A Review on Green Technology Importance in the Present Society

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Abstract: Although it cannot be created or destroyed, energy is a quality of objects that may be changed into other forms or transferred to other objects. Energy that is produced with minimal harm to the environment is referred to as green energy. It is a renewable energy source. Green energy sources including solar, wind, geothermal, and hydropower are being developed and marketed as alternatives that either have negligible or no impact on global warming. The purpose of this essay is to examine how green energy might benefit the world's future. Additionally, there are present applications for this new technology, including the heating and cooling of water as well as producing power for diverse uses.

Keywords: Green Energy, different types of sources, advantages and disadvantages, applications.

1. Introduction

The concept of green energy was launched in November 2006 as part of a mission to make renewable energy commonplace. The short name for that offer was SOP or RESOP. For projects involving hydro, wind, solar (PV), and biomass, it instituted a 20-year feed-in tariff. On February 23, 2009, the Ontario Green Energy Act (GEA), formally known as the Green Energy and Green Economy Act 2009, was introduced in the Ontario Legislature with the goals of increasing the generation of renewable energy sources and promoting energy efficiency [1]. When we hear the word "green," we automatically picture a clean, environmentally friendly world. Therefore, the term "green energy" refers to the belief that energy produced from renewable natural resources, such as sunshine, wind, rain, tides, plants, algae, and geothermal heat, has little to no negative environmental impact. These energy sources can be renewed naturally because they are renewable. Renewable and non-renewable energy sources are the two main categories of energy sources in the globe.

Directly produced by nature, such as the sun, rain, wind, and tides, renewable energy sources can be continuously produced whenever it is required. Renewable energy sources are plentiful and unquestionably the cleanest on the planet. Solar energy, biomass energy, wind energy, tidal energy, hydropower, and geothermal energy are just a few examples of the various sorts of renewable energy sources. For example, it is possible to employ solar energy, which is transformed into electricity. Additionally, geothermal, wind, tides, and biomass from plants can all be used in a variety of ways, including The Earth's natural weather patterns are used to generate wind. Rivers in motion and reservoirs provide hydropower. The light and radiation of the Sun are the source of solar energy. Geothermal energy is derived from the heat that the Earth produces under the surface. The quantity and cost-free nature of wind, solar, ocean, and geothermal energy are advantages of renewable energy. The carbon emissions from renewable energy sources are very low or nonexistent, making them environmentally benign. Another benefit is that, unlike their non-renewable counterparts, renewable energy sources can be produced by any nation.

Non-renewable resources are bad for the environment and can be quite harmful to our health. The majority of the energy consumed in the world today comes from non-renewable energy sources. These energy sources are able to be quickly replenished. The fossilized remains of extinct plants or animals are the source of natural gas and oil. After millions of years of pressure and temperature changes, we are left with these remnants. Oil, coal, natural gas, and nuclear power are all examples of non-renewable energy sources. Non-renewable energy sources have the advantages of being ready, affordable, and simple to use. One non-renewable energy kind is converted into another by the non-renewable energy. Non-renewable energy sources' main drawback is that they are limited and will eventually run out of fuel. The cost of these non-renewable energy sources will consequently skyrocket. They also seriously alter the environment, contributing significantly to climate change and global warming. Non-renewable energy sources are definitely not environmentally friendly, and they can have a negative effect on human health. Therefore, we cover many green energy kinds, their benefits, and uses in this research.



Fig.1. Energy Flow Diagram of Renewable and Non-Renewable Sources [2]

2. Green Energy Technology

Natural resources like sunshine, wind, rain, tides, plants, algae, and geothermal heat are used to produce green energy. These energy sources can be renewed naturally because they are renewable. Solar energy, marine energy, wind energy, hydropower, bioenergy, geothermal energy, and other forms of renewable energy are among them. Technology for renewable energy come in a variety of forms, including hybrid and connected technologies. These are useful for storing energy produced by renewable energy, forecasting the supply of renewable energy, and facilitating the efficient transfer of energy produced by renewable energy technology to energy consumers.

