

# Renewable Energy: Sources and Forms

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**Abstract**— The term renewable energy expresses energy resulting from natural processes, without human intervention, and is constantly renewed. There are several types in nature, such as sunlight, geothermal energy, and wind, sea waves, running water energy or falling from slopes, in addition to biomass energy in its various forms. One of the most important advantages of renewable energy is that it is impermeable and free, in addition to being clean energy. As for the concept of alternative energy, it expresses any energy source that can be used as an alternative to fossil fuels, and it is often non-conventional energy sources that do not affect nature as much as burning fossil fuels.

**Keywords**— Renewable Energy – Solar Energy – Wind energy – Solar panels - energy

## I. INTRODUCTION

Over the past 150 years or so, humans have relied heavily on coal, oil, and other fossil fuels to power everything from light bulbs to cars to factories, as fossil fuels have been an integral part of nearly everything we do. The greenhouse gases emitted from the combustion of this fuel to historically high levels, and because these gases trap heat in the atmosphere, it would have leaked into space, which led to the warming of the planet, hence the thought of renewable energy sources to maintain our planet is being destroyed. Renewable energy is some of the emerging sources of alternative energy found in solar, wind, and biomass, and

other options include hydro, wave, tidal, ocean, and geothermal (although they haven't achieved as much growth and mainstream adoption as others).

## II. WHAT IS RENEWABLE ENERGY

- Renewable energy, often referred to as clean energy, comes from natural sources or processes that are continually replenished.
- For example sunlight or wind continues to shine and storm, even if its availability depends on time and weather.

- While renewable energy is often seen as a new technology, nature's energy has long been used for heating, transportation, lighting, and more.
- The winds powered boats to sail the seas and windmills to grind grain.
- The sun provided warmth during the day and helped ignite the fires until evening. But over the past five hundred years or so, humans have increasingly turned to cheaper and dirtier energy sources such as coal and frack gas.
- Now that we have innovative and less costly ways to capture and retain wind and solar energy, renewables are an even more important source of energy, accounting for more than one-eighth of the US generation. The expansion of renewables is also happening on large and small scales, from rooftop solar panels in homes that can sell energy back onto the grid to giant offshore wind farms.
- Even some entire rural communities rely on renewable energy for heating and lighting.
- As the use of renewable energy continues to grow, a key goal will be to modernize the US electric grid, making it smarter, safer, and better integrated across regions.

### III. TYPES OF RENEWAL ENERGY

#### Solar Energy:

The sun is one of the largest sources of light and heat on the face of the earth, and this energy generated from nuclear

fusion reactions inside the sun is distributed over the parts of the earth according to its proximity to the equator, and this line is the region that receives the largest share of that energy, and the thermal energy generated by sunlight. Solar energy means the emitted light and heat from the sun, which man has harnessed for his benefit since ancient times using a set of technologies that are constantly evolving.



It is important to mention here that only a small part of the available solar energy has been used in our lifetime.

#### Positives

- Solar energy is renewable energy as long as the sun is present.
- Solar energy is clean energy and does not pollute the environment.
- In sunny countries large amounts of energy can be obtained and can be used in remote or remote places.
- Solar energy can be used with high efficiency for heating purposes.
- Solar equipment prices are steadily decreasing and its production capacity is steadily increasing.

**Negatives**

- Solar electricity is currently more expensive than some other types of renewable energy.
- Solar energy is not available at night and may not be available due to weather conditions or clouds, so it must be stored to be used as needed.
- The time required to produce electrical energy is relatively slow compared to other energy sources.
- It must be maintained constantly.

**Wind Energy:**

It is energy defined as the process of converting the movement (energy) of the wind into another form of easy-to-use energy such as electricity, using turbines from helicopters.

**Positives**

Wind energy does not pollute the environment because it does not use chemicals that produce harmful substances such as carbon dioxide.

Wind energy does not contribute to global warming because it does not emit greenhouse gases.

The energy from the wind never runs out.

Wind towers can be useful for people who live in remote areas, where it may be difficult to transmit electricity through power wires from the power plant to remote locations.

Agriculture and irrigation can remain in the places where there are wind turbines.

Because wind turbines can be located in agricultural and marine areas, the cost of constructing wind farms will be relatively low.

**Negatives**

- Wind cannot be accurately predicted and thus the energy generated from it.
- Unexpected and unstable, and this makes wind energy unsuitable in the event of an increase in demand for high production capacity and in a constant quantity.
- Wind farms may be considered a nuisance to some residents of those areas.
- Wind farms may be dangerous to birds.
- Wind farms may interfere with radar by creating a gap in radar coverage, which affects national security.

## Nuclear Energy

Nuclear energy is the energy released during the fission or fusion of atomic nuclei. Nuclear energy constitutes 20% of the world's generated energy. Scientists view nuclear energy as a real and inexhaustible source of energy.



What raises some opposition about the future of nuclear energy is the high costs of building reactors, the public's safety concerns, the difficulty of safely disposing of highly radioactive waste, and the reason for classifying nuclear energy as an alternative and renewable energy is also the possibility of recycling some fuels used today, such as plutonium.

### Positives

- One kilogram of uranium or plutonium of energy (if fully used) contains the equivalent of 3.5 million kilograms of coal.
- The cost of producing nuclear energy at the present time is almost equal to the cost of producing coal, and this is very cheap compared to previous conditions.

