



Which Wind Turbine is More Efficient?

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Abstract

As the prices on crude oil are growing rapidly and oil supply has never been secure, people around the globe started to think about alternative sources of energy. Sources of energy that would be more stable, cheaper and cleaner to the environment. One of them is wind energy. In this poster we are looking into two different types of wind turbines: horizontal axis and vertical axis. The questions we will answer are:

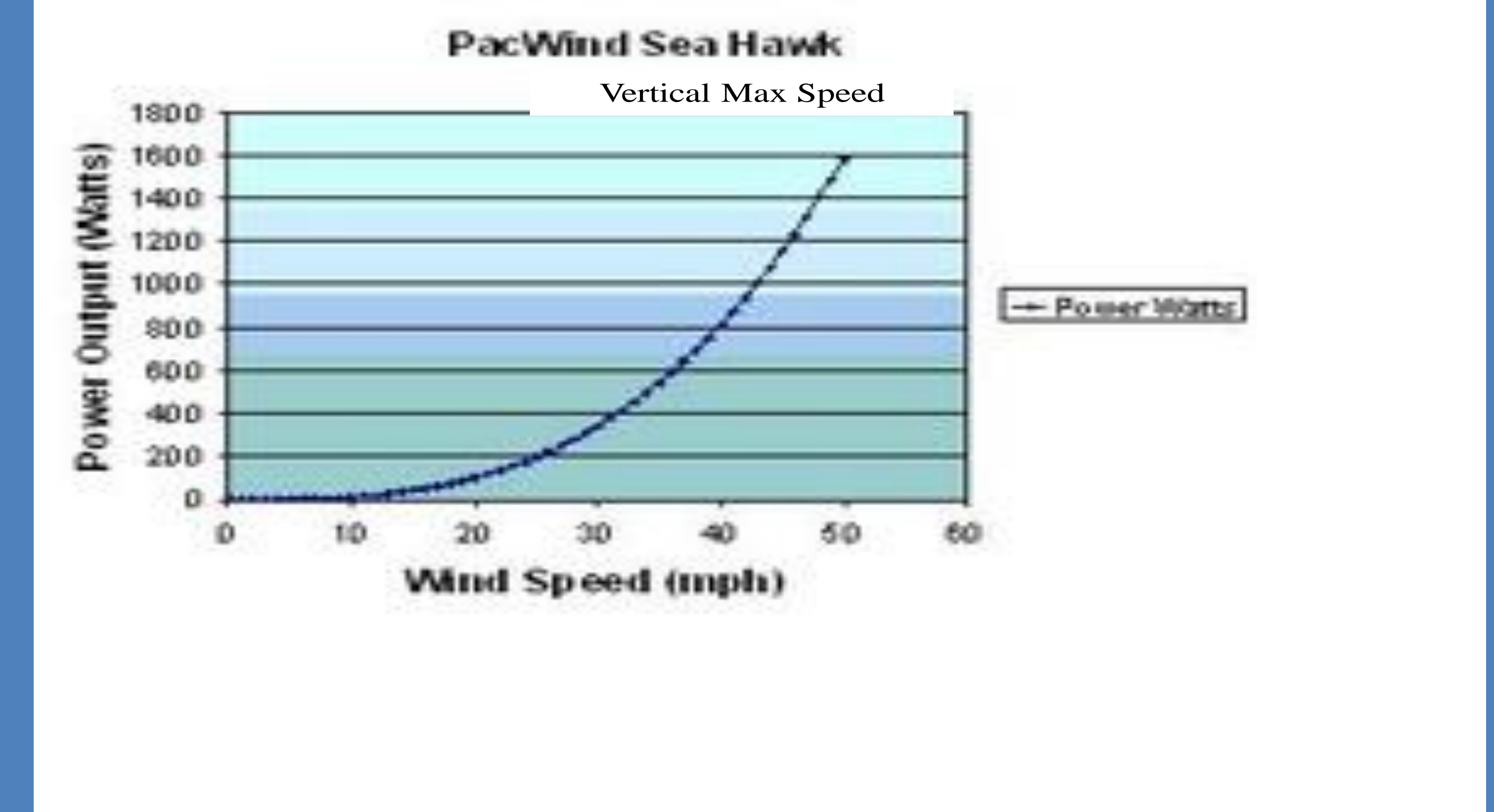