2.1. Theory:

We need to develop a solution to these issues by introducing the idea of Green Energy because our traditional energy sources, such fossil fuels, play a significant role in the effects of global warming and climate change on the world. The main objective of producing green energy is to produce power while minimizing waste and pollution, in order to lessen the environmental impact of energy production. According to scientists that support employing green energy, doing so will slow the rate of climate change. These are renewable energy sources as opposed to fossil fuel sources. When it comes to problems like cogeneration, heating, and electricity, the idea of green energy is most frequently taken into account. Customers or businesses can purchase these sources as a way to support living that is environmentally friendly by lowering negative effects of energy generation. To encourage the implementation of green measures, energy certificates or certificates for renewable energy can now be acquired. According to estimates, 1 million American homes and more than 35 million residences in Europe use Green Certificates to signify their use of green energy. Green energy is ultimately clean energy.

Green Technologies and Sustainability (GTS) International journal, under the support of KeAi explained various types of green technology methods. [11]

2.2. Requirement for Green Energy

Green energy comes from renewable resources and has a very small environmental impact. So, we should start using green energy for industrial and home purposes in order to protect Mother Nature from pollution and to assure a steady supply of energy. Green energy technology is crucial to preventing global warming and safeguarding ecosystems by reducing CO_2 emissions through energy efficiency and renewable energy. As temperatures rise, agricultural production will decrease, storm and flood damage will grow, (tropical) diseases will spread more widely, and access to water will become a bigger issue for an increasing number of people. Our ecology bears a heavier burden, and the damage is irreparable. Both directly from increasing temperatures and indirectly through harm to their habitats, the Earth's flora and animals will suffer. Ecosystems will go extinct. Coral bleaching and the hazard to some amphibians will both be caused by even little temperature increases. Major extinctions will occur all throughout the world as a result of temperature increases of 3° or 4°C and higher [2].

2.3. Uses of Green Energy

There are numerous ways to use renewable energy in homes or businesses.

Solar energy is the most prevalent type of renewable energy. Solar panels can be installed in residential and commercial buildings where there is an abundance of sunshine. Other areas with strong winds might erect wind turbines to produce sustainable energy. The energy obtained in this way can be used to power sailboat batteries or to pump water. Another well-liked renewable energy source is biomass. It is a fuel for transportation as well as for the generation of power. Bio-energy is the term used to describe the utilization of biomass as a renewable source of energy.

On the other hand, geothermal energy harnesses the interior heat of the Earth for a range of purposes, including the cooling and heating of buildings as well as the generation of electricity. Another significant renewable energy source is marine energy. It originates from a multitude of sources, such as tidal energy and energy produced by ocean waves that are influenced by both tides and winds.

3. Possible Green Energy Types

3.1. Solar Energy

All life on earth receives its energy from the sun, which is a vast source of solar energy. It is a clean, renewable source that generates about 10,000 times as much energy as the earth can in the twenty-first century. We can use this solar energy as "green energy" because it is the most suitable renewable energy source, providing us with energy both directly and indirectly, unlike hydro, wind, and other energy sources, and because it has the least negative effects on the environment because it does not contribute to the increase of carbon dioxide or global warming in any way.

It may be immediately transformed into useable energy utilizing a variety of technologies divided into two main categories.

Solar Photovoltaic (**PV**): Photovoltaic cells are used to directly convert solar energy into electricity. Since the solar cell was only first successfully produced in 1975, this technology is still very new. The photoelectric effect allows solar cells to harness the sun's light energy to produce electricity. They are set up in this way to let in as much sunshine as they can.

The parts of the PV system that are set up so we may utilize them in specific applications are called photovoltaic modules. Although the PV array may account for the majority of the initial system capital cost, the components that make up the "rest of the system" have a greater impact on the installation's overall dependability, efficiency, and safety. Direct current was produced from sunlight using photovoltaic modules (DC). After being converted to alternating current (AC) via an inverter, this direct current is subsequently modified to fit the power requirements of the utility grid or the load.



Fig.2. Solar Panel working [3]

Solar thermal systems: Solar thermal systems make use of the sun's heat energy. First, solar "collectors" can be used to capture solar radiation and produce low-temperature solar space or water heating. In large-scale applications, parabolic reflectors may focus solar radiation to produce high temperatures that can be utilized for direct heating or to produce energy. by way of, say, a typical heat engine.

