



European Fuel Cells and Hydrogen

PIERO LUNGHI CONFERENCE

BOOK OF PROCEEDINGS

September **13th-15th** 2023
Capri / Italy



ATENA
FUTURE TECHNOLOGY



Italian National Agency for New Technologies,
Energy and Sustainable Economic Development



Università degli Studi
di Napoli Parthenope



A.D. 1308
unipg
UNIVERSITÀ DEGLI STUDI
DI PERUGIA



European Fuel Cells and Hydrogen

PIERO LUNGI CONFERENCE

Proceedings

OF THE 10TH EUROPEAN FUEL CELL PIERO LUNGI CONFERENCE

To Piero Lunghi. We miss you a lot. To you our gratitude for ever.

This book is dedicated to the memory of Piero Lunghi, creator of the European Fuel Cell Technology and Applications Conference, dear friend and colleague, who prematurely passed away in a car accident on damned November 9, 2007.

Piero made significant contributions in the field of fuel cells in the course of his too short career. He was the leading figure in the formation of the fuel cell research group at the University of Perugia and several activities and research projects initiated by him are still ongoing.

This means that, thanks to Piero, many young people are working in this exciting research field and are coming to Naples to present their results. Therefore, Piero's memory is in the conference name but Piero's contribution is still in the contents of this book.

The memory of our friend Piero, his great personal generosity and energy, survives in our hearts, his contribution and his tenacity survive in the work of young people who carry on his vision throughout the world.

Give them your passion, your strength, and make all necessary effort to realize them. There is no greater satisfaction than seeing one's ideas become reality and become part of the future of our world.

Piero strongly desired this, and constantly followed this through with conviction, passion and dedication.

For a better future, we need young researchers of this kind.



European Fuel Cells and Hydrogen

PIERO LUNGI CONFERENCE

CAPRI, GRAN HOTEL QUISISANA
13 > 15 September, 2023

edited by
Viviana Cigolotti, Francesco Marino
2023

ENEA

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY
AND SUSTAINABLE ECONOMIC DEVELOPMENT

Lungotevere Thaon di Revel, 76 / 00196 / Rome

ISBN 978-88-8286-446-0

SUPPORTED BY



MINISTERO DELL'AMBIENTE
E DELLA SICUREZZA ENERGETICA



ATENA
FUTURE TECHNOLOGY



Italian National Agency for New Technologies,
Energy and Sustainable Economic Development



Università degli Studi
di Napoli Parthenope



A.D. 1308
unipg
UNIVERSITÀ DEGLI STUDI
DI PERUGIA



BIO-Hydrogen, the CNR activity in the framework of AdP-PNRR program

Gaetano Squadrito^a, Massimo Trotta^b, Pierfrancesco Cerruti^c, Stefano Gandolfi^d and Giuliana d'Ippolito^e

Consiglio Nazionale delle Ricerche (CNR)

a Istituto di Tecnologie Avanzate per l'Energia "Nicola Giordano" (CNR-ITAE), via Salita S. Lucia sopra Contesse 5, 98126 Messina, Italy

b Istituto Processi Chimico Fisici (CNR-IPCF), Via Orabona, 4, 70126 Bari, Italy

c Istituto Polymeri, Compositi e Biomateriali (CNR-IPCB), Via Campi Flegrei, 34 - fabbricato 70, 80078 - Pozzuoli (NA), Italy

d Istituto di Scienze e Tecnologie Chimiche "Giulio Natta" (CNR-SCITEC), Via Mario Bianco 9, 20131 Milano, Italy

e Istituto di Chimica Biomolecolare (CNR-ICB), Via Campi Flegrei, 34, 80078 Pozzuoli (NA), Italy

** Presenter author. Tel.: +39 090 624274; fax: +39 090 624247.*

E-mail address: gaetano.squadrito@itaecnr.it (G. Squadrito).

Abstract

According to the European Recovery & Resilience policies launched to react to COVID-19, Italy launched its own "Piano Nazionale di Recupero e Resilienza – PNRR" (National Plan of recovery and resilience) supported by EU. Within the actions, a significant effort for research was considered, and hydrogen technologies were considered as the training technologies for de-carbonisation and future energy market.

In particular, the Minister for Energy Transition (now renamed Minister of Environment and Energy Security) launched the research agreement "AdP - Research and Development of technologies for the hydrogen supply chain" (AdP-Hydrogen), with an investment of 110 M€.. The program foresees an intensive collaboration between the three main research bodies involved in energy and environmental research (ENEA, CNR and RSE). The aims are: reinforce the collaboration between the three research bodies, and speed-up the technology transfer to industry of hydrogen technologies. For this reason the AdP-Hydrogen research program covers all the aspects of hydrogen value chain, including the new promising early stage hydrogen technologies that could be of interest for the national hydrogen value chain.

The program is divided in Topics, Work Packages and Line of Activity, where each research body contributes with research activities that are complementary to each other. In this framework the Line of Activity 1.1.30 "Development of sustainable biological processes and bioreactors for the production of hydrogen with bacteria and/or photosynthetic



microorganisms from by-products and biomass of the agro-food industry" (SusBioH), falls within the new promising approaches for sustainable hydrogen production.

As clearly exposed in the title the SusBioH research activity aim is the valorisation of waste water by producing hydrogen as a high added value product. This approach will allow the concomitant depuration and reuse of waste water with the production of hydrogen and, possibly other valuable products, thus reducing the today energy consumption for waste water treatment.

The research activity was started in July 2022 and foreseen:

- Bio-chemical studies on anaerobic hyperthermophiles bacteria of the Thermotogale order for bio-hydrogen production and CO₂ capture.
- Study of Micro-algae and cyanobacters for the production of hydrogen fomr waste water.
- Photo-fermentation of organic compound from polluting water and soil.
- Development of materials for bacteria and micro-organism support, linkage and growth
- Development of a new concept bio-reactor prototype for hydrogen production for demonstrating technology application potentialities and its transfer to industry.

In this way the SusBioH research activity will contribute the four UN Sustainable development goals:

Goal 6 – Clean water and sanitation

Goal 7 – Affordable and clean energy

Goal 9 – Industry, innovation and infrastructures

Goal 11 – Sustainable cities and communities.

In this presentation the premises, the aims and the research plan of LA 1.1.30 are presented together with a selection of the first year research results.

Acknowledgement

This research was funded by the European Union – NextGeneration EU from the Italian Ministry of Environment and Energy Security POR H2 AdP MMES/ENEA with involvement of CNR and RSE, PNRR - Mission 2, Component 2, Investment 3.5 "Ricerca e sviluppo sull'idrogeno", CUP: B93C22000630006.