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ORIGINAL ARTICLE

Wind Power: The Technical and Institutional Option for Future

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ABSTRACT

Wind is emerging as one of the most potential source of alternate energy that will be helpful to a great extent in bridging the gap between the energy demand and supply. This energy can be utilized for performing mechanical and electrical work. Harnessing wind energy to generate electricity has great potential, and wind is becoming increasingly important in supplying our energy needs. It is currently the most cost-competitive of all forms of solar energy, and new technological advances suggest that wind energy could become an important source of electricity within the next decade. This paper begins by describing the importance of wind energy and its advantages over fossil fuels. It gives an overview of the wind energies in India with evaluating its Pros and Cons.

Key Words: *Renewable energy, wind energy, carbon emission environmental protection.*

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INTRODUCTION

There is a close link between availability of energy and future growth of a nation. Energy is consumed in a variety of forms and produced from variety of sources. Oil, Coal, Solar, wind and nuclear energy sources have become a permanent necessity of modern society. About 80% of energy demand still being met by Fossil fuels (Coal, Oil and solid biomass etc.) in which coal is the bulk primary contributor with a share of 56.9%. Growing energy needs through conventional sources such as coal, gas, etc. creates environmental problems. Emission of greenhouse gases, limited coal availability, environment distortion, rising prices of fossil fuels and pressure on foreign exchange reserves have created hindrance in the prolongation of these resources. Wind energy is indigenous and helps in reducing the dependency on fossil fuels. Wind has kinetic energy by virtue of the movement of large masses of air caused by differential heating of the atmosphere by the sun (Nikola Nilivojevic, 2010). India has a vast coastal line which is a good resource of the fresh wind. Harnessing wind energy is most profitable in rural areas that receive fairly continual winds, such as islands, coastal areas, mountain passes, and grasslands. Due to the geographic conditions of India, plenty of renewable energy sources such as solar, wind biomass, hydro and tidal are available to it. Wind power has emerged as the biggest source of renewable energy in the world (Mani and Dhingra 2013). Since wind turbines themselves run strictly on the power of wind generated, there is no need for fuel. So wind energy does not contribute carbon emission (American Wind Energy Association, 2015). India is presently fourth among the few nations that deliver greater power from wind control. Germany is the biggest breeze energy creating nation in world. Spain is the nation with the fourth biggest breeze vitality generation on the planet. China has seen a huge

increment in sustainable power sources, particularly after 2007 and has greatest development in wind vitality. This is motivation behind why numerous nations are utilizing wind power as a wellspring of energy.