Solar radiation is focused on a limited region in solar thermal power plants to create high temperature output. In order to generate electricity, the steam created by this heat is then permitted to fall on a turbine-generator. This system is hybridized and occasionally utilized as a storage system so that it may be used when there is no sunlight. These are typical solar thermal power systems:

a) Parabolic Trough Systems:

In the Parabolic Trough system, sunlight is focused into a receiver tube using a mirror with a parabolic trough form. This is transporting a heat transfer fluid, usually water or oil. To create steam, this fluid is heated and circulated through heat exchangers. In order to generate energy, turbine-generators are then powered by this heat. The most reliable solar thermal electric technique at the moment is the Parabolic Trough technology. This system typically rotated and aligned on a north-south axis to follow the Sun as it moved across the sky every day. The CSP Technology that is the most advanced and established is this one. The ideal capacity is from 150 to 250 MW. 44,000 ho mes might be powered by this [3].

b) Systems with Solar Towers:

Ground heliostats, a tower, and a central receiver at the top of the tower are the three basic parts of tower systems. The sun's solar energy is collected by heliostats and directed toward the main receiver. East, west, and north and south are the two directions in which a heliostat revolves. Each heliostat is computer-programmed to track the sun and increase overall power output. Abengoa Solar of Spain constructed what is known as PS10 at the Solucar Platform in the Spanish province of Seville, the first commercial solar tower system. The project began in March 2007 and is still in progress [4].

c) A dish/Stirling system:

This renewable energy source produces electricity by heating a gas chamber coupled to a piston and motor shaft using parabolically arranged mirrors to reflect sunlight onto a small thermal receiver. A generator that generates electricity to provide a grid is powered by the driving shaft. This system's main components are a Stirling engine at the dish's focal point, a thermal receiver, and a parabolic dish concentrator. The sunlight is tracked by the parabolic dish concentrator, which concentrates it into a cavity receiver where it is absorbed and sent to a Stirling Engine. Due to their high thermal to mechanical efficiency, Stirling Engines are the most well-liked and commonly used.

3.2. Energy with Water (Hydro)

Hydro energy is seen as renewable because the sun's energy drives the world's hydrologic cycle. The ability to create electricity is obtained from the water cycle, a continual process of falling and swiftly flowing water.

Approximately 19% of the world's electricity is produced by hydroelectric power, a recognized renewable energy source [5]. The vast bulk of hydroelectric power currently used worldwide is generated via elaborate plans. Small-scale hydroelectric projects have more room to grow because: 1. Large-scale schemes can generate hundreds of megawatts and also require the building of large dams to provide a sufficient head to the turbine; 2. Small-scale schemes have less capacity and therefore have small dams and less impact on the environment; 3. Micro-scale schemes generate power in kilowatts and are used in small villages and individual homes.



Fig.3. Hydropower plant [5]

3.3. Energy from the Earth (Geothermal)

Since "geo" stands for "the earth" and "thermal" stands for "the heat," geothermal energy is defined as heat energy produced by the radioactive decay of minerals within the earth. It is a source of energy that is both sustainable and renewable. Larderello is where

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the first geothermal power plant was constructed. Lots of heat is produced by the radioactive decay of uranium and potassium in magma that forms beneath the earth's crust. According to the US National Renewable Energy Laboratory (NREL), hot dry rock deposits have a capacity of roughly 4 million MW, which is greater than all the country's current energy needs. If we evaluate geothermal in terms of both scale and consistency, It may be crucial in creating a more sustainable and clean electricity grid. **Resource Geothermal:**

The four different categories of geothermal resources include magma, hot dry rock, geo-pressured, and hydrothermal. Only hydrothermal resources are currently being used economically, while additional technologies are presently being created. Hydrothermal resources consist of three fundamental elements: a heat source (magma), an aquifer (a reservoir for water), and an impermeable cap rock that covers and seals the aquifer. Aquifers are drilled, and hot water and steam are extracted to harness the geothermal energy.



Fig.4. Geothermal energy generation [6]

Using geothermal energy

Geothermal energy can be utilized to generate electricity or directly for industrial activities such as space heating, water heating, greenhouse heating, aquaculture, and laundry.

Mechanical and disposal systems are the two main producing facilities that make up geothermal systems. First, hot water and steam are brought to the surface by wells and bore holes, and then energy is transported for various uses by a mechanical system made up of pipes, heat exchangers, pumps, and controls. The cool fluid is then taken up by a disposal system and stored in storage ponds or injection wells. Both a heat source and a heat sink can be created using geothermal energy. There are several technologies utilized in geothermal energy, including hot dry rock, flash steam, binary cycle systems, and dry steam. The materials used in these technologies are very hot.

Steam Technology in Flash

In cases when the hydrothermal resource is liquid, single flash steam method is employed. In a flash tank, which is at a pressure significantly lower than the fluid, the fluid is pumped and sprayed, causing the hydrothermal fluid to evaporate into steam. After that, this steam is directed into a turbine that is connected to a generator in order to produce energy.

