

**WINDMILL – AN AGENT OF POLLUTION FREE ENVIRONMENT
AND ECONOMIC STABILITY.**

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ABSTRACT

This study concentrates on air pollution, the pollutant responsible for it, particularly the carbon monoxide from the electric power generator, its deadly effect on the environment especially to man (the workforce) and the economy. It goes ahead to show the statistics for the number of deaths caused by the deadly fumes (carbon monoxide) emanating from the so called electric power standby generators. This study also suggests the wind mill as an alternative means of generating electrical energy to meet up with the increasing demand for electricity (in the society) other than the primitive pollutant-producing electric generator. It also gives an insight into the design, benefits and working principles of the wind mill.

Keywords

INTRODUCTION

What is pollution? Pollution is the introduction of contaminants into the natural environment that causes the adverse change. Pollution can take the form of chemical substances or energy, such as noise, heat or light. Pollutants, the components of pollution, can either be foreign substances/ energies or naturally occurring contaminants. A pollutant is a waste material that pollutes air, water or soil. Three factors determine the severity of a pollutant: its chemical nature, its concentration and persistence.

The major forms of pollution and the particular contaminant relevant to each of them are as follows:

Light pollution: includes light trespass, over-illumination and astronomical interference.

Littering: the criminal throwing of inappropriate man-made objects, unremoved, onto public and private properties.

Noise pollution: which encompasses roadway noise, aircraft noise, industrial noise as well as high-intensity sonar.

Soil contamination: this occurs when chemicals are released by spill or underground leakage. Among the most significant soil contaminants are the hydrocarbons, pesticides and herbicides.

Radioactive contamination: this results from 20th century activities in atomic physics, such as nuclear power generation and nuclear weapons research.

Thermal pollution: this is a temperature change in natural bodies caused by human influence.

Plastic pollution: this involves the accumulation of plastic products in the environment that adversely affect wildlife and the habitat.

Water pollution: this is as a result of the discharge of wastewater from commercial and industrial waste (intentionally or through spills) into surface waters; discharges of untreated domestic sewage and chemical contaminants such as chlorine from treated sewage; release of waste and contaminants into surface runoff flowing into surface waters (including urban runoff and agricultural runoff, which may contain chemical fertilizers and pesticides); waste disposal and leaching into groundwater. (*en.m.wikipedia.org*)

Air pollution: the release of chemicals and particulates into the atmosphere particularly the carbon monoxide (a deadly colourless and odourless gas emanating from electric generators).

The fumes - carbon monoxide- from the electric power generator has been responsible for the deaths on many Nigerians. In a bid to finding a solution to this menace, this paper proffers solution by giving a safer and better substitute for electric power generation using the windmill which harnesses the wind energy to generate electric power.

MATERIALS AND METHODS

Wind

Wind is simply air in motion. It possesses energy and this is displayed when it picks up things and sends them flying in various directions. It can make big sand dunes by moving the sand

and depositing it in a particular place, it can as well send huge trees crashing by hitting hard on them; it sometimes rips off the roofs of buildings and even send some weakly grounded buildings crashing as well as capsizing both small and large ships on the water ways. The energy possessed by the wind cannot be underestimated.

This energy possessed by the wind is due to its high speed (velocity) i.e. the wind possesses a high kinetic energy and the kinetic energy it possesses can be utilized to do work. This energy has been harnessed in the earlier days to works like, sea transport, wind mills to pump water from one place to another, grinding grains in mills for flour etc. In recent years, this energy is employed in producing electricity for the world's increasing power requirement, it is also used by aeroplanes to manipulate their upward and downward movement, and it is also used by helicopters to aid its movement and also by gliders (engine-less aeroplanes).

Wind energy comes indirectly from the sun. It is caused by the uneven heating of the earth's surface by the sun, because the earth's surface is made of very different types of land and water, it absorbs the sun's heat at different rates. One example of this uneven heating can be found in the daily wind cycle i.e. during the day, the air above the land heats up more rapidly

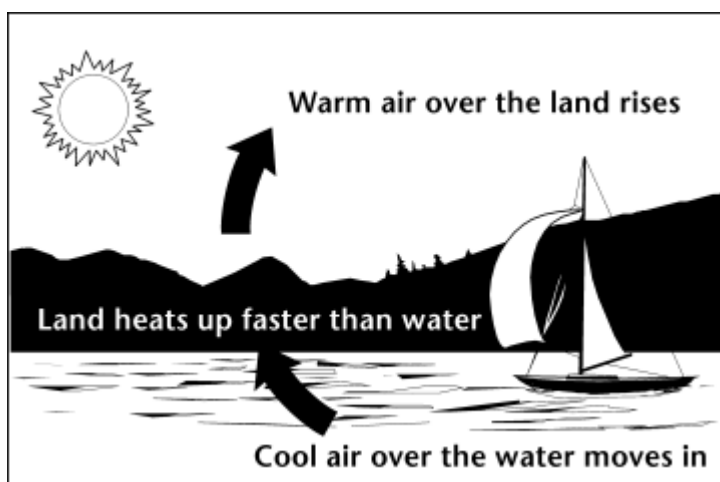


Fig1. The daily wind cycle

than the air over water. The air over the land expands and rises, and the heavier cooler air rushes in to take its place, creating wind. At night, the winds are reversed because the air cools more rapidly over land than over water. (windandenergyfoundation.org)

Wind is also caused by differences in the atmospheric pressure. When a difference in atmospheric pressure exists, air moves from the higher to the lower area, dovetailing down to winds of various speeds.

