Wind turbine diagram simple

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Photo: A small wind farm in Colorado, United States. These are relatively small turbines: each one produces about 700kW of energy (enough to supply about 400 homes). The turbines are 79m (260ft) high (from the ground to the very top of the rotors) and the rotors themselves are 48.5m (159ft) in diameter. The top part of each turbine (called the nacelle) rotates on the tower beneath so the spinning blades are always facing directly into the wind.Photo by Warren Gretz courtesy of US Department of Energy/NREL (DoE/NREL).

A turbine, like the ones in a wind farm, is a machine that spins aroundin a moving fluid (liquid or gas) and catches some of the energy passing by. All sorts of machines use turbines, from jet engines tohydroelectric power plants and from diesel railroad locomotives to windmills. Even a child"s toy windmill is a simple form of turbine.

Wind varies all the time so the electricity produced by a single wind turbine varies as well. Linking many wind turbines together into a large farm, and linking many wind farms in different areas into a national power grid, produces a much more steady supply overall.

Photo: Head for heights! You can see just how big a wind turbine is compared to thisengineer, who"s standing right inside the nacelle (main unit) carrying out maintenance. Notice howthe white blades at the front connect via an axle (gray—under the engineer"s feet) to the gearbox and generatorbehind (blue). This is a 900kW turbine with a 55m (182ft) diameter rotor mounted on a tower 33m (110ft) off the ground. Photo by Lance Cheung courtesy of US Air Force.

Although we talk about "wind turbines," the turbine is only one ofthe parts inside these machines. For most (but not all) turbines, another key part is a gearbox whose gears convert the relatively slow rotation of the spinning blades into higher-speed motion—turning the drive shaft quickly enough to power the electricity generator.

Photo: A 3MW wind turbine with its rotor blades removed, showing the pitchcontrol mechanism. The tower is on the right and notice the engineer perched on top (for scale). Photo by Werner Slocum courtesy of NREL.

Photo: In theory, wind is still at ground level and blows faster the higher from the ground you go, in a region that"s known as the boundary layer. Generally, the taller a wind turbine, the better, although there are practical limits anddiminishing returns from going ever higher.

Since the blades of a wind turbine are rotating, they must havekinetic energy, which they "steal" from the wind. Nowit"s a basic law of physics (known as the conservationof energy) that you can"t make energy out of nothing, so the windmust actually slow down slightly when it passes around a windturbine. That''s not really a problem, because there''s usuallyplenty more wind following on behind! It is a problem if you want tobuild a wind farm: unless you''re in a really windy place, you haveto make sure each turbine is a good distance from the ones around it so it''s not affected by them.

At first sight, it''s hard to imagine why anyone would object to clean and green wind turbines—especiallywhen you compare them to dirty coal-fired plants and risky nuclear ones, but they do have some disadvantages.

Photo: You can put lots of turbines togetherto make a wind farm, but you need to space them out to harvest theenergy effectively. Combining the output from many wind farmsin many different areas produces a smoother and more predictable power supply.This is the Ponnequin Wind Farm in Colorado, United States.Photo by Warren Gretz courtesy of NREL.

Artwork: Wind turbines are much bigger and more powerful than theywere just a few decades ago. Each one of these turbines shows how the state of the arthas improved dramatically every five years since the mid 1980s. The numbers on top are the rotor diameter and maximum power. Artwork by Joshua Bauer courtesy of NREL.

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Web: https://www.hollanddutchtours.nl/contact-us/
Email: energystorage2000@gmail.com
WhatsApp: 8613816583346