Title: Green or Renewable Hydrogen Production: Unlocking Sustainable Energy Solutions

Abstract:

This book chapter delves into the critical topic of green or renewable hydrogen production and its pivotal role in fostering sustainable energy solutions. As global concerns regarding climate change and fossil fuel depletion intensify, the quest for clean and renewable energy sources has gained significant momentum. Hydrogen, often hailed as the "fuel of the future," has emerged as a promising candidate due to its versatility, high energy content, and negligible emissions when utilized as an energy carrier. The chapter begins by providing a comprehensive overview of hydrogen production methods, exploring both traditional and emerging technologies. It highlights the crucial distinction between green hydrogen, produced using renewable energy sources, and hydrogen derived from fossil fuels, emphasizing the environmental benefits and potential for decarbonization associated with green hydrogen. Various production pathways, such as electrolysis, biomass gasification, and solar thermal processes, are explored in detail, shedding light on their technical feasibility, efficiency, and scalability. Also, the chapter examines the key drivers and challenges surrounding green hydrogen production. It discusses the importance of policy support, infrastructure development, and international collaborations in accelerating the transition to a hydrogen-based economy. The significance of cost reduction strategies, advancements in catalyst and materials research, and integration with existing energy systems is also thoroughly investigated. To provide a holistic understanding, the chapter presents case studies and real-world examples that showcase successful green hydrogen projects, highlighting their positive environmental impacts and economic benefits. Moreover, it explores the potential applications of green hydrogen in various sectors, including transportation, industry, and power generation, underscoring its potential to revolutionize energy systems and enable a sustainable future.