Globally, the two major factors of large-scale wind patterns are the differential heating between the equator and the poles and the rotation of the planet (**coriolis effect** – a deflection of moving objects when the motion is described relative to a rotating reference frame).

Wind energy technologies uses the mechanical or electrical power created through the kinetic energy of the wind for doing works like pumping of water, charging batteries, grinding grains and electricity generation can be harnessed using machines like windmill. A windmill is like a large fan having large blades which is fixed to the top of a tall pole.

Windmill history, design and working principle.

The first windmills invented had a vertical axis, meaning the blades were like small ship sails and moved like a merry-go-round. In the 1180s, in Europe, horizontal axis wind mills were invented. At first, windmills were fixed and therefore, only effective in places where a constant wind from one direction blew, as occurs for instance in coastal areas which get a steady off-shore breeze. Later models were self-adjusting; the top portion of the windmill turned to position the blades into the wind. The wind power available is proportional to the cube of its speed, which means that the power available to wind generator increases by a factor of eight if the speed of the wind doubles. The blades of a windmill are aerodynamically optimised to make most of the energy in the wind and turn it into rotational energy – making the blades spin round.

The windmill's (turbine) blades are similar to the propeller blades on an airplane. These blades are connected to a generator, sometimes through a gear box (in what's known as fixed speed machines) and sometimes connected directly (in what's known as 'variable speed' or 'direct drive' machines) – in both cases the generator converts the mechanical energy – the rotation of the blades – into electrical energy i.e. electricity. Green electricity.

Fixed speed machines runs at one speed of rotation whatever the wind speed while variable machines speed up and slows down as the wind speed increases and reduces.

Fixed speed windmills uses a gear box to create electricity at the right frequency for the grid, 50hz for the UK while the variable speed ones uses electronic gearbox to do the same job.

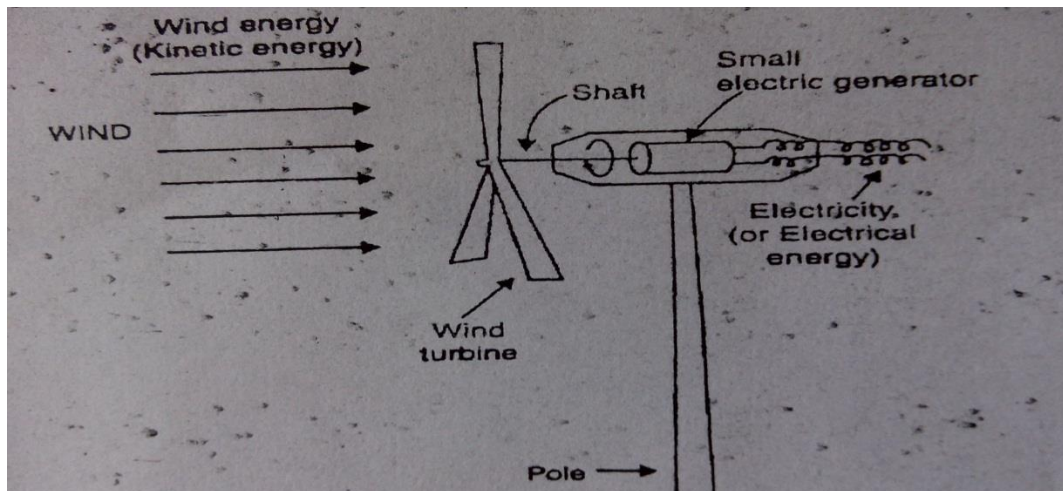


Fig: working principle of the windmill in generating electricity

In both cases, once the electricity is made, and made suitable to enter the local grid – where its been sent via underground cables – from where it can be sent to homes to power appliances.

The energy payback of a modern windmill (the time it takes to get back the energy used to manufacture and install each wind mill) is between 6-9 months depending on the location (some places are more windy than others). After that, for perhaps another 20-25 years, windmills bring a big net gain of clean energy and avoided carbon emissions. (ecotricity.co.uk)

The electric generator

An electric generator is a device that converts mechanical energy obtained from an external source into electrical energy as the output.

It is important to understand that a generator does not actually ‘create’ electrical energy. Instead, it uses the mechanical energy supplied to it to force the movement of electric charges present in the wire of its windings through an external electric circuit. This flow of electric charges constitutes the output electric current supplied by the generator. This mechanism can be understood by considering the generator to be analogous to a water pump, which causes the flow of water but does not actually ‘create’ the water flowing through it. (www.dieselserviceandsupply.com)

The modern-day generator works on the principle of electromagnetic induction discovered by Michael Faraday in 1831-32. Faraday discovered that the above flow of electric charges could be induced by moving an electrical conductor, such as a wire that contains electric charges, in a magnetic field. This movement creates a voltage difference between the two ends of the wire or electrical conductor, which in turn causes the electric charges to flow, thus generating electric current.

