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Editorial

Renewable and Sustainable Energy: Current State and Prospects

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1. Introduction

The last two decades of the twentieth century represented a period of above-average, systematic growth of formal and informal interdependencies between economies of different countries and between world markets. The intensity, magnitude, and diversity of these interdependencies have never been recorded before in economic history, and the market transformations taking place have been referred to in the literature as the process of world globalization. Over the next twenty years of the 21st century, the dynamic and systematic development of globalization processes has progressed to such an extent that, in fact, a very high level of interdependence has been achieved in every sector of the economy [1]. This means that national economies for the last forty years have faced functioning in new economic conditions, forced mainly by the developing globalization processes. This has mainly contributed to a significant increase in the socio-economic development [2,3] and the associated enrichment of the populations of most economies and worldwide changes in the labor market [4]. In addition, there have been new trends in consumer attitudes [5,6], where environmental issues have begun to play a dominant role in consumer decision-making.

It should be emphasized that the progressing globalization processes have contributed to a significant increase in the level of foreign direct investment, especially in less developed countries, and thus to an increase in investment expenditures in enterprises. In addition, over the last 20 years, there has been a hitherto unseen increase in the level of innovation and the number of innovations implemented [7,8]. All this, combined with the high competitiveness of economies, has created the possibility of introducing modern technologies, including the use of energy from renewable energy sources (RES) [9]. The appearance of further innovations in the production of renewable energy, a significant reduction in the cost of production facilities and a change in consumer attitudes combined with a significant increase in the level of household wealth have resulted in the fact that every consumer in the world has the opportunity to produce renewable energy. It can be concluded that a new branch of the world economy, the RES has emerged in the 21st century and is one of the fastest-growing sectors in world economies. On the other hand, the global change of consumer attitudes gave the opportunity to implement the idea of sustainable development, both in its economic, environmental, social, and institutional aspects [10,11]. It should be emphasized that in the European countries that are members of the European Union, the process of implementation of sustainable development goals is fully institutionalized, and the member countries are obliged to adapt their institutions and legislation to the adopted Community-wide sustainable development strategies [12].

However, within the dynamically developing processes of globalization and civilization changes caused by them, including above-average economic growth, a key problem turned out to be the systematic increase of energy demand. The developed global supply chains proved to be insufficient, as they led to overexploitation of non-renewable energy sources and to the destruction of the natural environment. This means that there was a

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Citation: Igliński, B.; Pietrzak, M.B. Renewable and Sustainable Energy: Current State and Prospects. *Energies* **2022**, *15*, 4735. https://doi.org/10.3390/en15134735

Received: 9 June 2022
Accepted: 27 June 2022
Published: 28 June 2022

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need for an intensive energy transition at the global level [13–15], which would be based on the development of new, alternative ways of energy production and consumption and on the gradual replacement of non-renewable energy sources with renewable or low-carbon sources [16,17]. It should be emphasized that the transformation, by taking into account the idea of sustainable development, leads to further fundamental changes in almost all sectors of the economy, as well as the way of life of the societies of most countries.

2. A Short Review of the Contributions in This Issue

There is a need to discuss the issue of energy transformation and the related problem of Renewable and Sustainable Energy Production. The answer is to prepare a special issue entitled "Renewable and Sustainable Energy: Current State and Prospects", which contains 14 published articles. The articles successively deal with the content related to the issue of sustainable development and the problem of achieving the goals of sustainable development. Subsequent articles then address issues related to RES mix production, different approaches to renewable energy production (from national-level production approaches to local level production, to a city level, and even to individual household level), and issues related to energy investment and renewable energy consumption, where attention has been focused on both businesses and households.

Cheba and Bąk in the article [18] undertook to present the relationship between the ecological efficiency of production and the 7th Agenda for Sustainable Development 2030. Both these areas indicate the relationship between the economy and the natural environment, emphasizing changes in the field of energy use. The multi-criteria taxonomy and selected taxonomic methods were used to investigate the relationship between these two areas. Despite the ongoing attempts to equalize the levels of development between individual EU countries in many strategic areas, they remain very diverse. Can it be assumed that the next steps taken by the European Commission will eliminate these differences? According to the authors, it is not entirely possible. In subsequent studies, the authors also plan to expand the scope of research, the methods used to study the relationship between these areas, and qualitative and quantitative techniques using, for example, cognitive mapping.

Kludacz-Alessandri and Cygańska in the work [19] pointed out that nowadays the company's reputation depends on corporate social responsibility (CSR). CSR has a positive effect on the company's financial performance (FP). The authors examined whether the financial results influence the adoption of corporate social responsibility in companies in the energy sector. It turned out that the measure of profit before interest, the measure of return on assets (ROA), and taxation (EBIT) were much higher among companies implementing a CSR strategy. Enterprise Value to Earnings Before Interest, Depreciation, EBITDA, and taxes was lower among companies that adopted CSR.

