

A Review on Renewable Energy and Its Types

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Abstract

Utilizing replenishable natural resources or techniques, renewable energy, often known as clean energy, is created. Sunlight and wind, for instance, continue to shine and blow despite though their availability is based on the time and climate. While using the power of nature has long been used for transportation, lighting, heating, and other purposes, renewable energy is frequently considered of as a relatively recent technology. Wind has been used to propel ships across the oceans and power grain mills. The light warmed the day and assisted in starting fires that lasted into the evening. But during the past 500 years or more, humans have relied more and more on dirtier, less expensive energy sources like coal and fracked gas. In order to attain the goal of decarbonization in the energy sector, technologies like wind power, solar power, and water power can be used as the primary sources of renewable energy. They do differ significantly from traditional power plants in some important ways, though. The proportion of renewable energy has changed and presented a number of difficulties, particularly in the power generation system. The decarbonization target can be reached with the reliability of the power system, but this goal frequently runs into a number of obstacles and breakdowns that put the target's achievement in danger. The difficulties and technological solutions are, however, still hardly ever covered in the literature.

Keywords: Renewable energy, hydro power, geothermal energy, bioenergy, ocean energy

INTRODUCTION

Renewable Energy

Renewable energy is derived from natural resources that regenerate more quickly than they are depleted. The sun and the wind are two examples of such continuously replenishing sources. Numerous renewable energy options are available to us. Contrarily, it takes hundreds of millions of years for non-renewable fossil fuels like coal, oil, and gas to form. When fossil fuels are burned to create energy, dangerous greenhouse gases like carbon dioxide are generated.

The production of power from renewable sources results in less emissions than the combustion of fossil fuels. To stop the climate calamity, it is imperative to switch from fossil fuels, which now provide the majority of emissions, to renewable energy.

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The majority of countries today have cheaper renewable energy options, which also generate three times as many jobs as fossil fuels [1].

We have been using the environment's natural power for a very long time, despite the fact that renewable energy is frequently mentioned as a solution for the future of our power demands. Granaries have been powered by water wheels, windmills, and the sun, while fire has been lit and heated by the sun.

However, the utilisation of fossil fuels like coal and natural gas came to be increasingly dependent on humans. It has been established that the extensive use of these forms of energy has had a negative effect on the globe, leading to a rise in extreme weather occurrences, an increase in global temperatures, and the destruction of natural habitats.

The generation of renewable and environmentally friendly energy has increased as a result of recent improvements in capture and storage and the global push toward Net Zero. These innovations cover a wide range of output, from small-scale installations like solar panels on a house to large-scale ones like offshore wind farms [2–4].

TYPES OF RENEWABLE ENERGY

Solar Energy

On our globe, sunshine is one of the most accessible and abundant energy sources. The quantity of solar energy that reaches the surface of the globe in a single hour is larger than the entire amount of energy needed to support the planet annually. In spite of the fact that solar energy may appear like the ideal renewable energy source, how much of it we can use depends on the time of day, the season of the year, as well as our geographic location. In the UK, solar energy is a supplement to your energy use that is growing more and more popular.

The most plentiful source of energy is solar energy, which may even be used under cloudy conditions. The rate of solar energy absorption by the Earth is approximately 10,000 times greater than the pace of human energy consumption.

Solar systems are capable of producing heat, cooling, power, fuels, and natural illumination for a variety of uses. Solar technologies use photovoltaic (PV) panels or solar radiation concentrators to convert sunlight into electrical energy.

Even though not every country has the same availability to solar energy, direct solar energy can nevertheless significantly contribute to the energy mix of any country.

Solar panels are now not only accessible, but frequently the cheapest source of electricity because to a sharp decline in the cost of solar panel production over the past ten years. Solar panels come in a range of colours based on the type of material used in their manufacture and have an average lifespan of 30 years [5].

Wind Energy

A plentiful source of renewable energy is wind. Wind farms are more prevalent in the UK as wind energy contributes to the National Grid at a steadily increasing rate. Electricity from wind energy is produced by turbines driving generators, which ultimately send electricity to the National Grid. Even though there exist methods for "off-grid" or household power, not every property can accommodate a residential wind turbine. Visit our wind power website to learn more about wind energy.

Despite the fact that average wind speeds vary greatly from place to place, most locations of the world have the potential for considerable wind energy deployment. In fact, the technical potential for wind energy is more than the global power production.

Strong winds can be found in many locations around the world, but often distant areas are the greatest for producing wind energy. Offshore wind energy has a lot of potential [6].

More than a century ago, the first wind turbines appeared. After the electric generator was developed in the 1830s, engineers began experimenting with harnessing wind power to create electricity. Denmark, where the first 22.8-meter wind turbines were installed in 1897 and horizontal-

axis wind turbines were created in 1891, is regarded to be the birthplace of modern wind power. In the United States and the United Kingdom, wind energy was generated in 1887 and 1888.

