Energy is the ability to do work. While energy surrounds us in all aspects of life, the ability to harness it and use it for constructive ends as economically as possible is the challenge before mankind.

There are two types of energy sources: Conventional and Non-conventional sources of energy. Conventional sources of energy include the fossil fuels, nuclear energy, etc. Whereas Non-conventional sources of energy include a large number like solar energy, geothermal energy, wind energy, tidal energy, biomass, hydrogen fuel, etc.

Today, the world is progressing at quite a fast rate with the use of the conventional sources of energy. The two major disadvantages of using it are the environmental pollution created by its use and its limited quantity. On the other hand the Non-conventional sources of energy are available in plenty, free of cost and pollution free.

So it’s the time to think for switching on to the Non-conventional sources and restrict the use of conventional sources of energy.

This paper deals with some of the Non-conventional sources of energy, their advantages and disadvantages.

**Key-Words:** Renewable Energy, Photovoltaic modules, fermentation, Tidal, solar, hydrogen energy, geothermal, green-house effect.
Many types of clean and renewable energy sources can be used in the production of electrical energy. Renewable energies are “driven by the natural energy flows of the planet. They do not deplete the world’s finite resources and when sensibly used do not risk destroying the environment.” These include solar energy, wind energy, wave energy, hydroelectricity (especially small-scale hydro - what is referred to as “run-of-the-river” hydro), biomass energy, energy from wastes, tidal power, and geothermal energy. All of these energy sources have environmental benefits over the use of fossil fuels. There are several benefits associated with using renewable energy supplies over conventional sources. Renewable decrease CO₂ emissions and cut the air pollutants, such as sulphur dioxide and nitrogen oxide, that cause acid rain and health problems. They also decrease a country’s reliance on imported fuel and help to diversify the energy supply. When the emissions of conventional fuels are compared with those of renewable resources, it becomes apparent that renewable have a much-reduced impact of the environment. However, almost none of the renewable releases pollutants during operation and if pollutants are released, they are generally in very small quantities. The combustion of fossil fuels, used mainly in electric and transportation industries, is the greatest source of atmospheric pollution. All fossil fuels release greenhouse gases and other pollutants into the atmosphere. Nuclear power and large hydroelectric dams also have adverse effects on the environment.

Energy has become an essential part of many people’s daily lives as well as important in the social and economic progress of every country. Ported fuel and help to diversify the energy supply. Most of the energy that we use, particularly in industrialized countries, is produced by burning fossil fuels such as coal, oil, and gas. Unfortunately, not only do these fossil fuels pollute the air that we breathe and contribute large amounts of carbon dioxide to the atmosphere, but their supply is not renewable. There are, however, energy sources that are both clean and renewable. Moreover, many of the technologies necessary to harness these energies are fully developed. Yet only one-fifth of the world’s commercial energy supply comes from these sources. Fossil fuels, such as coal, oil, and natural gas, have all slowly developed from long-dead organic and animal matter. The advantages of using fossil fuels are that they are relatively cheap sources of energy and the technology involved is fully developed. However, all fossil fuels contribute to the global warming process through the production of greenhouse gases such as carbon dioxide and each fossil fuel has health and environmental impacts of its own.
SOLAR ENERGY

Four-fifths of the sun’s energy falls on the oceans and drives the water cycle. Evaporation from the sea causes rain to fall on the land, resulting in the global hydropower resource. The one fifth of the sun’s energy falls on the land and is still about 2,000 times greater than total world energy demand. The three main technologies that have been developed to capture this energy are Passive Solar, Solar Thermal, and Photovoltaic modules.

Solar thermal refers to the use of solar energy to heat water. A solar water heater is simply water pipes that are painted black to improve heat absorption. The pipes are small in diameter, ensuring that there is a large surface area of water exposed to the sun. Then, the pipes are placed in a small greenhouse which acts to keep them insulated.

Solar power involves using solar cells to convert sunlight into electricity, using sunlight hitting solar thermal panels to convert sunlight to heat water or air, using sunlight hitting a parabolic mirror to heat water (producing steam), or using sunlight entering windows for passive solar heating of a building.

Advantages
1) Solar power is a renewable resource. As long as the Sun exists, its energy will reach Earth.
2) Solar power generation releases no water or air pollution, because there is no combustion of fuels.
3) In sunny countries, solar power can be used in remote locations, like a wind turbine. Solar energy can be used very efficiently for heating (solar ovens, solar water and home heaters) and lighting.

