

Is green hydrogen a suitable off-grid energy storage option?

Gray et al. [54] evaluated a green hydrogen system based on solar PV, H<sub>2</sub> storage, PEM electrolyzer, and PEM fuel cell, considering a small-scale reference system. The authors concluded that H<sub>2</sub> is a suitable off-grid energy storage option because of its reliability and safety features.

How is a hydrogen storage system sized?

The sizing of the hydrogen storage system takes place after determining the maximum energy generation from the PV, WTGs, and the minimum load power. The ELZ utilizes surplus energy to produce a maximum of 23 kg of hydrogen per hour.

How efficient is a hydrogen storage system?

The simulated system included a wind system, an alkaline electrolyzer, and a PEM fuel cell. The hydrogen generated from the excess wind energy was compressed to a maximum pressure of 125 bar. Consequently, the overall storage efficiency was estimated at approximately 24.5%.

Is hydrogen storage a sustainable alternative?

Batteries had been a predominant choice in hybrid systems, but the allure of hydrogen storage as a sustainable alternative was undeniable. Still, the harmonious interplay between wind and solar PV systems mitigated their energy production shortfalls, enhancing the system's comprehensive reliability.

How can hydrogen be used to meet future off-grid energy needs?

In the second corner, hydrogen storage and efficiency are addressed to satisfy future off-grid energy needs. The third corner discusses fuel cell-based technologies to transform hydrogen to fulfill a community's energy needs (e.g., cooking, heating, lighting).

Is green hydrogen the future fuel for off-grid applications?

Some scholars consider green hydrogen the future fuel and another appropriate technology for off-grid applications [8]. Hydrogen is deemed green only when clean and renewable energy technologies are used in its fabrication process through water electrolysis.

This study can allow others to consider green hydrogen as an alternative for supplying electricity to off-grid communities. The primary findings include using green hydrogen for long-term storage in off-grid applications.

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