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Going from Green Hydrogen to Blue hydrogen for our blue earth

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Abstract

"Black", "grey" or "brown" refer emissions to the production of hydrogen from coal, natural gas and lignite, respectively. "Blue" is commonly used for the production of hydrogen from fossil fuels with CO2 reduced by the use of carbon capture, use and Storage (CCUS). "Green" is a term applied to production of hydrogen from renewable electricity. In general, there are no established colors for hydrogen from biomass, nuclear or different varieties of grid electricity. As the environmental impacts of each of these production routes can vary considerably by energy source, region and type of CCUS applied. Building novel blue communities need to be oriented in buildings. Stationary fuel cells are units that provide electricity (and sometimes heat) but are not designed to be moved. These include combined heat and power (CHP), uninterruptible power systems (UPS) and primary power units. The heat produced as a by-product of combined heat and power is used to cover part of the buildings heat demand. The mostly electricity-led mode of operation results in a low thermal output from fuel cell heating systems. The remaining heat requirement of the building is covered by an additional heating system, e.g. a condensing boiler. For that reason, fuel cells are particularly suitable for buildings with a low space heating requirement, such as low-energy or nearly zero-energy buildings. In buildings with a higher space heating requirement, hybrid fuel cell heating systems, comprising a fuel cell and a condensing boiler to cover peak heating requirements, are used. Stationary fuel cells in the output range up to 10 kWe are usually PEM or SO fuel cells. The typical CHP output range for houses and apartment buildings is 0.7 to 5 kWe. Probably the biggest advantage of fuel cells over thermal power processes is the direct electrochemical conversion during electricity and heat generation and the associated higher electrical efficiency. In combined mode, i.e. electrical and thermal, fuel cells can achieve efficiencies of up to 95 %. The electrical efficiency is up to 45 %. Furthermore, fuel cell systems are characterized by high efficiencies over all load points, they are quiet, have low maintenance costs and operate (locally) emission-free.

Biography

Sofoklis Makridis is an elected Associate Professor (tenured) at the Department of Environmental Engineering, University of Patras in Greece & Visiting Professor of KU Leuven at Belgium - Prof. Pontikes Research Group (Sustainable Metals Processing and Recycling). His Postdoc research has been accomplished on Materials for Hydrogen Storage by having a fellowship from the State Scholarships Foundation while he holds an MBA in spin-offs. He serves as Editor-in-Chief at Challenges (MDPI) and at Verizona Publishing Ltd, London. He is involved in the Editorial Board of Materials and SCi (MDPI), Open Chemistry (DeGruyterOpen), of the Scientific Reports of the Nature Publishing Group, and Heliyon, Materials Science and Engineering B of Elsevier. He has more than 65 publications in international journals, international conference proceedings and book chapters. He has more than 10 invited lectures in Research Centers and Universities and 5 invited lectures in conferences overseas in the last 5 years.

Publication

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