

RENEWABLE ENERGY AND CLEAN TECHNOLOGY

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Abstract. This article explains the need of renewable energy and clean technologies in today's world, where energy demand is rapidly increasing and causing environmental problems such as air pollution, climate change, habitat destruction, and biodiversity loss. Also, how renewable energy sources such as wind, solar, hydro and geothermal reduce our dependence on fossil fuels and minimize the impact of global warming. It also shows how sustainable, cheap and abundant renewable energy sources are critical to a sustainable future. The article also provides an overview of the current state of renewable energy production.

Keywords: renewable energy, sustainability, climate change, pollution, biodiversity loss, energy sources.

Introduction

In today's world, the demand for energy is increasing at an unprecedented rate. This demand is driven, among other things, by population growth, urbanization and industrialization. However, this energy requirement comes at a significant cost to the environment. The burning of fossil fuels causes environmental problems such as air pollution, climate change and habitat destruction. Furthermore, the finite nature of these resources means that they will eventually be exhausted. To alleviate these environmental problems and meet the growing energy demand, the world needs to turn to renewable energy and clean technologies.

Renewable energy is energy obtained from naturally renewable sources such as wind, solar, hydroelectric and geothermal energy. Unlike fossil fuels, renewable energy sources are limitless and their use has minimal environmental impact. For example, wind and solar energy produce no greenhouse gases, and hydroelectric and geothermal energy have very little emissions compared to fossil fuels. By using renewable energy sources, we can reduce our dependence on fossil fuels, reduce air pollution, and mitigate the effects of global warming.

The use of renewable energy and clean technology is essential to ensuring a sustainable future. The continued use of fossil fuels harms the environment and poses serious risks to the economy and human health. By implementing these technologies, we can reduce greenhouse gas emissions, increase energy efficiency and provide future generations with a clean and sustainable source of energy.

Switching to Eco-Energy: Benefits and Urgency

Environmental conditions are becoming more and more concerning for our planet. As population and resource consumption grow, soaring demand for natural resources is leading to environmental degradation and climate change. According to the Intergovernmental Panel on Climate Change (IPCC), if current carbon emission trends continue, global warming is projected to reach 1.5°C above pre-industrial levels between 2030 and 2052. (IPCC, 2018) [1]. Such kind of warming will have serious consequences that affect the livelihoods of millions of people, including rising sea levels, more frequent heat waves, and extreme weather events.

In addition, biodiversity loss is also a matter of concern. According to the World Wildlife Fund's Living Planet Report 2020, global populations of mammals, birds, fish, reptiles and amphibians have declined by 68% since 1970, mainly due to habitat loss, climate change and pollution. (WWF, 2020) [2]. This loss of biodiversity not only undermines natural beauty, but also threatens the availability of human resources.

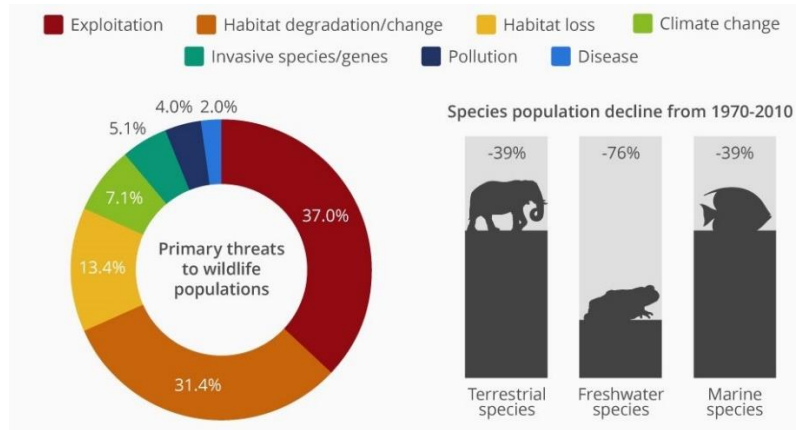


Figure 1. Decrease in the population of different wild species [3]

Secondly, air and water pollution continue to pose significant threats to human health and the environment. Approximately 7 million premature deaths per year (WHO, 2021) [4]. Similarly, approximately 2 billion people worldwide lack access to clean drinking water (WHO, 2021).

Renewable energy has many advantages over conventional fossil fuels. In essence, renewable energy sources such as wind, sun and water do not emit greenhouse gases that contribute to climate change. According to the International Renewable Energy Agency (IRENA) [5], using renewable energy sources could reduce global CO₂ emissions by 70% by 2050 (IRENA, 2018). This reduction in emissions could significantly slow the pace of global warming.

