

THE RELEVANCE OF BIOFUEL AS AN ALTERNATIVE ENERGY SOURCE

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Abstract. This article discusses biofuels as a promising source of alternative energy. Biofuels are used for the production of biogas, electric and thermal energy, biofertilizers, creating the basis for a fundamentally new, highly profitable energy industry. The types of biofuels, their advantages in the environmental component and development trends are discussed.

АКТУАЛЬНОСТЬ БИОТОПЛИВА КАК АЛЬТЕРНАТИВНОГО ИСТОЧНИКА ЭНЕРГИИ

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Ключевые слова: альтернативная энергетика, биотопливо, экология, актуальность и преимущества биотоплива.

Аннотация. В данной статье рассматривается биотопливо как перспективный источник альтернативной энергии. Биотопливо применяют для производства биогаза, электрической и тепловой энергии, биоудобрений, создавая основу для принципиально новой, высокорентабельной отрасли энергетике. Обсуждаются виды биотоплива, его преимущества в экологической составляющей и тенденции развития.

The period of industrial development has become a new stage of human relations with the biosphere. Humanity seems to be struggling with nature, striving to take away from it as much as possible. Society does not notice that it is leading the Earth to destruction with great strides, the causes of which lie in the global environmental problems of our time. Now we are seeing climate changes, which are pushing us to develop in the field of ecology.

Since it is almost impossible to reduce our needs, people are looking for other ways to extract energy that will be unlimited and less dangerous to the environment. Biofuels, just helps us in this. Since the fuel we use has a certain reserve and can run out at any moment, we need an alternative that will give us energy and not cause much harm to the environment.

Bioenergy is called the production of energy from biological fuel. Such fuel can be different: wood derivatives (wood chips, sawdust, etc.), briquettes made of straw, husk, peat, paper, as well as biogas and liquid biological fuel.

Bioenergetics is not at all an innovative invention of today. Such fuels have been used by mankind since ancient times. But over time, biofuels were replaced by fossil fuels: gas, coal, oil. However, fossil reserves are coming to an end, and the

history of energy is making another turn, returning to biological options that have a significant plus: they are renewable energy sources [1].

Biofuel is an alternative type of fuel obtained as a result of processing biological waste or biological raw materials. To date, waste from the agricultural and food industries can produce biological fuel. Raw materials can be: animal manure, agar waste and others.

It is divided into several types, namely: liquid, solid and gaseous.

The solid type of biofuel is the most common in our life. The most striking example is firewood, and the list of solid biofuels also includes wood pellets, pellets, etc., which are made from sawdust, bark, straw, manure and other waste from agar farming. Direct burning of wood is well known at the household level. The technology of energy use of wood waste is constantly being improved. The most common is the transfer of boiler houses from liquid fuel or coal to wood waste, which requires the reconstruction of furnace devices and the creation of the necessary infrastructure for fuel storage and preparation (Fig. 1) [2].

