POSITIVE IMPACT OF EUROPEAN DIRECTIVES ON THE IMPLEMENTATION OF BIOFUELS IN CROATIA

PROFESSIONAL PAPER

Jona Šurić[1]✉, Nikola Bilandžija[1], Anamarija Peter[1], Marsela Miliša Gregurić[2], Neven Voća[1]

DOI: 10.5281/zenodo.5520525

RECEIVED 2021-06-10 **ACCEPTED** 2021-07-13

[1] University of Zagreb Faculty of Agriculture, Svetošimunska cesta 25, Zagreb, Croatia
[2] INA d.d. Rafinerija Rijeka, Urinj bb, Kostrena, Croatia
✉ jsuric@agr.hr

ABSTRACT:
The first Directive on the promotion of renewable fuels was adopted in 2003 - Directive 2003/30/ EC of the European Parliament and of the Council of 8 May 2003 on the promotion of biofuels or other renewable fuels for transport. In 2009, a new (so called RED Directive, 2009/28/ EC) was adopted, which creates a legal framework to promote the use of energy from renewable sources. First generation biofuels require an increased share of arable land on which crops are grown for biofuel production. The Directive RED II limits the share of conventional biofuels to 7% and requires a minimum share of advanced biofuels from lignocellulosic feedstocks and waste in final energy consumption in the transport sector of at least 0.2% in 2022, 1% in 2025 and 3.5% in 2030.

KEYWORDS: biofuels, renewable energy sources, Renewable Energy Directive

INTRODUCTION

The main driving force for the development and implementation of renewable energy projects comes from the Directive related to renewable energy sources and the reduction of greenhouse gas emissions. According to the plan European Commission, the Energy Union is based on the existing energy policy, which has three main objectives: Security of energy supply, reduction of dependence on oil imports and environmental protection (Russo et al., 2012).

To prepare for advanced biofuels and minimise the impact of direct and indirect land use, it is appropriate to limit the number of biofuels and liquid biofuels produced from grains and other starch- and sugar-rich crops and oilseeds that directly compete with food production. Advanced biofuels, particularly second-generation biofuels and biogas produced from lignocellulosic biomass and waste, can reduce greenhouse gas emissions and spur decarbonization of the transport sector, as well as improve energy diversification in the transport sector and reduce dependence on energy imports (Krička et al., 2006; Knothe, 2010; Lari et al., 2019).

Liquid biofuels used to achieve the Union's goals should meet sustainability criteria and save as many greenhouse gas emissions as possible. Setting transparent standards for biofuel production is essential for achieving the Union's single energy policy. It is essential that the previously agreed criteria for sustainability and greenhouse gas emission savings, which ensure that liquid biofuels qualify for support, are met. Only if it is guaranteed that the agricultural raw materials do not come from biodiversity areas, protected areas or protected areas for the conservation of rare and endangered species will it be favorable to the production of biofuels. It is assumed that future biofuel production will be based on feedstocks that are not used for food production. The lack of available agricultural land for food production, the situation on the food market and the prices of food for humans and animals will lead to alternative sources of raw materials for biofuel production (Tomić et al., 2008; Knothe, 2010, Naik et al, 2010).

On the basis of all these facts, the article aims to determine the obligations arising from the Directive RED II, which the Republic of Croatia assumed upon accession to European Union. First of all, it is necessary to limit the amount of cereals and other crops used for food purposes for the production of biofuels and to determine the limits for the production of biofuels from these raw materials. Only then can such biofuels be considered as part of the objectives set out in the Directive without limiting the overall possibility of using such biofuels and bioliquids.