Since the majority of the geothermal fluid is not flashed, it can either be reinjected into the reservoir or used directly for heating purposes. However, if the fluid is at a high temperature, it is transferred to a second tank and flashes into steam to produce power once more. As a result, output power will rise.



Fig.5. Net energy ratios for various renewable and non-renewable energy sources. [5]

3.4. Wind Energy

Wind energy is produced by employing wind turbines to harness the power of the wind. It is a renewable energy source that can be used in place of fossil fuels. Wind energy is a clean energy source that emits no hazardous pollutants, such as greenhouse gases, or any pollution. It is regarded as one of the sources of green energy because of this. The heating of the atmosphere by the sun, the

earth's rotation, and irregularities in the surface of the earth all contribute to wind, which is a type of solar energy. Large land farms are often where wind turbines are erected. By December 2014, wind power capacity had increased to 369.553 MW, and the amount of wind energy produced overall had increased quickly.

4% of the total amount of power used [6]. Most large wind turbines have the same basic design, which consists of a horizontal axis wind turbine with an upwind rotor that has three blades. A medium voltage power collection system and communication network connect each turbine in a wind farm. Today, between the turbine generator and the collector system in wind turbines, we utilize a combination of variable speed generators and partial or full scale power converters. A wind turbine is a machine that transforms wind's kinetic energy into electrical power. The smaller turbines are utilized for things like charging batteries and traffic light signs. Large turbines are utilized to supply home energy, and through the electrical grid, the excess energy is sold back to the utility provider. A significant source of renewable energy is wind farms, which are collections of enormous turbines. Today, several nations are making use of these resources to lessen their reliance on fossil fuels. Typically, wind turbines are built such that they can function in both high and low wind conditions.



Fig.6. Wind Turbine parts [6]

3.5. Vibration energy

It is also possible to collect vibrations from towering buildings, long bridges, transportation systems, trains, and ocean waves. These vibrations are caused by large crowds or by heavy traffic on the road. Many low power electronic appliances can be powered by vibration energy, which can be turned into electric energy and stored, and large-scale vibration energy harvesting can produce 1 W to 100 kW or more [7].

Vibration energy is a mechanical phenomenon that happens when vibrations occur around an equilibrium point. Every object in the world vibrates at some frequency, some of which may be seen by the human eye because they are low enough to be detected. In recent years, vibration energy has come into emphasis. As a result, we now need to identify various, ongoing, renewable energy sources that we may employ in place of fossil fuels. The two basic types of vibrational energy are as follows:

1. Free vibration: Free vibration is the state in which a mechanical device is allowed to vibrate after being initially set up with an input. A tuning fork can be struck and allowed to vibrate as an example of this type of vibration. The mechanical system vibrates one or more times its normal frequency in this type, eventually reaching zero frequency.

2. Forced Vibration: Forced vibrations arise when time-varying disturbances are introduced to some mechanical systems, such as load, displacement, or velocity. The applied disturbances can be of the periodic, steady-state, transient, random input, or transient input types. These can have harmonic or nonharmonic periodic disturbances.

Transducers can be used to transform vibrational energy into electrical energy. For this, two transducers are available. The first is electromagnetic transducer, while the second is piezoelectric materials. Vibrational energy is transformed to electrical energy via transducers, a device that transforms various forms of energy into electricity.



4. Benefits of Green technology

Solar Energy

- Solar energy is a useful source of electricity for many commonplace goods like calculators and other modest power consumers.
- Because it lasts forever, it is a superior source of energy for the next generation (infinite).

Water Energy

Hydroelectric power is a home source of energy, enabling each state to manufacture their own energy without being dependent on foreign fuel sources. It is one of the cleanest sources of energy because it produces no byproducts during conversion.

• It is a plentiful, dependable, and inexpensive source of energy.

- Rainwater is gathered in reservoirs at hydroelectric power plants, where it is later used for agriculture or human use.
- Communities benefit from hydroelectric installations that bring electricity, roadways, industry, and commerce, which boosts the local economy, increases access to healthcare and education, and enhances overall quality of life.

Wind Energy

• It is an air-purifying fuel source that is clean. Acid rain- or greenhouse gas-causing atmospheric pollutants are not produced by wind turbines.

• It is a less expensive, renewable source of energy.

The area around a wind turbine can be used for other purposes, such as farming, and when combined with solar energy, it can be used to generate a steady and dependable source of electricity.

