

Grey, blue, and green hydrogen: A comprehensive review of production methods and prospects for zero-emission energy

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ABSTRACT

Energy is the linchpin for economic development despite its generation deficit worldwide. Hydrogen can be used as an alternative energy source to meet the requirement that it emits zero to near-zero impurities and is safe for the environment and humans. Because of growing greenhouse gas emissions and the fast-expanding usage of renewable energy sources in power production in recent years, interest in hydrogen is resurging. Hydrogen may be utilized as a renewable energy storage, stabilizing the entire power system and assisting in the decarbonization of the power system, particularly in the industrial and transportation sectors. The main goal of this study is to describe several methods of producing hydrogen based on the principal energy sources utilized. Moreover, the financial and ecological outcomes of three key hydrogen colors (gray, blue, and green) are discussed. Hydrogen's future prosperity is heavily reliant on technology advancement and cost reductions, along with future objectives and related legislation. This research might be improved by developing new hydrogen production methods, novel hydrogen storage systems, infrastructure, and carbon-free hydrogen generation.

KEYWORDS

Carbon-free hydrogen generation; Ecological outcomes; Greenhouse gas; Grey, blue, and green hydrogen; Hydrogen energy

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