Review of Non Conventional Energy Sources-Wind Energy

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Abstract: Energy is an important factor in the process of economics, social and industrial development. Energy sources that do not get exhausted are non-conventional renewable energy sources which include solar, wind, water. The power available in the wind increases rapidly with the speed hence wind energy conversion machines should be located preferably in areas where winds are strong and persistent. High speed wind energy generators fabricated now-a-days have only two blades and can deliver power from few hundred KW to a few MW. Wind farm or part is suggested where large number of units to be clustered to provide larger amount of power. Energy extracting from the wind is initially in the form of rotary, translational or oscillatory mechanical. Derived energy can be converted to other forms of energy or can be stored through use of compressed fluids, batteries, hot water, water saver system etc. Wind powered pumps can be used to save fuel and electricity.

Keywords : Energy; economics development; social development ; industrial development; non-conventional renewable energy sources; wind energy conversion machines;

I. ENERGY SITUATION

Energy is an important factor in the process of economics, social and industrial development. Besides these factors energy is very important to develop land, capital and labour in context of development.

High energy use has been associated with higher quality life. The concern for economical development amongst nations has drawn considerable attention to global energy resources, inventions and development of energy sources.

Energy sources that cannot be used again are called as non-renewable energy sources, which include coal, petroleum, natural gas etc. Whereas energy sources that do not get exhausted are non-conventional renewable energy sources which include solar, wind, water.The most commercial energy sources are coal, oil and hydro electricity. Large amount of energy is derived from commercial fuels like agriculture waste, dung, fire wood etc. Due to increase in demand of energy rapid deforestation is going on. Due to this India is losing its forests, coal and oil every year and it is a serious situation to the ecology and environment. The development of non-conventional renewable energy sources on a large scale to meet the energy requirements of rural and urban area is important.

II. NON-CONVENTIONAL RENEWABLE ENERGY SOURCES -

All the available energy sources in the world today arise basically from three different primary sources.

1) Isotopic dissociation in core of Earth.
2) Movement of planet.
3) Thermo-nuclear conversion in the Sun.

The renewable energy source that originates from Earth itself is called as geothermal energy. The movement of planets and of the result of gravitational force between the Earth and planets results in development of tides and wind. Non-renewable energy sources need new technology to suit our need of energy. Now consider energy source as wind.

III. WIND ENERGY

Origin of wind - Large differences in the incident solar flux on Earth's upper surface lead to different air temperatures all over the globe. In regions with strong solar radiation the atmospheric air gets heated and expands giving rise to high pressure region. At places where radiation is less air gets cooled giving rise to low pressure region. These air pressure differences in the atmosphere cause an acceleration of air particles as a result

of which air movement begins which is termed as gradient winds. Energy associated with wind is basically the kinetic energy of air, which is basically evaluated as, Some attempts have been made to estimate wind energy potential on Earth. As a rough estimate the wind energy available on Earth is of the order of 1013 MW, which is many times more than the present energy consumption.

IV. SITE SELECTION CONSIDERATIONS -

The power available in the wind increases rapidly with the speed hence wind energy conversion machines should be located preferably in areas where winds are strong and persistent. Although daily winds at a given site may be highly variable, the monthly and especially annual average speeds are remarkably constant from years. The most suitable sites for wind turbines would be found in areas where the annual average wind speeds are known to be moderately high or high.

In the WECS (wind energy conversion system) sites are wrongly or poorly chosen. The net wind electric energy generated per year may be sub-optimal with resulting high capital cost for WECS and low returns.

Technical, economical, social and other factors must be examined before a decision is made for selecting site for wind energy generation. Some of the main considerations are as below.

High annual average speed - A basic requirement to the successful use of WECS is an adequate supply of wind as stated above. The power in wind through a given cross sectional area is directly proportional to the cube of uniform wind velocity, due to which the small increase in wind velocity affects power in wind. A**vailability of anemometry data –** It is another important site factor. The principal object is to measure the wind speed, which basically determines output power of WECS.

The anemometry data should be available over some time period at the precise spot where any proposed WECS to be constructed and that should be accomplished before selection of site.

Wind structure at the proposed site – The ideal case for the WECS would be site with smooth, steady wind that blows all time, which is not practical. Wind near ground is turbulent and dusty and changes rapidly in direction and in velocity. This departure from homogeneous flow is collectively referred as structure of the wind.

Altitude of proposed site - It affects the air density and thus the power in the wind and hence the useful WECS electric power output. Higher the altitude higher is the wind velocity.

Local Ecology – If grass tree or vegetation is present, all wind will be destroyed and the system needed will be large and hence cost will be more.

Distance to roads and railways – It must be considered that heavy machinery, structure, materials, blades and other apparatus which will be needed to move to the chosen WECS site.

