

# Renewable Sources of Energy:A Survey

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**Abstract**—Energy has turned an extremely helpful and has changed everybody's life since the day it was found. Without energy the majority of the things that we utilize consistently just couldn't work and would never have been created. The explanation behind the advancement of energy was because of experimental curiosity. Now, it has turned into the need of advanced life. Energy has made our nights equal to days.

**Keywords**—Energy; Renewable energy Sources; Solar; Wind; Hydro; Geothermal; Biomass; Ocean

## I. INTRODUCTION

All the energy we use originates from the earth. The energy we utilize consistently doesn't come specifically from the earth, but by utilizing earth's resources. The sources of energy are divided into renewable sources of energy and non renewable sources of energy.

Renewable sources of energy are those which are generated by us or which are constantly generated by natural processes or whose supply is unlimited. Non renewable sources of energy are those which were produced in the past by natural process [1], whose supply is limited and cannot be generated once again.

Energy is the key part to cutting edge engineering and a good source of energy is one:

- a) Which would do a lot of work for every unit for every volume or mass
- b) Be effectively available
- c) Be simple to store and transport
- d) It must be economical
- e) That would be easily available.

## II. RENEWABLE ENERGY SOURCES

Renewable energy is the energy from a source that is not depleted once used. It is outlined as energy that comes

from resources that are naturally replenished on a personality's timescale. Renewable is additionally known as clean energy or green energy. It is a naturally produced product and is employed without worrying. Renewable sources are the sources that renew themselves i.e. they are created naturally. They are replenished by the setting over comparatively short periods of time. Renewable suggests that it is used once more i.e. recycled and keeps reviving itself.

### A. Solar Energy

The earth receives a large quantity of energy from the sun. The sun is a supply of energy for billions of years. Solar power is harnessing the sun's energy to provide electricity. Each square meter of the earth's higher atmosphere receives about 1.36 kilojoules (kJ) of solar power per second. In alternative words, solar power is incident at the speed of 1.36 Kw/m<sup>2</sup>. The entire energy incidents on the higher atmosphere of the world doesn't reach its surface. About 40% of this energy is reflected by the atmosphere into space. Some of it is absorbed by the gases and particles present in the atmosphere. Finally, only about 47% of the incident energy reaches the earth's surface. Solar energy sustains life processes on the earth [4][5].

Solar energy additionally referred to as photovoltaic energy. It is inexhaustible and cheaper than ever. It is a vital supply of renewable energy and its technologies are divided as either passive solar or active solar depending on the method they capture and distribute alternative energy or convert it into electrical energy. The fig. 1 shows the arrangement for solar energy.



Fig 1: solar energy

Advantages of solar energy are-

- a. It is available everywhere.
- b. It is available in plenty (renewable)
- c. It is free.
- d. It does not cause pollution.

Disadvantages of solar energy are-

- a. It cannot be used at night.
- b. Devices based on solar energy do not work well on cloudy days.

#### B. Wind energy

Today, individuals are realizing that wind generation "is one in every of the foremost promising new energy sources" .Among the renewable energy sources wind energy is the fastest growing source. Wind is caused by huge convection currents within the Earth's atmosphere, driven by heat from the Sun i.e. Winds are caused by the uneven heating of the atmosphere by the sun, the irregularities of the Earth's layer, and rotation of the planet. Wind flow patterns are changed by the earth's tract, bodies of water, and vegetative cover. Wind is caused by variations within the air pressure. Once a difference in air pressure exists, air moves from the upper to the lower pressure area, leading to winds of varied speeds.

Wind energy is that the kinetic energy of the air in motion. As described earlier, prevailing and native winds don't seem to be spread equally across the earth, which suggests that wind speeds also change by region. Surface friction also causes winds to blow additional inward into low pressure areas.