The most utilised source of electricity in Nigeria is the electric generator which is a useful appliance that supplies power during a power outage and prevents discontinuity of daily activities or disruption of business operations. They are available in different electrical and physical configurations for use in different applications.

Discussion

The functioning of the electric generator is made possible because of the combustion of fuel used in generating the mechanical energy which serves as the input energy the generator later converts to the electrical energy as the output. This combustion emits a waste material called the carbon monoxide which is very injurious to health.

Over the years, the monumental failure of the antiquated National Electric Power Authority, NEPA, and its equally moribund descendant Power Holding Company of Nigeria PHCN, plc. compelled the average Nigerian to invest in portable generators to provide electric power more on a substantive rather than standby basis(*vanguard newspaper oct.2013*).

As stated in the vanguard newspaper for august 8th, 2014, ‘no fewer 10000 nigerians have died over the years from poisonous generator fumes, especially in the years between 2008 and 2014’. These deaths involved the children, adults, men and women- the death of a 69-year old man in Ibadan, Oyo state and 7 of his family members in after they were overcome by fumes from a portable generator that was running on the first floor of their home, the death of two teenagers as a result of generator fume poisoning - almost daily, there is a report or the other of generator-induced death.

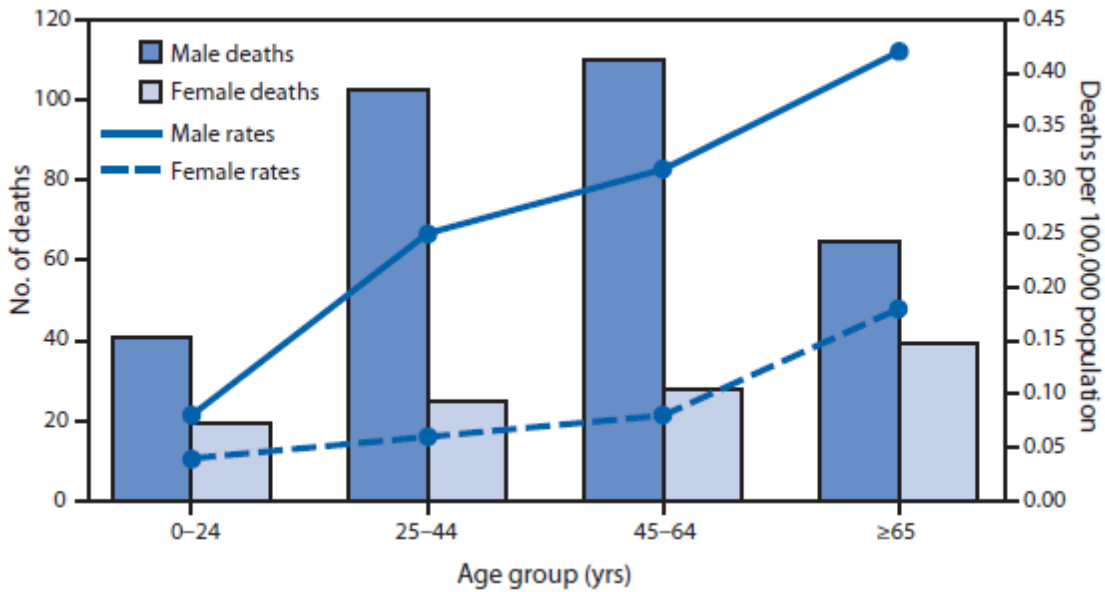


Fig 2. The bar chart showing the death rate for carbon monoxide induced death per 100,000 populations in Nigeria

If this persists the workforce will continue to suffer depletion and as the death toll for children increases, future of the nation might be jeopardized therefore endangering the economy.

As earlier said the kinetic energy of the wind is converted into rotational energy by the windmill which in turn is later converted to either mechanical or electrical energy. The windmill therefore generates clean and emission free electrical energy by harnessing the wind energy and using it to do useful work in generating electricity without releasing any harmful substance into the atmosphere. Also the windmill uses renewable energy and therefore can last for so many years.

Conclusion

Since the windmill does not generate any harmful waste, it therefore saves the environment the danger of toxic carbon monoxide which is terrorising its inhabitants and hence, gives a better hope of long life to the old, and as well spares the youth and the children which constitutes the workforce and economy builders. Hence economic stability is assured.

Recommendation

The windmill as an alternative electric power source is therefore recommended to government, factories and industries.

References

www.windandenergyfoundation.org/about-wind-energy/how-wind-works

en.m.wikipedia.org/wiki/Pollution

www.ecotricity.co.uk/our-green-energy/our-green-electricity/how-windmills-work

www.dieselserviceandsupply.com/How_Generator_Works.aspx

www.vanguardngr.com/2014/08/nigeria-records-10000-deaths-generator-fumes/