Disadvantages
1) Solar energy cannot available in night.
2) Local weather condition affects the intensity of solar radiation.
3) Solar energy is in diffused form & it requires concentration.

WIND ENERGY

The uneven heating of the earth’s surface by the sun causes wind. This heat is absorbed by the ground or water and is then transferred into the air, causing differences in air temperature, density and pressure. These differences then create forces that push the air around. Like the water that flows in the river, the wind contains energy that can be converted into electricity using wind turbines. Currently, more than 20,000 wind turbines are used for generating electricity around the world and over a million for pumping water. Countries such as Denmark, Germany, Britain and Spain have installed numerous wind systems in order to help meet some of their energy requirements. Wind power projects can also be very stimulating for local economics. Wind energy is 80 per cent cheaper than it was 15 years ago.
Fig. 5. Windmill

**Advantages**

1) Wind power produces no water or air pollution that can contaminate the environment. Hence, there are no waste by-products, such as carbon dioxide.

2) Wind generation is a renewable source of energy, which means that we will never run out of it.

3) Wind towers can be beneficial for people living in remote areas.

4) Farming and grazing can still take place on land occupied by wind turbines.

5) Due to the ability of wind turbines to coexist within agricultural fields, siting costs are frequently low.

**Disadvantages**

1) Wind energy available in dilute & fluctuating in nature

2) Wind mills are noisy in operation.

3) Windmill requires large area as propeller is large in size.

4) Wind mill can produce limited power.

**GEOTHERMAL ENERGY**

Geothermal energy harnesses the heat energy present underneath the Earth. The hot rocks heat water to produce steam. When holes are drilled in the region, the steam that shoots up is purified and is used to drive turbines, which power electric generators.

**Advantages**

1) There are no by products, which are harmful to the environment.

2) There is also no consumption of any type of fossil fuels.

3) In addition, geothermal energy does not output any type of greenhouse effect.

4) After the construction of a geothermal power plant, there is little maintenance to contend with.

5) In terms of energy consumption, a geothermal power plant is self-sufficient. Another advantage to geothermal energy is that the power plants do not have to be huge which is great for protecting the natural environment.

**Disadvantages**

1) We cannot just build a geothermal power plant in some vacant land plot somewhere. The area where a geothermal energy power

**HYDROELECTRIC ENERGY**

In hydro energy, the gravitational descent of a river is compressed from a long run to a single location with a dam or a flume. This creates a location where concentrated pressure and flow can be used to turn turbines or water wheels, which drive a mechanical mill or an electric generator. An electric generator, when there is excess energy available, can be run backwards as a motor to pump water back up for later use.

Hydro-electricity is already a well-established technology worldwide and has been producing competitively priced power for about a century. Hydroelectric power stations are some of the largest artificially constructed installations in the world. The construction of these massive structures can result in widespread disturbance and damage and, although the building period may only be a few years, the effects on the environment may continue for years afterwards. Additionally, being highly visible structures, these dams alter the landscape and in populated regions, "their socially disruptive effects may be considered unacceptable".

On the positive side, hydro has several environmental benefits. No CO$_2$ is produced and there is little other effect on
the atmosphere. Noise pollution is quite small and there is little involved that will explode, catch on fire, or emit dangerous chemicals.

Renewable energy offers a solution to many of the environmental and social problems that arise from the use of fossil and nuclear fuels. Technically, it appears to be possible to replace all fossil and nuclear fuels with renewable. This, however, would result in a substantial increase in the price of energy. The strong counter-argument to this point is that conventional fuels are currently under priced because their prices do not cover the environmental damage that they cause.

The words ‘the greenhouse effect’ spark visions of climate change and global warming in the minds of many. The greenhouse effect, however, is a natural process that makes life on earth possible. There are a number of gases in the earth’s atmosphere that work like a greenhouse to trap heat. They allow solar radiation to pass through to the earth while they trap some of the radiation that leaves the earth. Why should we worry then? The problem arises when too many gases being pumped into the atmosphere unbalance the natural greenhouse effect, which is vital to our survival on this planet.

Graph of consumption of energy

**Advantages**

1) Hydroelectric power stations can promptly increase to full capacity, unlike other types of power stations. This is because water can be accumulated above the dam and released to coincide with peaks in demand.

2) Electricity can be generated constantly, because there are no outside forces, which affect the availability of water. This is in contrast to wind, solar or tidal power, all of which are far less reliable.

3) Hydroelectric power produces no waste or pollution.

4) Hydropower is a renewable resource; oil, natural gas, and coal reserves may be depleted over time.

