

J E T WIND TURBINE POWER CALCULATION

New invented JET wind turbines are both types – horizontal axis and vertical axis.

Power output calculation of horizontal axis jet machines follows same basic formulas as for conventional wind turbines.

Power output calculation of horizontal axis non jet machines is presented below:

NON JET URBAN WIND TURBINE POWER CALCULATION

Because air has mass and it moves to form wind, it has kinetic energy. We know from physics class that:

$$\text{Kinetic energy (joules)} = 0.5 \times m \times v^2$$

Where:

m = mass(kg) (1 kg = 2.2 pounds)

v = velocity (meters/second) (meter = 3.281 feet = 39.37 inches)

Usually, we're more interested in power (which changes moment to moment) than energy. Since energy = power x time and density is a more convenient way to express the mass of flowing air, the kinetic energy equation can be converted into a flow equation:

Power in the area swept by the wind turbine rotor:

$$P = 0.5 \times \rho \times A \times v^3$$

Where :

p = power in watts (746 watts = 1 hp) (1,000 watts = 1 kilowatt)

rho = air density (about 1.225 kg/m³ at sea level, less higher up)

A = rotor swept area, exposed to the wind (m²)

v = wind speed in meters/sec (20mph = 9m/s) (mph/2.24 = m/s)

This yields the power in a free flowing stream of wind. Of course, it is impossible to extract all the power from the wind because some flow must be maintained through the rotor (otherwise a brick wall would be a 100% efficient wind power extractor). So, we need to include some additional terms to get a practical equation for a wind turbine.

Wind Turbine Power:

$$P = 0.5 \times \rho \times A \times C_p \times v^3 \times N_g \times N_b$$

Where:

p = power in watts (746watts = 1 hp) (1,000 watts = 1 kilowatt)

rho = air density (about 1.225 kg/m³ at sea level, less higher up)

A = rotor swept area, exposed to the wind (m²)

Cp = Coefficient of performance (.59 [Betz limit] is the maximum theoretically possible, .35 for a good design)

V = wind speed in meters/sec (20mph = 9m/s)

Ng = generator efficiency (50% for car alternator, 80% or possibly more for a modern permanent magnet generator or grid-connected induction generator)

Nb = gearbox/bearings efficiency (depends, could be as high as 95% if good)

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Basically, above described calculation is used for JET turbine, as well.

Two basic differences have to be made:

Cp = Coefficient of performance have to be about .45 because of better JET blade performance (0.35 for conventional design) - see the calculation below.

Ng = generator efficiency instead 80% for a modern permanent magnet generator is above 90% because of higher rpm of JET rotors based on smaller rotor diameter for the same power output (see the calculation below).

Overall efficiency increasing of **SINGLE ROTOR JET URBAN WIND TURBINE** is calculated as follow:

$$[0.45 \times 0.9] / [0.35 \times 0.8] = 1.45 \text{ times more efficient}$$

The power calculation of SINGLE ROTOR JET axial hydrokinetic turbines is based on above approach.

See more at www.tonchev.org