PRINCIPLES & TECHNOLOGY

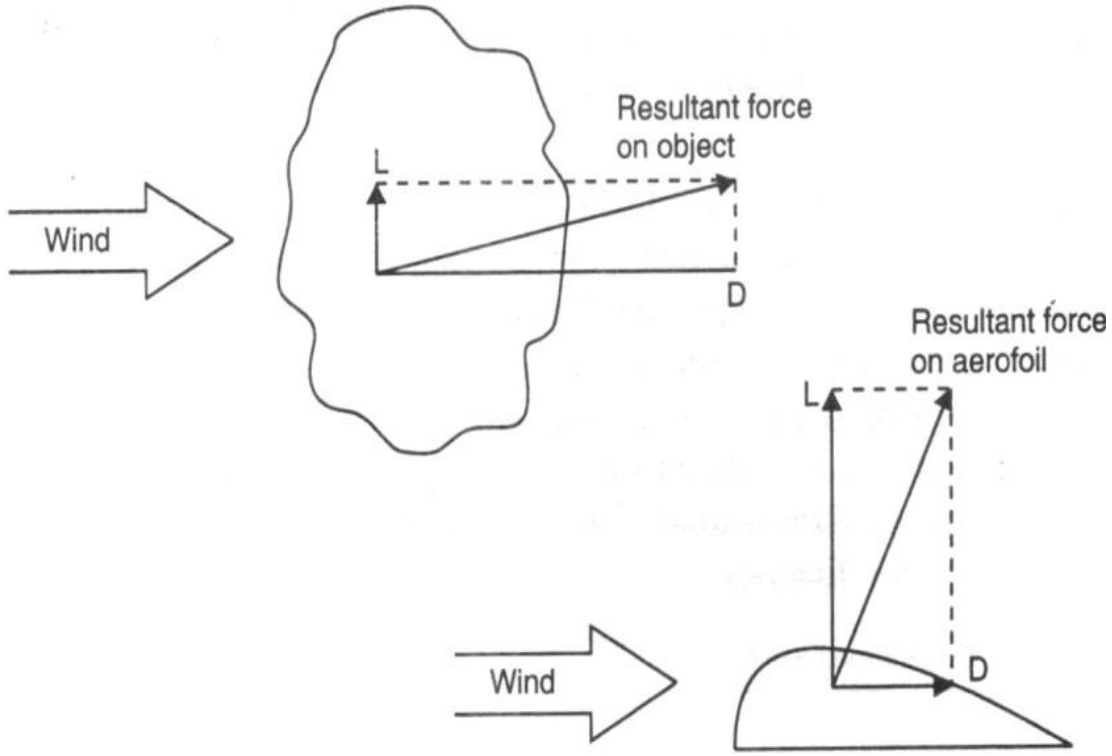

Fig. 1: The relative sizes of lift and drag forces for blunt and streamlined objects

