



## patents on hydrogen energy storage

What is a hydrogen patent? Their patent portfolios are mainly focused on production by electrolysis and applications based on fuel cells but also extend to established technologies for the storage and distribution of liquid or gaseous hydrogen, an area of focus for these countries which plan to import stored hydrogen in the near future. What happened to hydrogen patenting in the US? By contrast, hydrogen patenting decreased significantly in the US after 2010, and the US was a distant third to the EU and Japan in 2018, despite being the main innovator in hydrogen in terms of volume of international patent families. What is a hydrogen storage power system? The power system containing hydrogen storage can be divided into power generation, energy storage, or load according to the different parts. Ensuring the system's safe operation and achieving the system's operating goals requires an appropriate energy management control strategy. Why do we need patents for hydrogen energy? Through patenting, inventors seek to ensure that they can recoup these investments in innovation. Coordinating the deployment of the full hydrogen energy value chain is perhaps the most complex of all the technical challenges facing energy engineers and it is sometimes hard to discern the status of all the underpinning technology areas. How many patents are there in Green Hydrogen Energy? Comprehensive analysis of 5,471 patents in the areas of green hydrogen energy from year to year. Classification of water electrolysis (ALK, PEM, AEM, SO, ALL) and system operation (BOP, CON). Natural Language Process (NLP) method for automatic parsing of the patent database. Which companies have patented hydrogen technology? Two Japanese companies - Toyota and Honda - as well as R. Korea's Hyundai stand out. All three feature in this list thanks to patent portfolios in established technologies for the storage, distribution and transformation of gaseous or liquid hydrogen. The grid scale renewable energy storage and release system 10 can provide efficient and grid scale storage of energy for solar and wind energy using hydrogen and for the transport of The present invention relates to an energy storage system for storing renewable energy which uses hydrogen as a medium. The present invention also relates to a method of storing and releasing renewable energy in grid scale by use of hydrogen as a medium. The world is increasing its use of renewable Abstract: The invention provides a thermal energy storage system comprising a metal-containing first material with a thermal energy storage density of about 100 kJ/kg to about 200 kJ/kg based on hydrogenation; a metal-containing second material with a thermal energy storage density of about 200 kJ/kg to about 400 kJ/kg based on hydrogenation. Innovators around the world are ramping up their efforts in areas as diverse as fossil fuel conversion, electrochemical splitting of water, graphene tanks, cryogenic storage, fuel cell motors for aircraft and the reduction of iron ore. If hydrogen is to play a major role in reducing fossil fuel Combining the energy expertise of the IEA with the EPO's patent knowledge, it provides the most comprehensive and up-to-date global review of patenting trends in a broad range of technologies - from the production of hydrogen to its storage, distribution and transformation, through to its end-use The present invention relates to a hydrogen storage system, and more particularly, to a cryogenic hydrogen storage system capable of accurately adjusting the supply amount and pressure of hydrogen to be supplied to a fuel cell system based on operating conditions of a mobility vehicle to which the An



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energy storage system and method employ electrolysis to convert excess electrical energy into hydrogen gas and oxygen gas stored in cryogenic flux capacitor units. When needed, the hydrogen and oxygen are liberated from the CFCs and mixed with supercritical CO<sub>2</sub> and combusted in a combustion Hydrogen Storage Patents (Class 420/900) Search for Hydrogen Storage Patents and Patent Applications (Class 420/900) Filed with the USPTO Patent analysis on green hydrogen technology for future To collect patents related to green hydrogen technologies, a wide range of research and development (R& D) projects concerning hydrogen are extensively searched as Hydrogen Patents for a Clean Energy Future - This study, which combines the expertise of the International Energy Agency and the European Patent Office, is the most comprehensive, global and up-to-date investigation of hydrogen-related patenting so far. Hydrogen patents for a clean energy future However, this report also flags some blind spots where more innovation is needed to unlock new applications of green hydrogen. By giving decision-makers an unparalleled perspective of US20220341546A1 Recently, to increase an energy storage density per unit volume of fuel (e.g., hydrogen) used for the fuel cell system, various attempts have been made to store liquid hydrogen in a Non-Cryogenic Hydrogen Storage At Low-Pressure | NISTNIST has developed a new metal-organic framework (MOF) that can be utilized for stationary hydrogen storage for long-duration energy supply. It has fast delivery rates, U.S. Patent for System and method for hydrogen-based energy This invention relates to systems and methods of storing electrical energy, and, more particularly, to those for storing energy using hydrogen gas. Overview of US patents for energy management of renewable This chapter provides an overview of the various energy management strategies used in US patents for hydrogen-containing energy storage power systems and analyzes the US20210293221A1 The present invention relates to energy storage. In particular but not exclusively, the invention relates to Compressed Air Energy Storage (CAES) in conjunction with hydrogen.Overview of US patents for energy management of renewable energy To fill this gap, this paper reviews relevant US patents to find potential and industrial hydrogen applications and energy management strategies in renewable energy Hydrogen Based Renewable Energy Storage System The system includes a hydrogen generation module for producing hydrogen through electrolysis of water, with the hydrogen generation module powered by one or more renewable energy WO2024138147A1 Provided herein are systems and processes for hydrogen production and storage. The systems have three main components that are a plasma-based reformer, a membrane and separation WO2012112787A4 Abstract Hydrogen energy systems for obtaining hydrogen gas from a solid storage medium using controlled laser beams. Also disclosed are systems for charging/recharging magnesium with Patent landscape review of hydrogen production methods: This article comprehensively reviews hydrogen production technologies, storage technologies, and end-use applications of hydrogen, based on the input energy source, Hydrogen patents for a clean energy future Combining the energy expertise of the IEA with the EPO's patent knowledge, it provides the most comprehensive and up-to-date global review of patenting trends in a broad range of US6787258B2 Utility power



