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Viktor Pryshlyak, Doctor of engineering sciences,
associate professor,
General Manager of department of agricultural machines
Vinnitsa national agrarian university

INVESTIGATION OF BIOMASS AS ONE OF THE MOST IMPORTANT RENEWABLE ENERGY SOURCE IN THE WORLD

Conducted research is devoted to studying of the innovative technology for production of biomass from agricultural field plants which have substantial energetic characteristics. It is planned as a prospective for production of biomass and it is aimed to be achieved due to the low cost and environmentally safe.

Determination of a problem. Biomass is receiving increasing attention as scientists, policy makers, and growers search for clean, renewable energy alternatives. Compared with other renewable resources, biomass is very flexible; it can be used as fuel for direct combustion, gasified, used in combined heat and power technologies, or biochemical conversions. Due to the wide range of feedstocks, biomass has a broad geographic distribution, in some cases offering a least-cost and near-term alternative.

The objective of this research is to estimate the biomass resources available in the world. To accomplish this objective, biomass feedstock data are analyzed both statistically and graphically using geographic information systems (GIS). A GIS is a computer-based information system used to create, manipulate, and analyze geographic information, allowing us to visualize relationships, patterns, or trends that are not possible to see with traditional charts, graphs, and spreadsheets.

The results of the research. While other biomass resource assessments concentrate on the economic or theoretical availability, this study estimates the technical biomass resources available in a world. The estimates are based on numerous assumptions, methodologies adopted from other studies, and factors that relate population to the amount of post-consumer residue generation. The main contribution of this research is that it adds a geographic perspective to biomass research by answering questions such as where the resources are and how much is available.

The world is on the verge of an unprecedented increase in the production and use of biofuels. Rising oil prices, national security concerns, the desire to increase farm incomes, and a host of new and improved technologies are propelling many governments to enact powerful incentives for using these fuels, which is, in turn, are sparking a new wave of investment.

Today, the question is not whether renewable biofuels will play a significant role in providing energy for transportation, but rather what the implications of their use will be – for the economy, for the environment, for global security and for the health of societies. Decisions made in the next few years will help determine whether biofuels have a largely positive impact or whether the gains from biofuel use will be coupled with equally daunting consequences. Rapidly growing interest in biofuels is being spurred by the realization that they represent the only large near-term substitute for the petroleum fuels that provide more than 95 per cent of the world's transportation energy. Humanity relied on bioenergy in the form of wood fuel long before oil was ever discovered. And fuels made from renewable resources, such as plant oils and sugars, have

been used to power motor vehicles for more than a century. But it is only during recent years that interest in these fuels, and in the newer "next generation" of biofuels, has exploded.

One of the most important and anticipated innovations is the development of cellulosic ethanol derived from plant stalks, leaves and even wood. Synthetic diesel, made from an even broader range of energy crops or waste streams, also holds great promise. These technologies, which are close to being introduced commercially, will make it possible to produce biofuels from agricultural and forestry wastes, as well as from non-food crops such as switchgrass that can be grown on degraded lands. Wise and innovative policies will be needed to steer the biofuel industry in these directions.

The broader social and economic impacts of biofuels will likewise be determined largely by policy decisions. One of the great promises of biofuels and the main political engine behind them – is to increase farm incomes and strengthen rural economies. Indeed, if farmers not only produce our food and fibre, but also a growing portion of our energy, biofuels could transform agriculture more profoundly than any development since the green revolution.. Conscious decisions will need to be made if smaller-scale biofuel production is to be successful. The ability of small farmers to benefit from biofuels will also be determined, in part, by broader decisions about land reform and tax policies.

The following crops are included in this analysis: corn, wheat, soybeans, cotton, sorghum, barley, oats, rice, rye, canola, beans, peas, peanuts, potatoes, safflower, sunflower, sugarcane, and flaxseed. The quantities of crop residues that can be available in each county were estimated using total grain production, crop to residue ratio, moisture content, and taking into consideration the amount of residue left on the field for soil protection, grazing, and other agricultural activities. All estimates were developed using total grain production by county for 2010 reported to the U.S. Department of Agriculture. Quantities that must remain on the field for erosion control differ by crop type, soil type, weather conditions, and the tillage system used. It was assumed that 30% residue cover is reasonable for soil protection. Animals seldom consume more than 20%-25% of the stover in grazing, and we presume about 10%-15% of the crop residue is used for other purposes: bedding, silage, etc. Therefore, it was assumed that about 35% of the total residue could be collected as biomass.