- Nuclear power plants do not produce any greenhouse gases or gases that may harm the environment, which means that it does not contribute to global warming.
- The extraction of raw materials for nuclear energy is safer than the extraction of coal and other similar ores.
- The energy possessed by nuclear energy ores is sufficient for human use for millions of years, making it sustainable.

### Negatives

The construction of poorly designed nuclear reactors with inadequate safety measures - especially near human settlements.

It can cause catastrophic accidents, as in the famous Chernobyl disaster in Ukraine, and its damage lasts for a long time that may extend for hundreds of years.

Waste materials used in the production of nuclear energy are radioactive and toxic, and they are very dangerous to the environment, so they must be stored in insulating drums for radioactive materials and kept in a safe place where their contents do not leak.

There is a relationship between the use of peaceful nuclear energy and the spread of nuclear weapons, and this may hinder the widespread use of peaceful nuclear energy.

Since nuclear power plants are usually huge, and are mainly thermal movements, thermal waste disposal becomes a problem at very high temperatures, and sometimes you need to stop to recondition the heat.

### Hydropower

Hydropower is the energy derived from the continuous movement of water that cannot be exhausted. It is one of the most important sources of renewable energy, in other words it is the utilization of water movement for useful purposes.

Before the spread of commercial electric power, the use of hydropower was in irrigation, grain milling, and the textile industry.



### Positives

- Hydroelectric plants can increase their total production capacity according to demand, unlike other types of power plants, because water accumulates behind the dam and is used to produce electricity as needed.
- Electricity can be generated continuously as long as water is available.

- Hydropower is cheap and renewable.

The energy generated by hydroelectric stations does not produce waste and does not cause any pollution.

The lake resulting from the station may have additional benefits such as providing a suitable environment for recreational activities, water sports and fishing, which provides an additional economic return.

### Negatives

The construction of a dam can have serious damage to the environment and the surrounding areas. The quantity and quality of water in some areas may affect marine and terrestrial organisms, because the areas near the dam are subject to drowning, which causes the destruction of natural habitats for some animals, and the migration of people from the neighboring areas.

Hydroelectric power can only be used in areas where there is a sufficient and continuous supply of water.

Dams can contain huge amounts of water, and in the event of failure to contain these quantities of water, it leads to catastrophic results such as floods and the destruction of nearby forests.

The dams of power plants form large lakes, which affects the terrestrial tectonic system in the region, causing earthquakes.

Hydroelectric stations are rarely built near the distribution stations, which requires long distribution lines.

### **Bioenergy**

It is the energy derived from living organisms, whether plant or animal, and it is one of the most important sources of renewable energy.



Unlike other non-renewable natural resources such as oil and coal, it is available and relatively cheap all over the world and is inexhaustible due to the presence of many organisms and biological materials, it does not pollute the environment significantly.

### **Positives**

Bioenergy production can be used to burn waste and organic products from agriculture, a way to get rid of waste and reduce pressure on Earth's resources.

Bioenergy is widely available on the surface of the earth and is generally renewable, because we run out of organic waste and fuel products, because we constantly produce it, and it is available all over the world.

When using other methods of bioenergy production other than direct combustion such as fermentation, their impact on the environment is minimal. Alcohol and other types of fuels produced in this alternative way are possible clean alternatives to fossil fuels.

Since the carbon dioxide in the environment was consumed for the cultivation and growth of plants used to produce bioenergy and then returned to the environment after burning, there is no actual increase in carbon dioxide in the air.

Switching to using vegetable oils for use as a type of fuel is as easy as biodiesel, and does not require more than slight modifications to be used in practice.

In the world, more than 100 billion gallons of raw materials are produced annually in the food industry, and this means that we have the technology and experience to produce it.

Infrastructure, equipment and facilities for biodiesel production is steadily increasing.

### **Negatives**

- The direct combustion of any carbon-based materials leads to air pollution, as in fossil fuels.
- Bioenergy production competes for food use and water consumption.
- Current production methods require huge areas of land to completely replace petroleum and diesel.

With current technology... biofuels cannot be produced to replace the demand for oil.

- This type of energy has a long list of reasons why bioenergy is mainly unusable at present.

### Underground energy

It is geothermal energy, where the high temperature in the ground is taken advantage of by extracting this energy and converting it into other forms. These springs erupt and quench several times per hour, and some of them flow continuously and smoothly, carrying with them dissolved minerals from the deep layers of rock, and thus the so-called hot springs appear, in addition to that there are projects based on exploiting the heat of the water emanating from the ground to generate electricity.

### Positives

- Underground energy produces energy in constant and continuous quantities.
- Ground energy has become an economically viable energy now.
- The cost of electrical power distribution is relatively low.
- Geothermal power plants have a high altitude, and they operate continuously day and night.
- After the geothermal power plant is built, it becomes practically free - if we do not take into account the maintenance and transportation costs -

- Geothermal power plants are relatively small and do not pollute the air or water, at least in theory.

### Negatives

Underground power plants, by injecting water into the ground, extract small amounts of minerals such as sulfur, which must be removed before entering the turbines.

For the production of thermal energy stored in the ground requires locations where the temperature is constant, at least five kilometers below the surface of the earth.

Some underground power stations caused a geological defect, which caused strong earthquakes.

### .Conclusion

As we have noted, the sources of energy are many and varied, and any suitable source can be relied upon in a way that ensures that no pollution is caused to the atmosphere.

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