

Energy Potential of Biomass in Ukraine. Forest and Agricultural Biomass

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Анотація

У даній роботі розглядаються основні види біомас, перспективи їх використання, переваги та обмеження розвитку використання біомас.

Ключові слова: біоенергія, біомаса, сільськогосподарська біомаса.

Abstract

This paper considers the main types of biomass, perspectives of its use, advantages and limitations of the development of biomass use.

Keywords: bioenergy, biomass, agricultural biomass, forest biomass.

Introduction

Energy Strategy of Ukraine until 2035, Ukraine is going to reduce fossil fuels consumption and increase the share of renewable energy sources in the total primary energy production from 4.4% (in 2017) to 25% (in 2035). In recent years, the biomass sector has accounted for about 80% of renewable energy in the country and is based mainly on utilization of woody biomass in heat generation: wood logs and wood pellets mostly for population and district heating, wood chips and residues mostly for industrial purposes, public heating and power production. Bioenergy development becomes especially relevant against the background of Russian military aggression and its impact on Ukraine's energy sector. Nowadays, the Ukrainian bioenergy market is represented by using four bioenergy resources: agricultural biomass, solid municipal waste capable of decomposition, wood biomass, and liquid biofuels. Therefore, the main focus of the article will be directed to the study of their existing potential for producing electricity, heat and liquid biofuels, the features of the state promoting policy in the bioenergy sector, the assessment of the results of its influence on the generating capacities development, the analysis of barriers that restrain the large-scale bioenergy development in Ukraine.

Main part

Ukraine has 60.35 million hectares of land. Of this, 70% is agricultural land, 17% is used for forestry, the rest is for housing, industrial and other purposes (used as state reserves, for recreation etc). Ukraine's agricultural sector employs 23.1 percent of the work force, but comprises only 6.5 percent of GDP. Fertile soil makes it possible to grow a variety of crops. Ukraine has a perfect climate for growing small grains throughout the country and is excellent for corn or soybeans in the north. Among all the European countries, Ukraine is the leader in growing sugar beet, buckwheat and carrot; the country is on the second place in growing wheat (after Russia) and tomato (after Poland). Ukraine is geographically the best situated of all the European countries for marketing with easy access to the Black Sea, China and all of Western Europe to feed a growing population. Ukraine, overall, has the best port access in this region of the world.

Currently, woody biomass is the major type of biomass which is used for energy production, mostly heat about 30 PJ/yr. It is firewood (domestic boilers in households) and wood waste/wood chips (industrial boilers at forestry and woodworking enterprises). Besides some amount of straw, manure and sunflower husks is also utilized for energy purposes but their contribution to Ukraine's energy balance is negligible. At present more than 60 straw fired boilers are in operation at agricultural enterprises and schools in rural areas. Practically all the oil-extraction plants have boilers which produce heat from sunflower husks. Three large biogas plants

generate power from manure. In addition, there are a few experimental plantations of energy crops which belong to different institutions/organisations, but there are no officially arranged production and utilisation of energy crops. Up to 200 small and medium scale installations produce pellets and briquettes from wood and agricultural residues. One of the main barriers to wide utilisation of straw potential in Ukraine is rather high cost of straw fired boilers. This applies to the boilers of foreign manufacture as well as to the boilers of domestic production. Currently there is a monopolistic manufacturer of straw fired boilers in Ukraine, and it keeps prices which are high for most potential consumers. Another important problem is unstable supply of straw. Practice of long-term contracts for biomass supply is not established in Ukraine yet. An owner of a straw fired boiler is aware that there is possibility of problems with straw supply unless it is his own straw.

