



What is a special issue on solar hydrogen production?

This Special Issue on solar hydrogen production focuses on innovative approaches and emerging technologies to transform solar energy into H₂ or derivative energy carriers via water splitting pathways; those discussed include photoelectrochemical, photocatalytic, and thermochemical processes.

Can solar energy produce hydrogen?

Solar energy is potentially the most abundant renewable energy resource available to us and hydrogen production from solar energy is considered to be the ultimate solution for sustainable energy. Many researchers have been involved in analyzing the different solar hydrogen production methods based on energy and exergy analysis.

How much hydrogen does a solar system produce a year?

The combined system produces 29,200 kg/year of H₂ with a levelized cost of hydrogen production (LCOP) of \$8.94 per kg of H₂. Maximum energy destruction was reported in the reactor, followed by the solar collector, which lays a strong foundation for optimizing the collector system to operate more efficiently.

How are solar hydrogen production systems classified?

They have classified the solar hydrogen production system based on the energy input and solar thermal, type of chemical reactants and for different hydrogen production processes involved for example, electrolysis, reforming, gasification, cracking etc.

Can a solar farm produce hydrogen fuel?

In a study by Y. Chen et al., a solar-based new energy generation and storage configuration was studied for energy and hydrogen fuel production. For the solar farm, a PTC was used, and the useful heat from the PTC powered the organic Rankine cycle (ORC), generating electricity.

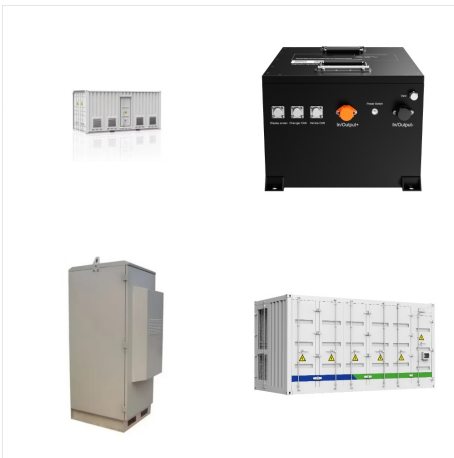
Are solar-based hydrogen production technologies scalable?

Advancements in photolysis for direct solar-to-hydrogen conversion and improving the efficiency of water

AN OVERVIEW OF HYDROGEN GAS PRODUCTION FROM SOLAR ENERGY



electrolysis with solar power are crucial. Comprehensive economic and environmental analyses are essential to support the adoption and scalability of these solar-based hydrogen production technologies.



Rehman et al. [22] reported hydrogen production up to 20 g/kWh using water vapor as a feed using Corona-DBD hybrid micoreactor. The results demonstrated that the energy yield of hydrogen production is on par with the electrolysis with additional advantage of the reduced power consumption and smaller equipment size.



The major problem in utilization of hydrogen gas as a fuel is its unavailability in nature and the need for inexpensive production methods [27]. A wide variety of processes are available for H₂ production which according to the raw materials used could be divided into two major categories namely, conventional and renewable technologies. The first category ???

AN OVERVIEW OF HYDROGEN GAS PRODUCTION FROM SOLAR ENERGY



An Overview of Green Hydrogen Production System through ??? THERMAL SCIENCE: Year 2024, Vol. 28, green hydrogen, solar energy, alkaline water electrolysis, proton exchange membrane, anion exchange membrane IEA show that 76%, 22%, and 2% of the hydrogen produced today comes from natural gas, coal, and water electrolysis, respectively [5]



The low solar energy conversion efficiency, technical issues, and environmental impacts in concert result in a high cost of solar H₂ production, making them economically uncompetitive compared to industrially fossil-based ???



Global energy demand has been growing steadily due to population growth, economic development, and urbanization. As the world population is expected to reach around 9.7 billion by 2050, energy demand will continue to increase [1]. Currently, fossil fuels (coal, oil, and natural gas) account for around 80% of the world energy consumption [2]. The burning of ???

AN OVERVIEW OF HYDROGEN GAS PRODUCTION FROM SOLAR ENERGY



Solar H₂ production is considered as a potentially promising way to utilize solar energy and tackle climate change stemming from the combustion of fossil fuels. Photocatalytic, photoelectrochemical, photovoltaic???electrochemical, solar thermochemical, photothermal catalytic, and photobiological technologies are the most intensively studied routes for solar H₂ ???

