

Wind Energy

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What is Wind and Wind Energy?

DEFINITION:

- Wind energy is a renewable energy source that uses wind power to generate electricity. The primary means to obtain it are the turbines, "windmills".

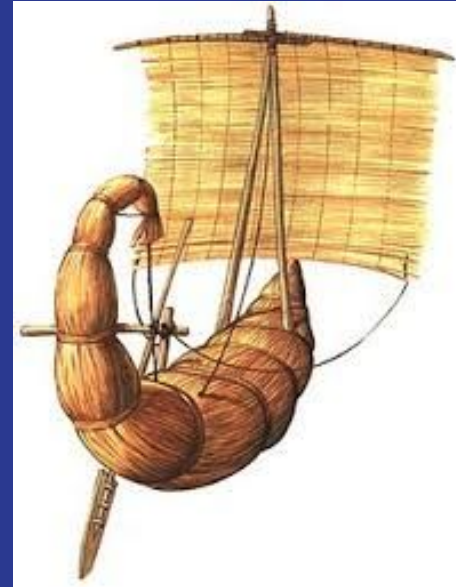


- Wind is air in motion and a form of solar energy
- Result of uneven heating of sun's atmosphere, rotation on axis, unconventional parts of Earth's surface
- Form of energy conversion where mechanical or electrical energy is gained as power
- The air above land heats up wind, making it a renewable resource because as long as sun shines, we will have wind

Wind Energy's Use:

History

- Ancient Egyptians used wind for sailing their ships along the Nile River (5000 B.C.)
- Windmills have been used to grind wheat and pump water from wells.
- From ancient Egypt to modern America, we are still harnessing the power of the wind to improve our lives.
- By 200 B.C., simple windmills in China were pumping water.
- People from Persia and Middle East grinded grain with vertical-axis windmills with woven reed sails



The Efficiency of Wind Energy

- Because wind energy doesn't rely on combustion of fossil fuels, no air pollution.
- One of the cheapest technologies for renewable energy (costing between four and six cents per kilowatt-hour)
- Economy benefitted in rural areas, as wind turbines placed in farms or ranches and not taking much space.



Relative Emissions of Fine Particles



VERY DIRTY

VERY CLEAN

Highest annual pollution

244 lbs. of annual pollution

97 lbs. of annual pollution

27 lbs. of annual pollution

<1/4 lb of annual pollution

<1/6 lb of annual pollution

ZERO annual pollution

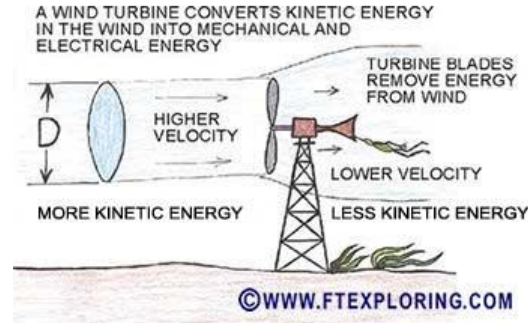
Shortcomings of Wind Energy

- Several wind turbines are designed for compatibility with different winds
- Only a little bit over a half of the wind's kinetic energy goes in and out of the turbine.
- Drag and friction reduces the efficiency of turbines by 15-20%-Slight decreases in efficiency over time due to wear, parts such as generator and gearbox deteriorate.
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- Environment somewhat affected by turbine blades: hazardous for local wildlife, creates much noise, visual impact.



Wind Turbine Physics

Wind turbines convert the kinetic energy from the wind into electrical energy, the work is equal to the mass of the blades multiplied by the circumference each blade travels.



The background is a solid pink color. In the top right corner, there is a decorative pattern of overlapping squares and triangles in various shades of pink, from light to dark, creating a geometric, stepped effect.

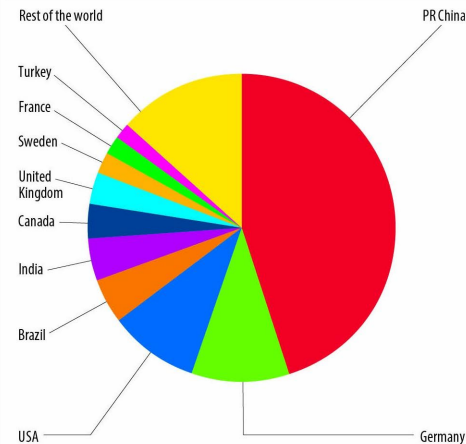
Model

Wind Energy Production and Use

- In 2004, wind energy in California produced 4,258 million kilowatt-hours of electricity, about 1.5 percent of the state's total electricity
- More than enough to light a city the size of San Francisco.
- Wind power seen generating up to 18% of global power by 2050.



TOP 10 NEW INSTALLED CAPACITY JAN-DEC 2014



Country	MW	% SHARE
PR China	23,196	45.1
Germany	5,279	10.2
USA	4,854	9.4
Brazil*	2,472	4.8
India	2,315	4.5
Canada	1,871	3.6
United Kingdom	1,736	3.4
Sweden	1,050	2.0
France	1,042	2.0
Turkey	804	1.6
Rest of the world	6,852	13.3
Total TOP 10	44,620	87
World Total	51,473	100

* Projects fully commissioned, grid connection pending in some cases

Source: GWEC

Top ten new installed capacity in 2014

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