

# Bioenergy and Biofuels

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Technology is setting strategic directions for change in the economy and industry. Among the global forces that we are currently observing and that will have the greatest impact on the shape of the world economy in the coming years are Industry 4.0, the circular economy model, sustainable finance, the talent market, the “silver economy” and electromobility. These affect and will affect for many years the course of many processes such as production, consumption, investments and environmental protection activities. The health of the fuel and energy sector affects economic development around the world. New technologies in the energy sector and the management of its development together with the dynamically changing environment, as well as care for sustainable development and energy security, make the power industry and the automotive industry the most important sectors of the economy, and their dynamic development has been observed for many years. Both conventional energy and motorization are the largest source of gas emissions into the atmosphere. The financial burden for exceeding permitted emissions, as well as public awareness, forces this to change.

The objective adopted by the European Union to reduce greenhouse gas emissions by 55% by 2030 and achieve full climate neutrality by 2050 means that the market for alternative energy sources must be developed dynamically. The regular increase in the share of renewables in the global energy mix for many years indicates that many public and private institutions are making efforts to decarbonize the economy. As a result of intensified energy transition efforts and the introduction of the so-called European Green Deal, entirely new ecosystems and new technologies are emerging. Various alternatives are being explored to reconcile economic growth with care for the environment. Product Life Cycle Assessment and the Closed Circuit Economy are helping to unleash innovation and technological progress. Ambitious climate neutrality goals cannot be achieved without alternative, low or zero carbon, energy and fuel technologies. The intensity of changes taking place in the fuel and energy sector, both at the regulatory and technological level, forces the research community and scientists to carry out new, increasingly interesting research. The pressures of energy transition present many challenges but also opportunities for both economic, technological and scientific development.

It should be stressed that an important factor mobilising the search for new technologies, especially in the energy and transport sectors, is the progressive climate change closely linked to greenhouse gas emissions.

The changes taking place are contributing to a dynamic transformation not only of activities based on conventional fuels, but also to the development of renewable energy sources. Many of the current moves towards decarbonization and climate neutrality present science and business with previously unknown and unique challenges, opportunities for transformation and growth. Decarbonisation means facing up to big changes. The way we obtain, use, consume and generally think about energy and raw materials needs to be revised. The current level of technological development and, above all, significant



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decreases in the costs of introducing the latest solutions facilitate the adoption of effective decarbonisation strategies. Given the scale of the challenge to achieve full climate neutrality, there is a need for commitment from the legislative side, from the scientific side, from business and from public institutions implementing the solutions developed using all current and future technologies and resources.

The Special Issue “Bioenergy and Biofuels” of the journal Sustainability was dedicated to the publication of works on obtaining energy from biological sources. Obviously, bio-based biomass contains mainly carbon and hydrogen and can be converted into various types of fuel or burned directly to provide heat. From the composition of biomass, it can be easily deduced that its combustion mainly causes the emission of carbon dioxide and water. Carbon dioxide from biomass is assumed to have been absorbed from the atmosphere during plant growth and will be reabsorbed. Therefore, it is not a source of climate warming, and it only temporarily increases the concentration of carbon dioxide in the atmosphere. This situation is the main reason for the use of plant biomass for energy purposes. Due to the variety of applications, there are many technologies for obtaining energy from biomass. New technologies for obtaining as well as technologies for converting bio-based fuels into various forms of energy may also emerge. The use of renewable energy sources is governed by a number of legal provisions on various aspects of the conversion of biomass into fuels, the use of waste biomass, etc. All these aspects are reflected in five published articles.

The first paper presents an analysis of the implementation of the Paris Agreement and recommendations for the reduction of greenhouse gas emissions in the EU in relation to the so-called countries of the Visegrad Group (V4), i.e., Poland, the Czech Republic, Hungary and Slovakia. It analyses the structures of energy production, its consumption over the years, and analyses the measures taken to improve energy efficiency.

The next article discusses the potential of wood fuel in the Swiss economy. It was stressed that developing an energy transition and decarbonisation strategy requires consideration of the different types of wooden biomass. The forecast of changes in the theoretical and sustainable potential of wood fuel from various wood resources was presented indicating perspectives of growth of sustainable potential of wood based fuels in the not distant future. However, the development of a circular economy and organization of the wood industry may play an important role as a condition assuring this growth.

The next work is devoted to the study of the behaviour of biodiesel produced from palm oil and its blends with petroleum diesel when burned in a test engine. It has been shown that biodiesel has a higher cetane number than classic fossil fuel and is well suited for engine propulsion, both in a pure state and in blends.

The research on the influence of the character of raw wooden material as well as the conditions of the agglomeration process of wood briquettes on their quality and mechanical properties will be the subject of another publication. Here, a significant influence of all the specified factors has been demonstrated and the optimal technological parameters have been selected to obtain high quality briquettes.

The last article in this issue is a literature review on the use of microalgae farming as a source of biomass for energy purposes. Despite the high potential of microalgae as a raw material for the production of biofuels, a number of problems in breeding and sourcing make it difficult to commercialize. The paper presents a number of solutions concerning both biological aspects and the technology of obtaining oily substances and their further processing. It should be mentioned that production of biofuels from organisms living in water is important from the viewpoint of competition between industrial and food products observed in land-based agriculture.

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### List of Contribution

1. Tucki, K.; Krzywonos, M.; Orynycz, O.; Kupczyk, A.; Bączyk, A.; Wielewska, I. Analysis of the Possibility of Fulfilling the Paris Agreement by the Visegrad Group Countries.
2. Erni, M.; Burg, V.; Bont, L.; Thees, O.; Ferretti, M.; Stadelmann, G.; Schweier, J. Current (2020) and Long-Term (2035 and 2050) Sustainable Potentials of Wood Fuel in Switzerland.
3. Nguyen, V.H.; Duong, M.Q.; Nguyen, K.T.; Pham, T.V.; Pham, P.X. An Extensive Analysis of Biodiesel Blend Combustion Characteristics under a Wide-Range of Thermal Conditions of a Cooperative Fuel Research Engine.
4. Nurek, T.; Gendek, A.; Roman, K.; Dąbrowska, M. The Impact of Fractional Composition on the Mechanical Properties of Agglomerated Logging Residues.
5. Shokravi, Z.; Shokravi, H.; Chyuan, O.H.; Lau, W.J.; Koloor, S.S.R.; Petru, M.; Ismail, A.F. Improving 'Lipid Productivity' in Microalgae by Bilateral Enhancement of Biomass and Lipid Contents: A Review.