

# HOW MUCH ENERGY DOES A WIND TURBINE PRODUCE

## The Basics of Wind Turbines

Wind turbines play a crucial role in harnessing wind power to generate electricity for a wide range of applications. As we aim to transition to greener, renewable energy sources, understanding the energy output of wind turbines becomes increasingly important.

The exact amount of energy produced by a wind turbine can depend on a number of factors such as wind speed, rotor diameter, turbine efficiency and where they are located.

According to the European Wind Energy Association, “an average onshore wind turbine with a capacity of 2.5-3 MW can produce more than 6 million kWh in a year”, which is enough to supply around 1,500 households with electricity. In comparison, the average offshore wind turbine can power over 3,312 households.

BGB are at the forefront of wind turbine technology, with our slip rings and slip ring repair service working to keep wind turbines moving and operating at maximum efficiency.

Continue reading to learn all about the intricacies of wind turbine energy production, the science that powers these unique structures and the factors that influence how much energy a wind turbine can produce.

...The average offshore wind turbine can power over **3,312** households...



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## The Basics of Wind Turbines

To understand wind turbine energy production, it's essential to first learn about how they operate.

A wind turbine yaws (turns) into the wind and pitches its blades to capture the kinetic energy. As the wind passes over the blades it generates lift which produces a turning motion. The speed of the rotor can be changed using a gearbox to bring the generator frequency in line with the grid or it can be directly converted as in the direct drive wind turbines. This power is then conditioned by power electronics before being transmitted over the grid.

To read more about this, check out our guide: 'How do Wind Turbines Work?'



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## Factors Influencing Wind Turbine Energy Production:

### Wind Speed

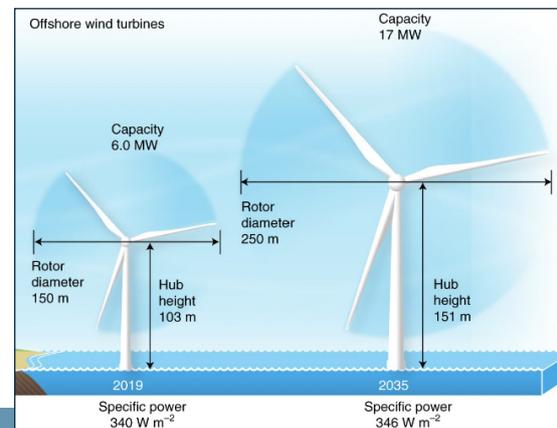
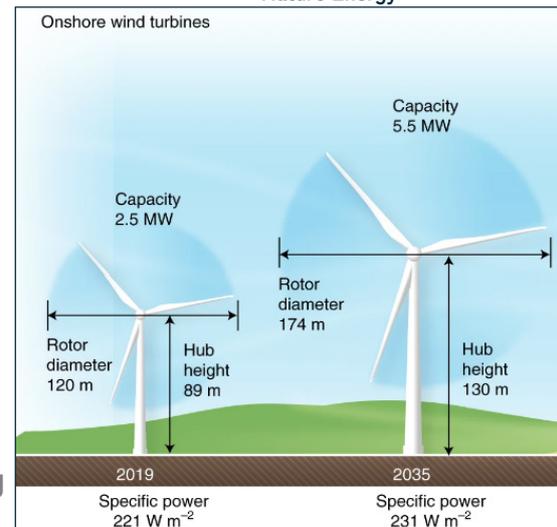
Wind speed is a pivotal factor affecting the energy output of a wind turbine. The power generated from the wind is cubed to its velocity. This means that a small increase in wind speed can result in a significant boost in energy production.

Developers and engineers carefully assess the wind resource at a specific location using a met mast and meteorological data before installing wind turbines to maximise efficiency. Depending on the governmental development landscape of a country it may be favourable to install a wind turbine onshore or offshore.

### Rotor Size and Blade Design

The size of the rotor and the design of the blades majorly impact a wind turbine's energy production. A larger rotor captures more energy however it may not be appropriate for a populated area. Additionally, advanced blade designs, such as those with aerodynamic features, enhance efficiency by optimising the conversion of wind energy into rotational motion.

Expected Turbine Size in 2035 - Nature Energy



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## Wind Turbine Height

The height of the turbine tower or hub height is a critical factor influencing energy production. Wind speeds generally increase with height above the ground, and taller towers enable turbines to access stronger, more consistent winds. As a result, taller turbines can produce more energy compared to those at lower heights.

## Quantifying Wind Turbine Energy Production:

Now that we have assessed the factors influencing wind turbine energy production, we can explore the metrics used to quantify their output.

### Capacity Factor

The capacity factor is a key indicator of a wind turbine's efficiency. Usually expressed as a percentage, it represents the ratio of the energy output over a period to the maximum possible output if the turbine operated at full capacity continuously. A high-capacity factor means an effective use of available wind resources.

### Annual Energy Production (AEP)

AEP is a measure of the total energy output of a wind turbine over the course of a year and is usually measured in MWh. It takes into account the variability of wind speeds and provides an overview of a turbine's performance under different conditions.



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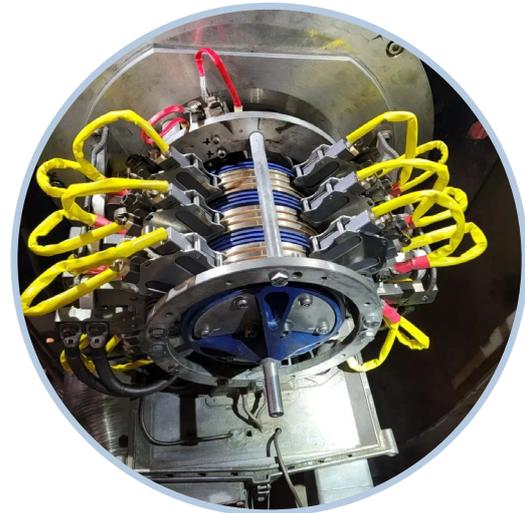
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## Slip Rings & Rotary Solutions in Wind Turbines:

In a wind turbine, slip rings are integral components that enable the transfer of electrical power and data between the stationary and rotating parts of the system. They play a crucial role in facilitating the continuous rotation of the blades, while maintaining electrical connectivity with the pitch system. Learn more about the fundamental parts of a wind turbine in our guide: 'Wind Turbine Parts: An Overview'.

BGB provide a leading slip ring repairs service; an economical, efficient way to extend the life of slip ring assemblies in wind turbines, thereby reducing waste and with a subsequent reduction of demand on resources.

At BGB, we're a leading provider of wind turbine slip rings and rotary solutions. We understand the importance of reliability and efficiency in wind operations. By offering high-quality slip ring assemblies, rotary unions and wind turbine spare parts, BGB contributes to the seamless functioning of wind turbines. These solutions are designed to withstand harsh environmental conditions, ensuring continuous and uninterrupted energy production. Get in touch with our team for more information today.



BGB Author:

**VARIOUS**

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