

## **Biodiesel production in the EU and Ukraine: current state and development prospects**

The role of renewable energy sources in global decarbonization of the economy and strengthening energy security is growing every year. The transport sector is one of the biggest polluters of the environment, and therefore the wider use of environmentally friendly types of motor fuels, namely biofuels, can solve the problem of decarbonisation of the transport sector.

The EU is one of the world leaders in solving the problem of decarbonization of the transport sector. In recent years, the production and consumption of motor biofuels belonging to renewable energy sources has increased in the EU. Biodiesel is one of the promising types of biofuels, which has prospects of application not only for road vehicles, but also for marine and aviation ones.

It should be noted that the greatest effect of decarbonization of the transport sector can be achieved through the use of advanced types of biofuels, that is, produced from raw materials that are not intended for food or feed production. The list of such types of raw materials (most of which refer to waste or byproducts, for example, food production waste), as well as the achieved (by default) reduction of greenhouse gas emissions from the use of conventional and advanced biofuels is given in Annex IX (Part A) of the EU Directive 2018/2001 on the promotion of the use of energy from renewable sources (RED II) [1]. The main difference of raw materials listed in part B of Annex IX of the RED II is that the biofuels produced from them are not considered advanced, but the double credit in fulfilling the EU's goal of RES in transport remains as for advanced ones. These raw materials include used cooking oil (UCO) and animal fats of categories 1 and 2.

The EU's consistent actions regarding the use of raw materials for the production of advanced biodiesel, which leads to a reduction in carbon dioxide emissions, have yielded results.

According to the report [2], the share of crop-based biofuels decreased from more than 90 % to 60 % between 2010 and 2022, at the same time the consumption of waste-based biodiesel has multiplied by eleven since 2010, making up a third of the overall EU biodiesel consumption in 2022.

One more effective step is the replacing of palm oil biodiesel, which represented the second largest feedstock used in European biodiesel until 2021, by UCO biodiesel in 2022. This decrease can be explained by early phase-outs of palm oil biofuels enforced by several Member States. Between 2021 and 2022, palm oil biodiesel consumption declined by 27 % across the EU. At the same time, 2022 data suggest that a surge in the consumption of animal fats (+47 %) and used cooking oil (+5 %) as well as an increase of palm derivatives such as palm oil mill effluent (POME) compensated for this decrease in conventional palm oil biodiesel [2].

Average biodiesel emissions have been decreasing over the years, specifically RED biodiesel emissions decreased by 24 % between 2010 and 2022,

resulting in official average emission savings of 63% in 2022 compared to 51% twelve years earlier. The particularly strong emission reduction has been achieved between 2020 and 2022. That can be explained by the decrease in palm oil consumption, the most emitting biodiesel feedstock, and an increase in waste-based biofuels (used cooking oil, POME etc.) [2].

As for Ukraine, the problem of providing the country with a sufficient amount of fuel is as urgent as possible. Dealing with lack of petrol and diesel since the beginning of the war in February 2022, along with the increasing effects of the current energy crisis, Ukraine focuses on enhancing energy security through the development of renewable energy sources, particularly biofuels and biomass.

As stated by G. V. Zhuk, the production of biodiesel in Ukraine is not recorded in statistical data, although the potential is estimated at 2 million t/year, since the raw material for obtaining biodiesel is technical oil, as well as rapeseed and soy, that is, crops that Ukraine grows and actively exports. This volume, by the way, could replace 20% of diesel imported by Ukraine [3].

It should be noted that the research of Furman I. V. & Tokarchuk D. M. testify that Ukraine has sufficient land areas to guarantee energy security when using agricultural raw materials for the production of biofuels, without endangering food security [4].

Therefore, the main directions of development of biodiesel production as food security measures should be [5]:

- introduction of a system of incentives for agricultural producers focused on compensation of 40% of the cost of equipment purchased from Ukrainian producers for the production of biodiesel;
- setting quotas for the export of rapeseed and rapeseed oil at the level of 30-40% of the total collection;
- development of public-private partnership between scientific institutions and private investors aimed at the development of advanced technologies for rapeseed cultivation and biodiesel production;
- development of methanol production at distilleries in order to support biodiesel production.

As noted in the work [6] the following issues are considered as the main directions of development of motor biofuels in Ukraine, in particular, biodiesel:

- creation of the domestic market and expansion of the export of 1st generation biofuels;
- expansion of the possibility of production of 2nd generation (advanced) biofuels with a significant share of their export to EU countries;
- adaptation of Appendix IX RED II for the conditions of Ukraine.

Taking into account the European integration obligations of Ukraine, the strategic direction of the development of motor biofuels in Ukraine, as noted in the work [6], is to increase the production of biofuels from types of raw materials that are not subject to the restrictions for food/feed raw materials specified in the RED II Directive. Advanced biofuels belong to this category. Obtaining biodiesel from energy plants grown on unused or polluted agricultural land has a significant perspective in this direction. According to

expert estimates, the area of unused agricultural land in Ukraine is 4 million hectares, and more than 5 million hectares are unsuitable for agricultural production due to pollution and other reasons related to the consequences of hostilities.

Another possible option, as noted in [6], is the production of biodiesel from oil cover crops, which can be grown as a second crop on existing cultivated areas, which does not lead to the involvement of new land for obtaining raw materials for biodiesel production.

The widespread use of motor biofuels will make it possible to significantly increase the consumption of renewable energy in the transport sector, while at the same time achieving a significant level of its decarbonization.

### References

1. Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources (recast), 2018. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L2001&from=EN>
2. Transport & Environment (2023). Biofuels: from unsustainable crops to dubious waste? Analysis of the European biofuels market. [https://www.transportenvironment.org/wp-content/uploads/2023/12/202312\\_TE\\_biofuels\\_update\\_report\\_clean-1.pdf](https://www.transportenvironment.org/wp-content/uploads/2023/12/202312_TE_biofuels_update_report_clean-1.pdf)
3. *Жук Г.В.* Перспективи виробництва альтернативного автомобільного палива в Україні: Стенограма доповіді на засіданні Президії НАН України 8 червня 2022 року [Prospects for the production of alternative automotive fuel in Ukraine: transcript of the report at the meeting of the Presidium of the National Academy of Sciences of Ukraine on June 8, 2022] // *Visnyk NAN Ukrainy*. — 2022. — № 8. — P. 19–24. <https://doi.org/10.15407/visn2022.08.019>
4. *Фурман І.В., Токарчук Д.М.* Продовольча безпека та економічні засади виробництва біопалива [Food security and economic principles of biofuel production] // *Економічний аналіз*. — 2018. — Том 28, № 1. — С. 93–98.
5. *Мазур К., Гонтарук Я.* Перспективи розвитку виробництва біодизелю як напрям забезпечення енергетичної безпеки держави // *Таврійський науковий вісник*. Серія: Економіка. — 2023. — № 15. — С. 84–90. <https://doi.org/10.32782/2708-0366/2023.15.10>
6. *Geletukha G.G., Zheliezna T.A., Drahnev S.V., Kucheruk P.P.* Prospects for the production of advanced biofuels in Ukraine // *Energy Technologies & Resource Saving* — 2023. — Vol. 76 (3). — P. 71–82.