



Editorial

Guest Editorial for the Special Issue on “Photosynthesis and Hydrogen Energy Research for Sustainability”



Today, environmental protection has become a critical area, challenged by irreparable environmental issues, as its preservation is often sidelined by economic development pursuits. The unchecked combustion of fossil fuels – residues of microorganisms over centuries – releases vast amounts of greenhouse gases into the atmosphere. This continuous release disrupts the environment's natural biological rhythms, causing significant harm to organisms in aquatic and terrestrial habitats. These human-induced actions not only damage the ecosystem but also impact human health, exacerbating chronic and malignant diseases.

The viable solution to these pressing issues lies in adopting environmentally friendly, renewable energy sources, including hydrogen. In recent years, significant advancements have been made in technology to position the hydrogen economy at the forefront of technological innovation. Following the Paris Agreement in 2015, which saw participation from 194 countries, there has been a noticeable shift towards hydrogen energy production in several developed nations. Yet, currently, 95% of the world's hydrogen is derived from fossil fuels, through processes that contribute to environmental pollution. In response, many companies are now focused on developing cleaner hydrogen production methods, such as blue hydrogen (which involves the separation of methane from CO₂ emissions) and green hydrogen (produced through the electrolysis of water using renewable energy sources). The United States, Japan, Canada, Russia and Turkey are leading the charge towards establishing a robust hydrogen economy, aimed at securing a sustainable future for coming generations.

Global hydrogen energy production is projected to reach 500 million tons by 2070, anticipating a shift towards renewable energy carriers over traditional fuels in the automotive industry. However, challenges such as the high cost of green and blue hydrogen and limited production activity remain. Despite these obstacles, research and development in renewable hydrogen energy continue, albeit sporadically across different countries. Many governments tend to prioritize short-term projects over long-term research endeavors.

These topics were extensively discussed at the 11th International Conference on Photosynthesis and Hydrogen Energy Research for Sustainability, held July 3–9, 2023 at Bahçeşehir University in Istanbul, Turkey.

The conference facilitated a debate on optimizing hydrogen energy use and advancing its technological processes. Presentations highlighted

strategic directions and recent achievements in hydrogen research. Young scientists gained insights from esteemed international colleagues, acquiring valuable knowledge for their scientific pursuits. The event served as a valuable platform for scientists, students, teachers, and engineers, offering in-depth information on hydrogen energy's origins, applications, political implications, and potential for utilization. A key takeaway from the conference was the pivotal role of modern technologies in achieving affordable hydrogen production, potentially heralding a new “hydrogen age.”

Following the conference, several papers were selected for publication in a special section of the International Journal of Hydrogen Energy, having undergone a rigorous peer-review process to ensure their quality for IJHE readers.

Ultimately, we encourage the readers to participate in the next 12th International Conference on Photosynthesis and Hydrogen Energy Research for Sustainability- 2024 (<https://phrs-conference.com>), which will be held in October 2024, in Turkey.

In conclusion, I would like to use this occasion to express my gratitude to the authors, reviewers esteemed editors and technical personnel at Elsevier for their efforts, complete help during any issues and which finally made the current special issue possible. Additionally, I would like to express our gratitude to the International Society of Photosynthesis Research and International Association for Hydrogen Energy along with T. Nejat Veziroglu (USA), Emre Veziroglu (USA), Ayfer Veziroglu (USA), John W. Sheffield (USA), Ibrahim Dinçer (Canada), Roberta Croce (The Netherlands), Robert Burnap (USA), Johannes Messinger (Sweden) for their invaluable contributions to the conference's success, as well as to the Bahçeşehir University staff for their diligent efforts.

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