Wind Energy

Renewable energy harnesses natural wind power

Effective answer for emission problem towards cleaner, safer and greener environment

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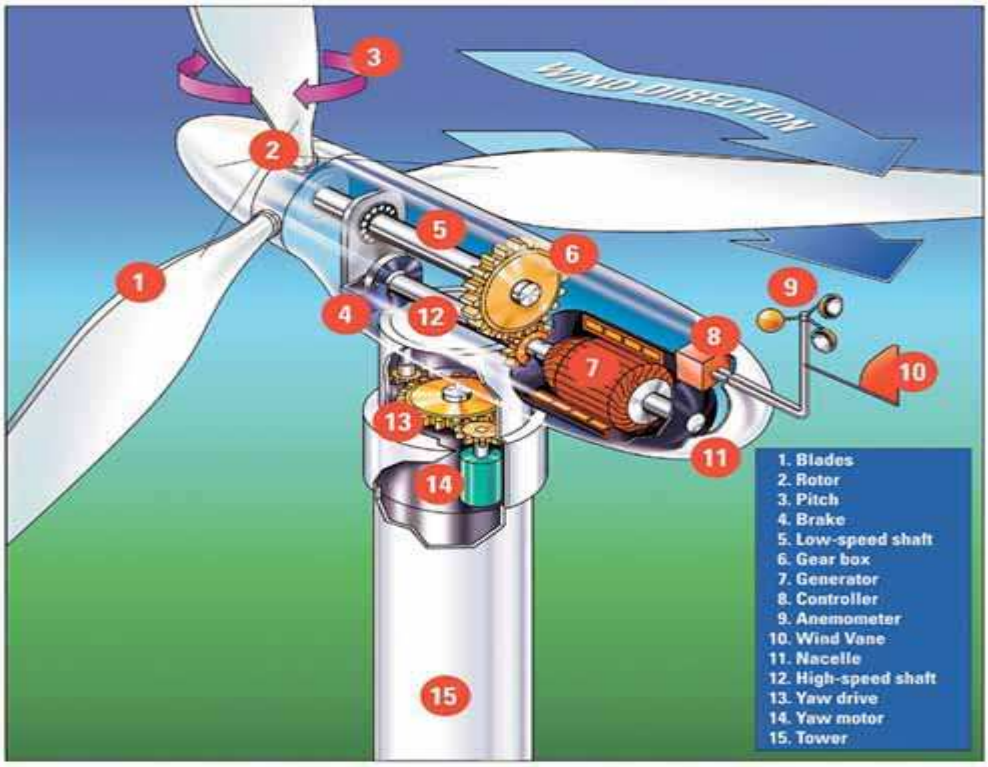
Harnessing renewable alternative energy is the ideal way to tackle the energy crisis that looms large over the world. Renewable energy is the energy which is made from resources that Mother Nature replaces. Renewable energy is also called “clean energy” or “green power” because it doesn’t pollute the air or the water. Wind energy is one such renewable energy source that harnesses natural wind power. People try to make many assumptions against wind turbines for generation of wind energy; but the fact remains, wind energy is most suitable form of renewable energy we can have to replace coal fired / nuclear powered / and even oil fired power plants in the near future. In support various points are discussed below:

1. Wind power is a clean, renewable source of energy which produces no greenhouse gas emissions or waste products. Power stations are the largest contributor to carbon emissions, producing tones of CO2 each year. We need to switch to forms of energy that do not produce CO2. Just one modern wind turbine will save over 4,000 tones of CO2 emissions annually.



2. Wind energy is generated by blowing air. Wind energy transform in kinetic energy and use as mechanical energy or electricity. The amount of energy produce depends mainly on blowing wind speed; density of air affects the energy produce by wind, which is determined by the humidity, barometric pressure, dryness.

