

How Fast Does a Wind Turbine Spin? The Surprising Answer

 linquip.com/blog/how-fast-does-a-wind-turbine-spin

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We all have seen wind turbines while driving down the roads or at least on TV. They are gigantic devices, and therefore, the question “how fast does a wind turbine spin” seems to naturally come to mind. They do not seem to be spinning that fast, but is that really so?

There is all the information you need to know about wind turbine equipment and devices available on Linquip’s website. If you have any questions concerning wind energy, Linquip’s expert team is ready to assist you. I would suggest that if you are curious about wind turbines and would like to learn more, you should first take a look at Linquip’s article, “**What Is Wind Power?**”.

You can check out Linquip’s list of **Wind Products** to learn more about a variety of devices and equipment used in wind power installations. In addition, you can also register as a **Linquip Expert** and take advantage of all the features that are available to you. Would you consider writing a **Guest Post** on Linquip? Linquip gives you the option of submitting your content as a guest.

The Linquip team is here for you, not only will we give you a simple answer to the question of “how fast does a wind turbine spin,” but also we provide you with a convenient way of finding your “wind turbine” **solution**. We should stress at this point

that we are not concerned about those small-scale wind turbines that we clearly see how fast they spin.

If you look at one of those large wind turbines from a distance, you might assume they are pretty sluggish, and the rotation speed of the blades must be relatively slow. You will be surprised to know that your perception is quite far from the truth. So, really, how fast does a wind turbine spin? To give you an answer that could give you a sense of what we are dealing with here, let us say that typical wind turbines would normally rotate at something between 15 to 20 RPM based on the wind speed and direction.

So, is that supposed to be fast? When you consider the typical blade length for wind turbines, you see that the tip of the blade would easily go as fast as 100 mph to 180 mph depending on their RPM. A safe short answer to the question of “how fast does a wind turbine spin” would be “something around 100 RPM an up”!



Image from Envato

Now, how about getting to know the terminology?

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How Fast Does a Wind Turbine Spin? – Wind Turbine RPM

One of the measure related to the wind turbine rotation speed is its RPM, which stands for Revolutions / Rotations Per Minute. As can be inferred from the term, this is a measure that tells us about the number of full rotations a wind turbine blade makes every minute. It is clear that a full rotation (revolution) is when a blade, that is located at some angle with the horizon, moves about its axis of rotation until it reaches at the same angle.

When one talks about wind turbine RPM they are probably talking about the blades, and as already mentioned, you would expect a number between fifteen to twenty for the typical ones. However, the blades are intended to rotate the power generator converting the wind energy to electrical energy. You could expect an RPM of 1800 to 2000 for a typical wind turbine’s power generator.

One thing to note here is that even by assuming operation within structural load limits, higher RPM values do not necessarily yield higher power generation rates due to improper flow field generation at the turbine blades. It is also obvious that you cannot expect power generation to happen when there wind speed is not high enough to get the blades reach to some minimum effective RPM.

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What is Wind Turbine? The Short and Essential Answer