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is wheeled to distributed hydrogen energy storage systems during off peak periods where it is used in an electrolyzer to disassociate water into hydrogen and oxygen. The The Influence of Fuel Cell, Hydrogen Production, and Hydrogen Storage This report describes the results of an analysis tracing the technological influence of hydrogen and fuel cell research funded by the Hydrogen and Fuel Cell Technologies Office (HFTO) in the Patent and Patent Application Analysis for Beginning in FY2008, PNNL has conducted an annual review of patents related to fuel cells, hydrogen production, delivery, and storage resulting from HFTO R& D funding\* Investigating diffusion and convergence trajectory of hydrogen storage Abstract Safe and flexible hydrogen storage technology (HST) emerges as a crucial element in driving the industrialization of hydrogen energy. Consequently, HSTs are Patent text mining based hydrogen energy technology evolution It is found that the hydrogen energy industry is in a period of rapid development; the succession and integration of hydrogen energy technologies are good, and the Hydrogen patent filings: Europe and Japan lead on innovation Europe and Japan are leading the world in hydrogen patent filings, says a new report from the International Energy Agency and European Patents Office. Overview of US patents for energy management of renewable energy To fill this gap, this paper reviews relevant US patents to find potential and industrial hydrogen applications and energy management strategies in renewable energy Hydrogen hybrid energy storage system The present invention relates to a hydrogen hybrid storage system as hybrid energy storage. The present invention comprises three main energy storage subsystems and a hydrogen Patent text mining based hydrogen energy technology evolution It is found that the hydrogen energy industry is in a period of rapid development; the succession and integration of hydrogen energy technologies are good, and the Hydrogen patent filings: Europe and Japan lead on Europe and Japan are leading the world in hydrogen patent filings, says a new report from the International Energy Agency and European Patents Office. Hydrogen hybrid energy storage system The present invention relates to a hydrogen hybrid storage system as hybrid energy storage. The present invention comprises three main energy storage subsystems and a hydrogen Research of Patents for Automotive Hydrogen Hydrogen fuel cell vehicle (FCV) technology is of great significance to energy security and environmental protection. With the rapid development of automotive hydrogen patents in the world, the Energy storage system and applications An energy storage system converts variable renewable electricity (VRE) to continuous heat at over  $\approx 176$ ; C. Intermittent electrical energy heats a solid medium. Heat from the solid medium WO2022104430A1 An integrated energy storage device, including: an electrolyser for generating hydrogen through electrolysis of water; a metal hydride store fluidly coupled to the electrolyser, for receiving and Hydrogen-based electrochemical energy storage An energy storage device (100) providing high storage densities via hydrogen storage. The device (100) includes a counter electrode (110), a storage electrode (130), and an Hydrogen-based electrochemical energy storage An energy storage device ( 100 ) providing high storage densities via hydrogen storage. The device ( 100 ) includes a counter electrode ( 110 ), a storage electrode ( 130 ), and an ion US20090107853A1 A system for the



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solid state storage of hydrogen in accordance with several exemplary embodiments is disclosed herein. The system includes a plurality of hydrogen storage US6074447A This invention relates to systems and methods for the chemical storage of hydrogen. Hydrogen has been identified as a major energy resource for the future. The problems and expense

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