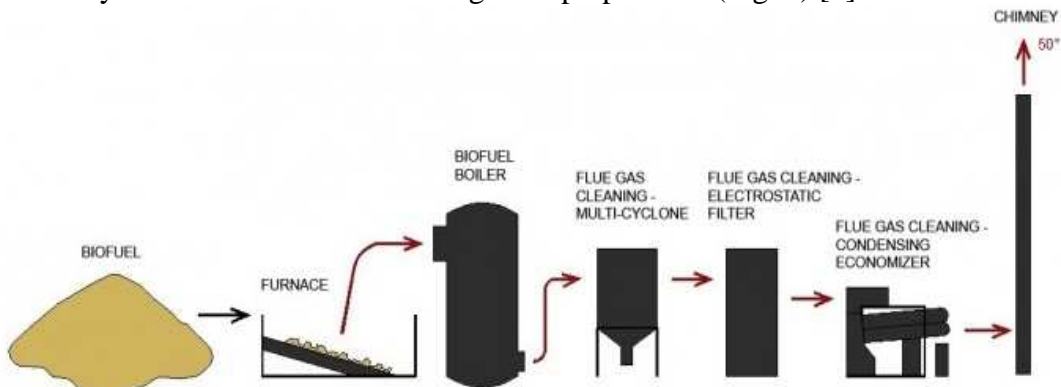


Fig. 1. Scheme of a biofuel boiler-house with a condensing economizer

Liquid biofuels are usually used in cars. It includes bioethanol, biomethanol, diesel fuel, second-generation biofuels, biobutanol. For example, second-generation biofuels are a type of fuel that is produced from straw, sawdust and other biomass, which is affordable and renewable, does not require special care and fertilizer. For example, biofuels from algae, which have a simple chemical composition, are amenable to splitting and processing, and absolutely any water and sunlight are needed for their growth. This makes this fuel one of the ways to solve the energy crisis.

The last subspecies is gaseous biofuels, which includes biogas, biofuels and methane. These types appear during fermentation of biomass. Among the biochemical technologies for processing liquid organic waste, the most widely used in many countries of the world is the technology of anaerobic (in the absence of atmospheric oxygen) decomposition of organic raw materials to produce biogas consisting of 55-60% methane.

The produced biogas is removed from the volume of the methane tank and sent to the gas tank – accumulator, from where the gas is taken away as needed, mainly for the purpose of heat supply to nearby facilities. Biogas can also be used

as fuel in internal combustion engines for the production of mechanical and/or electrical energy.

Also, for each type of fuel there is its own combustion technology, justified both technically and economically. The fuel pellet can be burned on various equipment. However, maximum efficiency can be achieved only with the help of boilers and burners specially designed for this purpose.

The process of obtaining thermal energy from pellets can be called combustion only with a big stretch, because pellets do not burn in the literal sense of the word, but smolder. At the same time, the boiler, having exhausted the fuel in the container, can continue to supply heat for 24 hours due to the low speed of the process.

In Europe, more than half of wood pellet boilers have an average power from 100 kW to 1 MW. Usually, such furnaces are installed in large private homes, schools, and small enterprises.

In addition to pellet boilers, there are also fireplaces on pellets and briquettes. Such fireplaces do not work as boilers, but as air heaters, therefore they do not require a piping system. More often they are used (like traditional fireplaces) as an additional means of heating.

To date, burners for converting liquid fuel boilers to pellets, high-power boiler equipment, industrial biofuel steam generators, low-power automated boilers for private homes, and indoor fireplaces for burning fuel pellets are presented in the CIS markets. Most of the equipment is imported. However, a number of domestic enterprises also offer equipment designed for burning pellets.

There is a special and specific technology for each type of biofuel. Boilers designed for biomass with a humidity of less than 30% will not be effective either for burning wet biofuels with a water content of about 50%, or for refined biofuels. Wet raw materials will not burn due to the fact that it needs a very high temperature inside the boiler. Wood pellets (refined biofuels) will burn in such a boiler, but at the same time they will lose economic feasibility, since the cost of a boiler on pellets is lower than on wet or dry (up to 35%) biomass – sawdust, wood chips, etc.

Currently, a fairly wide range of types of biofuel boilers have been developed in Europe: 1) boilers on pressed biofuels – pellets and briquettes; 2) boilers on dry biofuel (humidity up to 30%); 3) boilers on wet biofuel (humidity up to 55%); 4) boilers for burning peat and peat mixtures; 5) boilers for burning bark and mixtures of bark; 6) boilers for burning other organic raw materials [2].

Considering the positive effect on the environment of this type of fuel, biofuels have a number of advantages, such as:

1. Environmental friendliness

Firstly, carbon dioxide emissions are reduced by 60-65% when burning biofuels, which helps prevent global warming. Secondly, biofuels include a lower concentration of chemicals that pollute the atmosphere. Thirdly, the resource is renewable, since it is produced as a result of processing plant substances, disposing of them.

2. Economic independence

This fuel makes it possible for the country to be energetically independent of oil supplies from other states, since it is able to independently produce materials for it. As well as reducing transportation costs, which in turn also reduces the polluting factor, and the emergence of new jobs in the regions, since fuel can be produced locally. There is no additional cost of resources for its production.

