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Aerothermal Energy

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Abstract—: The wind energy and solar energy are the future energy sources but both are not capitalized efficiently. This theory throws a light on the tremendous potential of both these energies when utilized in combination known as "AEROTHERMAL ENERGY". This energy can produce a greater amount of power with minimum input. This energy also has the potential to produce power even in the absence of wind energy.

Index Terms— Aerothermal energy, Solar energy, Wind energy.

1 INTRODUCTION

Currently wind energy and solar energy are the two forms of energy that are treated independently and they produce less energy compared to fossil fuel energy.

This experiment will test whether the solar and wind energy can be combined together to produce equivalent energy.

Winds are caused by the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. The earth's surface is made of different types of land and water. These surfaces absorb the sun's heat at different rates, giving rise to the differences in temperature and subsequently to winds. During the day, the air above the land heats up more quickly than the air over water. The warm air over the land expands and rises, and the heavier, cooler air rushes in to take its place, creating winds. At night, the winds are reversed because the air cools more rapidly over land than over water. In the same way, the large atmospheric winds that circle the earth are created because the land near the earth's equator is heated more by the sun than the land near the North and South Poles. Humans use this wind flow for many purposes: sailing boats, pumping water, grinding mills and also generating electricity. Wind turbines convert the kinetic energy of the moving wind into electricity.

Wind Energy, like solar is a free energy resource. But is much intermittent than solar. Wind speeds may vary within minutes and affect the power generation and in cases of high speeds-may result in overloading of generator. Energy from the wind can be tapped using turbines.

The range of wind speeds that are usable by a particular wind turbine for electricity generation is called productive wind speed. The power available from wind is proportional to cube of the wind's speed. So as the speed of the wind falls, the amount of energy that can be got from it falls very rapidly. On the other hand, as the wind speed rises, so the amount of energy in it rises very rapidly; very high wind speeds can overload a turbine. Productive wind speeds will range between 4 m/sec to 35 m/sec. The minimum prescribed speed for optimal performance of large scale wind farms is about 6 m/s. Wind power potential is mostly assessed assuming 1% of land availability for wind farms required @12 ha/MW in sites having wind power density exceeding 200 W/sq.m. at 50 m hub-height.

In today's climate of growing energy needs and increasing environmental concern, alternatives to the use of non-renewable and polluting fossil fuels have to be investigated. One such alternative is solar energy.

Solar energy is quite simply the energy produced directly by the sun and collected elsewhere, normally the Earth. The sun creates its energy through a thermonuclear process that converts about 650,000,0001 tons of hydrogen to helium every second. The process creates heat and electromagnetic radiation. The heat remains in the sun and is instrumental in maintaining the thermonuclear reaction. The electromagnetic radiation (including visible light, infra-red light, and ultra-violet radiation) streams out into space in all directions.

Only a very small fraction of the total radiation produced reaches the Earth. The radiation that does reach the Earth is the indirect source of nearly every type of energy used today. The exceptions are geothermal energy, and nuclear fission and fusion. Even fossil fuels owe their origins to the sun; they were once living plants and animals whose life was dependent upon the sun.

Much of the world's required energy can be supplied directly by solar power. More still can be provided indirectly. The practicality of doing so will be examined, as well as the benefits and drawbacks. In addition, the uses solar energy is currently applied to will be noted.

Due to the nature of solar energy, two components are required to have a functional solar energy generator. These two components are a collector and a storage unit. The collector simply collects the radiation that falls on it and converts a fraction of it to other forms of energy (either electricity and heat or heat alone). The storage unit is required because of the non-constant nature of solar energy; at certain times only a very small amount of radiation will be received. At night or during heavy cloudcover, for example, the amount of energy produced by the collector will be quite small. The storage unit can hold the excess energy produced during the periods of maximum productivity, and release it when the productivity drops. In practice, a backup power supply is usually added, too, for the situations when the amount of energy required is greater than both what is being produced and what is stored in the container.

Methods of collecting and storing solar energy vary depending on the uses planned for the solar generator. In general, there are three types of collectors and many forms of storage units.

People use energy for many things, but a few general tasks consume most of the energy. These tasks include transportation, heating, cooling, and the generation of electricity.
Solar energy can be used for other things besides heating. It may seem strange, but one of the most common uses of solar energy today is cooling. Solar cooling is far more expensive than solar heating, so it is almost never seen in private homes. Solar energy is used to cool things by phase changing a liquid to gas through heat, and then forcing the gas into a lower pressure chamber. The temperature of a gas is related to the pressure containing it, and all other things being held equal, the same gas under a lower pressure will have a lower temperature. This cool gas will be used to absorb heat from the area of interest and then be forced into a region of higher pressure where the excess heat will be lost to the outside world. The net effect is that of a pump moving heat from one area into another, and the first is accordingly cooled.

Besides being used for heating and cooling, solar energy can be directly converted to electricity.
Of the main types of energy usage, the least suited to solar power is transportation. While large, relatively slow vehicles like ships could power themselves with large onboard solar panels, small constantly turning vehicles like cars could not. The only possible way a car could be completely solar powered would be through the use of battery that was charged by solar power at some stationary point and then later loaded into the car. Electric cars that are partially powered by solar energy are available now, but it is unlikely that solar power will provide the world's transportation costs in the near future.

Solar power has two big advantages over fossil fuels. The first is in the fact that it is renewable; it is never going to run out. The second is its effect on the environment.