Moreover, renewable energy sources are sustainable and abundant. Unlike fossil fuels, which are finite and eventually depleted, renewable energy sources can be replenished indefinitely. Moreover, the cost of renewable energy has fallen significantly in recent years, making it more competitive with conventional energy sources. According to the International Energy Agency (IEA) [6], renewable energy has become the most cost-effective source of new power generation in many parts of the world (IEA, 2020).

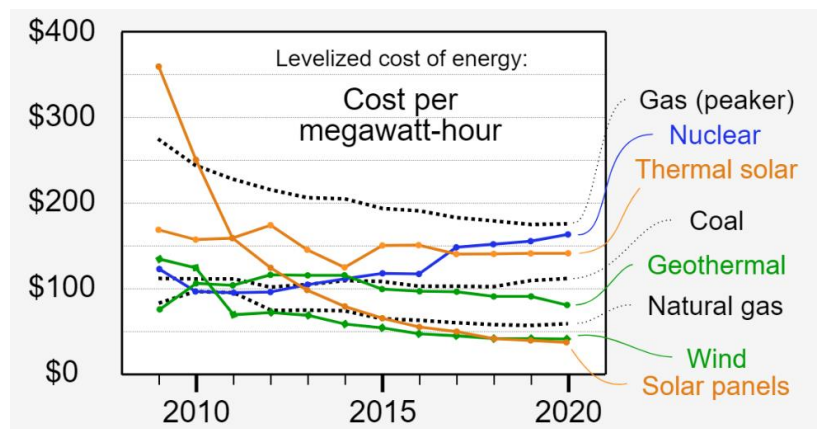


Figure 2. Cost per megawatt-hour of different energy sources [7]

Finally, renewable energy offers significant economic advantages. The renewable energy sector has created millions of jobs worldwide and the growth of renewable energy is expected to continue creating employment opportunities. In addition, renewable energy can help reduce fuel poverty by providing affordable and reliable electricity to remote and rural areas.

Types of renewable energy

Renewable energy is a must in the worldwide campaign against climate alteration and the minimization of carbon emissions. Sustainable energy sources have no emissions of contaminant gases or greenhouse gases into the atmosphere like traditional fossil fuels do. To meet the world's energy requirements while protecting the environment for future generations, a renewable energy system has to be an essential part of the equation. There are a variety of renewable energy varieties, including solar, wind, hydro, geothermal, and biomass. We've seen notable advancements in the global development and usage of these technologies in recent times. This article will investigate the present condition of renewable energy, comprising of figures and worldwide achievements. Of the renewable energy sources, solar energy has encountered the most remarkable expansion. The International Energy Agency (IEA) anticipates that in 2020, the world's capability for solar photovoltaic (PV) power will ascend by 127 GW [6]. More than 120 million homes could benefit from the 773 GW of solar PV that was introduced all around the globe as of the end of 2020 [8].



Figure 3. Elaboration of solar energy [9]

Well over four-tenths of the global photovoltaic capability is currently created in China, making it the leading creator of solar power on the planet. Additional noteworthy solar energy producers with installations surpassing 250 GW include the US, India, Japan, and Germany [8].

Wind energy is a swiftly developing renewable energy source. The IEA approximates that the mounted wind energy capacity expanded by 114 GW in 2020, or 17%, from 2019 [6]. The installed wind energy capacity came to 733 GW at the end of 2020, which is adequate to supply more than 200 million homes. With more than 30% of the world's wind energy capacity, China is currently the top producer of wind energy. Other substantial wind energy manufacturers with installed capacities surpassing 300 GW include the United States, India, Germany, and Spain [8].



Figure 4. Elaboration of wind energy[10]

Brazil, the United States, Canada, and Russia unitely own the capability to exceed 400 GW of geothermal vigor. A blossoming origin of clean energy is geothermal power. According to the IEA, its strength raised by 300 MW, or 1.5 percent, worldwide in 2020 as compared to 2019 [6]. By the end of 2020, 14.9 GW of installed geothermal energy will exist.

Boasting over a quarter of the world's geothermal energy capacity, the United States stands at the forefront of this form of power.

Hydropower is the most prevailing renewable energy source, creating more than half of the world's renewable energy necessities. As indicated by the International Energy Agency, introduced hydropower limit expanded by 12 GW in 2020, or 2% more than in 2019 . To provide electricity to in excess of a billion homes, the world's hydropower limit was 1,311 GW as of the finish of 2020. With a limit of more than 30%, China is the biggest hydropower maker .



