Integrated Autonomous Hydrogen Energy Systems – Resilience advantages & humanitarian crises response

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ABSTRACT

The increasing frequency of natural disasters, exacerbated by climate change, has necessitated the development of resilient and environmentally friendly energy systems. Hydrogen technology, particularly when integrated with renewable energy sources like solar power, offers a promising solution for humanitarian crisis management [1]. This work explores the application of an autonomous hydrogen-based Cell on Wheels (CoW) system coupled with a mobile hydrogen refueling station in response to humanitarian crisis [2]. The system is designed to ensure energy security and support the mobility of emergency response vehicles. A comprehensive cost-benefit analysis compares the proposed hydrogen system to conventional diesel-powered alternatives, emphasizing long-term sustainability and substantial CO_2 savings.

Natural disasters and crises, such as the recent flooding in Thessaly, Greece, pose significant challenges for energy security and emergency response. The breakdown of infrastructure often hampers access to traditional energy sources, complicating relief efforts. Hydrogen-based solutions provide a resilient and clean alternative, capable of supplying both electricity and fuel for specialized vehicles. Hydrogen, as an energy vector, offers the potential for decentralized and renewable energy generation, storage, and consumption, making it ideal for use in crisis situations [3].

In this study, we investigate the feasibility of a hydrogen-based CoW system, powered by solar photovoltaics (PV), combined with a mobile hydrogen refueling station. The system can supply uninterrupted power for humanitarian vehicles using green hydrogen, providing energy security, reduced emissions, and noiseless operation in sensitive contexts.

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