

The state and prospects of the development of bioenergy in the EU member states

Bioenergy in the modern world is at the crossroads of important problems such as climate change, consumption of natural resources and environmental pollution. In particular, the use of biofuels and biogas is one of the key directions for reducing dependence on hydrocarbons and reducing greenhouse gas emissions. The EU is actively developing bioenergy as part of its strategy to reduce CO₂ emissions and create a sustainable energy system. The two biggest challenges to achieve emission reductions are population growth and GDP growth, as higher living standards correlate with increased consumption of resources and energy (which continues to be generated to some extent using fossil sources). The modern economy is faced with the need to find stable, ecologically clean sources of energy to ensure sustainable development. In this context, bioenergy, which is based on the use of organic materials for energy production, is gaining increasing importance. The relevance of studying the state and prospects for the development of bioenergy in the countries of the European Union is explained not only by the need to reduce carbon emissions, but also by the potential opportunity to stimulate economic development and reduce energy dependence. The issue of bioenergy development in Ukraine is relevant given its potential and Ukraine's ambitions to become a Member State of the European Union.

The European Union is one of the global leaders in the development of renewable energy. Today, we see that renewable energy sources are crucial not only for reducing CO₂ emissions in Europe and achieving climate neutrality by 2050, but also for strengthening the EU's energy independence.

Bioenergy occupies one of the prominent places in the development of renewable energy in the EU. One of the main sources of energy in the EU in the balance of primary energy production is biomass. The volume of primary energy produced from biomass in the EU in 2021 is 140,674 thousand toe. A larger amount of primary energy was generated only in the nuclear energy sector — 186,663 thousand toe (Fig. 1) [1].

If we consider only the renewable energy sector, the amount of energy produced using biomass also significantly exceeds the amount of energy obtained from other renewable sources (Fig. 2) [1].

As for the gross final consumption of renewable energy in the EU-27 in 2021 (%), the following can be noted (Fig. 3) [1]. The share of bioenergy in this balance is 55.7%, which significantly exceeds the share of energy generated by wind and hydropower plants — 14.9% and 14.4%, respectively.

The gross final consumption of energy from biomass in the EU during 2005–2021 had a tendency of constant growth (Fig. 4) [1]. The largest share of bioenergy, as can be seen from Fig. 4, used for heating. At the same time, there is a noticeable trend towards increasing the use of bioenergy resources in the transport sector. To a lesser extent, there is an increase in the use of

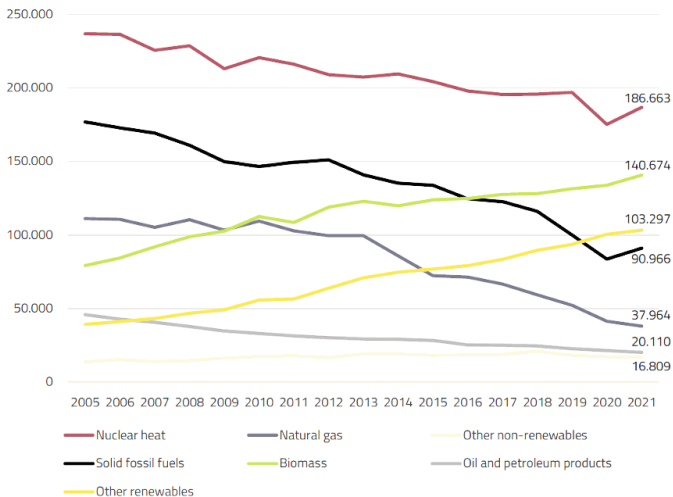


Fig. 1. Evolution of primary energy production by main fuel types in EU27 (ktoe)

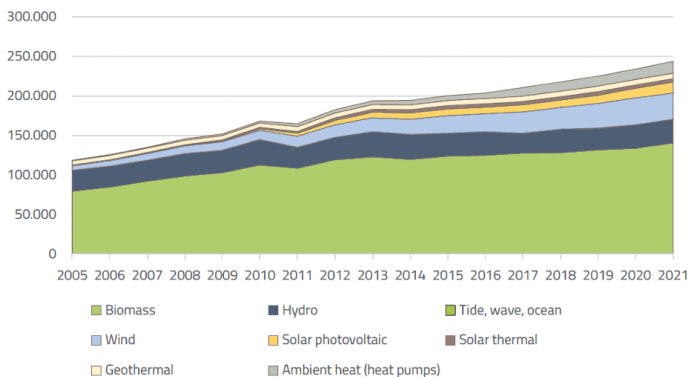
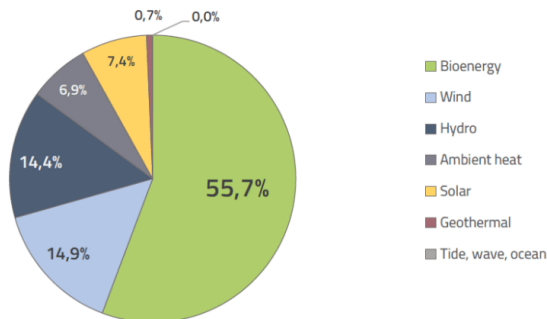