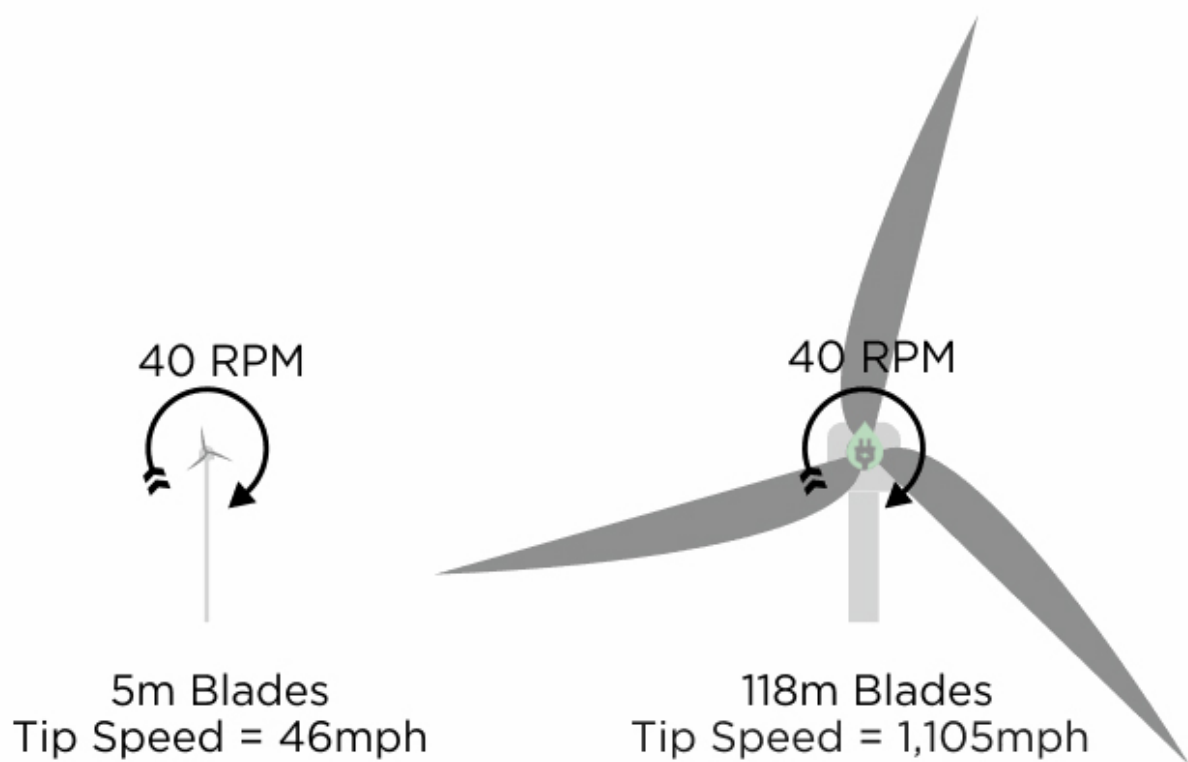
How Fast Does a Wind Turbine Spin? – Wind Turbine Tip Speed

As absurd as it sounds, imagine yourself sitting at the tip of a blade of a wind turbine. Now, imagine a friend sitting at some point on the blade that is closer to the root of the blade, say the middle. It is obvious that for each full rotation or revolution, the distance you or your friend go is equal to the circumference of a circle with a radius equal to anyone's distance to the blade root. Nonetheless, you both finish your full rotation at the same time. Now, since you are the furthest from the root (you are sitting at the tip of the blade) you must experience the highest speed.



Image from Vermont Public Radio

Now, in order to wrap up the concept of blade tip speed, you can calculate it by first calculating the amount of time spent on each revolution. To do so, you should inverse your RPM value which gives you the fraction of a minute required to complete a revolution. Then divide the blade tip rotation circumference by the time spent on each revolution. The rotation circumference can be calculated by multiplying the prime number Pi with twice the radius of the blade (blade diameter).



The concept of wind turbine tip speed (Reference: energyfollower.com)

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[Types of Wind Turbines](#): The Quick and Easy Intro

Is It Possible to Stop a Wind Turbine from Spinning?

In order to make a wind turbine slow down, you have to increase the electrical load (resistance) applied to the generator of the turbine. This method is known as electromagnetic braking and is usually the first method that is used to slow down the blades as quickly as possible.

Can Wind Turbines Be Damaged If They Spin Too Fast?