While the burning of fossil fuels introduces many harmful pollutants into the atmosphere and contributes to environmental problems like global warming and acid rain, solar energy is completely non-polluting. While many acres of land must be destroyed to feed a fossil fuel energy plant its required fuel, the only land that must be destroyed for a solar energy plant is the land that it stands on. Indeed, if a solar energy system were incorporated into every business and dwelling, no land would have to be destroyed in the name of energy. This ability to decentralize solar energy is something that fossil fuel burning cannot match.

As the primary element of construction of solar panels, silicon, is the second most common element on the planet, there is very little environmental disturbance caused by the creation of solar panels. In fact, solar energy only causes environmental disruption if it is centralized and produced on a gigantic scale. Solar power certainly can be produced on a gigantic scale, too.

Suppose that of the 4.5x1017 kWh per annum that is used by the earth to evaporate water from the oceans we were to acquire just 0.1% or 4.5x1014 kWh per annum. Dividing by the hours in the year gives a continuous yield of 2.90x1010 kW. This would supply 2.4 kW to 12.1 billion people.

Unfortunately, at this scale, the production of solar energy would have some unpredictable negative environmental effects. If all the solar collectors were placed in one or just a few areas, they would probably have large effects on the local environment, and possibly have large effects on the world environment. Everything from changes in local rain conditions to another Ice Age has been predicted as a result of producing solar energy on this scale. The problem lies in the change of temperature and humidity near a solar panel; if the energy producing panels are kept non-centralized, they should not create the same local, mass temperature change that could have such bad effects on the environment.

2 METHOD

2.1 Apparatus

A turbine with alternate absorber and reflector porous metallic plate acting as blades.

2.2Procedures: The turbine with alternate absorber and reflector porous metallic plate was exposed to the wind .The absorber and reflector plate were arranged in alternate fashion. The absorber plates were made black & the reflector metallic plates were made silver or shiny. Solar radiation was allowed to fall on all the plates.

2.3Case Study:

Measurement of wind speed on DECEMBER 2003 MACHILIPATNAM CYCLONE

The variations in wind direction and wind speed are presented while the cyclone was crossing the coast. 1-hour average wind speed (in mps) as recorded by the system from 1600 h. of 15 Dec. to 1700 h. of 16 Dec. . . . The peak wind speed was observed between 1800 h. and 1900 h. Hence 10-minute average wind speeds (in mps) as recorded by the system between 1830 h. and 1930 h. 1-minute average wind speeds (in mps), as recorded by the system, between 1830 and 1930 h. 1-minute average wind speeds (in mps), as recorded by the system, when cyclone was 80km south of Machilipatnam . 1-minute average wind speeds (in mps), as recorded by the system, after the cyclone crossing the coast. Similarly, changes in wind direction (in degree), as observed before during and after the cyclone crossed the coast.
The wind speed/wind direction with time when cyclone was

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about 80 km south of the station shows no significant variation. However, when cyclone was crossing the coast, following variations in wind speed and wind direction are observed: A sharp increase in wind speed from 14 mps to 27 mps between 1800 h. and 1900 h. and from 2000 h. and 2100 h. A sharp decrease in wind speed in between these two peaks, i.e. between 1900 h. and 2000 h. The peak hourly average wind speed recorded is of the order of 27 mps between 1800 h. and 1900 h. The peak 10-minute average wind speed recorded is of the order of 36 mps during 1900 h. and 1910 h. The peak 1-minute average wind speed recorded is of the order of 40 mps from 1847 h. and 1853 h. and again between 1902 h. and 1925 h. The change of wind direction from 'NNE' to 'southerly' is experienced between 1902 h. and 1930 h. The significant changes both in wind direction and wind speed is recorded between 1830 h. and 1930 h. of 15 Dec., 2003. The cyclonic wind experienced is seen to be for a very short duration and weakened immediately after crossing the coast. The wind speed tracked emphasizes the amount of wind speed available but not utilized to produce energy.

3 RESULT

From the above it can be observed that the wind speed varies and can produce large amount of energy if integrated with solar energy. The wind speed has kinetic energy and in combination with electromagnetic energy of the electromagnetic wave gives an energy known as aerothermal energy E_a.

Wind energy is the kinetic energy of air in motion;

Total wind energy flowing through an imaginary area *A* during the time *t* is:

$$E = 1/2mv^2 = 1/2(Avt\rho)v^2 = 1/2At\rho v^3 \quad (1)$$

where *v* is the wind speed; ρ is the air density; *Avt* is the volume of air passing ; $Avt\rho$ is therefore the mass *m* passing per unit time. $½ \rho v^2$ is the kinetic energy of the moving air per unit volume.

The energy of electromagnetic radiation is

$$E = hf \quad (2)$$

Where *E* is the energy, *h* is Planck's constant, and *f* is frequency

$$E_{rotational} = 1/2\, I\omega^2 \quad (3)$$

Where

ω is the angular speed

I is the moment of inertia around the axis of rotation.

E is the kinetic energy.

$$E_a = j\,\{(1/2At\,\rho V^3) + (hf) + (1/2\, I\omega^2)\} \quad (4)$$

Where j=proportionality constant,
E_a= aerothermal energy

After certain time in the absence of wind the equation reduces to:

$$E_a = j\{(hf) + (1/2\, I\omega^2)\} \quad (5)$$

as the absorbed radiation is radiated.

4 CONCLUSION

The turbine rotates as the metallic plates of the turbine experiences a force on it due the pressure difference created .The gas flows through the porous metallic plate from the cooler to the hotter side. The pressure difference causes the plate to move cold sided forward.
In the absence of wind the turbine turns backward because the black sides cool more quickly than the reflector sides.
Among the available renewable resources, only in aerothermal power do we find the potential for an energy source capable of supplying more energy than is used. This would be enough energy to supply the entire planet regardless of the population.

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