Wind turbines are used to convert wind energy into electrical or mechanical energy. Large-scale wind farms are usually connected to the native power transmission network with tiny turbines used to give electricity to isolated areas. Residential units are coming into production and are capable of powering large appliances to entire homes depending on the dimensions. Wind farms put in on agricultural land or grazing areas, have one among the lowest environmental impacts of all energy sources. .Wind turbines like windmills are mounted on a tower to capture the foremost energy. At a hundred feet (30 meters) or additional higher than ground, they will take advantage of the quicker and fewer turbulent wind. Turbines take the wind's energy with their propeller-like blades. Usually, 2 or 3 blades are mounted on a shaft to create a rotor. A blade acts very similar to a plane wing [2][3]. Once the wind blows, a pocket of low-pressure air forms on the downwind side of the blade. The low-pressure air pocket then drags the blade towards it. This makes the rotor to turn. It is referred to as lift. The force of the lift is stronger than the wind's force against the front side of the blade that is termed as drag. The mix of carry and drag causes the rotor to spin like a mechanical device and therefore the turning shaft spins a generator to form electricity. Wind turbines are erected on high hills and mountain ridges to make use of prevailing winds. Fig.2 shows the generation of wind energy



Fig 2: Generation of wind energy

Advantages of wind energy are-

- a. The supply of energy (wind) is free.
- b. Harnessing wind energy is pollution-free method, with no smoke, chemicals being produced.
- c. A tiny wind-electric plant may be originated close to a industrial plant to have pollution-free power for its use.
- d. Low operating cost as there is no fuel consumption.

Disadvantages of wind energy are-

- a. If there's no wind, the Wind turbines never work
- b. The turbine is damaged if the wind speed is very high
- c. The technology needs a higher initial investment than fossil-fueled generators. Roughly eightieth of the value is for the machinery and rest balance for site preparation and installation.
- d. Although alternative energy plants have comparatively very little impact on the environment compared to fuel power plants, there's some concern over the noise made by the rotor blades, aesthetic (visual) impacts, and birds and bats having been killed (avian/bat mortality) by flying into the rotors.
- e. The major challenge to use wind as a source of power is that it is intermittent and does not always blow when electricity is required.
- f. Wind cannot be stored
- g. wind sites are often located in remote locations far from areas of electric power demand
- h. it is difficult and expensive to repair rotating parts as there are located at high level.
- i. Sometimes it is difficult to link wind energy to a utility grid.

### C. Hydroelectricity

Energy in water may be controlled and used. Even a slow flowing stream of water will yield respectable amounts of energy as water is about 800 times denser than air. Hydroelectricity is electricity generated by hydro power. The power is produced by the use of the gravitational force of falling or flowing water. It's the foremost wide used variety of renewable energy. Energy from moving water is the largest supply of renewable electricity water is continually moved around in various states on earth, a method is known as the hydro-logic cycle. Water evaporates from the oceans. This evaporated water forms as clouds. From cloud pours as rain and snow. Then gather as streams and rivers. Again water flows back to the ocean. All this movement provides a vast chance to harness helpful energy[9].

The theory is to make a dam on a large river that encompasses a large drop by elevation .The dam stores lot of water behind it and this area is called as reservoir. Close to rock bottom of the dam wall there's the water intake. Gravity causes it to founder the penstock inside the dam. At the tip of the penstock there's a turbine propeller that is rotated by the falling water. The shaft from the turbine goes up into the generator that produces the power. Power lines are connected to the generator that carries electricity to our destination. It is the most widely used type of renewable energy. .For popular energy

supply small scale hydro or micro-hydro power has been used, particularly in remote areas wherever alternative power sources aren't viable [7]. A small scale hydro power system is put in small rivers or streams with very little or no discernible environmental impact or disruption to fish migration. Most small scale hydro power systems don't require dam or major water diversion. They use water wheels to get energy. Fig.3 shows a dam construction for generating power.



Fig 3: A Dam with Hydro power station.

Advantages of Hydro electricity are-

- a. Once the dam is constructed the energy is just about free.
- b. No waste or pollution
- c. Much more reliable than wind, solar or wave power.
- d. Water is often stored above the dam able to deal with peaks in demand.
- e. Hydro-electric power stations will increase to full power very quickly, unlike different power stations.
- f. Electricity is often generated constantly.