Geothermal Energy

• It is a more cost-effective and accessible source of energy used for cooking, heating homes and offices, and taking a bath.

• By utilizing geothermal energy sources, current generations of people won't jeopardize the ability of future generations to use their current resources in the same manner.

• This is also economical, dependable, sustainable, and eco-friendly.

• Geothermal energy is seen to have excellent potential for reducing global warming because of its minimal emissions.

Vibration Energy

- Since batteries used in medical implants contain hazardous heavy metals, vibration energy harvesting can be used to replace them.
- Vibration damping and vibration isolation can be used to employ vibration energy to reduce noise in the environment, which is mainly caused by industries, aircraft, etc.

5. Uses of Green Technologies

- 1. Use solar energy in calculators, traffic signs, satellites, etc.
- 2. Solar energy is used for passive room heating.



insulation



3. Using solar energy to warm and preserve the food's freshness.



Fig.9. Solar Fridge [9]

- 4. Use irrigation driven by solar energy to water your plants.
- 5. Solar cookers with a parabolic focus.

6. Wind and solar power vehicles.



Fig.10. Solar wind powered car design [10]

7. Wind-powered activities such as wind skiing, kite flying, kite surfing, hang gliding, and more.

8. Water pumps with wind power.

9. Using geothermal energy in aquaculture, such as fish farms.

10. Use in businesses to extract gold and silver from ore by drying fruits, vegetables, wood, and wool.

11. Use to warm roads and sidewalks to prevent them from freezing during the winter.

12. Structure technologies: When there is a power outage, some wireless sensors are built for the structural monitoring and safety systems of the building.

13. Medical implants: For a person's health, some medical equipment are implanted inside their bodies. However, in order for these devices to work correctly, they require electricity, which they obtain from the vibration of the patient's own bodily motions, such as heartbeats.

14. Producing electricity from the weight of pedestrians and cars. Researchers in Mexico have developed a novel method of producing sustainable energy from the movement of automobiles.

According to Héctor Ricardo Macas Hernández, the system's creator, "This is a technology that offers sustainable energy and may be deployed at low costs because it's a complement of previously existing infrastructure: the concrete of streets and avenues" [8].

15. Mexican businesspeople created a mechanism that can be used the movement of vehicles to produce electricity [9]. In order to raise the street level by around 5 cm, a polymeric integrated ramp step is initially constructed. The weight of the moving vehicles puts pressure on the bellows, which contain air that is released via holes as the vehicle passes. Later, through the use of a turbine, this is compressed to generate power.

16. Ingenious tanks: An architect and designer created some inventive tanks that can simultaneously gather water and solar energy. 17. Concept of solar-powered charging of transparent batteries: The creation of a luminescent lithium-ion battery that can be recharged outside in the sunlight.

18. Sunny paper charging device concept: An ultra-thin solar cell is presented. It is transportable by folding into a book, etc.

6. Future Scope

Nearly every sector of society, including industrial, agricultural, medical, and residential, has a future for green energy. Scientists have already discovered a variety of green energy sources, like solar, wind, hydro, etc., and are currently working on some new ones, including radiation and biomass, to limit the use of non-renewable energy sources, which are already running out. As researchers are already working on it, solar panels' efficiency will rise in the upcoming years and they will be able to function even in cloudy conditions. a brand-new hybrid solar and Hybrids of solar and wind power are also on the way. Studies have shown that this technique, which combines solar photovoltaic (PV) panels and wind turbines to produce more energy, is roughly twice as efficient as existing technologies[9].

Similar to these, there are technologies that have already been developed or that only have concepts. These innovations allow us to create eco-friendly environments that entirely rely on green energy [10].



Reductions of CO₂ emissions from changes in the fuel mix in power generation



7. Conclusion

Through this review, trying to draw attention to the need for energy that is both environmentally responsible and renewable, which calls for technological advancement to achieve the highest possible utilization of green energy. Because the naturally occurring resources can help to preserve the environment and lessen reliance on finite non-renewable resources.

From a future perspective, green energy is a source of electricity that can be produced in a variety of ways. The only requirement is to educate people about environmental and energy conservation. This is a step toward producing various forms of energy from clean sources in the majority of fields (less use of fossil fuel). The need for clean energy is growing every day, and green energy will satisfy that need with more cutting-edge technical systems. However, it will take some time before every home uses a power generation system of their own, such as solar panels, small wind turbines, etc., to power their electrical appliances. **References**

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