Biomass resources include wood and wood wastes, agricultural crops and their waste byproducts, municipal solid waste, animal wastes, waste from food processing and aquatic plants and algae. Biomass has been recognized as a potential source for the renewable energy to substitute the declining fossil fuel resources. The majority of biomass energy is produced from wood and wood wastes (64%), followed by municipal solid waste (24%), agricultural waste (5%), and landfill gases (5%). Most biomass consists of hemicelluloses, cellulose, lignin and minor amounts of other organics.

Biomass is used to meet a variety of energy needs, including generating electricity, heating homes, fueling vehicles and providing process heat for industrial facilities. The conversion technologies for utilizing biomass can be separated into four basic categories: direct combustion processes, thermochemical processes, biochemical processes and agrochemical processes. Thermochemical conversion processes can be subdivided into gasification, pyrolysis, direct liquefaction and supercritical fluid liquefaction.

There are three ways to use biomass. It can be burned to produce heat and electricity, changed to gas-like fuels such as methane, hydrogen and carbon monoxide, or converted to a liquid fuel. Liquid fuels, also called biofuels, are predominantly two forms of alcohol: ethanol and methanol. Because biomass can be converted directly into a liquid fuel, it could someday supply

much of our transportation fuel needs for cars, trucks, buses, airplanes, and trains. This is very important because nearly one-third of our nation's energy is now used for transportation.

Biomass today represents only 3% of the energy consumed in industrialized countries. However, much of the rural population in developing countries, which represents about 50% of the world's population, relies on biomass, mainly in the form of wood, for fuel. Biomass accounts for 35% of primary energy consumption n developing countries, raising the world total to 14% of primary energy consumption. The importance of biomass varies significantly in different world regions. In Europe, North America and the Middle East, the share of biomass averages 2 to 3% of total final energy consumption, whereas in Africa, Asia and Latin America, which together account for three-quarters of the world's population, biomass provides a substantial share of the energy needs: a third on average, but as much as 80–90% in some of the poorest countries of Africa and Asia (e.g., Angola, Ethiopia, Mozambique, Tanzania, Democratic Republic of Congo, Nepal and Myanmar). Indeed, for large portions of the rural populations of developing countries, and for the poorest sections of urban populations, biomass is often the only available and affordable source of energy for basic needs such as cooking and heating.

The term "modern biomass" is generally used to describe the traditional biomass use through the efficient and clean combustion technologies and sustained supply of biomass resources, environmentally sound and competitive fuels, heat and electricity using modern conversion technologies. Modern biomass produced in a sustainable way excludes traditional uses of biomass as fuelwood and includes electricity generation and heat production, as well as transportation fuels, from agricultural and forest residues and solid waste. On the other hand, "traditional biomass" is produced in an unsustainable way and it is used as a non-commercial source usually with very low efficiencies for cooking in many countries.

Biomass can be thermochemically converted into liquid fuel, gases, such as methane, carbon monoxide, or hydrogen by pyrolysis. Bioethanol can be obtained from cellulosic biomass by fermenting and distilling sugar solutions. Vegetable oils such as soybean and canola oils can be chemically converted into liquid fuel known as biodiesel. These fuels can be used as diesel fuel and gasoline in conventional engines with little modification to the system.

Certain organic compounds, specifically municipal biosolids (sewage) and animal wastes (manures) can be biochemically converted into methane by anaerobic digestion. Energy crops, especially liquid biofuel (vegetable oils and biodiesels) crops have the potential to be substituted for a fraction of petroleum distillates and petroleum-based petrochemicals in the near future.

In the future, biomass has the potential to provide a cost-effective and sustainable supply of energy, while at the same time aiding countries in meeting their greenhouse gas reduction targets. In the short to medium term, biomass is expected to dominate energy supply. For the generation of electricity and heat, while using advanced combustion technology, organic wastes can be used as modern biomass. Also a number of crops and crop residues may fit modern bioenergy chains.

