuel consumption makes over 85% of total RES. Lack of wood may restrict the use of wood fuel for heat and energy generation in future, thus we need detailed assessment of Lithuania's forests characteristics with regard to increase available resources.

The total forest area was 2159.8 thousand ha on January 1, 2010 and it covered 33.1% of Lithuania's area [12]. This area increased by 130.0 thousand ha since January 1, 2001 and total forest coverage-by 2.0%. Coniferous trees are prevailing tree species (56.3%); soft deciduous trees make 39.6%, and hard deciduous trees −4.1% of total forests. Total growing stock volume, mill. m^3 (NFI) was 479.4 millionion m^3 on January 1, 2010.

Lithuania's forests are to be increased according to National Sustainable Development Strategy [6] and Forests Coverage Increase Program [13] by 2–5% till year 2020. Forests of State ownership made nearly half (49.4%)–1068.0 thousand ha-of total forests area on January 1, 2010. Forests reserved for restitution made 12.2% (262.7 thousand ha). Private forests, which made 829.4 thousand ha (38.4%), were managed by 242 thousand forest owners. Most private forests are protective forests. Thus private forests play important environmental role and the use of wood is more complicated in such forests.

3.1. Forests cutting

Based on data of State Forest Management Service [12] 5.7 million m^3 of wood was cut in all forests of Lithuania in 2009. It decreased by 0.1 million compared with 2008. Removals from state forests were stable over 2006–2008 years. Increase by 0.1 million was reached in 2009. Removals from state forests totaled 3.6 million m^3 of round wood. From this, 3.3 millions where felled by enterprises themselves or by contractors, while stumpage sales made up 0.3 million m^3.

Main cuttings reached 2.6 million m^3/a in state forests. Intermediate cuttings made about 1.1 million m^3/a of wood. Cuttings from sanitary cleanings increased. The volume of sanitary cuttings reached 612 thousand m^3 which is related to declining of forests quality. Current cuttings made 321 thousand m^3. Thinning increased up to 82 thousand m^3. Total amount of 2.0 million m^3 of wood is annually cut in private forests. State Forests Management Service provides data on wood volumes, which have permissions for cutting in private forests. However, certain share of wood