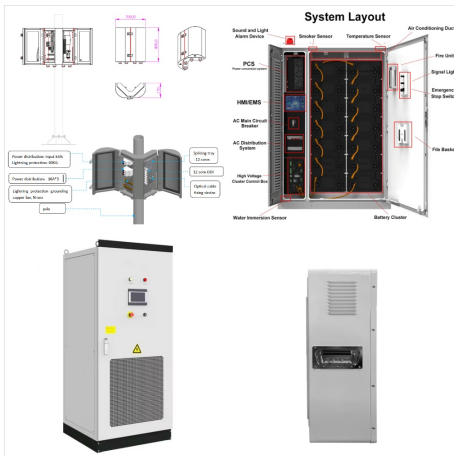


It is overall determined that the development of methods to increase the production of hydrogen from solar energy will continue to achieve competitive costs for hydrogen production. H₂ occurs as an essential energy carrier that holds miscellaneous applications such as the production of ammonia, hydrogenation, methanol synthesis, rocket fuel



The relationship between solar-hydrogen energy production and consumption has been an important issue for policy-making related to energy, industry, and environment in many countries. solar hydrogen production coupled with gas H₂ cross-regional delivery; (3) An overview on the current status of hydrogen energy research and development

AN OVERVIEW OF HYDROGEN GAS PRODUCTION FROM SOLAR ENERGY



Hydrogen is a type of clean energy which has the potential to replace the fossil energy for transportation, domestic and industrial applications. To expand the hydrogen production method and reduce the consumption of fossil energy, technologies of using renewable energy to generate hydrogen have been developed widely. Due to the advantages of widespread distribution and ???

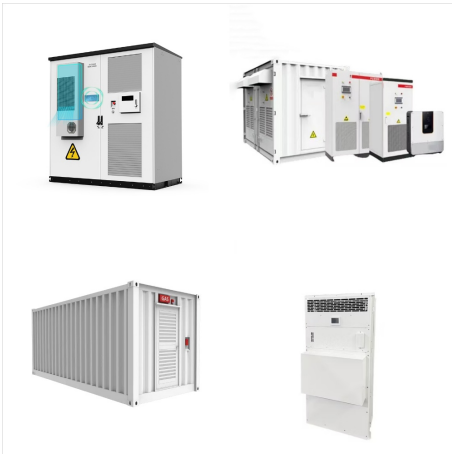


Introduction. Nowadays, the technology of renewable-energy-powered green hydrogen production is one method that is increasingly being regarded as an approach to lower emissions of greenhouse gases (GHGs) and environmental pollution in the transition towards worldwide decarbonization [1, 2]. However, there is a societal realization that fossil fuels are not ???



Several research works have investigated the direct supply of renewable electricity to electrolysis, particularly from photovoltaic (PV) and wind generator (WG) systems. Hydrogen (H₂) production based on solar energy is considered to be the newest solution for sustainable energy. Different technologies based on solar energy which allow hydrogen production are ???

AN OVERVIEW OF HYDROGEN GAS PRODUCTION FROM SOLAR ENERGY



of the inherent variability of solar energy (and other renewables), cost-effective conversion and storage solutions are necessary in order to realize a truly sustainable energy future. Hydrogen is attractive as an energy vector because of its high mass-specific energy density, its inconsequential emissions upon combustion,



Hydrogen energy can be obtained by fossil fuel hydrogen production, solar energy hydrogen production, biological hydrogen production, and other ways. Meanwhile, hydrogen energy is the cleanest renewable energy, which is called the "ultimate energy". The substances generated by its combustion will not cause any pollution to the environment.



Solar energy can be utilized in two ways to produce hydrogen: either indirectly through the production of electricity (photovoltaic) or with direct solar-thermal splitting. The latter uses solar energy directly to split water into hydrogen by photochemical or thermochemical pathways without the intermediate step of electrolysis.

AN OVERVIEW OF HYDROGEN GAS PRODUCTION FROM SOLAR ENERGY



Hydrogen can be produced from various sources of raw materials including renewable and non-renewable sources which are around 87 million tons/year (Dawood et al., 2020, Milani et al., 2020). However, as of 2020, most of the hydrogen (95%) was produced from non-renewable fossil fuels especially steam reforming of natural gas, emitting 830 million ???