3. Durability of biofuel engines. This fuel has fewer impurities that cause engine contamination [3].

At present, the biofuel industry is developing dynamically and has great prospects:

1. Technologies for generating heat and electricity from biomass can improve production efficiency.

2. The development of biomass pressing, for example: briquetting or drying reduces the cost of supply channels.

3. The importance of agronomy and biotechnologies used to optimize biomass plantations for energy will grow.

4. Automation is expected to be a factor in reducing the cost of biological raw materials, which improves economic performance and contributes to the growth of the industry [4].

Over the past 20 years, biofuels, which is one of the sources of alternative energy, have shown high growth rates.

In total, in 2019, global biofuel production exceeded 1.8 thousand barrels, with a market share of \$136 billion [5].

Pioneers in the field of bioenergy, such as Sweden, Finland and Denmark, are successfully introducing capacities powered by biological raw materials into their energy systems, and the friendly policy of the European Union contributes to further attracting investment in the industry.

Bioenergy, as an alternative fuel, is only part of the global energy complex, as it complements it, but will not be able to replace it completely, since it does not have high productivity, but at the same time benefits from its environmental friendliness.

The volume of renewable energy generation is growing at a rapid pace, as is its global energy consumption. Most bioelectricity is obtained in North America, Europe, South America and Southeast Asia.

According to experts, the volume of investments in renewable energy is growing every year, unlike oil and gas production. In the next decade, alternative energy will become the largest energy sector in terms of investment [6].

Alternative energy is developing at a rapid pace, it is possible to identify the main companies developing in this area, including in bioenergy.

Foreign companies:

1. British Petroleum (BP) invests in renewable energy sources (RES). Together with Bunge, BP BungeBioenergia has been created, which combines efforts in the field of bioenergy and the production of ethanol from sugar cane.

2. TotalEnergies. This French company is seriously engaged in the development of alternative energy, increasing capacity indicators. They are

increasingly increasing their attention in the field of photovoltaic solar energy, wind power, bioenergy, hydropower [7].

TotalEnergies plans to reduce its refining capacity to adapt it to reduced demand. Europe predicts a 30% decline in oil demand (Figure 2) [8].

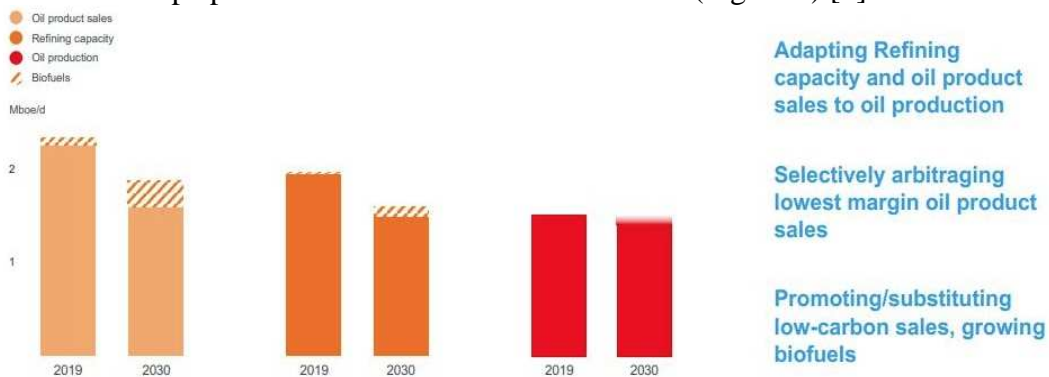


Fig. 2. Biofuels growth

Russia, given its ample opportunities for the production of various types of biomass, can become a fairly serious exporter of biofuels to the world market. Now there are two organizations that are developing in bioenergy.

Companies in Russia:

1. Bioenergy Development Center of the All-Russian Research Institute of Agricultural Mechanization.
2. Technological platform "Bioenergetics" at the SIC "Kurchatov Institute".

They are creating large-scale programs for the development of bioenergy in the country. Their projects are being implemented in an industrial biogas power plant in the Belgorod region (two BGS "Baitsury" and "Luchki") [9], as well as in Kirov at the Kirov Biochemical plant for the production of pellets.

