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Editorial

Special Issue on Cutting-Edge Technologies for Renewable Energy Production and Storage

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1. Introduction

Anthropogenic greenhouse gas emissions are dramatically influencing the environment, and research is strongly committed in proposing alternatives, mainly based on renewable energy sources [1]. Low-greenhouse gas (GHG) electricity production from renewables is well established, but issues of grid balancing are limiting its development. Energy storage is a key topic for the further deployment of renewable energy production [2]. Besides battery and other types of electrical storage, electrofuels and bioderived fuels may offer suitable alternatives in some specific scenarios [3,4]. This Special Issue welcomed contributions on energy conversion technologies and use, energy storage, technologies integration, e-fuels, and pilot and large-scale applications.

2. Technologies for Production and Storage: Enabling Larger Renewable Energy Uptake

In light of the above, this Special Issue collected the latest research papers on relevant topics about energy production and use. As the predictability of the output from a power production plant is a key element for a stable, reliable energy infrastructure [5], the Special Issue welcomed the paper "Improved Probability Prediction Method Research for Photovoltaic Power Output" by Ze Cheng, Qi Liu, and Wen Zhang. In this interesting piece of work, the authors presented probabilistic prediction methods. The results showed that existing models can be improved to increase the predictability in photovoltaic plants power output.

Interestingly, most of the received papers touched, directly or indirectly, the use of alternative sources of energy for the transport sector. According to a recent International Energy Agency report [6], emissions from transport are continuing to rise, and several modes of transport appear complex to decarbonize. This topic is challenging, and many papers in this Special Issue present interesting analysis and technical solutions.

In "Is Deployment of Charging Station the Barrier to Electric Vehicle Fleet Development in EU Urban Areas? An Analytical Assessment Model for Large-Scale Municipality-Level EV Charging Infrastructures" by Giacomo Talluri, Francesco Grasso, and David Chiaramonti, the authors investigated the minimum charging infrastructure size and cost for two typical EU urban areas (Florence and Brussels). The analysis shows how policy can steer the deployment of infrastructures, especially with respect to the distribution of fast vs. slow/medium charging stations (CS). Interestingly, the authors pointed out that the critical barrier for CS development in the two urban areas is likely to become the time needed to install CS in the urban context, rather than the related additional electric power and costs.

Again on the possibility to use electricity to decarbonize transport modes, the Special Issue contains an interesting paper titled: "PTG-HEFA Hybrid Refinery as Example of a SynBioPTx Concept—Results of a Feasibility Analysis" by Franziska Müller-Langer, Katja Oehmichen, Sebastian Dietrich, Konstantin M. Zech, Matthias Reichmuth, and Werner Weindorf. The work analyses the

aviation sector, considering that limited alternative fuels for a CO_2-neutral aviation sector have already been accepted by ASTM-certificarion process [7]. Among others, synthetic paraffinic kerosene from hydrotreated esters and fatty acids (HEFA–SPK) is a sustainable aviation fuel. This fuel can be produced via power-to-gas pathways, and alternative scenarios on feedstocks, electricity supply, necessary hydrogen supply, and different main products are analyzed. As a result, the attainment of at least 50% GHG mitigation might be possible: this highly depends on the renewability grade of the hydrogen provision as well as on the used feedstock. The scenario in which hydrogen is produced by steam reforming of internally produced naphtha proves to be the best combination of highly reduced GHG emissions and low HEFA–SPK production costs.

Energy storage can also be based on chemical molecules. Ethanol production from cellulosic material is considered one of the most promising options for future biofuel production contributing to both energy diversification and decarbonization of the transport sector [8], especially where electricity is not a viable option (e.g., aviation). In the paper "What is Still Limiting the Deployment of Cellulosic Ethanol? Analysis of the Current Status of the Sector" by Monica Padella, Adrian O'Connell, and Matteo Prussi, a comprehensive overview of the status of cellulosic ethanol production in the EU and outside the EU is presented. This was made by reviewing the available literature and highlighting technical and non-technical barriers that still limit cellulosic ethanol production at a commercial scale. The review shows that the cellulosic ethanol sector appears to be still stagnating, characterized by technical difficulties as well as high production costs. Competitiveness issues against standard starch-based ethanol are evident, considering many commercial-scale cellulosic ethanol plants appear to be currently in idle or on-hold states.

Beside road and aviation, maritime transport is a mode of transport that is seeking low-GHG alternatives [9]. In the paper "Analysis of Internal Gas Leaks in an MCFC System Package for an LNG-Fueled Ship" by Gilltae Roh, Youngseung Na, Jun-Young Park, and Hansung Kim, a 300 kW molten carbonate fuel cell (MCFC) for maritime application system was studied. The paper presented the challenge to ensure safety in case of a gas leak by applying computational fluid dynamics (CFD) techniques.

On the same subject, the paper "Analysis of a Supercapacitor/Battery Hybrid Power System for a Bulk Carrier" by Kyunghwa Kim, Juwan An, Kido Park, Gilltae Roh, and Kangwoo Chun, presented a hybrid power system combining conventional diesel generators with two different energy storage systems (ESSs) (lithium-ion batteries (LIB) and supercapacitors (SC)) focused on port operations of ships. The results show that the proposed system can reduce emissions (CO_2, SOx, and NOx) substantially and has a short payback period, particularly for ships that have a long cargo handling time or visit many ports with a short-term sailing time.

3. Perspectives on the Future of Research and Developments

All the interesting received contributions allowed covering a wide range of applications of alternative energy, expanding the original borders and definitions of the Special Issue. Although the Special Issue is now closed, more in-depth research in renewable energy technologies is expected. The papers received and the interaction with the author have encouraged us to propose a new Special Issue titled: "Frontier Trends of Renewable Energy Production and Storage Technologies".

This new Special Issue is looking for contributions on these topics, and MDPI and the editors of the journal *Applied Sciences* are delighted to have the privilege of publishing this Special Issue.

We would like to thank all the authors who contributed to the success of the Special Issue "Cutting-Edge Technologies for Renewable Energy Production and Storage" and we look forward to new interesting papers.

Acknowledgments: This issue would have not been possible without the contributions of various talented authors, hardworking and professional reviewers, and the dedicated editorial team of *Applied Sciences*. As the Editor, I would like to congratulate all authors. Finally, I would like to take this opportunity to record my sincere

gratefulness to all reviewers and place on record the gratitude towards the editorial team of *Applied Sciences*, with special thanks to Damaris Zhao from MDPI Branch Office.

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