Analysis of global photovoltaic energy storage patents

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

The study comprises four key strata: (i) a thorough literature review of recent energy trends, (ii) a comparative study of global energy patents using the World Intellectual ...

For the solar energy calculations, ... Snapshot of Global Photovoltaic Markets 2017 ... C. S. & McCulloch, M. D. Levelized cost of energy for PV and grid scale energy storage systems.

Against the pressing challenges of climate change and fossil fuel depletion, renewable energy sources such as solar photovoltaics (PV) are considered a clean and sustainable alternative. PV technologies have grown into a substantial field of research and development through large stocks of scientific publications and patents. Besides cell ...

Solar photovoltaic-thermal hybrid with phase change material (PVT-PCM) emerges as an intelligent game changer to stimulate the clean, reliable, and affordable renewable energy technology. This PVT-PCM technology can be manipulated into generating both electricity and thermal energy that feature its practicality for residential and industrial applications. ...

With the rapid development of renewable energy, photovoltaic energy storage systems (PV-ESS) play an important role in improving energy efficiency, ensuring grid stability and promoting energy ...

Novel ideas related to new energy technologies are likely patented before they are scientifically published to request exclusive rights for their commercial exploitation (Mueller et al., 2015), (Chanchetti et al., 2016).Patent documents provide a strong source for e.g., which countries, institutes, and companies are investing in different technologies and to what extent.

The seamless increase in global energy demand vitally influences socio-economic development and human welfare [1, 2] dia is the second-highest populous country witnessing rapid development, urbanization, ...

Research activities on solar energy has been growing and use of patents becomes an important innovation source for many types of studies. This paper aims to analyze solar photovoltaic (PV) patents and describes its assignees cooperation profile. PV patents based on IPC Green Inventory code were selected from 1990 to 2014, filtered out co-ownership ...

The International Energy Agency and the International Solar Alliance have joined forces to produce this guide

providing policy makers, industry, civil society and other stakeholders with the technological information and methodological tools to map a course towards robust, accelerated solar energy deployment.

The framework for tracing the biomass power generation technology development and trajectory is shown in Fig. 1, which shows the data collection, growth curve analysis, and path analysis research steps.The data collection involved extracting the most relevant records from the patent database, after which the logistics growth curve and patent ...

If, on the one hand, there is a growing world demand for energy, concern about the current dependence on non-renewable energy sources and the need to mitigate the climatic impacts caused by the use of fossil energy, on the other hand, the challenges for the development of technologies to take advantage of solar energy are large and involve production costs, ...

As shown in Table 1, across all EST lists (EPO, 2019; USPTO, 2009; WIPO, 2010), we found that all forms of renewable energy generation either come directly or indirectly from thermal energy generated by the sun or deep inside the earth - this includes solar energy, wind energy, biomass energy, geothermal energy, nuclear energy, water energy, ocean ...

A recent trend in smaller-scale multi-energy systems is the utilization of microgrids and virtual power plants [5].The advantages of this observed trend toward decentralized energy sources is the increased flexibility and reliability of the power network, leveraging an interdependent system of heterogeneous energy generators, such as hybrid ...

Patents and the Energy Transition - Analysis and key findings. A report by the International Energy Agency. ... Carbon Capture, Utilisation and Storage; Decarbonisation Enablers; Explore all. Topics . ... Patents and the Energy Transition. Global trends in clean energy technology innovation April 2021

Since GIS leads to the global PV value chain segmentation, the PV technology innovation has attracted academic attention. Currently, most studies explore the PV technology innovation at a single country level (Zhao and Wei, 2020) or conduct a comparative analysis of the developing PV industry across two or more countries from a macroeconomic perspective (Choi ...

Based on the global PV patenting data from 1970 to 2018, this paper reveals the network structure of international PV technological competition and further explores the competing relations between regions and nations. ... Understanding the development trends of low-carbon energy technologies: a patent analysis. Appl Energy (2014) S.P. Borgatti ...

Renewable sources of energy include wind, solar, hydropower, and others. According to IRENA"s 2021 global energy transition perspective, the 36.9 Gt CO 2 annual emission reduction by 2050 is possible if the six technological avenues of energy transition components are followed; those include onshore and offshore wind

energy, solar PV, ...

Renewable energy achieved a 28.8% share of the global electricity supply in 2020, the highest level on record, with solar photovoltaic (PV) and wind each accounting for about one third of the total renewable electricity generation growth that year [1].Solar PV generation uses semiconductor materials to convert sunlight into electricity [2], [3]. ...

This is shown in the figure below, which also highlights the concentration of clean-energy investment in the so-called "new three" of solar, energy storage and EVs. Clean energy was also the top contributor to China"s economic growth overall, contributing around 40% of the year-on-year increase in GDP across all sectors.

Currently, electricity derived from the grid or renewable sources such as wind, solar, geothermal, or biomass is also used to produce hydrogen. Solar energy and wind energy have only been mentioned in the patent to produce hydrogen. Based on the data in Table 3, it is apparent that solar energy is the most recently patented renewable energy ...

The study used PATSTAT, a worldwide patent statistics database managed by EPO, to look at six main RETs - solar energy, wind energy, ocean energy, geothermal energy, hydropower and ...

The study has presented a bibliographic and technological analysis of global patents to identify the present status of the patent in the field of grid-connected LIB ESS . ... Levelized cost of electricity for solar photovoltaic and ...

The transition towards a low-carbon energy system is driving increased research and development in renewable energy technologies, including heat pumps and thermal energy storage (TES) systems [1].These technologies are essential for reducing greenhouse gas emissions and increasing energy efficiency, particularly in the heating and cooling sectors [2, 3].

Aimed at decision-makers in both the private and public sectors, this report is a unique source of intelligence on the innovation trends across the energy system, in particular ...

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