In developing countries, decentralized renewable energy systems such as mini-solar grids (MG) play and will play an important role. Stritzke and Jain [20] believe that RES in developing countries is facing major technical, financial, and social challenges in terms of sustainable development. The research conducted by the authors aimed to understand the sustainable development of RE MG in a developing context based on an integrated assessment of the technical, financial, and social dimensions of the exploitation of the ME through empirical data from community surveys on energy consumption from Uganda and Zambia and two other in-depth case studies MG from Zambia. The authors concluded that the complex ecosystem of the rural community is the most important determinant of the sustainable development of the ME. There should be an appropriate match between the tariffs of the ME and the affordable price for consumers.

On the other hand, Piekut [21] presented an analysis of sustainable development and fuel and energy transformation in the household sector in 2004–2019 in the EU. The subject of the research was various sources of RES used by households, i.e., primary solid biofuels, charcoal, solar systems, geothermal technologies, biogas, biodiesel, bioethanol, and heat

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pumps. In the analyzed period of 2004–2019, there was an absolute and relative increase in the use of RES in the household sector.

It should be emphasized that for most countries the problem of the production of the RES becomes a priority in the policy concerning the development of the economy. RE plays a key role, especially in EU policy, which assumes that in 2050 the share of the RE is to increase to 50%, and 80% of electricity is to be generated from low-emission sources. The authors of the article [22] analyzed the changes in the use of RES for electricity production from 2005 to 2019 in the EU countries. The k-mean and the Gini coefficient were used in the study. The research confirmed that the EU countries, in line with the assumptions of the energy policy, increased both the share of RES in energy production, especially electricity, and increased the use of RES. Individual EU countries differed in terms of the use of the RES for the production of electricity. This means that the energy transformation in each of the EU countries proceeds in a different way. EU countries with similar problems should undertake joint actions with regard to the Community's internal policy, technological development, and energy production. Programs promoting the purchase and use of RES installations should be launched/continued. Moreover, cooperation between individual countries in the field of RES should be increased, such as joint research, joint projects, or joint support systems.

As already mentioned, the EU aims to create sustainable, low-carbon economies based on the RES. This also applies to the new EU member states. In order to be successful, the new EU member states must carry out quick and effective changes in the energy sector. Wałachowska and Ignasiak-Szulc in the work [23] presented in the article evaluation of new EU member states in terms of diversification of renewable energy countries. Ward's method was used for the analysis. The obtained results can be used in countries of comparable specificity to undertake activities of a similar nature with regard to internal energy production, technological development, or a common energy policy.

Poland as an EU member state should decarbonize the economy and become "climate neutral" by 2050. In the case of Poland, it is very difficult, as currently, about 80% of energy comes from hard coal and lignite. The country's energy transformation is openly opposed by miners or some energy engineers. Several programs supporting the development of the RES have been introduced in Poland. One of the most important ones is "My Electricity", which, depending on the edition and investment, is subsidized from 3000 to 20,500 PLN. In the article [24] authors believe that the development of prosumer photovoltaics in Poland is important, but it will not replace coal-fired power plants. More research is needed on the ecological energy mix of Poland. The most important goal of the research was to make a proper review of the energy sector, with particular emphasis on technologies that can be used as ecological systems of distributed energy production, and to outline scenarios for the development of the sector. The authors used the Delphi method supported by the Computer Assisted-Web Interview (CAWI) technique, Desk research, and the Weighted SWOT analysis. The obtained results showed that despite some disadvantages, it is the photovoltaic systems that will be the fastest-growing energy sector in Poland. Additionally, technologies will be developed on the basis of dispersed systems of biomass and biogas use.

In recent years, a transformation of energy towards RES has been observed in many countries. Huterski et al. [25] undertook to assess the level of development of electricity production from RES using one of the methods of multivariate comparative analysis (WAP)—a taxonomic measure of Hellwig's development. A total of 28 countries were surveyed, including Great Britain and 27 countries of the present EU. Panel models were used to describe the relationship between the share of RES electricity production in total electricity production and GDP per capita, electricity production from water, wind, solar, and biogas per person, and countries' public energy expenditure as a percentage of GDP. It was found that rich countries are much easier to invest in the RES than in countries that have recently joined the EU.

Rapid economic development implies increased production and consumption of energy. As a result, conventional sources are no longer sufficient, and their extraction and

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combustion cause a large burden on the environment and climate. In connection with the above, many countries have decided to transform their energy towards a low- and zero-emission economy. In the EU, the development of a "green economy" has become a strategic goal in the fight against climate change. The systematic development of the RES leads to the improvement of the energy security of a given country and the entire EU.

Another very important problem is the issue of socio-economic development, innovativeness and RES at the regional level [26–29]. In the paper [30] authors took up the problem of carrying out energy transformation in the example of Pomerania Voivodeship (Poland). In this regard, the current status, potential, and development prospects of the RES in the Pomerania region are presented. Additionally, a PEST analysis was performed for the renewable energy sector. The calculated RES potential indicates that Pomerania could become energy self-sufficient on the basis of RES. It was concluded that not only this Voivodeship but also the whole of Poland is characterized by a high potential of the RES [14].

