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Wind power generation environmental protection system

Overview

The energy sector contributes significantly to the emission of greenhouse gases (GHGs) due to the use of fossil fuels which leads to climate change problems. Worldwide, there is a shift from fossil fuel-based energy to cleaner energy s. The energy sector contributes significantly to the emission of greenhouse gases (GHGs) due to the use of fossil fuels which leads to climate change problems. Worldwide, there is a shift from fossil fuel-based energy to cleaner energy sources such as solar, wind, geothermal, and biomass. Wind energy is one of the promising cleaner energy sources as .

••Wind energy can provide energy over 165.1 PWh/year.••Wind energy faces energy, cost and environmental sustainability issues.••The impacts of environmental issues are discussed.••Mitigation approaches of environmental impacts are elucidated.

Wind energySustainabilityAvian lifeNoise pollutionVisual impactsMitigation strategies.

The use of fossil fuels for energy generation led to the energy sector contributing the most (73.2 %) of the 49.4 billion tonnes CO2-eq GHGs emissions emitted globally in 2016 (Ritchie and Roxer, 2020). The GHGs cause disasters like global warming, extreme weather, food insecurity and others (Hussain et al., 2020). These disasters mean that it is essential for the world to shift from fossil fuels to renewable energies such as wind, solar, hydro, and geothermal, producing fewer GHGs (Eshiemogie et al., 2022). Wind energy is one of the most feasible renewable energies as it is cost-effective and sustainable compared to other energy sources (Chien et al., 2021). Many countries worldwide have been deploying wind farms to add more clean energy to their national grid, replacing fossil fuels (.

Currently, several countries have invested and focused on wind energy generation. In 2020, the world faced a global pandemic that hindered some operations of wind power installations due to supply chain disruptions and unavailability of the workforces (WWEA, 2020). Regardless, countries made progress in wind energy generation. Approximately 93 GW of wind energy was installed globally, with onshore accounting for 89.3 GW and 6.1 GW offshore in 2020 (Fig. 1). These installations account for a 53 % increase compared to the previous year. China and the US were the leading countries in wind energy installation, accounting for more than 74 % (Fig. 2). The wind share in total electricity consumption also increased; for example, in Europe, Denmark had

48 %, Ireland 38 %, Germany 27 %, UK 27 %, Portugal 2.

How does wind energy generation affect the environment?

Apart from environmental impacts, wind energy generation faces issues in energy and financial sustainability, such as the wind power fluctuation, technology lagging and use of fixed feed-in tariff contracts that do not consider wind energy advancement and end-of-life management.

Can wind energy provide energy over 165.1 PWh/year?

Wind energy can provide energy over 165.1 PWh/year. Wind energy faces energy, cost and environmental sustainability issues. The impacts of environmental issues are discussed. Mitigation approaches of environmental impacts are elucidated.

How can we combat wind energy environmental impacts?

We discussed that turbine deterrents, automatic curtailment, low gloss blades and sustainable siting of wind farms as some of the effective ways to combat wind energy environmental impacts.

What is the IEA Wind Energy Systems Technology collaboration programme?

The IEA Wind Energy Systems Technology Collaboration Programme, which provides an information platform for participating governments and industry leaders on co-operative R&D efforts to reduce the cost of wind energy technologies, increase transmission and power system flexibility, and raise social acceptance of wind energy projects.

Why is wind power a viable alternative to conventional energy?

Wind power offers a compelling solution to many of the environmental problems stemming from conventional energy generation. Its primary strength lies in its near-zero emissions during operation. Unlike coal, natural gas, or nuclear power plants, wind turbines don’t burn fuel to generate electricity.

Is wind energy good for the environment?

Wind energy has emerged as a promising solution to our growing energy needs, but its environmental impact remains a topic of much debate. As

countries around the world invest heavily in wind power, it’s crucial that we carefully examine both the benefits and drawbacks of this renewable energy source.

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