



# FACT SHEET

## Wind energy

### What is wind energy?

Wind energy is in fact a form of solar energy – but then, when you think about it, so is almost every form of energy! (The exception is geothermal energy – see below.)

Heating the Earth's surface creates rising air in some places, to be replaced by air from elsewhere, causing both local winds like sea breezes and trade winds that cross oceans. Wind energy represents an estimated 0.25% of the Sun's energy reaching the lower atmosphere.

### How is it used?

Traditional images of Australian rural life show small windmills pumping water out of the ground in a dry landscape. Nowadays, however, most wind energy is harvested by rotating wind turbines that can be as large as football fields turned sideways. Mounted high up behind the turbines are generators that convert the mechanical energy into electricity, contributing to the grid supply.

Wind turbines are usually clustered into wind farms at locations where the wind is reliable and strong enough. They are also installed by some energy users who would like to make their own clean-energy contribution. In general, though, good

winds are found far from cities and towns. This contrasts with solar energy, because the quality of sunshine can be very good in urban regions, so it is much more common to see rooftop PV arrays than rooftop wind turbines.

Choosing sites for wind farms requires at least one year of wind-speed data to be collected, and preferably more: “interannual variations” in wind should be understood because there can be significant differences between years. Wind turbines can be designed for higher or lower wind speeds, and often the main issue is the wind’s reliability.

## **Challenge**

The cost of wind turbines is an issue, like the cost of solar PV cells, although in a good location wind energy is more closely competitive with electricity generated by fossil fuels. Due to the remoteness of many good locations, connecting wind farms to the electricity grid is a significant expense, and this is preventing the construction of a lot of wind farms that would otherwise be economic.

There are community concerns about the visual impact of wind farms on the Australian countryside and coastline, about potential health problems due to the noise of wind turbines, and about birds being killed by fast-moving turbine blades. These are being addressed by planning controls and, in some cases, by operating procedures.

Due to its excellent wind resources, South Australia has one of the world's highest proportions of wind energy, generating almost 20% of its electricity from the wind each year. This means some problems of relying on intermittent energy sources are being seen in this state before others. Rapid changes in wind farm output place stresses on the electricity system, cause energy to be wasted when the surplus is more than can be sent interstate, and require fossil-fuel generators to run on standby to prevent electricity shortfalls when the wind drops too suddenly.

Source: CSIRO CarbonKids Curriculum Unit, Sustainable Energy for All, pages 25-32

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*These educational resources are designed to introduce teachers and students to Australia's use of 'clean energy' as one of the carbon dioxide mitigation options available for achieving significant reductions in atmospheric carbon dioxide emissions. Whilst not an exhaustive educational resource, it is intended to raise the awareness of school-aged students about our changing climate, clean energy practices and applications and the other alternative energy technologies that reduce greenhouse gas emissions.*

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