EUROPEAN UNION DIRECTIVES ON THE USE AND PROMOTION OF BIOFUELS

, Biofuels were used to start the first cars, and the first internal combustion engines were powered by various fuels made from biological raw materials. At the first World's Fair in 1900, Rudolf Diesel demonstrated an engine that ran on peanut oil. With the transition to fossil fuels, global energy consumption has grown steadily. The production of fossil fuels (oil, coal, gas) produces most of the energy, about 87%, forming carbon dioxide. It is one of the main causes of the greenhouse effect, rising temperatures and climate change. To meet the growing demand for energy sources, new ones are constantly being sought. Energy dependence and instability of energy supply are a result of accelerated consumption of fossil fuels due to population growth and industrialization. Until 1973, non-renewable natural forms of energy (oil and coal) were consumed uncontrollably and without regard for future generations. This year is important in history as the year when people began to understand the importance of energy and the role of energy in human life. After 1973, it was realized that energy consumption should be better planned and used more rationally used. In that year, the world learned that major problems in energy supply will arise unless new forms of energy are provided. Projections show that the world's total petroleum resources will be depleted in 100-150 years, depending on the world market's demand for fuels produced from crude oil. Significant efforts are being made to develop renewable energy production (Rezić et al., 2014; Kolundžić, 2015). Pollution is to be prevented with alternative fuels, among others. Transport is responsible for up to 25% of carbon dioxide emissions, as fossil fuels are used in this sector (Mujčinović, Vukošić, 2017). For this reason, transport has become an essential segment in the struggle to reduce greenhouse gasses (Jegathese, Farid, 2014).

The importance of implementing biofuels in transport is highlighted in the EU documents White Paper at Renewable Energy Sources (1997) and Green Paper: Towards a European strategy for the security of energy supply (2000) (Kurevija, 2007). In 2003, the European Commission adopted the first Directive to promote the use of biofuels and other renewable fuels for transport. This directive provided the framework for biofuel market development policy and set indicative targets for biofuels (Jones et al., 2007). With the adoption of the above mentioned Directive, the European Union officially started to focus on renewable energy in transport fuels. Within the same Directive, three main objectives were set: reducing CO_2 emissions, improving security of supply and supporting rural economies (Mirabela, 2011).

The purpose of the Directive is to promote biofuels to partially replace mineral fuels in the transport of Member States with specific national targets to be achieved by 2010 (National Renewable Energy Action Plan, 2011-2020). Indeed, Directive 2003/30/ EC requires Member States to set a national target to ensure a minimum share of biofuels in total transport fuels placed on the market. The reference values were 2% share of biofuels in transport in 2005 and 5.75% in 2010. The 2% target set in the Directive was not reached in 2005 and the EU average for 2005 was 1.4% (Jones et al., 2007). Due to various problems such as limited national potential for production of raw materials, loss of state subsidies or high production costs, more than half of the countries in the Union failed to meet the target set for 2005 (Kurevija, 2007). Similarly, the Directive was subject to objections from green associations because the primary raw materials for biofuel production was still food products. It became a competition for food production and increased food prices. Mainly for this reason, Directive 2003/30/ EC on the promotion of the production and use of biofuels for transport is replaced by another Directive in 2009 (National Renewable Energy Action Plan, 2011-2020, Đurišić-Mladenović et al., 2016).

The Renewable Energy Directive - RED I (Directive 2009/28/ EC) was prescribed in 2009 by the European Commission (Directive 2009/28/ EC), which establishes a general policy for the promotion and production of energy from renewable sources in the Union. The main task of the Directive was to reduce greenhouse gas emissions and dependence on energy imports, to develop renewable energy sources and to increase energy efficiency. The Directive regulates the production and use of all forms of energy from renewable sources and biofuels. In addition to energy use, the Directive defines binding targets for the Member States to achieve by 2020 (Directive 2009/28/ EC). For this reason, it is known as "20-20-20", which means reducing greenhouse gas emissions by 20%, increasing the share of energy from renewable sources in total consumption to 20% and increasing energy efficiency to 20%. The same Directive requires that a percentage of 10% share of biofuels in transport be achieved by 2020. The achievement of this target is still based on biofuels obtained from the same raw materials as those used for food production. For this reason, restrictions are introduced on the maximum quantities of first-generation biofuels produced. The Directive refines the definition of biofuels, which are now liquid or gaseous fuels derived from biomass as the biodegradable fraction of products, waste and residues of

biological origin from agriculture (including plant and animal matter), forestry and related production activities, including fisheries and aquaculture, and biodegradable industrial and municipal waste.

