

Environmental Assessment of Hydrogen Production by Solar Photovoltaic Power Generation

Can solar PV produce hydrogen?

Hydrogen production via water electrolysis using solar PV electricity might result in substantial emissions in the short term--due to current PV wafer production in China with fossil energy--if the capacity factor of the solar PV system is low (resulting up to 5.6 kgCO₂-eq. kg⁻¹ H₂).

Can a photovoltaic power station produce green hydrogen?

However, the majority of hydrogen production today relies on fossil fuels (96%), with only a small fraction (4%) being produced through water electrolysis. Even though there have been many studies on climate change mitigation with a focus on Africa, a green hydrogen production from a photovoltaic power station approach has not been reported.

Can solar energy be used to produce hydrogen?

Using solar energy to produce hydrogen can greatly reduce the greenhouse gas emissions and produce 'Green Hydrogen'. Previous studies reported that LCA (Life Cycle Assessment) can be a good evaluation method to analyze different hydrogen production process.

Can Africa generate clean hydrogen from photovoltaic power output?

This study focuses on the African green hydrogen production industry, utilizing Nigeria as a case study to explore the feasibility of generating clean hydrogen vectors from a percentage of photovoltaic power output in various regions of the country through stand-alone solar grid electrification projects.

Why is hydrogen not included in energy system analysis & assessment models?

Its historically high production cost and sluggish industrial response to climate science have led to hydrogen being largely absent from energy system analysis and integrated assessment models (IAM) until now [4].

Can battery-assisted hydrogen production reduce solar irradiation instability?

This study proposes an innovative energy management strategy that ensures a stable hydrogen production rate, even with fluctuating solar irradiation. By integrating battery-assisted hydrogen production, this approach allows for decentralized, grid-independent renewable energy systems, mitigating instability from PV intermittency.

The results show that the ultra-light grid-connected hydrogen production system, due to the support of the power grid, has improved the reliability of the hydrogen production ...

Hydrogen energy utilization is pivotal in mitigating climate change impacts, as hydrogen's high energy density and clean combustion (i.e., producing only water when combined with oxygen) ...

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Given the comparable transient power production of Ain Sokhna and Jabal Al-Zait, Fig. 8 a shows that their transient hydrogen production using solar resources (blue and red lines, respectively) ...

The electrical energy generated through this process is [30], (3) $P_{PV} = Q_{PV} \cdot i_{PV,h} (T_{PV})$ where Q_{PV} is the total solar energy converged to the PV cell and T_{PV} is the temperature of ...

1 ??· The proposed system can be expanded with a combination of solar PV & wind turbine power plants, hydrogen production plants, hydrogen storage systems, fuel cell power ...

Research in hydrogen production using solar energy has been carried out by the scientific community with different points emphasized. ... Solar power generation by PV (photovoltaic) technology: a review ... System ...

Tapping the full potential of clean, renewable energy resources to effectively meet the steadily increasing energy demand is the critical need of the hour and an important proactive step ...

Solar hydrogen production technology is a key technology for building a clean, low-carbon, safe, and efficient energy system. At present, the intermittency and volatility of ...

The power generation of (PV) cells was calculated using the following equation (Zhang et al., 2021): (4) $P_{PV} = I_{sc} \cdot V_{oc} \cdot F F 1 - v_{ref} T_{PV} - 298.15 K$ where I_{sc} is ...

The study examines the methods for producing hydrogen using solar energy as a catalyst. The two commonly recognised categories of processes are direct and indirect. Due to the indirect ...

This study proposes a conceptual design of green hydrogen production via proton exchange membrane electrolysis powered by a floating solar photovoltaic system. The system contributes to industrial ...

This study proposes an innovative energy management strategy that ensures a stable hydrogen production rate, even with fluctuating solar irradiation. By integrating battery ...

The negative effects of climate change have burdened humanity with the necessity of decarbonization by moving to clean and renewable sources of energy generation. While energy demand varies across the sectors, ...

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