The most common types of biomass used to produce heat energy are the following (Geletukha, 2015):

- Straw, stalks of corn, sunflower, etc. (bales, granules (pellets),briquettes);
- Husks and other waste from the processing of sunflower, grainand other agricultural crops (pellets, briquettes);
- Wood, its waste and products of its processing (pellets, chips,briquettes, firewood);
- Animal and poultry waste;
- Waste of vegetable crops and products of their processing;
- Vegetable waste from the food industry;
- Annual and perennial grass biomass (energy willow, sorghum,miscanthus, etc.);

The advantages of using solid biomass in heating processes include the following:

- Biomass is a local type of fuel. Therefore, its production anduse contribute to the development of the local economy bycreating new jobs, introducing innovative energy technologiesand reducing the amount of unprocessed waste;
- Rational use of biomass, which is a renewable type of fuel,provides an almost inexhaustible source of energy and sustainable development of territories;
- Low sulphur content and the possibility of avoiding emissions of nitrogen oxides when burned at low temperatures makebiomass an environmentally friendly type of fuel comparedto fossil fuels;
- Considering the rapidly increasing prices of natural gas,oil, and coal, biomass is a cheaper fuel of local importance.

In Ukraine, the main component of the energy potential of solid biomass is agricultural biomass, which includes waste and by-products of agriculture and energy plants. At the same time, agricultural residues amount to 9.4 million tons per year (43% of the total potential), and energy plants –7.5 million tons per year (34% of the total potential). The most significant shares of the potential of agricultural residues are straw of cereal grain crops 6%) and by-products/waste of grain corn production (33%) . The forest biomass potentials were assessed for total area of forested lands in Ukraine (closed canopy forests) that consist 9.4 million ha or 15.7 per cent of the Ukraine’s territory. The theoretical and technical potentials for forest biomass consist 3 12,24 and 89,08 PJ accordingly. Positive feature of current status of energy biomass use is that certain legislative framework already has created in Ukraine. In 2009 Parliament of Ukraine approved the law of Ukraine “About alternative type of fuels”. The law provides all need legislative conditions and economical incentives for implementation of modern technologies of use of forest biomass for energy purposes. In parallel, by order of Cabinet of Ministries of Ukraine 25 millions of Ukrainian HRN (2.5 mln Euro) were designated from stabilization fund of Government for purchasing 10 technological complexes for harvesting and utilization forest residues and low diameters timber to energy (fuel) pellets and its transportation to boilers of municipal or regional levels. This kind of decree shows that the issue now is in the level of national priorities and policy and Government is trying to create some legislative and economic environment for developing of use of biomass for energy purposes. It is also worth noticing that almost one fifth of the technical potential of forest biomass in the form of logging residuals, wood residuals on smallscale wood working enterprises, wood residuals in households, communal sphere is being rotten, thrown out, taken out as trash, burned or disposed in other way of without any beneficial effect.

Current economical condition, in particular, world financial crisis does not create favorable conditions for large scale utilization of secondary forest residues into bio fuel. There is a lack of large wood processing enterprises where economically feasible volumes of residues can be processed, while costs of delivering of raw material from numerous middle and small size enterprises is too high and reduce of potential profitability of pellets production.

Conclusions

For Ukraine, bioenergy is one of the strategic directions for the renewable energy sector development, considering the country's high dependence on imported energy sources and the great potential of biomass available for energy production. Ukraine has quite a big potential of agricultural residues which mainly consists of straw from cereals and production residues from sunflower and maize from grain. Ukraine has quite a big potential of agricultural residues which mainly consists of straw from cereals and production residues from sunflower and maize from grain. At present, less than 1% of the PAR potential is used for energy purposes (combustion in boilers, production of pellets and briquettes). This is because of the poorly developed infrastructure and logistics system for a reliable feedstock supply in Ukraine. These factors prevent a lot of potential customers from installing straw fired boilers. At present, less than 1% of the PAR potential is used for energy purposes (combustion in boilers, production of pellets and briquettes). This is because of the poorly developed infrastructure and logistics system for a reliable feedstock supply in Ukraine. These factors prevent many potential customers from installing biomass boilers.

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