Utilizing the kinetic energy provided by moving air, wind energy is used to generate electricity. Using wind turbines or other wind energy conversion technologies, this is converted into electrical energy. Wind strikes a turbine's blades first, turning them and the turbine attached to them. This transforms kinetic energy into rotational energy by turning a shaft connected to a generator, which then uses electromagnetism to produce electrical energy.

Hydro Energy

Another indirect source of solar energy is hydropower. It is regarded as the most developed and greenest renewable energy source. The renewable energy source known as hydropower is created when water falls from a high potential to a low potential. Utilizing the potential energy of the falling water to power a hydro turbine, hydro energy is generated. This turbine is connected to the electrical generator's rotor. The stator of the electrical generator induces a series of three-phase voltages [7, 8].

Hydropower is one of the most established and financially viable renewable energy sources. A huge reservoir can be utilised to create a regulated flow of water that will run a turbine and produce power. This flow can be controlled by building a dam or other barrier. This energy source may often be stored for use during times of high demand, making it more dependable than solar or wind power (especially if it's tidal rather than river-based).

Like wind energy, hydro can occasionally be more cost-effective when used as a commercial energy source (depending on the type and when compared to other energy sources), but it can also be used for domestic, "off-grid," generating. For additional information, go to our hydropower website. The energy of water flowing from higher elevations to lower elevations is captured by hydropower. It can be produced by rivers and reservoirs. Run-of-river hydropower facilities use the river's available flow to generate energy, whereas reservoir hydropower plants rely on water that has been stored in a reservoir.

Geothermal Energy

Heat that is generated beneath the surface of the earth is known as geothermal energy. To transport the geothermal energy to the Earth's surface, water or steam is required. Geothermal energy can be utilised for producing clean electricity as well as for heating and cooling applications, depending on its properties. But in order to produce power, high- or medium-temperature resources are required, and these are typically found nearby tectonically active areas.

Geothermal reservoirs can be heated using wells or other methods.

Hydrothermal reservoirs are those that are naturally sufficiently hot and permeable, whereas enhanced geothermal systems are those that are naturally adequately hot but improved by hydraulic stimulation.

Different temperature fluids can be used to produce electricity once they reach the surface. Since it has been in use for more than a century, the technology for producing energy from hydrothermal reservoirs is established, dependable, and mature [9].

Ocean Energy

Ocean energy encompasses all marine-derived renewable energy sources. Wave, tidal, and ocean thermal technologies are the three primary categories of ocean technology.

The commercialization of all ocean energy sources is still in its early stages. The cost of wave energy continues to exceed that of the other ocean technologies. In areas with significant tidal resources,

such as La Rance in France and Sihwa in South Korea, tidal range (see explanation below) has been implemented, whereas tidal stream (see explanation below) has only been tested on a small scale.

Ocean energy comes from processes that use the kinetic and thermal energy of the ocean's waves and currents to generate heat or electricity.

The development of ocean energy systems is still in its infancy, and several wave and tidal current prototypes are being investigated. Theoretically, ocean energy could easily provide all of the world's energy needs [10].

Bioenergy

One of the many different resources that can help us meet our need for energy is bioenergy. It is a type of renewable energy produced from recently living organic elements called biomass, which can be used to create products, heat, power, and transportation fuels.

Bioenergy is made from various organic resources, known as biomass, including wood, charcoal, dung, and other manures for the production of heat and power, as well as agricultural crops for the creation of liquid biofuels. The majority of biomass is utilised by impoverished populations in developing nations in rural regions for cooking, lighting, and space heating.

Dedicated plants or trees, agricultural and forestry waste products, and diverse organic waste streams are all used in modern biomass systems.

When biomass is used for energy, greenhouse gas emissions are produced, although at a lesser rate than when fossil fuels like coal, oil, or gas are burned. However, given potential adverse environmental effects connected to significant expansions in forest and bioenergy plantations, and the ensuing deforestation and land-use change, bioenergy should only be employed in limited applications.

CONCLUSION

A free source of energy generation is one of the many advantages that renewable energy offers. As the industry expands, so are the number of jobs being created to design and implement tomorrow's renewable energy solutions. Additionally, renewable energy sources increase access to electricity in developing countries and can lower energy costs.

Naturally, one of the key advantages of renewable energy is the fact that a substantial portion of it also qualifies as green and clean energy. As a result, renewable energy has increased, with solar and wind energy being particularly common.

Renewable energy sources, however, are not the only ones that can offer these environmental benefits. Since nuclear energy produces or emits very little CO₂, it is also a carbon-free energy source. Some people prefer nuclear energy to sources like solar and wind since it is a reliable source that is not affected by the weather.

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