In addition, the Directive regulates the calculation of the share of renewable fuels in transport fuels, the analysis of greenhouse gas savings, the criteria for the sustainability of biofuel production and other requirements to be implemented in national regulations. The Directive introduced some sustainability criteria, including standards for the protection of high biodiversity value land from high carbon stock land. Nevertheless, it did not cover the issue of indirect land use change. Indeed, the growing demand for biofuels should not lead to the destruction of high biodiversity land through the application of this directive.

The European Union adopted Directive 2015/1513/EU amending Directive 98/70/ EC on the quality of petrol and diesel fuels and amending Directive 2009/28/ EC on the promotion of the use of energy from renewable sources. The Directive is essential because for the first time it formally limits the consumption of first generation biofuels and increases the share of advanced biofuels produced from raw materials not used for food production. Directive 2015/1513/EU is called "ILUC", which is derived from the English acronym: "Indirect Land Use Change". ILUC is a factor referred to as indirect land use change. It indicates the extent to which the use of arable land for biofuel production leads to the need to develop new arable land at the expense of the use of non-agricultural land in other parts of the world.
Deforestation is cited as the most significant negative trend in the expansion of agricultural production for biofuel production. Indirect changes in land use occur when the cultivation of raw materials for biofuels and biomass replaces traditional agricultural production of food for humans and animals. This additional demand increases land pressure and can lead to expansion of agricultural land into carbon-rich areas such as forests, wetlands and peatlands, causing further greenhouse gas emissions.

The ILUC Directive for the first time set a limit of 7% for the share of conventional biofuels for 2020. It obliged member states to introduce an indicative target for advanced biofuels for 2020, which should be 0.5% (it can be lower for objective reasons, but only according to the Member State's assessment). In addition, double scoring was introduced for all biofuels produced from non-food raw materials, including category 1 and 2 cooking oil and slaughterhouse waste.

EU Directive 2015/1513/EU confirmed that large-scale indirect change in land use related to greenhouse gas emissions could offset some or all greenhouse gas emissions savings from biomass fuels. The risks arising from indirect land use change are proportional to their impacts. Depending on the type of raw material, the level of additional demand for raw materials due to biofuels and how high carbon land is protected will depend on the risks of indirect change. The amount of greenhouse gas emissions caused by indirect land use change cannot be accurately determined. The greatest opportunities for indirect land use for biofuel production from raw materials have been identified. Significant expansion of the production area has been observed on land with high carbon stocks. For these reasons, it is appropriate to limit biofuels from biomass-based crops for food and feed production. In addition, a further restriction in the form of requests from Member States to set a specific and progressively decreasing limit value for biofuels, bioliquids and fuels produced from biomass used for food and feed crops where a significant expansion of the production area on land with high carbon stocks is observed is appropriate. Biofuels produced from low-risk biomass with indirect land-use change should be exempted from the specific and decreasing limit value. Directive 2015/1513/EU proposes to provide a long-term perspective for investment in sustainable biofuels with low risk of indirect land use change, with the primary objective of decarbonising the transport sector. Decarbonisation involves feedstocks that cause indirect land use change when used for biofuel production.

In 2017 and 2018, the Directive was created, amended and supplemented at RED II EU Directive 2018/2001/EU. It promotes renewable sources and provides guidelines for its implementation in the period from 2021 to 2030. The binding target of the European Union is to reduce greenhouse gas emissions by at least 40% below 1990 levels by 2030. For this reason, a binding Union target of at least 32% energy from renewable sources has been set. All members should identify their contribution to achieving this target through integrated national energy and climate plans. The national targets for 2020 should represent a minimum contribution from the Member States to the new framework by 2030. If a country fails to meet its share, it should take additional measures to achieve a baseline share. If it still fails, a Member State can make up the market shortfall through organized trading of energy shares from renewable sources (Directive 2018/2001/EU).

