

Green Power Part 1 — Wind Turbines

Wind Turbine Basics

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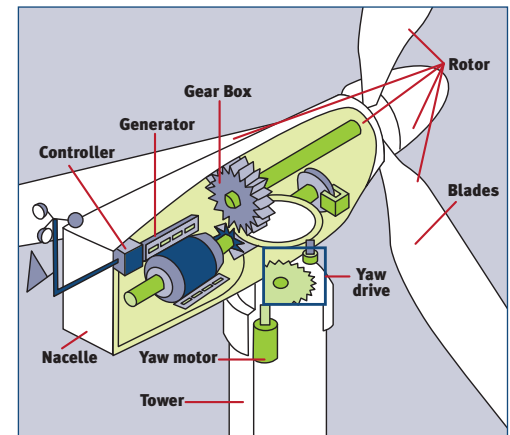
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This is the first of a series of *Insights* that focus on cause, cost, and downtime aspects of damage to alternate sources of power. Wind turbines are a rapidly growing sector of the power generation industry. We are encountering a higher frequency of damage to this type of equipment because there are many more wind turbines generating electrical power.

SOME WIND TURBINE BASICS

Spinning air foil-style blades (they look like airplane propellers) of wind turbines convert wind power to electrical energy by turning a rotor, the gearbox, and electrical generator. These units are controlled electronically, often remotely, to align the blade angle and rotor positioning with wind direction and speed to optimize the performance of the turbine.

A wind turbine can be installed as a single unit or in a group to form a small wind farm strategically located in the path of prevailing wind patterns. The base station where the units are controlled may be located on the property or at a remote location.



Apartment building wind turbine



Office building wind turbine



Individual turbine

Cause

One can expect to encounter a variety of situations that can cause wind turbine damage. Excessive wind speed and manufacturing defects are common sources of blade damage. Minor damage can become major damage if the blades are not in alignment with the wind. This can occur when power is interrupted to the turbine's controls.

Spinning blades can contain a lot of rotating energy (inertia)—damage to spinning blades can cause tower damage necessitating extensive repair or even replacement of the entire unit (tower, generator, gearbox and rotor system).

Electrical failure of the controls, generator or transformer (all mounted within the turbine's nacelle) can also lead to significant damage to the unit.

Cost

Replacement parts are often purchased new since comparable used equipment can be difficult to find due to the lack of widespread use of similarly sized units. Currently the biggest hurdle for residential and small business use of wind energy is permitting. Most areas are not zoned for wind turbines. Alternative energy groups are working with local governments across the country to change zoning laws for small wind turbines.

Downtime

Wind turbines are a rapidly growing sector driven by public interest and government sustainability initiatives. When the quantity of power generated by a wind turbine is not sizable enough to feed back to the power grid, the downtime considerations often are focused on the extra costs of makeup power.

Repair periods can take longer than you might expect:

- Component replacements can be delayed due to the need to wait for calmer weather to perform work with lift equipment
- The components are often manufactured overseas and are typically only available from the original equipment manufacturers—expect longer lead times

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Wind turbines can involve several engineering disciplines. You may need to consider:

- Structural for the towers
- Mechanical for the blading and other rotating components
- Electrical for the unit's generator, and the farm's electrical apparatus like transformers, switchgears, and electrical turbine controls
- Material analysis to review blade components

Cause
Cost
Downtime

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