Renewable Energy – Wind Power Generation

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With depleting energy resources, coupled with growing awareness of the impact of greenhouse gases, more and more countries have proactively turned to renewable energy to meet part of their increasing power demand. Renewable energy is basically energy generated from natural resources, such as sunlight, wind, hydro, tides and geothermal heat, which are naturally replenished.

One of the renewable energy sources that has gained much popularity in recent years is wind power, in which energy from wind is captured by wind turbines. When the wind turbine rotates, it spins a shaft that is coupled to a generator, and hence transforming the rotational energy into electricity.

At the end of 2008, the total capacity of wind-powered generators exceeded 120 gigawatts[1], *i.e.* about 1.5% of worldwide electricity use. This capacity has almost doubled from 2005 to 2008, and is growing at a much faster rate today. Large scale wind farms, both onshore and offshore, are being developed in Europe, America, China, India, etc.

Modern wind turbines incorporate sophisticated aerodynamic principles to capture the wind's energy efficiently. Turbine blades are shaped a lot like airplane wings, *i.e.* with airfoil design to optimise the conversion of wind energy into rotational energy. The output of a wind turbine has increased substantially from approximately 1 MW in the 1990s to as high as 3.6 MW today, though 1.5-3 MW is still the most common range for commercial use. In general, the output of a wind turbine is highly dependent on the length of the blades (*i.e.* the swept area of the rotor) and the wind's speed through the blades.

Horse Hollow wind farm (Photo: Wind Power Works)

Compared to other power generation, the environmental effects of wind power are relatively minor. Wind power consumes no fuel, and emits no air pollution. However, the feasibility of wind power generation is greatly dependent on the wind resources in a country, and generally an annual average wind speed greater than 4 m/s is required for small scale wind power generation. ■

[1]*Global Wind 2008 Report, Global Wind Energy Council*

Shaiky's View

Note:

a) Elaborated further in Engineering Miscellany on page 38.

*b) A compilation of **Shaiky's View** cartoons are available, see announcement on page 31.*