The most efficient solar hydrogen production schemes, which couple solar cells to electrolysis systems, reach solar-to-hydrogen (STH) energy conversion efficiencies of 30% at a laboratory scale³.

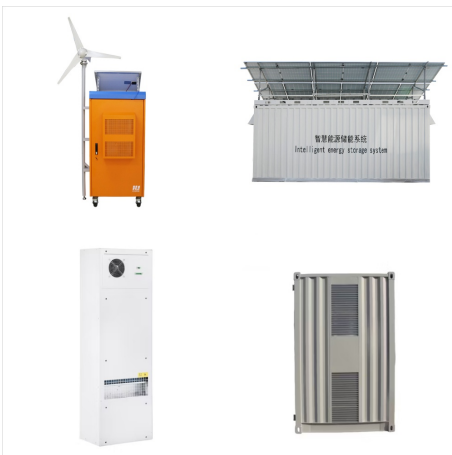


Due to its characteristics, hydrogen is considered the energy carrier of the future. Its use as a fuel generates reduced pollution, as if burned it almost exclusively produces water vapor. Hydrogen can be produced from ???

AN OVERVIEW OF HYDROGEN GAS PRODUCTION FROM SOLAR ENERGY



Hydrogen energy, as clean and efficient energy, is considered significant support for the construction of a sustainable society in the face of global climate change and the looming energy revolution. Hydrogen is one of the most important chemical substances on earth and can be obtained through various techniques using renewable and nonrenewable energy sources. ???



solar energy-based autothermal and steam combined reforming systems with natural gas. Carbon emission and cost analyses, as well as study of multi-objective optimization. Energy and energy efficiency were found to be 59.1% and 31.1 percent, respectively. (Wang, Lu & Zhong, 2021) Catalysts' role in hydrogen production from water electrolysis



As a clean energy source, hydrogen not only helps to reduce the use of fossil fuels but also promotes the transformation of energy structure and sustainable development. This paper firstly introduces the development status of green hydrogen at home and abroad and then focuses on several advanced green hydrogen production technologies. Then, the advantages ???

AN OVERVIEW OF HYDROGEN GAS PRODUCTION FROM SOLAR ENERGY



Hydrogen has tremendous potential of becoming a critical vector in low-carbon energy transitions [1]. Solar-driven hydrogen production has been attracting upsurging attention due to its low-carbon nature for a sustainable energy future and tremendous potential for both large-scale solar energy storage and versatile applications [2], [3], [4]. Solar photovoltaic-driven ???



Various potential uses for hydrogen exist, such as the propulsion of non-polluting automobiles, heating, and aviation. Consequently, it is projected that hydrogen will join solar energy as the main energy source in a sustainable energy future (Hassan 2020; Hassan et al. 2022c; Hunt et al. 2022). How near we are to the hydrogen era may be gauged by recent attempts to construct ???



The potential for solar energy to be harnessed as solar power is enormous, since about 200,000 times the world's total daily electric-generating capacity is received by Earth every day in the form of solar energy. Unfortunately, though solar energy itself is free, the high cost of its collection, conversion, and storage still limits its exploitation in many places.

AN OVERVIEW OF HYDROGEN GAS PRODUCTION FROM SOLAR ENERGY



Hydrogen production through solar energy technology plays a very important role in the development of sustainable energy systems. Traditionally, a wide variety of methods are available for



3.1 Utilizing Renewable Energy Sources for Electrolysis. Utilizing renewable energy sources, such as solar, wind, and hydroelectric power, for electrolysis is a key strategy in producing green hydrogen???a sustainable and carbon???neutral energy carrier [].This approach leverages the inherent benefits of renewable energy to drive the electrolysis process, ???



The coupling of hydrogen production with solar energy opens the potential of introducing new "players" to the energy sector, where importance is shifted from fossil fuel reserves to the available solar potential. An overview on gasification of biomass for production of hydrogen rich gas. Der Chem Sin. 2012;3(2):323???35.

AN OVERVIEW OF HYDROGEN GAS PRODUCTION FROM SOLAR ENERGY



;150:386???93. Fremaux S, Beheshti S, Ghassemi H, Shahsavan-markadeh R. An experimental study on hydrogen-rich gas production via steam gasification of biomass in a research-scale fluidized bed. Energy Convers Manag 2015;91:427???32. Ni M, Leung DY, Leung MKH, Sumathy K. An overview of hydrogen production from biomass.