In the case of a wind-electric turbine**,** the turbine blades are designed to capture the kinetic energy in wind. When the turbine blades capture wind energy and start moving, they spin a shaft that leads from the hub of the rotor to a generator. The generator turns that rotational energy into electricity. At its essence, generating electricity from the wind is all about transferring energy from one medium to another.

The simplest possible wind-energy turbine consists of three crucial parts:

*** Rotor blades** - The blades are basically the sails of the system; in their simplest form, they act as barriers to the wind (more modern blade designs go beyond the barrier method). When the wind forces the blades to move, it has transferred some of its energy to the rotor.

*** Shaft** - The wind-turbine shaft is connected to the center of the rotor. When the rotor spins, the shaft spins as well. In this way, the rotor transfers its mechanical, rotational energy to the shaft, which enters an electrical generator on the other end.

*** Generator** - At its most basic, a generator is a pretty simple device. It uses the properties of electromagnetic induction to produce electrical voltage - a difference in

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electrical charge. Voltage is essentially electrical pressure - it is the force that moves electricity, or electrical current, from one point to another. A simple generator consists of magnets and a conductor. The conductor is typically a coiled wire. Inside the generator, the shaft connects to an assembly of permanent magnets that surrounds the coil of wire. In electromagnetic induction, if you have a conductor surrounded by magnets, and one of those parts is rotating relative to the other, it induces voltage in the conductor. When the rotor spins the shaft, the shaft spins the assembly of magnets, generating voltage in the coil of wire. That voltage drives electrical current (typically alternating current, or AC power) out through power lines for distribution.

3. Energy of wind power depends upon speed of air when increase in speed of air then increase in generation of energy and when decrease then decrease in energy generation. So locate the wind power plant in windiest areas.

4. The cost of wind energy is determined by initial cost of the wind power plant - any wind power plant that is installed in a windy area generates less expensive electricity than the same unit installed in a less windy area.

5. The average wind farm will pay back the energy used in its manufacture within 3-5 months of operation. This compares favorably with coal or nuclear power stations, which take about six months.

6. A modern wind turbine is designed to operate for more than 20 years and at the end of its working life, the area can be restored at low financial and environmental costs. Wind energy is a form of development which is essentially reversible – in contrast to fossil fuel or nuclear power stations.

7. A modern wind turbine produces electricity 70-85% of the time, but it generates different outputs depending on the wind speed. Over the course of a year, it will typically generate about 30% of the theoretical maximum output. This is known as its load factor. The load factor of conventional power stations is on average 50%. A modern wind turbine will generate enough to meet the electricity demands of more than a thousand homes over the course of a year.

8. All forms of power generation require back up and no energy technology can be relied upon 100%. Variations in the output from wind farms are barely noticeable over and above the normal fluctuation in supply and demand.

9. The cost of generating electricity from wind has fallen dramatically over the past few years. Between 1990 and 2007, world wind energy capacity doubled every three years and with every doubling prices fell by 15%. Wind energy is competitive with new coal and new nuclear capacity, even before any environmental costs of fossil fuel and nuclear generation are taken into account. As gas prices increase and wind power costs fall – both of which are very likely – wind becomes even more competitive, so much so that some time after 2010 wind should challenge gas as the lowest cost power source. Furthermore,

the wind is a free and widely available fuel source; therefore once the wind farm is in place, there is no fuel requirement or no waste related costs.

10. In future, we will need a mix of both onshore and offshore wind energy to meet the challenging targets on climate change. At present, onshore wind is more economical than development offshore. However, more offshore wind farms are now under construction. Thus, prices will fall as the industry gains more experience.

11. Wind energy is a benign technology with no associated emissions, harmful pollutants or waste products. In over 25 years and with more than 75,000 machines installed around the world, and there is no report of any body has ever been harmed by the normal operation of wind turbines.

12. The evolution of wind farm technology over the past decade has rendered mechanical noise from turbines almost undetectable with the main sound being the aerodynamic swoosh of the blades passing the tower.