Figure 5. Baihetan Hydropower Station, China[11]

A renewable power source derived from organic materials such as vegetation and rubbish, biomass energy is derived from these substances. As per the International Energy Agency, in 2020 the installed capacity of biomass energy rose by 2 GW, which is 2 percent more than the preceding year [6]. The total installed capacity of biomass power globally as of the end of 2020 was 121 GW. The United States is currently the greatest producer of biomass-based electricity, with more than 20% of the world's biomass capacity. Germany, Brazil, China, and the United Kingdom are also significant producers of biomass energy

Boasting over a quarter of the world's geothermal energy capacity, the United States stands at the forefront of this form of power . Around the world, the move to renewable energy is accelerating, with numerous countries setting sky-high adoption objectives. Even with the challenges posed by the COVID-19 pandemic, 72% of fresh power capacity augmentations worldwide in 2020 were generated by renewable energy [7]. With respect to augmenting their utilization of renewable energy, numerous countries have made remarkable progress. By 2020, over 80 countries had set objectives for renewable energy, with many aiming for 100 percent renewable energy by 2050 or even earlier [8]. Several nations, including Costa Rica, Sweden, Denmark, and Costa Rica, have already achieved 100% renewable energy in their electricity production .

Hiding parts of renewable energy

First of all, renewable energies contaminate a lot less the environment, which can slow climate change on our planet and also aren't finite sources of energy like fossil sources of energy (coal, gas, diesel fuel). So it can be said that alternative sources of energy have more advantages than non-renewable sources, but also sustainable energy isn't perfect and sometimes their use can be difficult or inefficient.

Renewable energies are, in most cases, wasteful, for example efficiency of the solar panels in the market is between 15% and 20%. On the other hand, non-renewable technologies that use coal or

natural gas can respectively reach efficiency levels of up to 40% and 60%. For instance, their output can be variable, depending on weather conditions and location, which makes it difficult to rely only on them for consistent power generation.

For example, Moreover, the initial costs of installing renewable energy systems can be high, making them less accessible to individuals and communities with limited financial resources. If we look at prices, the Forbes magazine says that installing solar panels in the United States costs on average 16.000\$, which is a significant investment for most people [14]. In addition, the production of certain renewable energy technologies needs the extraction of rare metals and minerals, such as arsenic or lithium, which can have negative environmental impacts if mined in forest or protected areas [15]. To prevent this, solar panels are recycled to reduce electronic waste and create a source for materials that would otherwise need to be mined, although such business is still small and work is ongoing to enhance and scale-up the process

Finally, large deployment of renewable energy infrastructure like solar, wind or hydropower can have unintentional consequences on local ecosystems and wildlife habitats. As an example, solar power can change the albedo of the surface, so if it is used on a huge scale (as covering 20% of the Sahara Desert) it can modify the global weather pattern. At the same time, they usually need 10 times more space than fossil fuel power plants. Also, there are more than 2000 renewable facilities around the world built in areas of a big environmental importance, being a threat for animal habitats [16]. A recent review by the National Wind Coordinating Committee (NWCC) found that collisions with wind turbines and air pressure changes caused by spinning turbines resulted in many bird and bat deaths. Similarly, offshore wind turbines can harm marine birds [17].

Furthermore, geothermal sites contain poisonous gasses that can escape when holes are being drilled in the earth's surface. Also, geothermal energy stations, at extreme circumstances, are able to cause earthquakes.

In addition to the previously mentioned disadvantages, another challenge with clean technology is storage of energy. Energy storage technologies are crucial to ensure a reliable energy supply, especially during periods of low renewable energy generation. Nevertheless, the current energy storage technologies are often expensive, bulky, and with limited storage capacity. However, the World Energy Council's report estimates that with the many new technologies in the pipeline, energy storage costs will fall by as much as 70% over the following 15 years, with solar in particular becoming more competitive as new battery technology makes it cheaper. Although research on new energy storage solutions is ongoing, the challenges and limitations of current technologies remain a significant obstacle to the widespread adoption of renewable energy sources.

While renewable energy is a key part of the transition towards a more sustainable future, it is important to consider and address its potential disadvantages, as well as ways of improving them in order to reduce weaknesses. In this way it is possible to improve green technology making them even more clean and affect less negatively the environment in the globe.

Conclusions

In summary, the urgency of switching to green energy has never been more important. Increasing energy demand and limited supply of non-renewable resources have made renewable energy sources the best alternative. The benefits of renewable energy are many and include reduced greenhouse gas emissions, lower energy costs, and new job opportunities.

Types of renewable energy available include solar, wind, hydro, geothermal and bioenergy. Each has its own advantages and limitations, and the best approach is to use a combination of different sources. However, it is important to note that some parts of renewable energy is hidden. For example, the production and disposal of renewable energy equipment can have a negative impact on the environment.

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