

Sustainable Development Processes for Renewable Energy Technology

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1. Introduction

Currently, the production of energy from traditional fossil sources is beginning to give way to renewable energy technologies. New technological, economic, and environmental requirements raise the question of how to make renewable energy sources a driver of sustainable development for the coming decades. Solar and wind energy, the recycling of synthetic materials, and new methods for their utilization can not only significantly reduce the burden on the environment, but also give a new impetus to the development of modern industry and help find a new balance between the needs of people and the capabilities of nature.

To enhance the international dissemination of these ideas, it is necessary to unite the efforts of researchers in the fields of traditional and modern energy, waste-free production, and ecology in multidisciplinary discussions of urgent problems of transition to the use of renewable energy.

In order to gain new ideas and insights in these areas worldwide, this Special Issue, entitled “Sustainable Development Processes for Renewable Energy Technology”, has been prepared. This Special Issue mainly covers original research integrating the principles of sustainable development, the production and recycling of new materials, and the use of renewable energy.

In this Special Issue, 11 original articles were accepted and published, including 1 review and 10 scientific articles. These published research papers appropriately cover the intended breadth of understanding of the complex interdisciplinary issues that the field of Sustainable Development Processes for Renewable Energy Technology presents.

2. Papers Presented in the Special Issue

The review presented by Beer et al. [1] deals with the assessment of the energy mix of five Central European countries in the context of achieving their carbon-neutral or carbon-negative future. The evolution of the assessed energy mixes as well as GHG emissions is presented in a long-term perspective, which allows the assessment and comparison of trends and approaches towards carbon-free energy sectors with each other.

The first scientific article presented by Feckova Skrabuulakova et al. [2] examines the level of readiness of Visegrad Group countries for the widespread use of electric vehicles, introducing a new quantifier—the electromobility infrastructure coefficient of the countries, K—comprising a number of indices that store specific information on the state of readiness for electromobility. The results show, on the one hand, a good position of Slovakia within the Visegrad Group, on the other hand a significant deficit behind the EU leaders.



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Papurello et al. [3], they modelled a microgeneration power system consisting of a solar concentrator system coupled to a Stirling engine, with CFD tools, by way of using two methods for comparison: the empirical first-order Beale equation and the Schmidt isotherm method. The results showed the level of electrical power generated for given concentrator parameters and solar power input level.

Teplicka et al. [4], present aspects of performance management in mining companies and their importance for gaining competitiveness in the market of mining companies in the direction of sustainable development and economic growth through performance indicators of mining processes after the implementation of strategic innovation evaluated through Pareto analysis. The results show the improvement of mining processes through the application of innovative mining space and the reduction of environmental impacts of resource exploitation.

The findings of Zhou et al. [5] propose a simple approach to introduce oxygen vacancies into a commercially used anode material for lithium-ion LTO batteries. The presented results show that LTO containing free oxygen exhibits much better performance than the sample before H₂ treatment, especially at high current rates. The results also indicate an improved and fast electrochemical kinetic process.

Wittenberger et al. [6] proposes a process for creating electronic monitoring and graphical mapping of the current technical condition of gas wells in the East Slovakian Lowland using the graphical software tool ArcGIS, using a stepwise algorithm extending the application potential of the method also for oil, geothermal, and hydrogeological wells, while the defined technical patterns were incorporated into the design.

Hong et al. [7] discuss the preparation of a 3D high-level nitrogen-doped metal-free electrocatalyst for high-performance fuel cells and metal–air batteries. Results have been achieved that suggest an increase in electrocatalytic performance compared to the commercial Pt/C form and most metal-free carbon materials in alkaline media, which was achieved due to the high active nitrogen group content, large surface area, and 3D hierarchical porous network structure of the material.

Rybár et al. [8] presents a case study describing the process of creating and validating the benefits of two Innovative Learning Tools aimed at more effective knowledge acquisition in the interdisciplinary field of earth resource extraction with links to the status of renewable energy. The opinions and attitudes of both students and educators towards the tools were surveyed, and some research questions related to this form of knowledge acquisition were validated. The presented results a potential of the educational form as well as the attractive content that goes beyond conventional educational subjects, with its connections.

Seňova et al. [9] propose the use of geothermal resource in the conditions of central Europe, for the purpose of heat supply to the population, while calculating the energy balance, they consider three scenarios, depending on the temperature level of the output medium. The results show the economic and environmental justification for the use of low- to medium-temperature sources in the given conditions and in the current energy-environmental and economic framework.

Szurgacz et al. [10] present the design of a driven section of support (hydraulic reinforcement) used in a system for deep reservoir mining. The research itself was focused on the analysis of the bearing capacity of selected elements of the proposed driven support section with the application of software using the finite element method. The results led to the design of a model with a strength value that meets safety standards.

Rybárová et al. [11] investigated the possibilities of the fragmentation of cultural, especially agricultural landscapes, which are characterized by a high proportion of large land units used for growing cereals and crops subsequently used as energy sources. A fragmentation method based on the reconstruction of dividing lines, mainly formed by dirt roads, based on historical mapping was proposed. The results show and quantify to what extent it is possible to achieve denser landscape fragmentation in this way, to create dividing green belts, to increase the resilience of the environment to water and wind erosion, and so on.

3. Conclusions

We anticipate that the development of the field of renewable resource technologies and the overall use of raw material and energy resources, and, in a broader sense, the Earth's resources in general, in accordance with the principles of sustainability will become increasingly significant and fundamental to the overall picture of the future of human society, also in view of the fact that the current global climate, environmental, energy and raw material problems of mankind are becoming more and more pressing and fundamental. One important prerequisite for the success of such endeavors is the breaking down of the boundaries of the individual disciplines or fields involved and the need for an interdisciplinary, holistic approach to the overall process. It is hoped that this Special Issue creates a suitable platform for an appropriately broad forum.

Finally, we would like to thank our authors, reviewers and editors who have contributed significantly to the success of our Special Issue. We also hope that the individual published papers will be of benefit to readers in their future scholarly work.

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