13. We need to act now to find replacement power sources - wind is an abundant resource, and therefore has a vital role to play in the new energy portfolio all over the world.

14. Generation of electrical energy by wind power plant rapidly growing in whole world, In terms of installation and operation world level. Average onshore turbines discussed here is of capacity 1.8 MW. For many on-going projects at present the capacity over 2 MW turbines are being installed. Offshore turbines currently being installed are rated at 3 MW, and it is expected to rise to a typical 5 MW per machine by 2010.

	2006 capacity (megawatts)	growth over 2005
Germany	20,622	12%
Spain	11,615	16%
U.S.	11,603	27%
India	6,270	42%
Denmark	3,136	0%
China	2,604	107%
Italy	2,123	24%
UK	1,963	48%
Portugal	1,716	68%
France	1,567	107%
Rest of the world	11,005	28%

Top Ten Wind Energy Producing Countries, 2006

15. The benefits of wind energy -

* Wind energy is an ideal renewable energy because, it is (i) Pollution-free, (ii) Does not require fuel and (iii) Does not produce toxic or radioactive waste.

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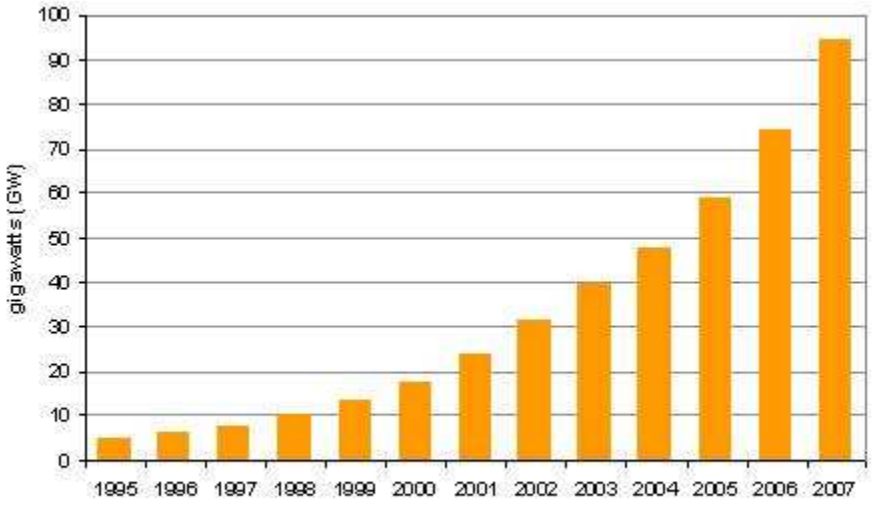
* Wind energy is quiet and does not present any significant hazard to birds or other wildlife.

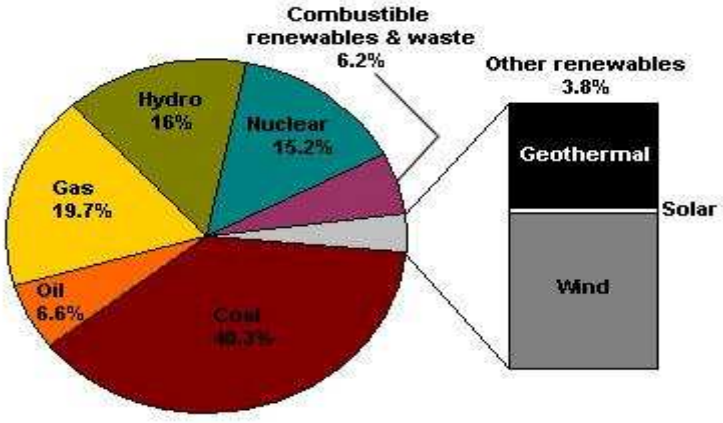
* When large arrays of wind turbines are installed on farmland, only about 2% of the land area is required for the wind turbines. The rest is available for farming, livestock, and other uses.

