

TUTORIAL SHEET 2

Exercise No. 1:

Calculate the energy at 15°C , 1 atm pressure, contained in 1 m^2 of the following wind regimes:

- 100 hours of 6 m/s winds,
- 50 hours at 3 m/s plus 50 hours at 9 m/s (i.e., an average windspeed of 6 m/s)

Exercise No. 2:

Calculate the average wind speed during a 10-h period; there were 3 h of no wind, 3 h at 5 m/s, and 4 h at 10 m/s using fraction and probability.

Exercise No. 3:

Find the power density in 10 m/s wind at an elevation of 2000 m and a temperature of 15°C and 5°C .

Exercise No. 4:

An anemometer mounted at a height of 10 m above a surface with crops, hedges, and shrubs shows a windspeed of 5 m/s. Estimate the windspeed and the specific power in the wind at a height of 50 m. Assume 15°C and 1 atm of pressure and $\alpha = 0.2$.

Exercise No. 5:

Estimate the average power in the wind at a height of 50 m when the windspeed at 10 m averages 6 m/s. Assume Rayleigh statistics, a standard friction coefficient $\alpha = 1/7$, and standard air density.

Exercise No. 6:

A wind turbine generator with a 48-m rotor is mounted on a 50-m tower in an area with 5-m/s average winds at 10-m height. Assuming standard air density, Rayleigh statistics, $\alpha = 0.3$, and an overall efficiency of 70%, estimate the annual energy (kWh/yr) delivered.