The Union's overall binding target for 2030 is for Member States to ensure that the share of renewable energy in the Union's total gross final energy consumption is at least 32% in 2030, although Member States may set their own more ambitious national targets. This is because the European Parliament went further

and concluded, under the influence of the Paris Agreement, that it would be desirable to propose much more ambitious targets for renewable energy sources. Member States should define their contribution to this target in the context of their integrated national energy and climate plans. The target set at Union level would give Member States more leeway to achieve their greenhouse gas reduction targets in the most cost-effective way and according to their specific circumstances and respective renewable energy production capacity. In addition, it was proposed on European Commission to reduce the share of biofuels produced from feedstocks from 7% in 2020 to 3.8%. Such an offer was not accepted and these Member States should limit the share of conventional biofuels to 7% and maintain it until 2030.

The agreed rules also serve to create a stimulating environment for accelerating public and private investment in innovation and modernisation in all key sectors. Member states are to set out their contribution to achieving the target in their integrated national energy and climate plans. Each Member State will set out a detailed plan for achieving the targets in the integrated national energy and climate plans. The plan will be prepared by each Member State on the basis of the guidance set out in the Energy Union Management Regulation. The national targets set for 2020 should represent the minimum contributions of Member States in the new framework by 2030.

The share of biofuels, bioliquids and biomass fuels produced from crops used for the production of food and feed that have a high risk of indirect land use change and have been identified as having a significant expansion of production area on high carbon stock land shall not exceed the consumption of those fuels in 2019, unless they are certified as biofuels with a low risk of indirect land use change. From 31 December 2023 until 31 December 2030 at the latest, this limit will be gradually reduced to 0%. In this way, the EU limits the production and use of HIGH ILUC biofuels (currently only palm oil) to 0% by 2030. Biofuels used to meet the Union's targets set out in RED II and those benefiting from the scheme must meet sustainability and greenhouse gas emission reduction criteria. Harmonization of those criteria for biofuels and bioliquids is key to achieving the Union's energy policy objectives. The setting of limits at Union level should not prevent Member States from providing for lower limits for the quantities of biofuels and other bioliquids produced from cereals and other starch-, sugar- and oilseed-rich crops calculated without restriction at national level in accordance with the objectives of RED II.

Unlimited opportunities for the use of such biofuels and other bioliquids. The promotion of feedstocks that have a low impact on indirect land use change when used for biofuels is necessary because of their contribution to the decarbonisation of the economy.

LEGISLATION IN THE REPUBLIC OF CROATIA

The flexibility of Member States, including the Republic of Croatia, in achieving the targets based on the Directive RED II depends on whether the State distinguishes between different fuel suppliers and energy carriers when determining the way to achieve the required targets. The State is free to choose the most appropriate way to promote renewable energy sources for transport and to distinguish between different types of conventional biofuels and to set different limit values for each generation of biofuels. Indeed, the State may set lower limits for first generation biofuels or higher limits for second generation biofuels produced from lignocellulosic biomass or waste. As Member States have to transpose the provisions of the Directive RED II into national law, some national legislative acts and national plans have to be adopted.

The Act on Biofuels for Transport (Official Gazette, 65/09) aims to achieve sustainable development in transport by reducing the negative impact on the environment, improving the security of fuel supply in an environmentally friendly way and meeting consumer demand for fuel. The Republic of Croatia, as a member of the Union, should fulfill its international obligation in the form of reducing greenhouse gas emissions by promoting the use of biofuels in transport as a substitute for diesel or motor gasoline (Stupin, 2015). The use of biofuels and advanced biofuels and electricity from renewable energy sources in transport realizes the interests of the Republic of Croatia in the field of energy, which are determined by the Energy Development Strategy of the Republic of Croatia (Official Gazette, 130/09). Laws and various regulations govern the implementation of energy activities, especially with the intention of achieving the national target for energy use from renewable energy sources in all modes of transport in 2020, which is 10% of total energy consumption for transport within the Republic of Croatia.