The development of the segment will improve the situation not only in global, but also in small markets. The incomes of the rural population will grow, the scale of work of farms will be increased. Previously unused lands will be used, new territories will be developed, and agricultural business and forestry companies will be able to diversify their activities. The total expected value of biofuel production enterprises is estimated by the United Nations Food and Agriculture Organization at more than \$50 billion in the near future. At such a scale, we need to talk not just about the emergence of a promising alternative energy sector, but also about the birth of a large economic industry, in which most countries of the world will be involved.

References

1. Bioenergy is the production of energy from biological fuel [Electronic resource]. – Access mode: <https://altenergiya.ru/bio/bioenergetika-vozhzhdenie.html>
2. Biofuel combustion equipment [Electronic resource]. – Access mode: <https://www.biointernational.ru/tiekhnologhiia-proizvodstva-biotopliva?ysclid=li7e0ngsqn723282028/>
3. What is biofuel, its types and advantages [Electronic resource]. – Access mode: <https://ekopower.ru/chto-takoe-biotoplivo-ego-vidy-i-preimushhestva/>

4. Prospects and trends of the bioenergy market development [Electronic resource]. – Access mode: <https://vsegdavkurse.ru/page/mirovoj-rynok-bio>
5. What problems does biofuel solve? [Electronic resource]. – Access mode: <https://perspectiva.company.ru/tag/%D0%B1%D0%B8%D0%BE%D1%82%D0%BE%D0%BF%D0%BB%D0%B8%D0%B2%D0%BE/>
6. Prospects and trends in the development of biofuels [Electronic resource]. – Access mode: <https://trends.rbc.ru/trends/green/610a89709a7947d644d231bb>
7. Trends in the development of the world economy, the dynamics of world commodity markets [Electronic resource]. – Access mode: <https://www.mirprognozov.ru/prognosis/economics/tendentsii-razvitiya-mirovoy-ekonomiki/>
8. TotalEnergies Strategy 2030: how oil majors are preparing for the energy transition [Electronic resource]. – Access mode: <https://smart-lab.ru/blog/728026.php>
9. The Belgorod region has become a leader in bioenergy in Russia [Electronic resource]. – Access mode: <https://www.belnovosti.ru/102809.html#>

Список литературы

1. Биоэнергетика – это получение энергии из биологического топлива [Электронный ресурс]. – Режим доступа: <https://altenergiya.ru/bio/bioenergetika-vozrozhdenie.html>
2. Оборудование для сжигания биотоплива [Электронный ресурс]. – Режим доступа: <https://www.biointernational.ru/tiekhnologiia-proizvodstva-biotopliva?ysclid=li7e0ngsqn723282028/>
3. Что такое биотопливо, его виды и преимущества [Электронный ресурс]. – Режим доступа: <https://ekopower.ru/chto-takoe-biotoplivo-ego-vidy-i-preimushhestva/>
4. Перспективы и тенденции развития рынка биоэнергетики [Электронный ресурс]. – Режим доступа: <https://vsegdavkurse.ru/page/mirovoj-rynok-bio>
5. Какие проблемы решает биотопливо? [Электронный ресурс]. – Режим доступа: <https://perspectiva.company.ru/tag/%D0%B1%D0%B8%D0%BE%D1%82%D0%BE%D0%BF%D0%BB%D0%B8%D0%B2%D0%BE/>
6. Перспективы и тенденции развития биотоплива [Электронный ресурс]. – Режим доступа: <https://trends.rbc.ru/trends/green/610a89709a7947d644d231bb>
7. Тенденции развития мировой экономики, динамика мировых товарных рынков [Электронный ресурс]. – Режим доступа: <https://www.mirprognozov.ru/prognosis/economics/tendentsii-razvitiya-mirovoy-ekonomiki/>
8. Стратегия-2030 TotalEnergies: как нефтяные мейджоры готовятся к энергопереходу [Электронный ресурс]. – Режим доступа: <https://smart-lab.ru/blog/728026.php>
9. Белгородская область стала лидером биоэнергетики России [Электронный ресурс]. – Режим доступа: <https://www.belnovosti.ru/102809.html#>

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