Fig. 2. Evolution of primary production of renewable energy in EU27 (ktoe)



Source: Eurostat

Fig. 3. Distribution of renewable gross final energy consumption in the EU-27 in 2021 (%)

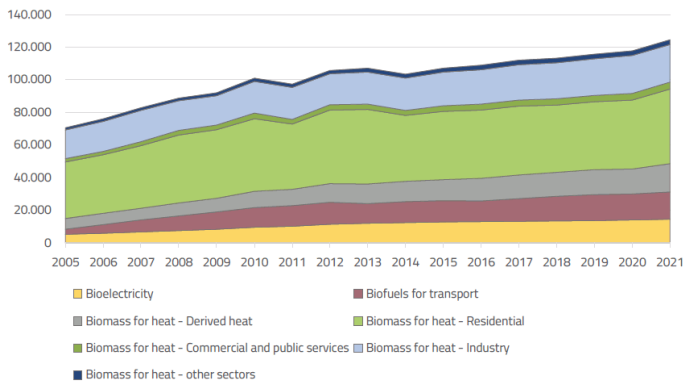


Fig. 4. Evolution of bioenergy in gross final energy consumption by end-use in EU27 since 2005 (in ktoe)

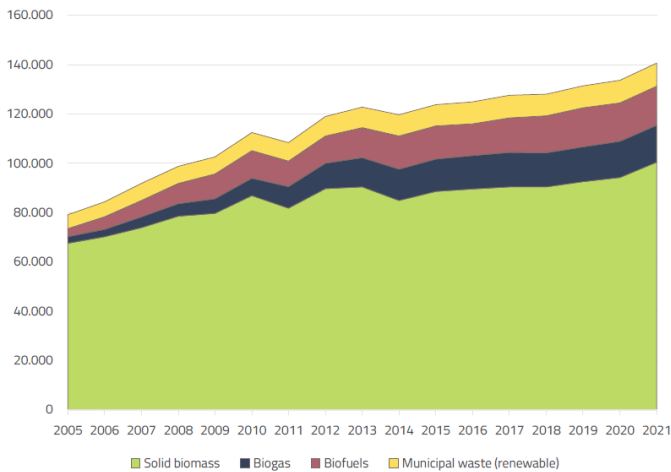


Fig. 5. Evolution of primary energy production from biomass by type (ktoe) in EU27 electricity generated with the use of biomass.

As for the production of primary energy in the EU by type of biomass, the following can be noted (Fig. 5) [1]. The largest volume of primary energy production is generated using solid biomass. Smaller amounts of energy are produced from biofuels, biogas and municipal waste.

Given the ambitious climate goals of the European Union and the urgency of ensuring energy security, it is safe to say that the share of bioenergy in the EU energy balance will grow steadily.

As noted in [2], biomass will remain a key energy source for the EU in 2030, as it is needed to enable the region to progress on the decarbonisation of energy uses for which no other cost-effective solutions are available.

To achieve climate neutrality by 2050, the EU expects greater progress in the use of renewable energy sources, but at the same time demands that this is not achieved at the cost of neglecting other environmental priorities. The adoption of the European Green Deal became a powerful impetus to increase

the role of restrictive means in the legal regulation of bioenergy relations, which are sustainability criteria and reduction of greenhouse gas emissions. In recent years, these criteria have been revised and cover an increasing amount of bioenergy resources. At the same time, the strengthening of sustainability requirements for solid and gaseous biofuels, as well as biofuels produced from forest biomass, is of particular importance. The outlined trends in the EU are of great importance for the further formation of the legal regulation of biomass and biofuel market in Ukraine. A distinctive feature of this regulation should be the stimulation of production and use of biomass exclusively under the condition of fulfilling the criteria of sustainability and reduction of greenhouse gas emissions. However, European legislation may not take into account Ukrainian specifics, in particular, in the area of stimulation and development of bioenergy. Therefore, in the future, it is expedient for Ukraine to focus on improving supranational and introducing additional national sustainability criteria.

Conclusions. As can be seen, the development of bioenergy in the Member States of the European Union has great potential for ensuring sustainable, reliable and environmentally acceptable energy supply. Thanks to a balanced approach to the political, technological, financial and social aspects of bioenergy development, the EU achieves its goal and contributes to the creation of a future energy system that meets the requirements of sustainable development and environmental protection.

Also, as a result of the conducted analysis, it can be concluded that bioenergy has a significant potential for development in Ukraine as well. However, achieving this goal requires a comprehensive strategy that takes into account economic, environmental and social aspects. A particularly important aspect in the development of bioenergy in Ukraine is the study of experience and the application of the best European practices in this field.

References

1. Bioenergy Europe (2023). Statistical Report 2023
2. International Renewable Energy Agency (2018). Renewable Energy Prospects for the European Union. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Feb/IRENA_REmap_EU_2018.pdf