Disadvantages of Hydro electricity are-

- a. The dams are very expensive to construct
- b. Building a large dam will cover a very large area upstream, causing problems for animals that are living there.
- c. Finding a suitable site for construction of dam is difficult.
- d. Water quantity and quality downstream can be affected.

### D. Geothermal energy

Geothermal energy is a very efficient and powerful way to extract a renewable energy from the earth through natural processes. It is the thermal energy generated and stored in the Earth .For every hundred meters below the ground, the temperature of the rock will increase around three degrees Celsius. In other words for each 328 feet below the ground, the temperature will increase 5.4 degrees Fahrenheit. So, 10,000 feet below the ground, the

temperature of the rock would be so hot that would even boil the water.

Geothermal energy uses the heat from deep underground to produce electricity. It can be used to produce steam which goes up a pipe, which then turns a turbine. It is best suited in places where the Earth's crust is not thick. A geothermal heat pump can extract enough heat from shallow ground anywhere in the world to provide home heating. Industrial applications need the higher temperatures of deep resources[11]. The thermal profitability and efficiency of electricity generation is sensitive to temperature. Fig.3 shows the formation of geothermal energy from the earth.



Fig 4: formation of geothermal energy

Advantages of Geothermal energy are-

- a. Geothermal energy is available as long as the earth exist
- b. Geothermal energy is almost pollution free.
- c. It is cheaper to run a geothermal plant than a coal-based plant.
- d. Geothermal energy is free and renewable.

Disadvantages of Geothermal energy are-

- a. Fluids drawn from the deep earth carry a mixture of gases such as ammonia (NH<sub>3</sub>), hydrogen sulfide (H<sub>2</sub>S), methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>).
- b. These gases have noxious smells and if these gasses are released they cause acid rain
- c. Hot water from geothermal sources may hold in solution some of toxic elements such as antimony, mercury, arsenic and boron.
- d. Geothermal plant has an effect on land stability
- e. Enhanced energy systems will trigger earthquakes as a part of hydraulic fracturing.
- f. It is not practical to transport steam generated by geothermal energy for a distance more than 2 miles.
- g. It will occur only in areas of volcanic activity.
- h. A millions of dollar required to install a geothermal energy.

#### E. Biomass Energy

Biomass is a living or recently dead biological material. It is used as fuel or for industrial production. Biomass refers to plant matter grown up to generate electricity like dead trees and branches, yard clippings and wood chips. Biomass also includes biodegradable substances. Biomass is obtained from different types of plants such as herbaceous plant, panic grass, corn, willow, hemp, poplar, sorghum, sugarcane, palm oil and a variety of tree species.

Biomass is used to generate electricity and also as transportation fuel. Biomass from plants or plant-derived materials is referred to as lignocelluloses biomass. As an energy supply, biomass is employed directly by combustion to produce heat or indirectly after changing it to various kinds of biofuel. Conversion of biomass to biofuel is done by three methods: chemical, thermal and biochemical methods.

The most common way of converting biomass to electricity is to burn it and to produce steam. This steam turns a turbine to generate electricity. The direct combustion of biomass results in waste of energy. It will also cause some pollution if it is not carefully controlled.

Advantages of Biomass energy are-

- a. A biogas plant is quite simple and can be easily built in rural areas.
- b. Biogas is an excellent, clean fuel that burns without producing ash and smoke.
- c. The spent slurry is good manure.
- d. Biogas plants are a safe and useful way of waste disposal.
- e. Use of biogas in rural areas leads to saving of firewood and reduces deforestation.
- f. The use of biomass will reduce requirement of oil

Disadvantages of Biomass energy are-

- a. Using biomass as a fuel produces green house gases like carbon monoxide, carbon dioxide, NO<sub>x</sub> (nitrogen oxides), VOCs (volatile organic compounds)
- b. A pollutant created by combustion of biofuels, and biomass leads to global warming.
- c. There is a problem with biomass supply chain.
- d. For energy production only two-third of agriculture residues are used.

#### F. Energy from Ocean

The ocean provides many forms of renewable energy, and everyone is driven by completely different forces.

