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 significantlyin the US after 2015,and the US was a distant third to the EU and Japan in 2020,despite being the main innovator in hydrogen in 2011 in terms of volume of international patent families.

Are hydrogen patents a good indicator of innovation?
Patents are strong indicators of innovation activitywhich can give very detailed insights into the state and direction of the science. 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.

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.

How many international patent families are there in hydrogen technology?
About half of international patent families (IPFs)1 in hydrogen technologies in the period 2011-2020 were related to hydrogen production. The other IPFs were split between end-use applications of hydrogen and technologies for the storage, distribution and transformation of hydrogen.

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.

This review explores hydrogen"s potential as an energy storage solution, comparing fossil fuels and renewable sources. It evaluates the technological, economic, and environmental implications of each method and highlights its benefits and drawbacks. ... Technological forecasting of hydrogen storage materials using patent indicators ...

Hydrogen is considered a promising energy carrier for the future, due to its abundance, high energy content (142 MJ/kg) and its ability to be employed both in fuel cells and combustion engines, in stationary or mobile

applications, potentially producing only H 2 O as an environmentally benign by-product. Hydrogen can also be generated from water using ...

Through a combination of renewables, energy storage, energy efficiency and smart grid technology, a large share of end-use applications will be decarbonised in the coming decades. As more countries foster deep decarbonisation strategies, green hydrogen produced from renewables via water electrolysis is expected to be at the

The technological composition of the hydrogen energy industry chain is divided into upstream, midstream, and downstream; the upstream industry chain is the infrastructure of the hydrogen energy industry, and the supply of hydrogen energy, which mainly includes hydrogen preparation, storage and transportation, and terminal hydrogen refueling ...

Abstract: The invention provides a thermal energy storage system comprising a metal-containing first material with a thermal energy storage density of about 1300 kJ/kg to ...

According to this report, the European Union, Japan, and USA hold 67-78 % of the global patents on hydrogen production, storage, transmission, and end-use applications, while Korea and China hold about 8-10 %. ... Thermal Control System in a Kind of Hydrogen Energy-Storage System and Application (C.N. Patent No. 106299412A) China National ...

Hydrogen is one of the most promising energy carriers as it can be transformed into electricity and replace the direct use of fossil fuels in combustion engines [9, 10].Hydrogen is also considered a green or clean energy system and can be viewed as a sustainable energy carrier because it can be produced from renewable raw materials such as water [[11], [12], [13]] and ...

Hydrogen energy technology research was concentrated among a few patent applicants; the second stage is 2001-2014, the domestic market demand for hydrogen energy continued to expand, leading to an increase in patent applications; the third stage is 2015-2021, when Toyota offered 5680 patents related to hydrogen fuel cell technology for free ...

In the realm of Chinese patents, lithium-ion batteries and supercapacitors demonstrate significant growth, alongside other flourishing technologies such as compressed air and hydrogen energy storage, liquid ...

The United States, with 20% of all hydrogen-related patents, is the only major innovation centre to see international hydrogen patent applications decline in the past decade. International patenting activity in hydrogen ...

Office (JPO) have focused strongly on solar power and hydrogen and fuel cell technologies. Patent applications at other patent offices based on priority applications at the JPO appear to mirror this pattern. Patent applications at the United States Patent and Trademark Office (USPTO) have been relatively evenly

distributed between domestic

of patents related to fuel cells, hydrogen production, delivery, and storage resulting from HFTO R& D funding* o In FY2017 the scope was expanded to include analysis of patent applications ...

The invention relates to the technical field of solar energy, wind energy, hydrogen energy and the like. Due to the characteristics of intermittence and not easy storage and transportation of renewable energy resources, such as solar energy, wind energy, and the like, a high-efficient and clean energy carrier is required to be the bridge between the renewable energy resources and ...

Various hydrogen storage materials (Activated Carbon, Amides, Fullerene, Graphene etc.) JP, US, CH, KR, EU, Other countries: ... for the energy transition. Different patent indicators, with Germany as a reference country, are used to provide insights into the technological maturity and countries positioning. Patenting activity for all three ...

The number of hydrogen patents is exploding, and hydrogen-based technologies seem to be subject to an increasingly obvious strategy. In the last ten years, according to a study by the European Patent Office (EPO) and ...

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Through the retrieval of previous research on hydrogen energy patents, it is found that in 2009 [22], ... During this phase, researchers focused on improving hydrogen supply systems, including hydrogen storage, transportation, and delivery technologies, to ensure sustainable hydrogen supply and stable operation of the fuel cell systems. This is ...

This study sorted patents of hydrogen energy with whole patent co-word map into several patent sub-maps by using the technique of K-core clustering [28]. From the perspective of graph theory, the closer the linkages among patents within a sub-map, the more similar or homogenous these patents are in terms of technological contents.

Energy Storage Platform On Hydrogen (ESPHy) A Multi-Institutional Centre on Hydrogen Energy Systems Supported By Department Of Science & Technology, Government Of India ... No. of Papers published in the area ...

One of the keys to the implementation of hydrogen energy technology is the production of hydrogen. This review presents a comprehensive analysis of patents related to hydrogen production from the years 2013-2022. Using the Derwent World Patents Index (DWPI), the study includes bibliometric analysis, technology evaluation, and technology updates in the ...

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Toyota, an Industrial Property (IP) leader in fuel cells, including fuel cell vehicles. Indeed, for 20 years, Toyota Group has built up a significant fuel cell-related patent portfolio with 12,000+ patented inventions - currently the ...

To fill this gap, this paper reviews relevant US patents to find potential and industrial hydrogen applications and energy management strategies in renewable energy ...

She has more than 65 International journal publications and four patents to her credit. She has been awarded with the "OutstandingService Award"by the International ... His area of research includes hydrogen energy storage, metal hydride based thermal machines, coupled heat and mass transfer in porous medium, porous medium combustion ...

The global hydrogen revolution. Patent Index 2022 lists the Top 50 applicants at the EPO. Among these are some of the ... In addition to energy storage systems, smart grids comprise smart metering infrastructure, smart distribution boards and circuit breakers. ...

The patent number KR 10-2012-7019134 shows a system for interconverting hydrogen and electrical energy, which includes a reversible conversion stage, a hydrogen ...

In addition, hydrogen works as an energy storage system, allowing for the integration of renewable energy sources and facilitating a more flexible and reliable energy system. Hydrogen can considerably contribute to the decarbonization of our energy landscape and pave the way for a sustainable future by investigating and exploiting these diverse ...

Safe and flexible hydrogen storage technology (HST) emerges as a crucial element in driving the industrialization of hydrogen energy. Consequently, HSTs are being extensively investigated globally, with an increasing number diffusing beyond national boundaries through transnational patent applications.

It covers technologies for the full range of hydrogen supply, storage, distribution, transformation and end-user applications, as well as introducing new search strategies to ...

VERNE has filed a notable patent titled "A system and method for managing a cryo-compressed state of hydrogen fuel." The patent filing date is May 30, 2024. ... which allows for denser storage and potentially increased ...

Research and development of hydrogen energy in China has been growing rapidly, despite starting relatively late. However, the country still lags behind the global average level in hydrogen energy storage and transportation technology as well as hydrogen fuel cell technology, indicating the need for accelerated innovation [19].

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Hydrogen storage and compression are critical for developing hydrogen as a sustainable energy source. The patent filed by Chevron U.S.A. Inc. outlines an innovative approach to improving the efficiency of hydrogen absorption and desorption using metal hydride composite materials.

A renewable energy storage system which uses hydrogen as a storage medium. The system includes a hydrogen generation module for producing hydrogen through electrolysis of water, ...

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