

-22 Priority to US13/189,038 priority Critical patent/US8758948B2/en ... endeavor to raise the round-trip energy efficiency of the iron-air battery to 80% and increase its cycle life to 5000 cycles for grid-scale energy storage applications. FIG. 1 illustrates several of the embodiments on an iron-air battery 100 described below.

In the realm of mechanical energy storage, it is clear that pumped hydroelectric (PSH), flywheel (FES), and compressed air energy storage (CAES) lead the way in patent publications. Of ...

New cell designs can optimize energy storage efficiency, improve safety, and reduce the cost of production. Patenting these innovations requires a strategic approach to ...

To make the patent database for the analysis, first, a comprehensive survey on green hydrogen projects worldwide was conducted and hydrogen-related technologies were classified into two network categories of the stand-alone and the grid-connected type, as well as three options for renewable energy resources, Energy Storage System (ESS) and ...

1. Patents in the field of energy storage are legal protection s granted for inventions that improve the efficiency, sustainability, and functionality of energy storage ...

The present disclosure provides pumped heat energy storage systems that can be used to store and/or extract electrical energy. A pumped heat energy storage system of the present disclosure can store energy by operating as a heat pump, whereby net work input can be used to transfer heat from the cold side to the hot side. A working fluid of the system is capable of efficient heat ...

To ensure grid reliability, energy storage system (ESS) integration with the grid is essential. Due to continuous variations in electricity consumption, a peak-to-valley fluctuation between day and night, frequency and voltage regulations, variation in demand and supply and high PV penetration may cause grid instability [2] cause of that, peak shaving and load ...

The energy storage system can release the stored cold energy by power generation or direct cooling when the energy demand increases rapidly. The schematic diagram of the cold energy storage system by using LNG cold energy is shown in Fig. 11. The conventional cold energy storage systems which can be used for LNG cold energy utilization include ...

Compressed air energy storage (CAES) processes are of increasing interest. They are now characterized as large-scale, long-lifetime and cost-effective energy storage systems. Compressed Carbon Dioxide Energy Storage (CCES) systems are based on the same technology but operate with CO<sub>2</sub> as working fluid. They allow liquid storage under non ...

The storage cycle consists of the exothermic hydrogenation of a hydrogen-lean molecule at the start of the transport, usually the hydrogen production site, becoming a hydrogen-rich molecule. This loaded molecule can be transported long distances or be used as long-term storage due to its ability to not lose hydrogen over long periods of time ...

The recently published patent insight report on Offshore wind energy features a maturity map showing the development over time of a technology by comparing the number of international patent families (IPFs) ...

The purpose of this article is to unveil a new type of bulk electricity storage technology - electrothermal energy storage - that is based on heat pump and thermal engine technologies utilizing transcritical CO<sub>2</sub> cycles, storage of pumped heat in hot water, and ice generation and melting at the cold end of the cycles [9] principle the idea of reversible heat ...

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To support the much-needed progress, understanding innovation in electrochemical energy storage revealed in patents is an important research, as well as public policy, issue for several reasons: firstly, as the economic potential for further improvements is tremendous, it is likely that novel ideas are first patented before scientifically published, if at all.

EPO's first joint study with the International Energy Agency underlines the key role that battery innovation is playing in the clean energy transition.

Kalina cycle: LAES: liquid air energy storage: LCOS: levelized cost of storage: LNG: liquefied natural gas: ORC: organic Rankine cycle: PHS: pumped hydro energy storage: SMES: ... Ding's patent reveals that the LAES system has potential for the black start service [38]. When a major disruption of the power supply in the power plant happens, the ...

low-temperature adiabatic compressed-air energy storage: ORC: organic Rankine cycle: PCM: phase-change material: PHES: pumped-hydro energy storage: PHP: power-to-heat-to-power: PTES: ... (figure 12) based on the patent developed in collaboration with Chen et al in 2007. The LAES systems are based on a Claude cycle, integrating a low-pressure ...

With a higher power-cycle efficiency and thermal energy storage energy density, the disclosed Brayton combined cycle system may offer advantages over steam Rankine and ...

Fig.2 Multiphysics model of the hybrid energy storage system. Zheng, JS., et al. developed a new hybrid

electrochemical device based on a synergetic inner combination of Li ion battery and Li ion capacitor (HyLIC) as ...

Yearly number of publications of academic articles and patents on energy storage from 2000 to 2018. There seems to be a decline in patents in recent years. However, this is an inherent result derived from the patenting process, in which there is a lag of at least one year between the date of application and date of publication of a patent ...

To date, various energy storage technologies have been developed, including pumped storage hydropower, compressed air, flywheels, batteries, fuel cells, electrochemical capacitors (ECs), traditional capacitors, and so on (Figure 1 C). 5 Among them, pumped storage hydropower and compressed air currently dominate global energy storage, but they have ...

The 12,000-cycle ultra-long-life energy storage batteries were used in the project for the first time, ... The project has obtained 68 patents and realized the application of a 100 MWh level lithium-ion battery energy storage system ...

Hybrid energy storage devices (HESDs) combining the energy storage behavior of both supercapacitors and secondary batteries, present multifold advantages including high energy density, high power density and long cycle stability, can possibly become the ultimate source of power for multi-function electronic equipment and electric/hybrid vehicles in the future.

Considering this, large amounts of energy storage may be required for short-term and long-term energy storage. Energy storage using secondary cells is a suitable alternative but has limitations, such as insufficient storage capacity and long-term storage. ... "Green chasm" in clean-tech for air pollution: patent evidence of a long innovation ...

Energy storage technology has attracted high attention from the industry because it has direct or indirect regulatory capabilities for volatile clean energy such as wind power and photovoltaic [9], ... lithium energy storage has the characteristics of good cycle characteristics, ... The patent retrieval system used in this study is IncoPat ...

Companies and inventors often prioritize filing patents at the USPTO due to the U.S. status as one of the largest and most competitive markets in the world, particularly for high-tech industries such as energy storage . ...

Justia - Patents - Patents and Patent Application Resources. Abstract: A heat storage system (400) comprising a system gas inlet (460), a system gas outlet (470), and at least two thermal stores (401, 402) connected together in series therebetween, wherein each store comprises a chamber having a gas inlet (461,462), a gas outlet (471,472), and a gas ...

To support the much-needed progress, understanding innovation in electrochemical energy storage revealed in patents is an important research, as well as public policy, issue for ...

Fortunately, the innovation of nanomaterials (NMs) and their corresponding processing into devices and electrodes could enhance the functionality and/or advancement of the current battery energy storage systems (BESSs). Patent ...

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A thermal energy storage (TES) system includes a plurality of closely packed TES modules, each TES module having a shell enclosing a plurality of sealed tubes that each contain a TES media. A computer-controlled flow control system includes a flow distributor, for example a flow distributor having a plenum configured to receive a heat transfer fluid (HTF), and a plurality of control ...

ESDs can store energy in various forms (Pollet et al., 2014). Examples include electrochemical ESD (such as batteries, flow batteries, capacitors/supercapacitors, and fuel cells), physical ESDs (such as superconducting magnets energy storage, compressed air, pumped storage, and flywheel), and thermal ESDs (such as sensible heat storage and latent heat ...

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