

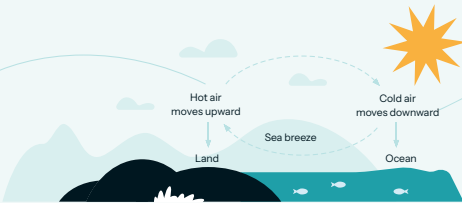
Wind basics

WIND ENERGY= a renewable source of energy

Wind is caused by three factors.

- The warming of the atmosphere by the SUN.
- The rotation of the Earth.
- The irregularities of the Earth's surface.

What is wind?



Components of a wind turbine

- 1 WIND METERS:** The anemometer and wind vane measure the direction and speed of the wind.
- 2 NACELLE:** This is where energy is converted into electricity. The front of the nacelle always turns into the wind.
- 3 BLADES:** Huge "wings". They are set in motion by the wind.
- 4 LOW-SPEED SHAFT:** The shaft to which the blades are attached rotates together with them.
- 5 GEARBOX:** The slow rotational movement is accelerated in the gearbox.
- 6 GENERATOR:** Driven by the high-speed rotation, it generates electricity.
- 7 STAIRS/LIFT**
- 8 HIGH-VOLTAGE CABLES**
- 9 TRANSFORMATOR:** Converts the voltage of the electricity.
- 10 FOUNDATION**
- 11 HIGH-VOLTAGE SUBSTATION:** Through the high-voltage substation, the generated electricity is fed into the power grid..

3 key factors that determine how much electricity a turbine can produce:

- WIND SPEED**
With stronger winds, we can produce more electricity. Not only the speed but also the 'consistency' of the wind is important.
- ROTOR DIAMETER**
The larger the radius or "swept area" of the blades, the more electricity can be produced. Doubling the rotor diameter results in four times more power.
- AIR DENSITY**
"Denser" (heavier) air exerts more lift on a rotor. High-altitude locations have lower air pressure and "lighter" air, and are therefore less productive locations for wind turbines.

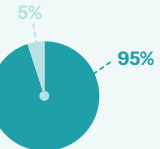
⚡ The transformer converts the electricity into the correct voltage and then sends it to the high-voltage substation. ⚡

TRANSFORMER?
Have you ever wondered why every computer or smartphone charger has a little box? That is actually a small "transformer." Your charger converts the 220V from the power outlet through that box into the voltage (volts) that your computer or smartphone needs to charge.

Elektricity to our homes

"Wind energy is... unreliable, because you cannot rely on the wind to be blowing."

WRONG



Wind energy is variable, but overall wind farms are not irregular in terms of production. Wind turbines operate up to 95% of the time and only stop for maintenance, to reduce potential impacts (noise, shadow flicker, birds or bats), for work on the electricity grid, when there is no wind at all, or... in case of negative electricity prices.

"Wind energy ... is part of the energy mix and is not sufficient as a sole energy source in Europe."

RIGHT



Wind energy will of course always remain part of the overall energy solution. Think of it like a puzzle: all the pieces have to fit together. **They complement each other and are all necessary.** The goal is to find a good balance with the largest possible share of renewable energy.

Types of turbines



12 MW = 12.000 HOUSEHOLDS

OFFSHORE WIND TURBINES

FLOATING, connected to the seabed with anchors. They can be installed in areas where the sea is very deep (>50 m).

FIXED FOUNDATION, with a tower anchored to the seabed. Designed for water depths of less than 50 to 60 meters.

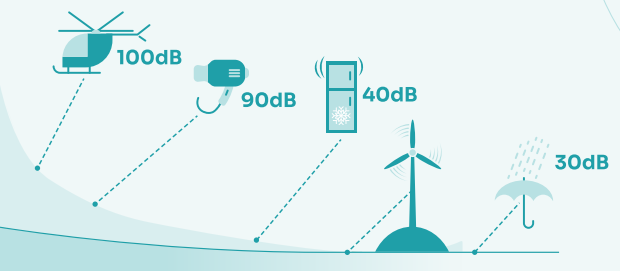
4,5 MW = 3500 HOUSEHOLDS

ONSHORE WIND TURBINES

The most recent onshore wind turbines have a capacity of 4.5 MW. This is enough to supply electricity to approximately 3,500 households.

Noise pollution

Noise regulations vary from country to country or from region to region. In Flanders, for example, specific maximum noise limits are set for wind turbines depending on the time of day (day/evening/night) and the type of area (such as residential areas).



Shadow flicker

Shadow flicker is an effect of a wind turbine that is limited and fully controllable, and every region or country has its own regulations. In Belgium, for example, no dwelling is allowed to experience more than 8 hours of shadow flicker per year, with a maximum of 30 minutes per day.

💡 Did you know ... that a wind turbine knows when it is cloudy? Wind turbines are equipped with light intensity sensors and smart control systems. This allows them to know exactly where the sun is, how intense the sunlight is, and when shadow flicker would reach a home, after which they automatically shut down if necessary.

1 The operation of a wind turbine is simple and safe.

2 The technology is very mature, and the sector continues to innovate.

3 It is a renewable energy source, inexhaustible, highly efficient, and particularly suitable as an independent energy source for EUROPE.

In a nutshell...

💡 Fun fact: The days when wind energy played a minor role in the energy market are definitely over. During very windy months, WIND is the largest electricity producer in Europe!

💡 Did you know ... that wind energy producers are often asked to shut down their turbines? On a sunny day with strong winds and low energy demand, there can be an oversupply of electricity on the grid. This can lead to negative prices, and wind energy operators are then requested to stop the wind turbines. This is a challenge we need to find a solution for, and batteries and energy storage are the future!

💡 Fun fact: The blades are often equipped with small serrations. This helps to reduce the noise they produce. This principle comes from nature, specifically from the wings of an owl! In this way, the industry continuously improves its technology.

💡 Fun fact: Super wind turbines are often criticized as being annoying and disruptive in the landscape. However, in terms of noise, larger wind turbines are much better for the environment: the nacelle (the noise source) is located much higher, and the blades are longer and often rotate more slowly.

INSIGHTS THAT ENERGIZE.

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