Name and contact information:
Ahmad Zahedi
Associate Professor
Email: ahmad.zahedi@jcu.edu.au

Website: https://portfolio.jcu.edu.au/researchers/ahmad.zahedi

Affiliation:
James Cook University, College of Science and Engineering

Speaker: Associate Professor Ahmad Zahedi is a Principal Research Fellow at James Cook University in Queensland, Australia. Educated in Iran and Germany, he brings over 30 years of international experience in teaching and research in Renewable Energy and Power Engineering technologies across Australia, Japan, and Europe. He has completed 15 industry-funded projects, produced over 200 publications including four books, successfully supervised 22 PhD candidates to successful completion, and served as an examiner for more than 50 PhD theses.

Green Hydrogen for Global Sustainable Energy Transition

The transition toward a sustainable energy economy is increasingly centred on green hydrogen H_2 as a pivotal, carbon-neutral energy carrier. Unlike conventional hydrogen production, which relies on fossil fuels and contributes substantially to global CO_2 emissions, exceeding 1,000 million tonnes of CO_2 from about 100 million tonnes of production in 2025 (IEA), green hydrogen utilizes electrolyzers powered by renewable energy sources to ensure zero-emission output. Given its high energy density and suitability for decarbonizing "hard-to-abate" industrial sectors, green hydrogen is currently the focus of significant international research and infrastructure investment.

While global interest is expanding rapidly, with projects actively under development across diverse nations including the United States, Japan, China, Saudi Arabia, and several European countries, the sector faces a primary economic barrier. Currently, the production cost of green hydrogen remains

notably higher than that of fossil-fuel-based "grey" hydrogen. Addressing this disparity requires a multi-faceted approach, including rigorous performance forecasting, optimized design, and accurate cost estimation, often modelled through integrated solar and wind energy inputs.

Technological advancements are expected to bridge this economic gap. The deployment of artificial intelligence (AI) and machine learning (ML) for system optimization is projected by the International Energy Agency (IEA) to render green hydrogen economically competitive with traditional methods by the early 2030s.

In summary, the transition from grey to green hydrogen is technically viable and essential for sustainable development. Future research and implementation strategies are now converging on technical modelling and the integration of advanced computational tools to enhance system performance, reduce costs, and solidify hydrogen's role in the global energy transition.