In industrialized countries the main biomass processes expected to be utilized in the future are direct combustion of residues and wastes for electricity generation, bioethanol and biodiesel as liquid fuels, and combined heat and power production from energy crops. In the short to medium term, biomass waste and residues are expected to dominate the biomass supply, to be substituted by energy crops in the longer term. The future of biomass electricity generation lies in biomass integrated gasification/gas turbine technology, which offers high energy conversion efficiencies. The electricity is produced by direct combustion of biomass, advanced gasification and pyrolysis technologies, which are almost ready for commercial-scale use. Biomass is burned to produce

steam and the steam turns a turbine and drives a generator, producing electricity. Because of potential ash build-up (which fouls boilers, reduces efficiency and increases costs), only certain types of biomass materials are used for direct combustion. Gasifiers are used to convert biomass into a combustible gas (biogas). The biogas is then used to drive a high-efficiency, combined-cycle gas turbine. Heat is used to thermochemically convert biomass into a pyrolysis oil. The oil, which is easier to store and transport than solid biomass material, is then burned like petroleum to generate electricity. Pyrolysis can also convert biomass into phenolic oil, a chemical used to make wood adhesives, molded plastics and foam insulation. Wood adhesives are used to glue together polywood and other composite wood products. Biomass can also be converted into transportation fuels such as ethanol, methanol, biodiesel and additives for reformulated gasoline. Biofuels are used in pure form or blended with gasoline.

The overuse and undersupply of biomass is currently a serious problem and potentially a greater long-term danger than ready lack of food. Today 14% of the world's primary energy is derived from biomass (including fuelwood) – equivalent to 20 million barrels of oil/day. Predominant use is in the rural areas of developing countries where half the world's population lives; e.g., Nepal and Ethiopia derive nearly all, Kenya 75%, India 50%, China 33%, Brazil 25%, and Egypt and Morocco 20% of their total energy from biomass. A number of developed countries also derive a considerable amount of energy from biomass; e.g., Sweden 15%, Canada 5%, and the United States and Australia 3% each. European-wide studies have shown that about 5%–10% of Europe's energy requirements could be met from biomass by 2000. An especially valuable contribution could be in the form of liquid fuels, now so prone to fluctuating price and supply and to large import costs. The success of alcohol fuel schemes in Brazil and Zimbabwe, for example, with their net energy and economic benefits, needs to be closely analysed [1].

Development of a successful bioenergy sector in both developed and developing nations, will make a useful long-term contribution to diversity, security and selfsufficiency of energy supply. Biomass will play a leading role in mitigating the environmental effects of fossil fuel energy use as it can offer major reductions in harmful emissions particularly greenhouse gases and sulphurous oxides. Continuous growth in the biomass industry to provide bioheat, biopower, transport biofuels and organic waste utilization as well as chemicals and bio-materials, will create employment opportunities (particularly among small to medium enterprises), increase export earnings and promote social cohesion and economic stability, particularly in remote and rural regions. It will also provide a platform for long-term co-operation between industrial nations and developing countries whose energy demands are expected to grow dramatically in the coming years [2, 3].

Conclusion. Rich soil can provide the humanity with the vast resources of energetic sources with the following production of biofuel from the biomass and in order to produce a lot of biofuel it is necessary to have a lot of biomass all over the world and it is necessary to produce it with low expenditures. In Ukraine the most prospective field cultures are sugar-beet, corn, rape, soybeen and also fast-growing types of trees. The development of technologies for growing these plants on the territory of Ukraine can provide the energetic and ecological security of our country.

Література

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Анотація

Наукове дослідження та вивчення біомаси як одного з найбільш важливих відновлювальних джерел енергії у світі / Прилшяк В.М.

Наведено результати досліджень з вивчення інноваційних технологій виробництва біомаси з сільськогосподарських польових культур які мають високі енергетичні характеристики. Це забезпечить планомірний розвиток виробництва біомаси за нижчою собівартістю з кращими екологічними показниками.