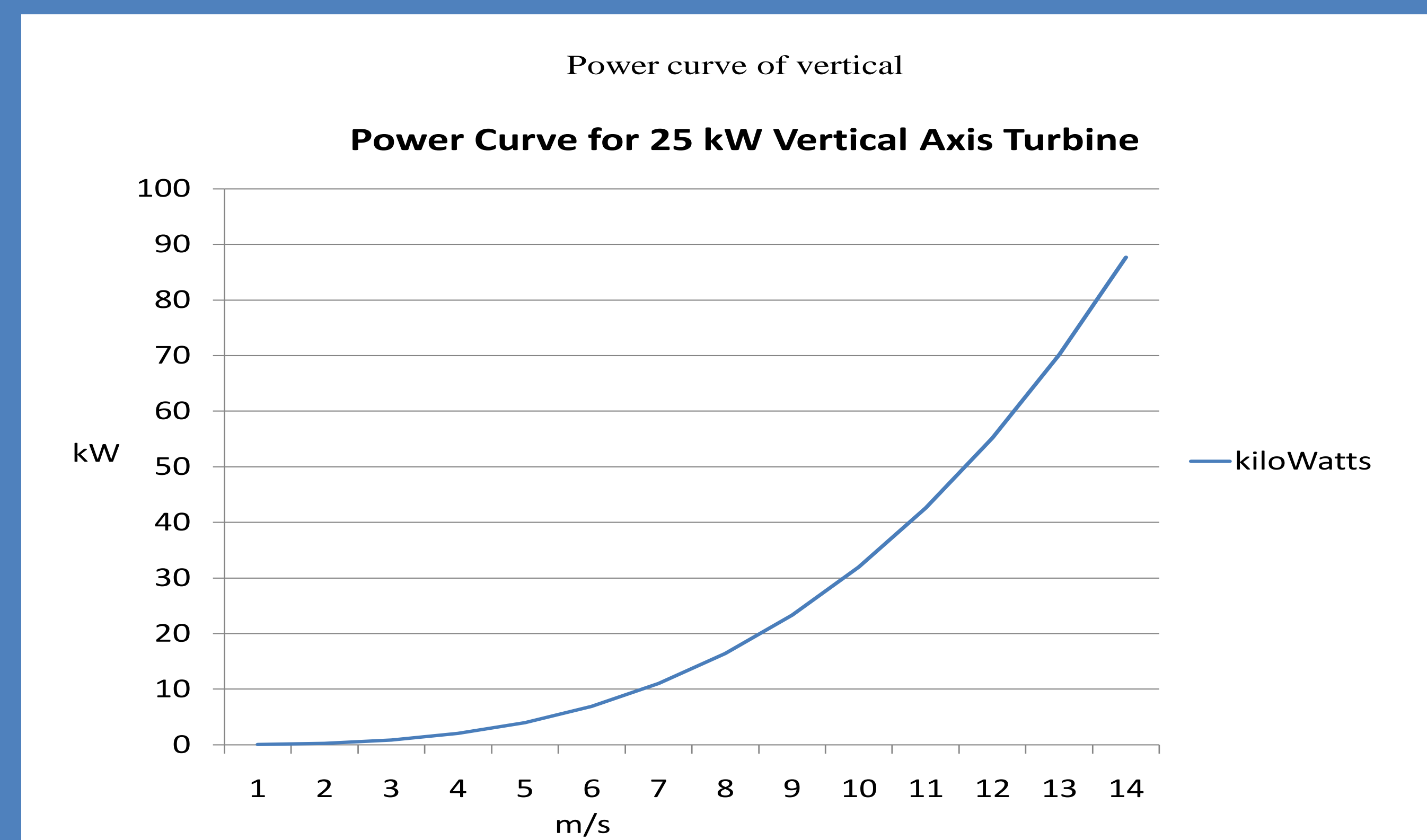
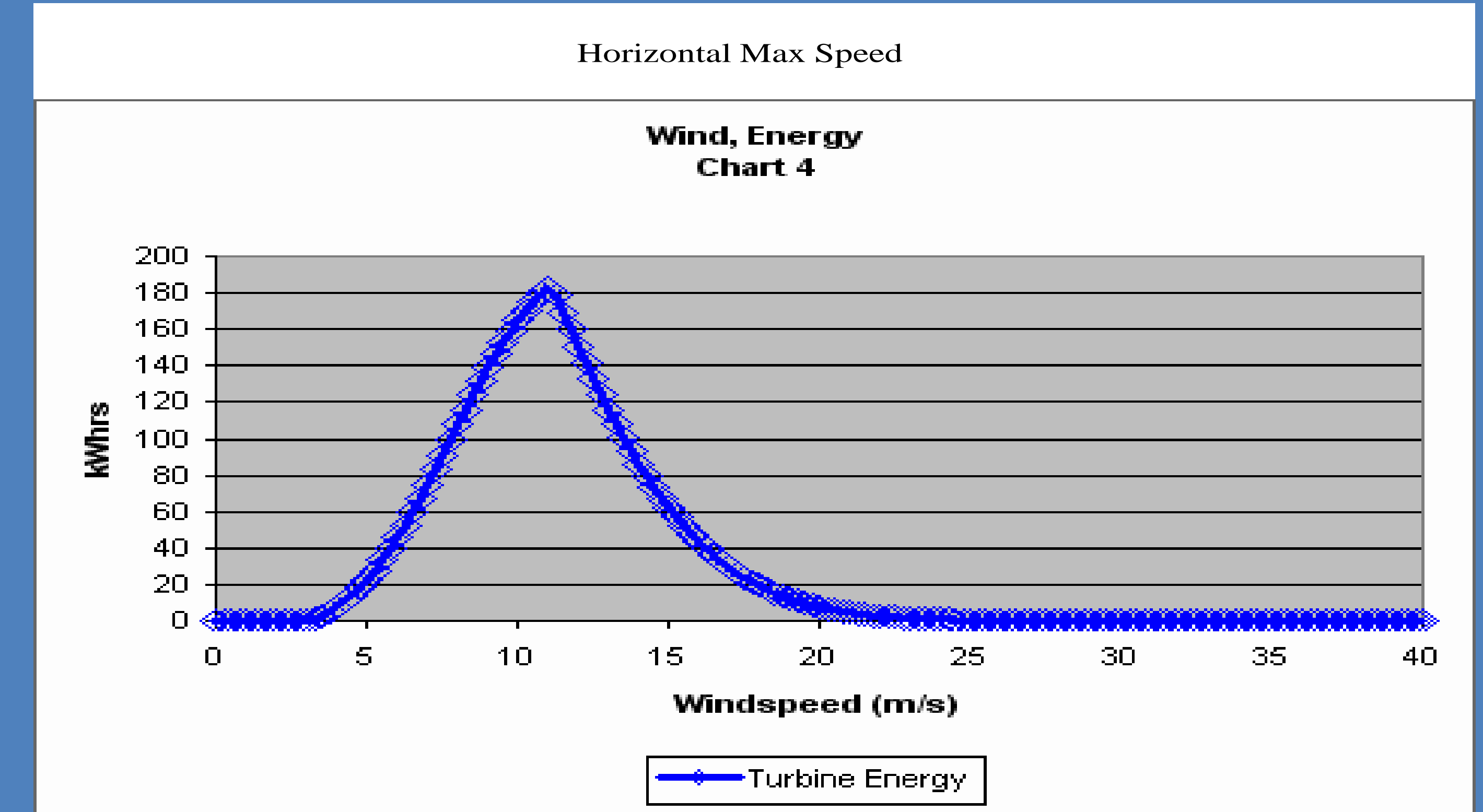
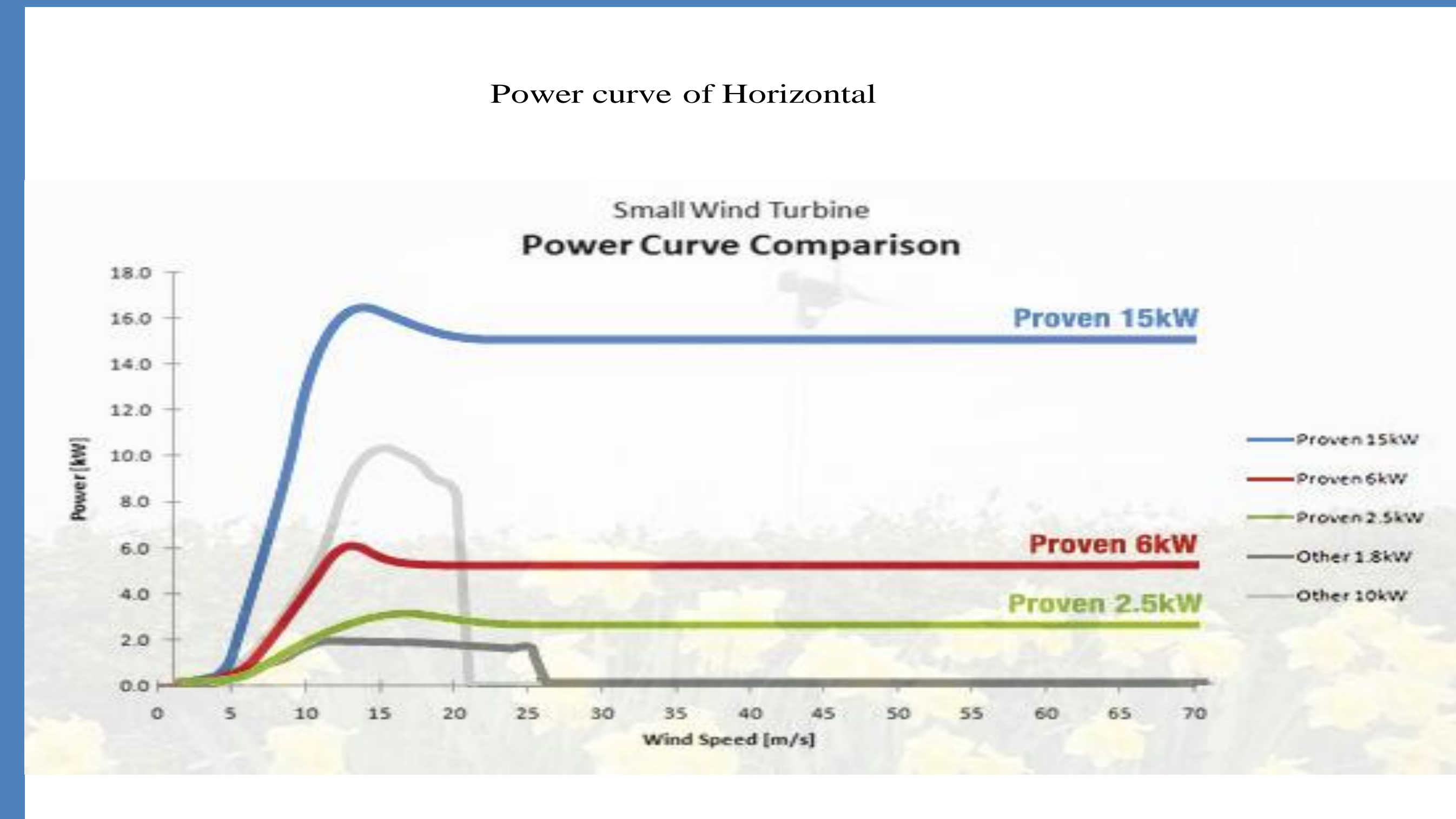
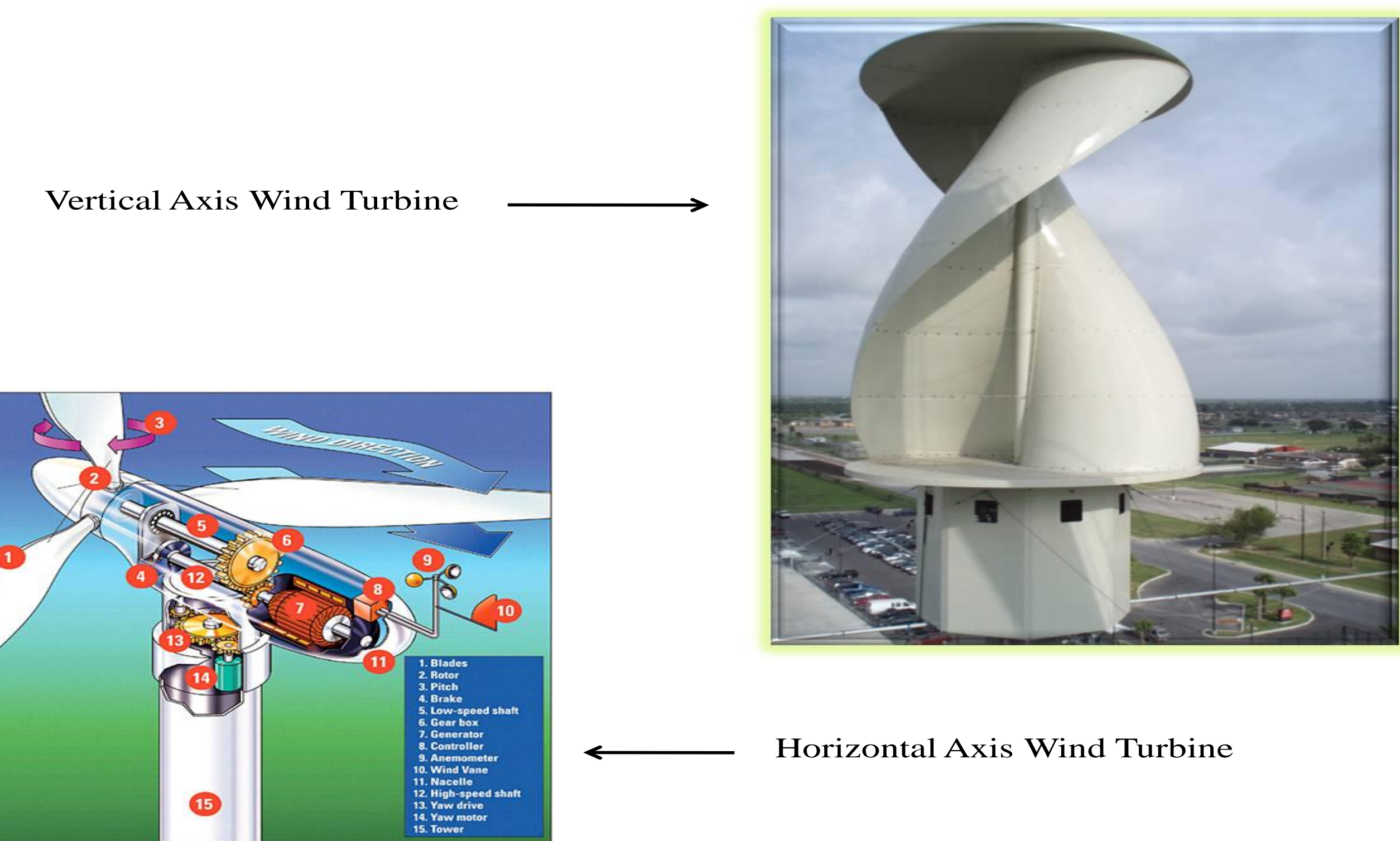
- How much power can we gain from wind, what is the maximum wind speed at a wind turbine can operate?
- What happens when we increase the height of the wind turbine?
- Which design is more efficient?