Nearness of site to local centre / users – Nearness of site to users minimizes transmission loss and length and hence the cost. **Nature of Ground -**

Ground condition should be such that the foundations for a WECS are secured and stable. There should not be erosion problem.

Land cost - Cost of land also must be considered, which affects the project cost and which must be reasonable in the site locality.

Other conditions like icing problem, salt spray, blowing dust should not be present at the site as they affect blades, machinery and electrical apparatus.

At the same time there should not be political and legal problems which affect safety of the project, human beings and smooth working of the project and finally cost of the project.

V. WIND ENERGY CONVERTERS:-

The power of wind has been utilized by mankind since thousands of year. In old cultures, 4000 years B.C., there were sailing vessels which were drive by wind power. In Alexandria, even today one can see the remains of windmills which are 3000 yrs old. There are known references to windmills relating to a Persian mill right in A.D. 6400 and to windmills in Seistan Persia in A.D. in 915. These earlier wind energy converters were essentially used for grinding cereals and for driving water pumping works. The first development of wind energy technique leads to use of wind mills for electricity generation. In 1895 the first wind electric generation system was built in Denmark.

High speed wind energy generators fabricated now-a-days have only two blades and can deliver power from few hundred KW to a few MW. The largest wind energy converters of this type called GROWIN (Grobe Wind Energy Analage) has a power of 3MW and is in operation at the coast of the North sea. The tower of GROWIN system is about 100 m high and the rotor blades have the diameter of 100 m.

VI. WIND FARMS

In view of time, labour and cost necessary to evaluate wind sites simple and rapid methods of locating those of good potential areas are very welcome. The technology of remote sensing via satellite and other means, some interesting possibilities are raised for locating wind prospecting areas or sites where the wind farms can be sited.

Wind farm or part is suggested where large number of units to be clustered to provide larger amount of power. The close proximity of units, lower installation, inter connection and maintenance costs. Given a limited area with high winds, the machine should be packed so as to minimize the performance degradation of interior units due to the downwind influences of one or more units. Space requirement, turbulence effects and interference problems are studied by a number of research workers. The assumptions made by wind energy mission analysis are a) not more than 3 units can be aligned in a given direction b) the spacing between units is 900 m c) the unit consists of horizontal axis machine 1500 KW and 60 m rotor diameter d) the wind rose be symmetrical.

VII. APPLICATIONS OF WIND ENERGY

The general applications of wind energy are given below.
Large wind energy conversion system-
a)Utility of power. b) Electrolysis and electrochemical processing. c) Pumping (Hydroelectric , water supply and irrigation) d) Domestic and industrial use
Small wind energy conversion system-
Resistance heating (hot water)
Agricultural pumping, crop drying
Food processing
Earthquake data stations
Remote locations (Galvanic protections)
Energy extracting from the wind is initially in the form of rotary, translational or oscillatory mechanical. Mechanical motion is used to pump fluids or can be converted to electricity and heat. Some of the most effective applications are those that use energy derived directly from wind without further energy processing, conversion or storage. Derived energy can be converted to other forms of energy or can be stored through use of compressed fluids, batteries, hot water, water saver system etc.

VIII. PUMPING APPLICATIONS

A typical wind powered pumping application is one that uses horizontal axis wind machine. It is mostly used to pump irrigation water. Large number of water-pumping wind mills have been used on Indian farms. They are also used in pumped- hydro application. Wind power can also be used to compress air for various applications including application of gas turbine for generating electricity during peak demand periods of public utility system. Wind powered pumps can be used to desalinate water using reverse osmosis units.Wind powered pumps can be used to save fuel and electricity.

IX. ELECTRIC GENERATION APPLICATION

Wind power can be used to drive a synchronous a. c. electrical generator. The energy is fed directly in to power networks through voltage step up transformers. Wind energy conversion system units can be integrated with existing hydroelectric networks and used in water saver mode of operation. When wind is blowing electrical generation at the hydro electrical plants in the network can be reduced by an amount equal to that being produced by WECS units. This part of load that is ordinarily produced by the hydroelectric generators is supplied by wind turbines. Under these conditions some water that would have been used by hydroelectric plant to supply the load is saved in the reservoir and made available for later use when wind is not blowing.
In dispersed applications, wind power can be used to generate direct current electrical power that in turn, can be used for direct current applications or space heaters, such as resistance heaters or can be stored in the batteries and then inverted for use by alternating current loads.

X. CONCLUSION

Wind energy is highly eco-friendly since it is clean and there no question of pollution. By using wind as energy ozone deplenation can be reduced and good environment can be created. Also there is no end product left just like thermal power stations. Wind energy is cheap means of energy production only it needs good site and wind velocity ranging from 8-15 kmph which is easily available in most part of the country. The wind mills with high efficiencies and lower costs are readily available which can operate at these wind velocities. For India it is possible to generate huge amount of energy from wind mills.

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