Energy from ocean waves, ocean tides and ocean thermal energy is controlled to get electricity.

**Wave Energy Technologies**-Transporting the energy from the ocean surface waves to capture the energy for helpful work is termed as wave energy. In capturing wave power, the up-and-down or back-and-forth movement of waves may be captured. There are three main kinds of wave energy technologies to produce electricity. In One type buoys, floats or pitching devices are used to get electricity using the rise and fall of ocean swells to turn the hydraulic pumps. In second type oscillating water column (OWC) devices are used to get electricity at the shore using the fall and rise of water wave. The turbine is driven by rising water drives air out of the top of the shaft. In third type a tapered channel is located either on or off shore. They concentrate on waves and pull them into an elevated reservoir. As the water is released the power is then generated using hydropower turbines [12]. Output energy is determined by wave speed, wave height, and wave length and water density. Fig. 4 shows the arrangement of generating energy from the ocean waves.

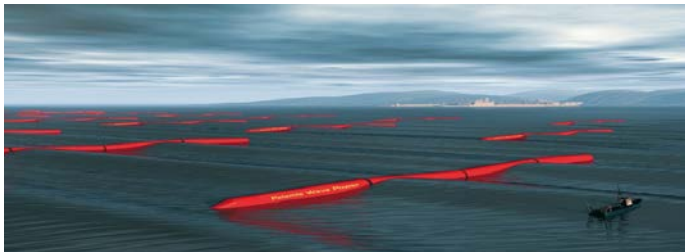


Fig 5: wave energy

**Ocean Tidal Power**-A tidal station is placed at the mouth of a narrow bay, wherever tides cause regular and considerable rise in the water level. At the mouth of the bay a dam with gates is built. The amount of the water within the bay will increase at high tide. Then water is allowed to flow within and collected backside the dam. The water level in the ocean starts falling once the tide ebbs,. The dam gates are then closed. Thus the amount of water behind the dam remains above that in the bay. The gates of the dam are opened once the difference within the levels is sufficient. Then water is allowed to fall into the bay. This water falling down is employed to drive turbines to generate electricity. Fig. 5 shows the arrangement of generating energy from ocean tides.



Fig 6: tidal energy

### **Ocean Thermal Energy Conversion (OTEC)-**

The surface of the ocean is warmed by solar energy falling on it. The water on the surface of the ocean is hotter than the water below. Generally, between the surface water and the water at a depth of 2 km the distinction in temperature is about 200<sup>0</sup>C. This temperature distinction is used to operate an ocean thermal energy conversion (OTEC) plant. Clearly, the ultimate supply of stored thermal energy of the ocean is the sun[13].

Advantages of ocean energy are-

- a. It is not cost effective
- b. Pollution free
- c. As India is covered by 3 side ocean it is easy to install

Disadvantages of ocean energy are-

- a. The danger of marine warm blooded creatures and fish being stricken by tidal struck cutting edges.
- b. The underwater noise emitted from operating marine energy devices.
- c. There will be effects of electro motive force
- d. Physical presence of marine energy projects and their potential to change the behavior of fish, mammals, and seabirds with attraction or avoidance.
- e. The potential result on far field and near field marine atmosphere and processes like sediment transport and water quality.
- f. It is most unreliable due to unpredicted wave direction.
- g. Plants are very expensive to build.

### **III.CONCLUSION**

Solar energy is useful in equatorial, tropical regions where in maximum energy is generated. Wind blows at deferent speed sometimes this speed are not sufficient to run the turbine. Therefore the energy generated by the wind is constant. The water in the reservoir must be at required level to generate hydro power. During draught this is not possible to achieve. Geothermal energy is limited to the areas near tectonic plate boundaries. Compare to other renewable sources generation energy

from biomass is not environmental friendly as it causes air pollution. Ocean will be the important potential energy source for the features but it is not cast effective compare to other renewable energy sources. Because of the drawbacks quoted in this paper on existing renewable sources of energy, there is necessary that a research has to be taken place on a new renewable energy source i.e., fuel cells.

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