Energy cheat sheet

What is energy?

Energy is the ability to make changes or the capacity to do work. Energy appears in many different forms including kinetic (movement), potential (stored energy), gravitational, light, heat, chemical, elastic and electrical. The Sun is the source of all energy on Earth. The energy from the sun comes in the form of light and heat. Plants are able to convert the light energy from the sun into a form of energy they can use to grow, move, repair their cells and reproduce.

Units

The basic unit of energy is the joule. To give you an idea of this unit, one joule is enough energy to lift a 1 kg weight to a height of 10 cm.

Unit	Number of joules	Symbol	Example of use
Joule	1	J	Sitting quietly, a person uses 100 J of heat every second
Kilojoule	10^3	kJ	On average a person uses 1 kJ every 10 seconds
Megajoule	10^6	MJ	On average a person uses about 8 MJ/day
Gigajoule	10^9	GJ	Daily energy use per capita in Australia is approximately 0.675 GJ
Terajoule	10^{12}	TJ	Yearly energy use per capita in Australia is approximately 0.32 TJ
Petajoule	10^{15}	PJ	In Victoria, annual energy use is about 1500 PJ
Exajoule	10^{18}	EJ	The annual energy use for the whole of Australia is about 63 EJ (for the world it is about 490 EJ per year)

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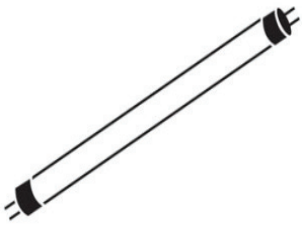
Power is a term related to energy. It is the amount of energy available or used over a given time (e.g. joules per second). Power is the rate at which energy is being used or that work is being done. The unit for power is the watt (W) and power can be calculated from the following:

$$\text{power} = \frac{\text{energy}}{\text{time}}$$

(One watt is one joule per second.)

The energy rating of electrical appliances is usually given in watts. For example, an electric radiator rated as 1000 watts is converting electrical energy into heat energy at the rate of 1000 joules per second.

The energy rating for the following electrical appliances is as follows:

Standard globe	Energy efficient globe	Fluoro tube	Computer
			
40 W + (check bulb)	40 W+ (check bulb)	13/20/40 W (check bulb)	190 W (PC and monitor)

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Energy efficiency

Energy can change from one form to another: this process is called energy transformation. No energy transformation is 100% efficient and often heat energy is produced as the by-product. For example, a light globe transforms electrical energy into light energy (useful) and heat energy (by-product).

Another example is a car: in a car, 80% of the energy of the petrol is lost as heat through the exhaust pipe and friction with the engine. The remaining 20% is converted into useful energy for turning the driveshaft, so the energy efficiency of this process is 20%.

Sources of energy

Humans focus a lot on electrical energy because we require it so frequently in our everyday lives. In Australia, we make most of our electrical energy from coal. There are many problems associated with the generation of electricity in a coal power plant.

One problem is that when coal is combusted it produces a large amount of the greenhouse gas carbon dioxide.

Another problem is that coal power plants are not very energy efficient and on average only 30 - 40% of the chemical energy in coal is converted to useful energy - the rest is lost as heat in the conversion process. Coal is also a fossil fuel, meaning that it is formed from 'dead things' over millions and millions of years. It is non-renewable, meaning that we will eventually run out!

Renewable energy is derived from sources that can be replenished within the time of human civilisation. Some of these sources include: solar, wind, hydro-electric, geothermal and biogas. A combination of these sources needs to be part of our energy plan to ensure a sustainable future.

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Energy and climate change

The greenhouse effect can be a good thing; greenhouse gases (GHG) in our atmosphere trap heat, warm our atmosphere and keep our Earth at a comfortable (and inhabitable) 15 degrees. However, as more GHG are released the temperature in our atmosphere begins to rise, causing global warming and climate change.

Increased industrial activity and energy consumption over the past two centuries have led to significantly higher levels of GHG being released into the atmosphere. This has seen a rise in temperatures of between 4 and 6 degrees between the last ice age and the start of the 20th century.

It is hard to predict how this rise in temperature will affect our planet as natural processes and systems – such as the climate – are extremely complex. What we do know is that by cutting the amount of greenhouse gases we release into the atmosphere we can slow the rate of climate change and global warming.

In Australia most of our GHG emissions come from burning fossil fuels for generating electricity for our homes, schools and industry. Transport, deforestation, and agriculture are also large contributors. Saving energy and switching to renewable energy are two of the best ways to reduce our emissions.

Greenhouse gases and black balloons

Black balloons are a useful way of understanding the volume of greenhouse gases.

One black balloon has a volume of 50 grams CO_2e.

The calculation for the number of black balloons that greenhouse gases can fill is:

Total kg CO_2e x 20 = number of black balloons