World demand for agricultural products is growing, and part of this increase in demand is likely to be met by increasing the amount of land in agricultural use. Reconstruction of land that is severely degraded and therefore cannot be used for agricultural purposes is one way to increase agricultural land. The sustainability program should encourage the use of such restored land.

The promotion of biofuels and fuels derived from biomass will contribute to the growth of demand for agricultural products in the Republic of Croatia.

Biofuels may be placed on the market as pure biofuels or as biofuels blended with diesel or petrol only if they meet the prescribed technical requirements for fuel quality established under the conformity assessment procedure. They must also be labeled in accordance with the fuel quality requirements. To ensure that the target is met, an obligation has been introduced for distributors who place diesel or motor gasoline on the market for powering motor vehicles to market biofuels in a certain percentage. Obligated parties that adjust biofuels to the needs of the Republic of Croatia are obliged to report to the relevant ministries on the placing of biofuels on the market. Suppose in the previous calendar year A distributor of biofuels did not place the prescribed amount of biofuels on the market. In that case, it is obliged to pay a special environmental levy for not placing biofuels on the market according to the polluter pays principle.

Each Member State shall adopt a National Renewable Energy Action Plan setting national targets for the share of energy from renewable sources for 2020, taking into account cooperation between local, regional and federal authorities, planned statistical transfers or joint projects, national strategies for the development of existing biomass sources for different uses and compliance measures. Member States should draw up national renewable energy action plans containing information on sectoral targets, taking into account that biomass is used in different ways. It is therefore important to mobilize new biomass sources.

National Renewable Energy Action Plan for the promotion of biofuel production and use in the Republic of Croatia was prepared in accordance with the Act on Biofuels for Transport (Official Gazette 65/09). The National Renewable Energy Action Plan is a document adopted for ten years (for the period from 2011 to 2020). It is in accordance with Directive 2009/28/ EC and the Energy Development Strategy, Sustainable Development Strategy, Agriculture Strategy and National Forestry Strategy and policy, which establishes a policy to promote the increase of production and use of biofuels in transport in the Republic of Croatia.

The labeling of a blend of biofuels with fossil fuels is obligatory in the Republic of Croatia as it is at the level European Union. Namely, blends of ethanol and gasoline are marked with the E sign and number, i.e. "E" numbers describing the percentage of ethanol fuel in the blend by volume. For example, E85 is a blend of 85% anhydrous ethanol and 15% gasoline. The most common designations are E5, E10, E85 and E95. The standards used in European Union are EN 15736 and EN 228, which prescribe ethanol characteristics and blend quality. Ethanol is not the only fuel that can be blended with fossil fuels. Biodiesel can be blended or mixed with fossil diesel in a smaller amount of 1.5-5% or in a larger amount of 5-30%. Such blends have a B symbol and number. The B stands for biodiesel and the number is a percentage. There are B5, B7, B20 and B100 on the market. The European standard for biodiesel is EN 14214 This standard specifies the requirements and test methods for fatty acid methyl ester (FAME) for diesel engines. Diesel fuel B7 is provided with up to 7% FAME (Đurišić-Mladenović i sur., 2016). The European standard EN 590 defines test methods and properties of diesel fuel.

CONCLUSION

Increased use of energy from renewable sources plays a key role in promoting energy security, sustainable energy at affordable prices and technological development. It also offers environmental, social and health benefits, as well as significant employment opportunities, particularly in rural and remote areas. It opens up the possibility of regional development in areas of low population or in areas of partial deindustrialisation. The European Union believes that renewable energy sources should partially replace fossil fuels, so it aims to expand and promote the use of biofuels and improve their production. By setting national targets, the Republic of Croatia will determine the contribution of the renewable energy sector, including biofuels. The recommendations of the European Union are certainly the transition to the second generation of biofuels with low greenhouse gas emissions.