5) Hydroelectricity secures a country’s access to energy supplies.

**Disadvantages**

1) The construction of a dam can have a serious environmental impact on the surrounding areas. The amount and the quality of water downstream can be affected, which affects plant life both aquatic, and land-based. Because a river valley is being flooded, the delicate local habitat of many species is destroyed, while people living nearby may have to relocate their homes.

2) Hydroelectricity can only be used in areas where there is a sufficient supply of water. Flooding submerges large forests.

**BIOMASS**

Biomass production involves using garbage or renewable resources, especially vegetation, like maize, to generate electricity. When garbage decomposes the methane produced is captured in pipes and later burned to produce electricity. Vegetation and wood can be burned directly, like fossil fuels, to generate energy, or processed to form alcohols.

**Advantages**

1) Biomass production can be used to burn organic waste products resulting from agriculture. This type of recycling encourages the philosophy that nothing on this Earth should be wasted. The result is less demand on the Earth’s resources, and a higher carrying capacity for Earth because non-renewable fossil fuels are not consumed.

2) Biomass is abundant on Earth and is generally renewable. In theory, we will never run out of organic waste products as fuel, because we are continuously producing them. In addition, biomass is found throughout the world, a fact that should alleviate energy pressures in third world nations.

3) When methods of biomass production other than direct combustion of plant mass, such as fermentation and pyrolysis, are used, there is little effect on the environment. Alcohols and other fuels produced by
these alternative methods biomass are clean burning and are feasible replacements to fossil fuels.

Disadvantages
1) Direct combustion without emissions filtering generally leads to air pollution similar to that from fossil fuels.
2) Producing liquid fuels from biomass is generally less cost effective than from petroleum, since the production of biomass and its subsequent conversion to alcohols is particularly expensive.

TIDAL ENERGY
Tidal energy involves building a dam across the opening to a tidal basin, called an estuary. The dam, called a barrage, is composed of turbines, located within tunnels in the dam that rotate when a tide comes in, generating electricity.

Advantages
1) Tidal power is free once the dam is built. This is because tidal power harnesses the natural power of tides and does not consume fuel. In addition, the maintenance costs associated with running a tidal station are relatively inexpensive.
2) Tides are very reliable because it is easy to predict when high and low tides will occur. The tide goes in and out twice a day usually at the predicted times. This makes tidal energy
3) Easy to maintain, and positive and negative spikes in energy can be managed.
4) Tidal energy is renewable, because nothing is consumed in the rising of tides. Tidal power relies on the gravitational pull of the Moon and Sun, which pull the sea backwards and forwards, generating tides.

Disadvantages
1) It provides power for around 10 hours each day, when the tide is moving in or out of the basin.
2) The barrage construction can affect the transportation system in water. Boats may not be able to cross the barrage outside of a lock system.
3) The erection of a barrage may affect the aquatic ecosystems surrounding it. The environment affected by the dam is very wide, altering areas numerous miles upstream and downstream. For example, many birds rely on low tides to unearth mud flats, which are used as feeding areas.
4) Maximum energy production is limited to 2.5 terawatts. This is the total amount of tidal dissipation or the friction measured by the slowing of the lunar orbit.

CONCLUSION
Fossil fuel nuclear power, and large hydroelectric schemes, all of which have negative effects on the environment, must be increasingly replaced by renewable energy sources such as wind power, solar power, biomass, small-scale (run-of-river) hydro, and fuel cells. The technologies involved with these renewable are all quite developed and during electricity generation, little or no pollution is created and they are therefore less harmful to the environment. Of course, no energy source is perfect and there are disadvantages involved with each renewable resource, ranging from visual effects to cost. However, as long as there is careful planning and implementation, the advantages of using renewable to produce electricity far outweigh any disadvantages involved. Renewable energy resources can be used to displace conventional energy sources, thus reducing greenhouse gases and other pollutants while continuing to supply the same amount of energy. As more renewable resources are used for energy production, more money will be
spent on developing methods to make these sources even cheaper and more reliable, and thus, more competitive with conventional fossil fuels.

Many consumers are willing to pay higher prices for products that are more environmentally friendly. Therefore, they should have the option to buy these products. In terms of electricity, this means that customers interested in “green energy” would pay a higher rate than those using electricity generated from fossil fuel in order to cover the higher cost of using renewable to generate electricity.

An alternative, or complementary, approach is to reward cleaner energy supply systems by paying a subsidy to balance the environmental costs of burning fossil fuels.

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