In the next article [31] authors also developed the subject of RES in Poland for the Greater Poland Voivodeship. It is important because the EU Member States are obliged to implement the adopted Community Energy Strategy, which was defined under the European Green Deal. Energy transformation is to be based largely on the diversification of energy sources used, with a predominance of the RES. The authors asked themselves whether, based on the available technologies of the RES mix, it is possible to decarbonize Greater Poland Voivodeship. The research consists in determining the energy potential of RES in Greater Poland Voivodeship based on the methods of the geographic information system (GIS). The GIS methods were chosen because they allow for spatial positioning of surface, linear, and RES potential structures, thus ensuring high accuracy of the obtained estimates. The authors concluded that the technical potential of the RES in the Greater Poland Voivodeship is higher than the current consumption of electricity and heat. It should be added that the Greater Poland Voivodeship is one of the regions dependent on coal in Poland, which has already prepared a structured plan for a just transformation towards clean energy technologies.

The paper [32] deals with the problem of using renewable energy at the city level. Sidełko dealt with an innovative approach to municipal waste management in the example of the commune of Koszalin (Poland). The author proposed the Waste Processing Energy Recovery model which is a universal solution for provinces and cities. The waste balance includes waste from the selective collection, mixed municipal and commercial waste as well as sewage sludge from the municipal sewage treatment plant. The developed model is based on the functioning of four facilities. Every day, this system produces 5519 m^3 of gas and high-energy waste fuel for combustion in the amount of 82.2 tons. The proposed energy recovery from waste is 754 kWh/inhabitant/year.

The overall energy mix is made up of many sources of renewable energy. Therefore, it is also important to consider the individual selected energy sources in detail. Every year the share of wind energy (EC) in the energy mix of many countries increases. It is clean energy and more and more competitive in terms of prices for energy from burning fossil fuels. Matching the appropriate statistical distribution to the wind speed (WS) data is crucial in analyzing and estimating the EC potential. In the paper [33] the efficient global optimization (EGO) technique to fit the statistical distribution to WS data were proposed, and the technique performance was compared to the genetic algorithm (GA), simulated annealing (SA), and differential evolution (DE). On the basis of Weibull parameters, the authors obtained the potential of the EC and the potential annual revenues for Gdańsk (Pomerania Voivodeship, Poland). The conducted research has shown that urban wind turbines can be installed in the city with virtually no restrictions. Installed on the roofs of shopping malls, office buildings, or houses, they would partially cover the electricity needs of these buildings.

In Poland, a new form of settlement of investments in improving energy efficiency is the formula of involving an energy service company (ESCO). Kurowska-Pysz and Ku-

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nikowski in the paper [34] showed that many entities in Poland still lack sufficient knowledge on this subject. The problem discussed in the article concerned the conditions for applying the ESCO formula (investment financing model with the participation of a specialized company) to support enterprises and local government units in the development of energy and energy projects. Research questions were asked to analyze the following issues: sources of knowledge and reasons for interest in the ESCO formula, activities and other factors that may increase or decrease the interest in the ESCO formula, and attractiveness of alternative instruments for financing energy projects. The research problem was solved by means of the triangulation of research methods: empirical qualitative research (desk research analysis and one of the foresight methods (plate expert), individual in-depth interviews, CAWI questionnaire, and focus questionnaire). It was noticed that there is a lack of knowledge among enterprises and local government units about the ESCO formula. Hence the most important conclusion: education of enterprises and local government units in the field of energy efficiency. The authors recommend strengthening the energy market and supporting ESCO companies.

In the last article [35] authors considered the issue of management of electricity consumption in manufacturing companies. This is to allow enterprises to optimally control the costs of electricity in the current times of pandemic, political crises, and energy transformation toward the RES. A method of analysis and management of electricity consumption in enterprises based on simulation modeling was proposed. The model takes into account energy consumption, production order execution time, machine load, and employee overtime. The obtained results show that it is possible to determine the level of power available for the process execution and its impact on the production volume and execution time. In the event that the available capacity was reduced by half, the order fulfillment time increased by nearly 25% and an increase in energy consumption by nearly 15%.

3. Conclusions

Summarizing the content of the articles in the special edition "Renewable and Sustainable Energy: Current State and Prospects", it should be stated that the energy transformation processes will systematically develop and will result in further, dynamic development of the RES sector. The process of producing renewable energy is particularly important, because the RES mix allows for the satisfaction of energy needs in the region, and even nationwide. Further development of RES means an increase in the energy security of a given country, which will increasingly use its own RES. This is of great importance especially at the present time, where, in the face of the war in Ukraine, many countries have given up importing fossil fuels from Russia and are looking for energy solutions in integrated RES. Undoubtedly, the RES sector needs additional determinants of development. One such factor is initiatives in the form of the creation of startups focused on the production, storage and distribution of renewable energy [36–38]. Another issue is to subsidize already existing successful companies in the RES sector by going public and raising new funds from the capital market. Here, the most important thing is the right moment for a company to go public (IPO) [39–42], since on the right moment depends upon the success of the debut in the form of sale of the majority of shares and their good price.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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