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HOW EFFECTIVE ARE RENEWABLE ENERGY SOURCES COMPARED TO FOSSIL-BASED ENERGY

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ABSTRACT----------
This article evaluates the effectiveness of renewable energy sources compared to fossil-based energy, highlighting their potential to mitigate climate change and reduce greenhouse gas emissions. It explores the advancements in renewable energy adoption, including notable efforts in the United States and globally, such as Hawaii's ambitious plans and the rise in wind and solar energy capacity. Challenges such as infrastructure limitations, high costs, and political opposition are also examined, alongside the variability of renewable energy generation and battery storage limitations. The analysis underscores the urgent need for a global shift toward renewables while addressing the practical and systemic obstacles that hinder their widespread adoption.

KEYWORDS: *Renewable Energy, Fossil Fuels, Greenhouse Gas Emissions, Climate Change, Energy Transition*

INTRODUCTION

Renewable energy has become a cornerstone of global efforts to address the mounting challenges of climate change and environmental degradation. As the world faces rising temperatures, extreme weather events, and the long-term impacts of greenhouse gas emissions, the transition from fossil fuels to renewable energy sources is increasingly seen as imperative. Energy sources such as wind, solar, hydroelectric, geothermal, and biomass offer the potential to meet growing energy demands while significantly reducing the carbon footprint associated with traditional fossil-based energy.

In recent years, countries worldwide have taken steps to expand their renewable energy capacity, with some, like Hawaii and certain European nations, setting ambitious goals to achieve 100% renewable energy in the coming decades. In the United States, federal and state initiatives have driven substantial growth in renewable energy adoption, as evidenced by the rapid increase in wind and solar energy production. These efforts reflect a growing recognition of the critical role renewable energy plays in creating a sustainable and resilient energy system.

However, the transition to renewables is not without its challenges. Infrastructure limitations, such as outdated power grids and the need for extensive transmission networks, pose significant barriers. Additionally, the intermittent nature of renewable energy sources like wind and solar raises questions about reliability, especially in the absence of advanced energy storage solutions. Economic factors, including the high initial costs of renewable energy projects and declining federal subsidies, further complicate the transition. Political resistance and conflicting priorities among stakeholders also hinder progress, with debates over policies such as the Green New Deal highlighting the complexities of building consensus around renewable energy adoption.

This article explores the effectiveness of renewable energy compared to fossil-based energy, analyzing their respective advantages and challenges. By examining advancements in renewable energy technologies, the obstacles to their widespread implementation, and the potential solutions to bridge the gap, this analysis seeks to shed light on the path toward a sustainable energy future. Through a comprehensive understanding of these dynamics, we can better navigate the transition to a cleaner, more sustainable world while addressing the pressing energy and environmental needs of today.

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An assessment of renewable and non-renewable energy sources

Nearly one-fifth of energy generation in the world as of 2022 comes from renewable sources like hydro dams, wind and solar, and some experts predict that by the middle of the next century, the US will be able to produce all of its electricity without using dirty fossil fuels. Already, Hawaii intends to use renewable energy sources exclusively by 2045, while California wants to completely phase out the utilization of hydrocarbons as a source of power by that time (Gavin, 2019).

Supporters assert that widespread adoption of renewable energy is essential to halting the worst consequences of climate change, not just in the United States but also internationally. However, a radical switch to renewable energy confronts significant obstacles. Electrical infrastructure needs technological advancements to effectively manage the erratic electricity distribution from the sun as well as wind, and the nation has yet to develop a national plan supporting renewable energy. While some moderate liberals and some conservatives fiercely oppose the Green New Deal, requiring a change in the use of fossil fuels, some democrats are pushing for it.

Globally, many climate scientists believe that a swift switch harnessing the potential of renewable resources is essential to prevent climate catastrophes and an increase in the frequency of extreme weather events, such as more intense storms and droughts. However, other analysts assert that global leaders like United States of America and other countries in the immediate future will continue to depend on hydrocarbons in the immediate future, in large part due to the unpredictability renewable energy sources and the fact that power networks were not built to handle renewable energy sources.

Renewable energy sources also include heat collected from deep down (geothermal energy), tidal and wave activity, water running through dams and rivers, heat from the sun and wind, and the gasification of biomass, such as wood, agriculture waste, or any other compounds like ethanol.