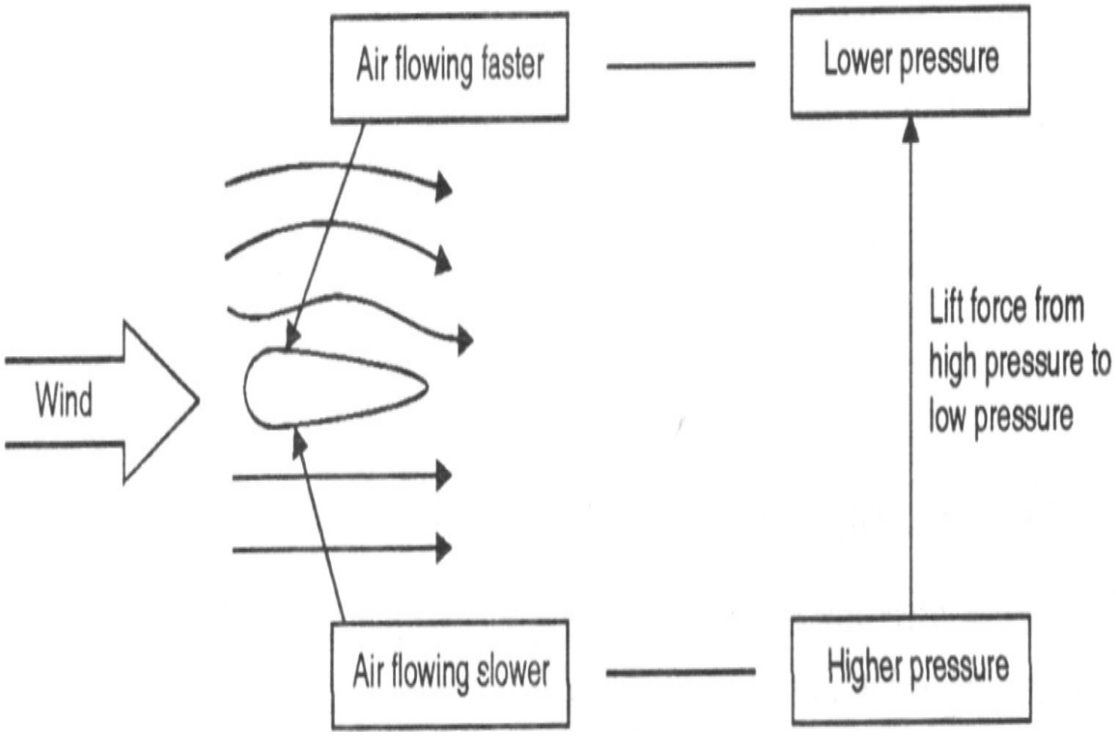

Fig. 2: Generation of lift by an aerofoil

Blowing wind exerts two types of forces, lift and drag, on the objects in its path. Drag force acts in the same direction as the wind while lift force in perpendicular to the direction of the wind. The relative sizes of the drag and lift forces depend entirely on the shape of the object. Streamlined objects experience much smaller drag forces than blunt objects. Generation of lift always causes a certain amount of drag force. Good aerofoils can have lift 30 times greater than drag. The relative sizes of lift and drag forces for blunt and streamlined objects are shown in Fig. 1. Lift devices are inherently more efficient than drag devices. Lift forces are produced by causing a difference in the velocity of the airstream flowing either side of the lifting surface. On the surface where the air is flowing faster, the pressure drops. This creates a pressure difference across the surface. The pressure difference produces force acting from the high pressure side towards the low pressure side. Generation of lift by an aerofoil because of pressure difference is shown in Fig. 2.

Wind energy technology demands careful attention to scientific and engineering details. The technology in the wind turbines has developed in several ways. The control system have become cheaper and more advanced, new profiles for the rotor blades can extract more power from the wind and new power electronic equipment makes it possible to use variable speed and to optimize the capacity of the turbines (Tore Wizelius, 2007). The kinetic energy, U, of a sample of air of volume, A(δx), and density ρ, moving with velocity υ, where A is a unit area perpendicular to the wind stream and δx is parallel to the wind stream, is-

$$U = \frac{\rho A\,(\delta x)\,\upsilon^2}{2}$$

The energy flux P_ω or wind energy density, is given by the time rate of change of U/A

$$P\omega = \frac{dU}{dT} \times \frac{1}{A} = \frac{P}{2}\left(\frac{\delta x}{\delta t}\right)\upsilon^2 = \frac{1}{2}\rho\upsilon^3$$

Not all of the wind power density is available for useful work; the maximum power that can be extracted from a wind stream is-

$16/27 \times P_\omega = 0.593 \times P_\omega$.

The average wind efficiency of turbines is 35-40% (Afgan and Carvalho, 2002).

PROS AND CONS OF WIND ENERGY

Role of wind energy is not only limited to energy generation, but it also contributes to the country by generating employment, reducing adverse effects of greenhouse gases and increasing size of GDP. According Global Wind Energy Council (GWEC), wind energy can create 213,000 green collar jobs every year in manufacturing, project development, installation, performance, maintenance, consulting, and so on. Global wind energy council estimated that by 2030 wind energy can supply up to 24% of India's power needs. The use of wind power does not cause major environmental problems, although there is a little adverse impact done by wind power. The California Energy Commission estimated that as many as 567 birds turned up dead in the vicinity of the 7000 turbines at Altamont Pass in California. High cost of generating energy from wind is also a cause of concern. Total Cost of installing an onshore wind power system in India is 1300 to 1450 USD/KW. Good wind sites are often in remote locations, far from cities where electricity is needed. Electricity is brought from the wind power plants to the city by transmission lines. So, its distribution should also be dealt with proper mechanisms to unleash its maximum potential. Although the turbines may cause noise and aesthetic pollution, the concern over the noise produced by the rotor blades, aesthetic visual can be tolerated in comparison to its advantages.

CONCLUSION

Development of wind power in India began in the 1990s, and has significantly increased in the last decade. Realizing its potential, Government of India has been actively putting efforts to promote renewable energy. Growth in the installed capacity of wind energy shows that investors are positively participating in Indian wind energy programme. If these challenges will be completely removed then India will set a new record of generating power & energy by wind, and the market of wind power generation will see an unprecedented growth. The Indian government should realize the long term benefits of renewable power generation and mark it top priority during their economic growth plans. They should increase their financial support for renewable energy in a variety of ways which includes funds for demonstration projects and loan guarantees. Many research and development centers should be opened for the further enhancement and progress of wind power.

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