National Wind Watch™

Presenting the facts about industrial wind power

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How big is a wind turbine?

An industrial-scale wind turbine is a lot bigger than one you might see in a schoolyard or behind someone's house.

The widely used GE 1.5-megawatt model, for example, consists of 116-ft blades atop a 212-ft tower for a total height of 328 feet. The blades sweep a vertical airspace of just under an acre.

The 1.8-megawatt Vestas V90 from Denmark is also common. Its 148-ft blades (sweeping more than 1.5 acres) are on a 262-ft tower, totaling 410 feet.

Another model being seen more in the U.S. is the 2-megawatt Gamesa G87 from Spain, which sports 143-ft blades (just under 1.5 acres) on a 256-ft tower, totaling 399 feet.

Many existing models and new ones being introduced reach well over 400 feet high, the higher towers and extra-long blades being necessary to turn the generator in sites with lower average wind speeds.

Transport of such large items and the cranes needed to assemble them often presents problems in the remote areas where they are typically built. Roads must be widened, curves straightened, and in wild areas new roads built altogether.

The steel tower is anchored in a platform of more than a thousand tons of cement and steel rebar, 30 to 50 feet across and anywhere from 6 to 30 feet deep. Shafts are sometimes driven down farther to help anchor it, and mountain tops have to be blasted for it. The platform has to stabilize the immense weight of the turbine assembly.

The gearbox — which transforms the slow turning rate of the blades to a faster rotor speed — *and the generator* are massive pieces of machinery housed in a bus-sized container, called the nacelle, at the top of the tower. The blades are attached to the rotor hub at one end of the nacelle. Some nacelles include a helicopter landing pad.

On the GE 1.5-megawatt model, the nacelle alone weighs more than 56 tons, the blade assembly weighs more than 36 tons, and the tower itself weighs about 71 tons — a total weight of 164 tons. The corresponding weights for the Vestas V90 are 75, 40, and 152, total 267 tons; and for the Gamesa G87 72, 42, and 220, total 334 tons.

Besides the *noise and vibrations* such huge moving machines unavoidably generate, they must be topped with *flashing lights day and night* to increase their visibility.

Finally, *the huge turbines require a correspondingly large area around them* clear of trees and other turbines to maximize the effect of the wind and avoid interference. For best results, they should have at least 10 rotor diameters of clearance in the direction of the wind and 3 rotor diameters in every other direction. In a line of several turbines perpendicular to the wind (as on a mountain ridge), the GE 1.5-MW model would need at least 32 acres and the Vestas V90 78 acres for each tower. In an array that can take advantage of the wind from any direction, the GE needs 82 acres and the Vestas V90 111 acres per tower.

In practice, the area used varies, averaging about 50 acres per megawatt of capacity. On mountain ridges, the turbines are generally squeezed in about eight per mile.

Bigger does not mean more efficient. It just means bigger. Output depends on wind speed and the combination of blade diameter and generator size. Bigger blades on a taller tower can capture more wind to run a bigger generator, but they don't do so more efficiently than smaller models.