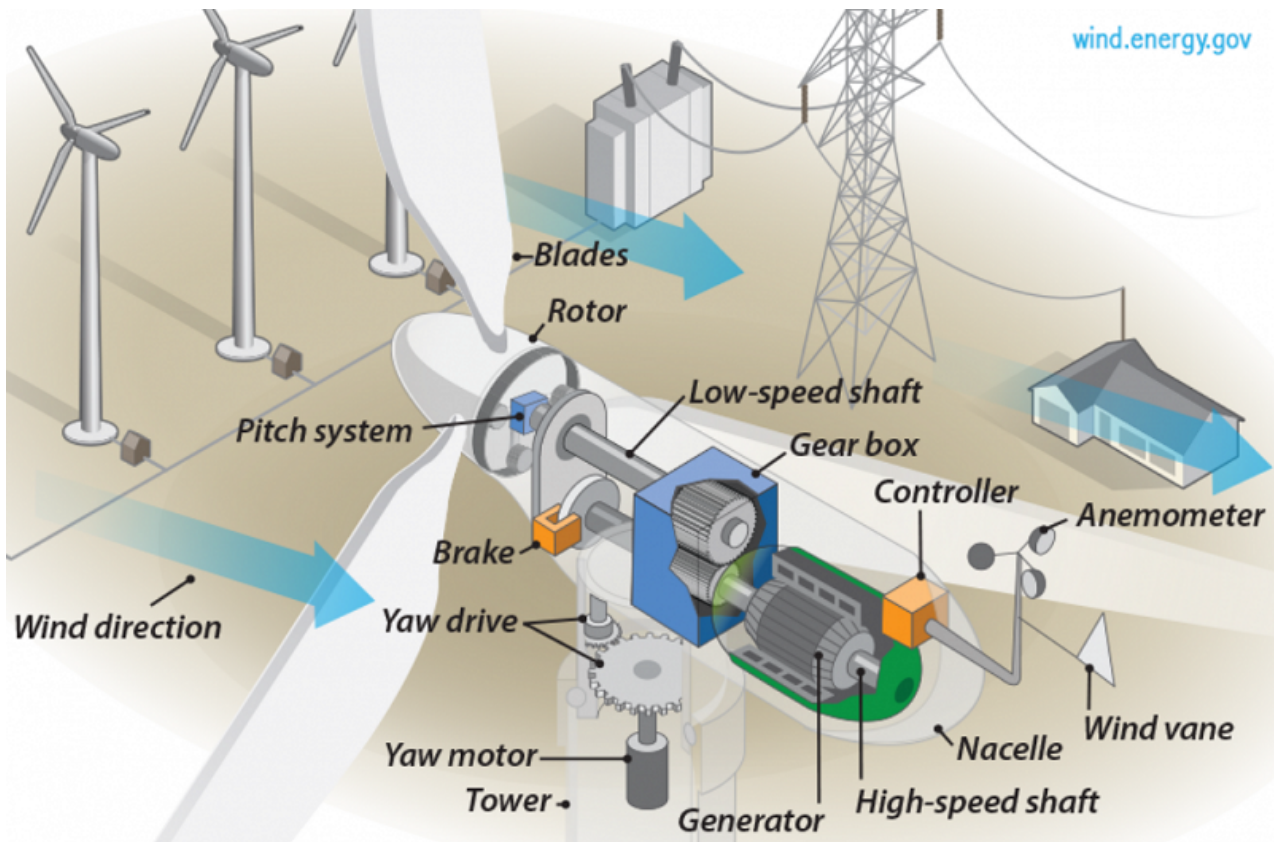
One problem with a wind turbine spinning too fast is that it can either cause mechanical damage or create a “wall” against the wind that prevents it from safely spinning to produce electricity. Almost all wind turbines have a maximum speed at which they are able to function effectively.

How Fast Does a Wind Turbine Spin? – Questions and Answers

Now that we know how to find the answer to the question of “how fast does a wind turbine spin”, let us find answers to some frequently asked questions:

What factors contribute to wind turbine RPM?

The important factors influencing the wind turbine RPM include air density, wind speed, the size and the number of blades. Air density and wind speed contribute to the available pressure exerted on the turbine blades, and the size and number of those blades contribute to the available surface on which the pressure is exerted.



The wind turbine's driving mechanism (Reference: actionrenewables.co.uk)

Do we want the wind turbine RPM as high as possible?

No! When the wind turbine RPM passes some specific threshold it would result in damage to its structure or installed devices on the wind turbine. Some brake mechanism is required to ensure not exceeding the speed limit.

What cut-in and cut-out speed of a wind turbine?

Cut-in speed is the minimum wind speed required to make the blades start rotating. Typical wind turbines require a wind speed of something between 7 to 9 mph.

Cut-out speed is the maximum wind speed that a wind turbine can handle before it shuts down to prevent damage. This value is something about 55 mph for most wind turbines.

Is there a measure related to how much blade tip speed would be considered optimum?

There is a measure called tip speed ratio (TSR), which is equal to the ratio of blade tip speed to the wind speed. The optimum value for this ratio is typically 6 or 7.