

THE MODERN ERA

As you can see from the few preceding pages dear readers, the *wind engine* has a long, venerable history. It's major impediment, namely irregularity of operation has largely been solved by combining them with photovoltaic (solar) power modules, together with efficient energy storage batteries and computerised control and management systems. The modern wind engine is ready, willing and able to deliver cost effective, pollution free power to enlightened Earthlings of the new millennium. It has evolved into the *wind driven generator*.

These modern machines operate at much higher speeds than their predecessors, owing to advanced aerodynamic blade profiles and materials. Smaller units such as the *Ampair 100* are invariably of brushless, permanent magnet design directly coupled to a six bladed propeller, without a gearbox. They produce low voltage D.C electricity for battery charging purposes. Medium size units up to several kilowatts in capacity can have either permanent magnet or field excited low rpm alternators. Propellers are either two or three bladed and the more reliable models tend to have no gearboxes linking them to the alternator. Like their smaller brethren they are mostly used for battery charging purposes, but they can be grid connected via an *Export Kilowatt-Hour* meter or directly coupled to electric water pumps.

Larger machines above 10 kilowatts output are usually designed for direct electricity grid connection. Large blades rotate more slowly, even though the blade tip speed can approach the sound barrier. Gearboxes couple their propeller shafts to three phase alternators, producing 415 or 600 volts a.c in step with the line frequency produced by the main power station. The Danish built *Vestas V27* units as used in the second wind farm at Esperance represent the current state of the art and full specifications are given on following pages. These machines and their successful application at the town of Esperance are a classic application of modern wind power technology. The future is here today for all to see!

LAW OF THE WIND

No matter what size or type of wind plant you install, all must obey *Wind Law*. This law states that the kinetic energy available for extraction is directly proportional to the *cube of the wind speed*. To put it simply, as the wind speed doubles ($\times 2$) the latent power within it increases eightfold ($2 \times 2 \times 2 = 8$). It is vital that you consider and understand the implication of this *cube law*, especially with regard to analysing the potential of the site you may be considering to install a wind plant.

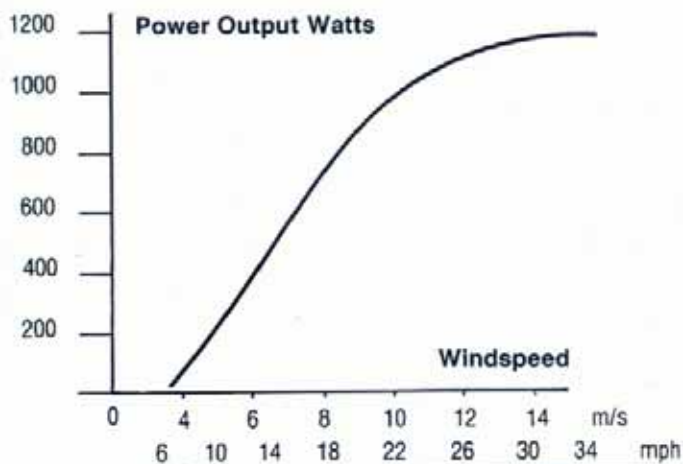


Fig 4.1 1 Kilowatt turbine

Power output curve for a SOMA 1 Kw wind turbine

Not that all wind machines follow the cube law exactly. They all have varying efficiencies and performances at different wind speeds depending on their design. Figure 4.1 is a typical example of a high performance unit, the SOMA 1000. This is one of my favourite machines as it has a beautifully made slow r.p.m alternator and a stunning one piece hollow moulded fibreglass propeller. As you can see, at 4 metres per second wind speed the Soma is producing 90 watts. At 8 metres per second (double the speed) power output has climbed to 720 watts (an eightfold increase), exactly following the cube law.

To predict the performance of a specific wind machine in a given location we need to know something about the average wind speeds of the area. The first logical step would be to approach the local bureau of meteorology and obtain monthly average figures. Also note the height above sea level and general topography where the readings were taken. Average wind