Some things to know:

•Betz law states the maximum energy of wind that can be obtained is 59.6%.

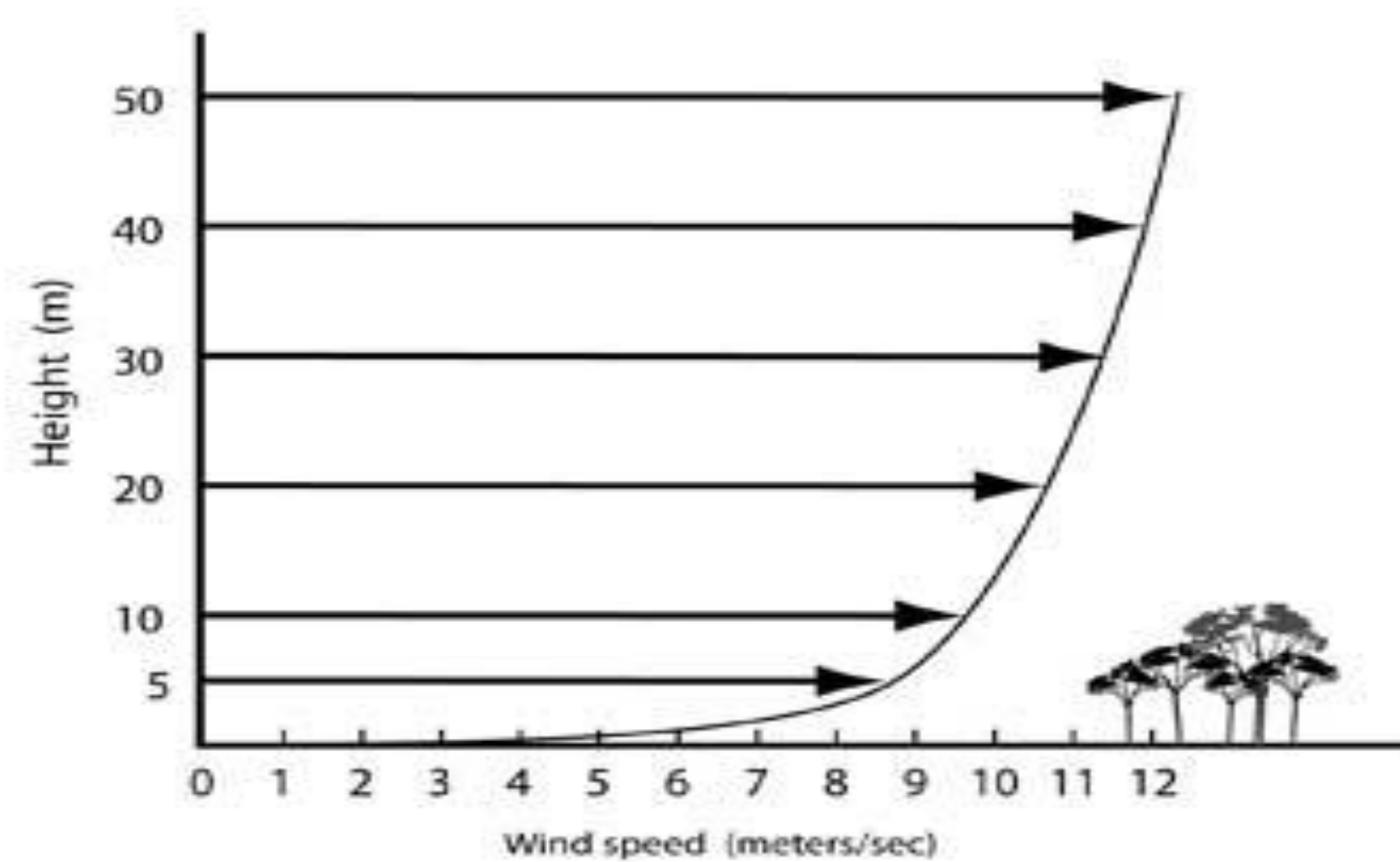
$$\text{Power} = 0.5 * \text{air density} * A * C_p * V^3 * N_g * N_b$$

- C_p = Coefficient of performance
- V = wind speed in m/s
- N_g = generator efficiency
- N_b = gearbox efficiency



Results

Wind speed increases with height



Conclusion

Compared in this experiment were two types of wind turbines: the horizontal axis wind turbines and the vertical axis wind turbines. First of all, it was found that wind speed increases as the height increases. Vertical axis wind turbines are generally closer to the ground than the horizontal axis turbines, so it may not require a tower but wind speeds are lower the closer they are to the ground. The power output for a horizontal axis turbine generally peaks at wind speeds of around 15 m/s, and then it remains at that level no matter what the wind speed increases to. The power output for vertical axis wind turbines continues to increase as the wind speed increases, but again, wind speeds are slower closer to the ground. Overall, the propeller design associated with the horizontal axis wind turbines proved to be more efficient than the vertical axis wind turbines.