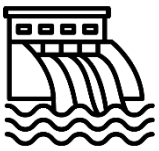
P1.6.3 Energy Resources

How energy can be obtained:

- **Fossil fuels** (coal, oil, gas) – Non-renewable, release CO_2 (linked to global warming / climate change).
  Burned in a boiler → makes steam → turns a turbine → turbine drives a generator → electricity.

- **Biofuels** (wood, plant oils, animal waste) - Renewable *if* crops are replanted. Will also release CO_2
  Burned like fossil fuels to heat water in a boiler → steam → turbine → generator.

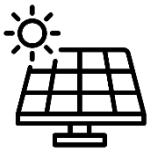
- **Water resources -** Renewable, no fuel needed. No pollution.
  Hydroelectric dam: falling water turns turbines → generator.
  Tides: moving tides turn turbines.
  Waves: moving waves drive turbines.



- **Geothermal** - Renewable, but only possible in some places (e.g. volcanic areas).
  Heat from underground hot rocks produces steam → turbine → generator.

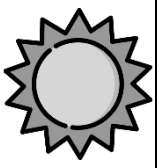
- **Nuclear fission**
  Splitting uranium nuclei in a reactor releases heat → heats water in a boiler → steam → turbine → generator.
  Very powerful, no CO_2 pollution, but produces radioactive waste.

- **Solar energy** - Renewable, no pollution, but depends on the weather.
  Solar cells (photovoltaic): sunlight directly makes electricity.
  Solar thermal collectors: infrared radiation heats water in pipes.



- **Wind** - Renewable, no pollution, but depends on wind speed.
  Wind blows large blades → turns turbine → generator makes electricity.

Main sources of energy on Earth



The Sun is the main source for most resources (fossil fuels, biofuels, wind, waves, hydroelectric, solar) but NOT for Geothermal (heat from Earth), Nuclear (fission), or Tidal (tides depend on Moon's gravity).

Nuclear processes

- **Fusion in the Sun**: energy released when hydrogen nuclei *join* together to form helium.
- **Fission in reactors**: energy released when uranium nuclei *split*.

Efficiency

- Efficiency shows how much **input** energy is turned into useful **output**.
- Formula to remember:
  - Efficiency = (useful energy output ÷ total energy input) × 100%
  - Efficiency = (useful power output ÷ total power input) × 100%
- Efficiency is always **less than 100%** because some energy is wasted (usually as heat or sound).