

# Power, Energy, Dynamics - Renewable energy power from wind turbines

## Lesson questions

### Q1: Kinetic energy of a mass of air

How can we determine the kinetic energy of a mass of air of density  $\rho$  that's moving at a speed  $v$  through a turbine of radius  $r$ ? (*Students to determine the general formula for calculating the kinetic energy of a mass of moving air*)

### Q2: Blade kinetic energy

Consider a wind turbine with a span of 100m is situated at a site, subjected to a constant  $8 \text{ m.s}^{-1}$  wind. If air density is  $1.25 \text{ kg.m}^{-3}$ , how much kinetic energy passes through the plane of the blades every second?

### Q3: Electricity in households

We want to sell this energy to households, and need a unit of measure that makes sense to consumers. This unit used is called a kilowatt-hour (kWh) and is defined as the energy delivered to a 1000 W appliance over 1 hour.

In pairs, determine how much 1 kWh is in joules.

### Q4: Independent practice

Consider a wind turbine with a span of 50m is situated at a site, subjected to a constant  $12 \text{ m.s}^{-1}$  wind. If air density is  $1.23 \text{ kg.m}^{-3}$ , how much kinetic energy passes through the plane of the blades every second? Round your answer to 3 s. f.