* Ownership of wind turbine generators by individuals and the community allows people to participate directly in the preservation of our environment.



Growth in Global Wind Power Installed Capacity

16. The Fastest-Growing Energy Source - Wind is the fastest-growing energy source in the world, enjoying an average annual growth rate of 28 percent over the past ten years, compared to less than three percent for fossil fuels. The major drivers of this growth include concerns over climate change and energy security.



World Electricity Generation by Fuel

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17. Untapped Potential - Despite monumental growth, wind energy still represents only a minute fraction of total energy consumption worldwide. Increasing this percentage to levels that will contribute to necessary reductions in global greenhouse gas emissions will require significant political support to overcome decades of policies encouraging conventional fossil fuel technologies. If a more level playing field is achieved, wind energy will likely play a major role in future climate change strategies in both national and international arenas.

18. Breakthrough In Small Wind Technology - The main work of wind turbines is to utilize the energy of wind and convert it into electricity; stronger wind is considered good for electricity production. But the speed of wind should not be too strong because it makes turbines spin too fast and in this process it commits suicide! Why is it so? Because turbine blades get ripped off by stronger winds – excessive heat damages the alternator. Turbine tower too can't remain unaffected by the strong wind. To prevent all this damage a mechanical breaking system furling is generally used. This method prevents wind turbine from spinning too quickly by turning the blades away from the direction of the wind. Furling can be manual or automatic with same goal i.e. turning the turbine blade edges into the wind when the wind is dangerously strong and stormy.

19. Drawbacks - We already know the benefits of wind energy and why we should opt for it. But currently manufacturers are concentrating on the drawbacks of the wind energy and trying to eliminate or minimize those shortcomings. For example turbines are noisy and this sound nuisance can be a problem for the residents of the areas. Wind turbines are unsafe for birds too. Birds can be injured or die if they are caught up in the wings of the turbines. Turbines might annoy you due to horizon pollution i.e. they might meddle with your aesthetic sense.

20. Wind Energy From Ocean Surface - When we talk about wind energy, we don't specifically mention ocean winds. But global satellite maps from NASA promise a new hope. Nearly a decade of data from NASA's QuikSCAT satellite gives us hope that we can harness ocean's wind for energy generation. These maps can help in locating and planning the offshore wind farms for producing electric energy.

21. Next Generation Wind Energy - Right now wind energy is only being harnessed in the windy regions of the earth. Installation of wind energy on individual basis is unpopular because of production and cost inefficiency. Noise pollution and birds getting killed are also not quite attractive side-effects of the windmills. We can't even imagine of installing windmills on high rise buildings due to their size and cost.

Researchers of university Illinois have thought about all the drawbacks of the windmills and have come up with their own version in the wind turbine technology. Their idea is to have double-helix wind turbine known as **'aeroturbines'**. The design of these aeroturbines is comparatively simple and to eliminate the drawbacks of the existing turbines. Harvesting wind energy from high rise buildings will be possible and production and cost efficiency will be the key factors. The propellers of these aero turbines resemble an electric beater and don't look like a blade. These aeroturbines will

not produce noise pollution and can be installed at the rooftops of high rise buildings. They are safe for birds as well.

22. Cost comparison and Govt. incentives - The cost of utility-scale wind power has come down dramatically in the last two decades due to technological and design advancements in turbine production and installation. The higher the wind speed over time in a given turbine area, the lower the cost of the electricity that turbine produces. Below a comparison of various energy generation costs (average) is shown:

Energy Costs Comparison	
Resource Type	**Average Cost (cents per kWh)**
Hydroelectric	2-5
Nuclear	3-4
Coal	4-5
Natural gas	4-5
Wind	4-10
Geothermal	5-8
Biomass	8-12
Hydrogen fuel cell	10-15
Solar	15-32

Government incentives for both large- and small-scale producers contribute to the economic feasibility of a wind-power system as well.

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