According to research firms Bloomberg New Energy Finance and the Business Council for Sustainable Energy, a collection of renewable power businesses and organizations in states like Washington, the nation's renewable energy capacity quadrupled between 2008 and 2017, driven by wind and solar energy. The two organizations said that since 2008, renewable sources had increased from 9 percent to roughly 18 percent of the nation's electricity supply. They saw that the cost of renewable energy was rising in comparison to that of coal, natural gas, and other traditional energy sources (Gavin, 2019).

However, there are still significant obstacles that the renewable energy sector must overcome to capture a bigger portion of the nation's electricity supply. Wind and solar farms are dispersed across huge, sometimes isolated areas, in contrast to decades-old fossil fuel facilities that are near to the areas they serve. Long, pricey transmission lines are sometimes needed to connect wind and solar facilities to cities and bringing them online themselves generally demands huge financing than fossil fuel-powered power stations.

Advocates for renewable energy also encounter political and legislative challenges. Over the next several years, federal tax benefits that have accelerated the growth of domestic and business installations for photovoltaic and wind power will be phased off. President Trump for example pushed back environmental restrictions from the Obama administration to support coal and other fossil fuel producers, claiming that he wants to keep jobs in those sectors Additionally, some experts claim that because wind and solar farms create variable amounts of power based on the weather, the nation's current electric grid system does not have the capabilities to support them. When the weather is ideal, such as when there is strong wind or intense sunlight, renewable energy sources can produce so much energy that traditional systems are unable to handle it (Union of Concerned Scientists,2017).

Can renewables meet global energy needs?

Fossil fuel opponents claim that hydroelectric dams, wind farms, solar farms, and other renewable energy sources can one day supply all the world's energy needs. They are looking to Hawaii to support their claims.

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Hawaii's electrical systems get power from sixty renewable energy projects, and it's on course to reduce reliance on hydrocarbons by three-thirds over the next three years. The plan is to scale up wind and solar, while also investing heavily in biomass energy produced by burning municipal solid waste.

Since electricity has the capacity to power almost everything, either directly or through batteries, it is the statistic that is most usually used to gauge the usefulness of renewable energy. Experts suggest that to meet the world's energy needs solely with renewable energy, practically everything would need to be electric.

But in order to heat buildings and power vehicles like automobiles, trucks, and airplanes, natural gas and other fossil fuels are considerably more frequently used than electricity around the world, thus renewable energy sources are hardly making a dent in addressing those needs.
According to some analysts, a number of issues with renewable energy significantly reduce its potency to ultimately phase out fossil fuels. It is claimed that offshore wind turbines may not be able to withstand hurricanes that get stronger and that wind farms installed inland, for instance, need more land area to provide large-scale energy needs.
The most evident issue with solar and wind energy is that often they produce no electricity at all while other times they produce excessively, endangering to burden electrical infrastructure. Experts argue on whether battery technology can resolve this issue. Batteries still are not able to store enough electricity, according to many energy researchers, to be economically viable for reducing variations in power from renewable sources.

Can the world make the switch to renewable energy soon enough to mitigate its worst effects?
Countries all over the world have agreed to drastically decrease emissions of greenhouse gases under the 2015 Paris Agreement on Climate Change as part of an international action strategy to avert the worst-case circumstances of rising sea levels, severe storms, droughts, and other increased temperatures influenced by global warming.

Many climate experts believe that the idea is unlikely to be successful currently. They point out that last year's emissions of carbon dioxide, which warms the globe, increased by an estimated 2.7 percent to a record 37 billion tons. In the US, the production of renewable energy is rising quickly. The U.S. Department of Energy's Energy Information Administration revealed in February that during 2017 and 2018, the electricity produced by wind and solar farms increased by 24.4 percent and 8.1 percent, respectively. Coal-based electricity production, meanwhile, fell by 4.9 percent.

CONCLUSION

Renewable energy holds significant promise for reducing greenhouse gas emissions and combating climate change. However, the transition faces hurdles, including technological, economic, and political challenges. While countries like Hawaii demonstrate progress, global reliance on fossil fuels remains substantial due to infrastructure limitations and energy demand in sectors like transportation and heating. To fully realize the potential of renewable energy, coordinated efforts in innovation, infrastructure development, and policy support are essential. Achieving a sustainable energy future requires a balanced approach that addresses these challenges while accelerating the transition to cleaner energy sources.

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