REFERENCES

[1] Directive 2003/30/EC of the European Parliament and od the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport

[2] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources

[3] Directive (EU) 2015/1513 of the European Parliament and of the Council of 9 September 2015 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels

[4] Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels

[5] Directive (EU) 2018/2001 (RED II) of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources

[6] Đurišić-Mladenovć, N. L., Predojević, Z. J., Škrbić, B. D. (2016) Konvencionalna i napredna tečna biogoriva, Hem.Ind 70 (3). 225-241

[7] Jegathese, S. J. P., Farid, M. (2014): Microalgae as Renewable Source of Energy: A Niche Opportunity, Journal of Renewable Energy, Volume 2014, Article ID 430203

[8] Jones, R., Rätzsch, T., Buchsbaum, A. (2007): Biogoriva u Europskoj uniji, Goriva i Maziva, 46 (4). 281-306

[9] Knothe, G. (2010): Biodiesel and renewable diesel: A comparison, Prog. Energ. Combust. 36. 364–373.

[10] Kolundžić, S. (2015): Dekarbonizacija energije mijenja paradigme u energetici, Kiklos. Krug knjige d.o.o, Zagreb

[11] Krička, T., Voća, N., Jukić, Ž., Janušić, V., Matin, A. (2006): Iskustva u proizvodnji i iskorištavanju obnovljivih izvora energije u Europskoj uniji, Krmiva 48 (1). 49-54

[12] Kurevija, T. (2007): Negativni ekološki učinci globalne proizvodnje biodizelskog goriva, Goriva i maziva, 46 (2). 103-127

[13] Lari, Z., Ahmadzadeh, H., Hosseini, M. (2019): Cell Wall Disrupotion: A Critical Upstream Process for Biodfuel Production, Advances in Feedstoc Conversion Technologies for Alternative Fuels and Bioproducts, New Technologies, Challenges and Opportunities, Wooshead Publishing Series in Energy, Pages 21 -35

[14] Ministry of Economy (2013): National Renewable Energy Action Plan, 2011-2020

[15] Mirabela, W. (2011): Uloga bioetera u ostvarivanju nacionalnih ciljeva vezanih za biogoriva, Goriva i maziva, 50 (3). 233-242

[16] Mujčinović, M. i Vukošić, F (2017): Uspostava infrastrukture za alternativna goriva i potreba uvođenja alternativnih goriva radi smanjenja utjecaja prometa na okoliš, Stručni rad, 95-115.

[17] Naik, S. N., Goud, V., Rout, P., Dalai, A.K. (2010): Production first and seconds generation biofuels: A comprehensive review, Renew, Sust. Energ. Rev. 14, 578-597

[18] Official Gazzete (2009): Act on Biofuels for Transport, 65/09, Republic of Croatia

[19] Official Gazzete (2009): Energy development strategy 130/09, Republic of Croatia

[20] Rezić, T., Filipović, J., Šantek, B. (2014): Mikroalge-potencijalni izvor lipida za proizvodnju biodizela, Hrvatski časopis za prehrambenu tehnologiju, biotehnologiju I nutricionizam 9 (1-2). 26-36

[21] Russo, D., Dassisti, M., Lawlor, V., Olabi, A.G. (2012): State of art of biofuels from Pure Plant Oil, Renew. Sust. Energy Review 16, 4056-4070

[22] Stupin, K. (2015): Stanje i perspektive energetskog zakonodavstva Republike Hrvatske, Zbornik radova Pravnog fakulteta u Splitu, god.52, 3/2015.,str 623-639

[23] Tomić, F., Krička, T., Matić, S. (2008): Raspoložive poljoprivredne površine i mogućnosti šuma za proizvodnju biogoriva u Hrvatskoj, Šumarski list br. 7-8, 323-330