



What is fusion?

**Fusion is the process which powers the sun and the stars.
It is the energy that makes all life on earth possible.**

How is fusion achieved?

To make fusion happen, a hot gas (plasma) containing light atoms, such as hydrogen, has to be heated at the same extremely high pressures and temperatures which exist at the centre of the sun (about 150 million °C). Plasma can be described as an “electrically-charged gas” in which the negatively charged electrons in atoms are completely separated from the positively charged atomic nuclei (or ions). To reach the necessary high temperatures and to minimise thermal losses, the hot fuel particles are kept away from the walls of the container by creating a magnetic “cage” made by strong magnetic fields which prevent the particles from escaping. The most developed configuration at present is the tokamak, a Russian word for a torus-shaped magnetic chamber.

The fusion reaction that is easiest to accomplish is the reaction between two hydrogen isotopes: deuterium, extracted from water and tritium, produced during the fusion reaction through contact with lithium. When deuterium and tritium nuclei fuse, they form a helium nucleus, a neutron and a large amount of energy. Only 150 kg of deuterium and 2-3 t of lithium are needed for a full year of electricity supply for 1 million people.

Why fusion energy?

Fusion energy has the potential to provide a sustainable solution to European and global energy needs. Its key advantages are:

- Very low global impact on the environment – no CO₂ greenhouse gas emissions
- It could provide a large-scale energy source with basic fuels which are abundant and available everywhere
- Power stations would be inherently safe with no possibility of “meltdown” or “runaway reactions”: when the fuel supply is interrupted, the reactions only continue for a few seconds so any malfunction of the device would cause the reactor to cool and the reactions would stop
- There is no long-lasting radioactive waste to create a burden on future generations