

Editorial

Inaugural Editorial: *Hydrogen and Fuel Cells*, a Pathway for the Energy Transition

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1. Introduction

The transition toward a fully decarbonized energy scenario has become one of the main goals for the energy policy of the majority of the worldwide Countries [1]. The continuous temperature increase of the Earth and the consequent impacts are pushing energy policymakers to move from the present energy scenario to a novel paradigm, ruled by carbon neutrality and sustainability for all the relevant energy sectors [2–4]. In this context, the use of renewables along with the implementation of energy saving and emission reduction strategies are crucial to limit the impact of human activities on the environment [5–7]. A significant effort has been performed by academia, industry and policymakers to develop technologies and strategies to achieve sustainable development. However, as clearly shown by the recent World Transition Outlook 2024 released by IRENA, we are very far from being on track to achieve the goal to limit temperature increase to 1.5 °C. Several important actions must be still implemented to achieve this goal: renewables, electrification, energy efficiency, heat pumps and hydrogen. In particular, the expected development of hydrogen technology is very far from being on track [8]: there are still important concepts that have to be addressed in order to design and implement technically optimal energy solutions for energy savings and emissions reduction. The idea of using hydrogen as fuel is not new and it was pioneered several decades ago, by predicting a transition toward an hydrogen economy, where the conventional fuels were replaced by hydrogen, for power production in fuel cells both for stationary applications and vehicles [9–12]. Unfortunately, the predicted transition was never achieved, due to the huge technical issues in hydrogen transportation, storage and safety management and to the technological and economic challenges related to a mature development of fuel cell technologies [13]. In addition, the social acceptance of the hydrogen-based technology is always challenging, mainly for its safety issues [14]. However, during the past few years a new interest [15] in hydrogen and fuel cells was driven by the urgent need to decarbonize energy systems [16–18], especially for transportation and in urban areas [19]. This renewed research interest resulted in the development of a number of novel technologies in all sectors: electrolysis and other production techniques from water [20–22], hydrogen production from different fuels [23,24], charging stations for vehicles [25], materials production techniques [26–28], fuel cells for both stationary and transportation applications [29–32], storage [33,34], transportation [35], microbial fuel cells [36], and many others. In this novel scenario, hydrogen plays also a crucial role in the management of the excess electricity produced by renewables. In fact, the basic idea of Power to X systems (P2X) lies in the possibility to convert this excess electricity [37] into hydrogen which can be suitably stored and subsequently converted into power [38–41], heat, fuels or chemicals [42]. This strategy is recognized to be extremely promising for managing the future energy networks and the related issue of the mismatch between renewable production and user demand. Despite this huge, renewed research effort and the massive funding policies by government, there are a number of issues that are far to be addressed. In particular, the high capital cost of fuel cells and electrolyzer is dramatically limiting their massive commercialization. As for fuel cells, the issues related to their stability, flexibility and operating life are still very challenging. Hydrogen storage is also an issue and there is no consensus about the best technique (pressurized tanks, liquid, metal hydrates, etc). In addition, the technologies and processes to convert hydrogen into e-fuels are only at their preliminary stage. Therefore, a



plurality of research gaps must be addressed in the field of hydrogen and fuel cells. In this context, the Journal *Hydrogen and Fuel Cells* aims at proving a relevant contribution to fostering the use of these technologies, establishing an international recognized platform disseminating high-quality, cutting-edge research results.

2. Aim and Scope

The Journal of *Hydrogen and Fuel Cells* is a peer-reviewed, open-access international journal dedicated to providing a platform for the dissemination of research findings in the fields of hydrogen, fuel cells, electrolyzers, and power-to-X technologies. This interdisciplinary journal covers all aspects of hydrogen production, transmission, storage, and utilization in fuel cells. It addresses scientific, economic, societal and engineering perspectives related to the development of key components, including fuel cells, electrolyzers, reversible fuel cells, and hydrogen storage systems. All types of fuel cell and electrolyser technologies are within the journal's scope, encompassing both low- and high-temperature systems. Special attention is given to emerging hydrogen storage technologies, such as metal hydrides, as well as hydrogen transmission methods. The journal also focuses on the role of hydrogen as an energy storage medium in future fully renewable energy networks. In this context, submissions related to power-to-X technologies are especially welcome.

The Journal of *Hydrogen and Fuel Cells* publishes original numerical and experimental research papers, as well as review articles, covering (but not limited to) the following topics:

- Hydrogen safety and hazard issues
- Steam methane reforming
- Electrochemical hydrogen generation
- Thermochemical processes for hydrogen production
- Photo-biologic hydrogen production
- Hydrogen production from algae
- Photo-catalytic water splitting
- Plasma based hydrogen production from hydrocarbons
- Hydrogen storage: compressed gas, liquid, cryo-compressed, metal hydrates, carbon nanotubes
- Hydrogen transport, distribution, and infrastructure
- Materials and components for fuel cells and electrolyzers
- Experimental and numerical analyses of fuel cells fed by alternative fuels
- Hybrid systems including fuel cells
- Stack design and manufacturing
- Reversible fuel cells
- Power to X technologies
- Smart energy networks including hydrogen and fuel cells
- Hydrogen and fuel cells for vehicles
- Multi-scale numerical analyses
- Single-level optimization
- Multi-criteria optimization
- Dynamic simulations of energy systems

3. Outlook

Hydrogen and Fuel Cells are expected to play a pivotal role in future energy networks, which will increasingly rely on variable renewable energy sources. Many Countries around the world are supporting these technologies through substantial funding policies aimed at overcoming the technological and economic challenges, currently limiting their widespread adoption. In this context, the new journal *Hydrogen and Fuel Cells* seeks to provide a platform for discussing recent advancements in the field, contributing to the development and deployment of hydrogen and fuel cell technologies. The journal prioritizes high-impact research papers that focus on technological and engineering innovations. Special emphasis is also placed on economic aspects, which are crucial for enabling the full commercialization of these technologies.

The journal is supported by an outstanding editorial board composed of international experts and active researchers with extensive experience in hydrogen and fuel cells. Their exceptional research and editorial expertise will ensure a fast, rigorous, and robust peer-review process. *Hydrogen and Fuel Cells* will follow a fully open-access publishing model, promoting broad dissemination of research findings. To encourage submissions and support the research community, article processing charges (APCs) will be waived for all authors during the first two years.

This publishing strategy is designed to attract high-quality contributions and lay a strong foundation for the journal's growth. The editorial board and publisher are confident that scientists and researchers worldwide will support this initiative by submitting their best work and helping to establish *Hydrogen and Fuel Cells* as a leading, internationally recognized journal in the field.

We thank all future contributors for supporting this project and helping to make *Hydrogen and Fuel Cells* a premier platform for innovation and discovery.

Conflicts of Interest

The author declares no conflict of interest.

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