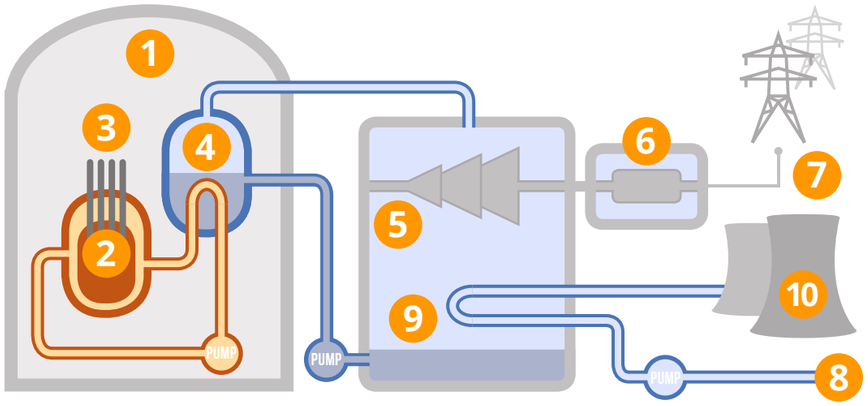
HOW DO NUCLEAR REACTORS GENERATE ELECTRICITY?

Nuclear reactors are one way of generating electricity – but how do they work, and what reactions are involved? This graphic takes a look.

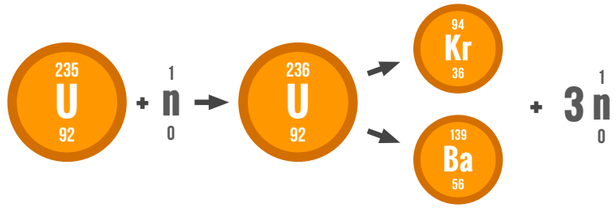
THE ANATOMY OF A NUCLEAR REACTOR

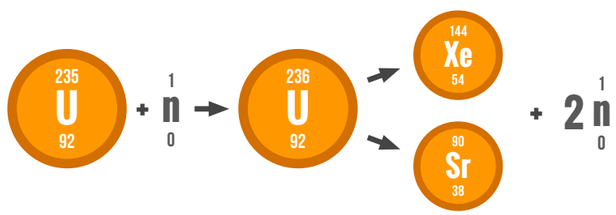


1. Containment structure
2. Nuclear reactor
3. Control rods
4. Steam generator
5. Turbine
6. Generator
7. Transformer
8. Cool water source
9. Condensor
10. Cooling towers

In a nuclear reactor, fission reactions generate heat, which heats water and turns it into steam. This steam is then used to drive a turbine which spins a generator, producing electricity. The steam used to turn the turbine condenses back into water and can be recycled back through the set up to continually drive the turbine.

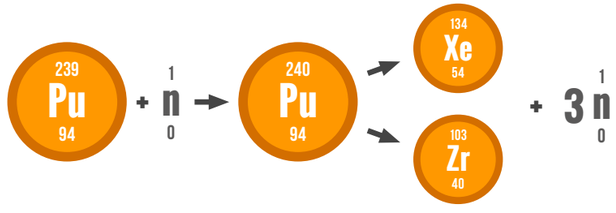
NUCLEAR FISSION





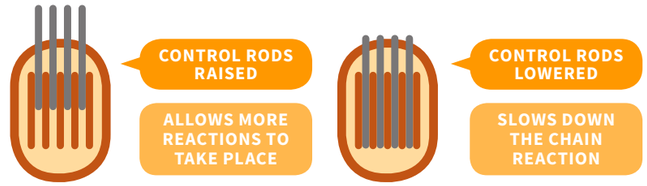
Example uranium fission reactions

Uranium oxide pellets are packed into fuel rods to be used as fuel in the reactor. During nuclear fission neutrons collide with uranium-235 atoms to produce uranium-236, which then splits into smaller elements, releasing energy. It also releases more neutrons, leading to a chain reaction, and fission of more uranium atoms.



Plutonium-239 is generated by neutron collision with uranium-238, and is also fissionable, creating around one third of a nuclear reactor's energy.

CONTROLLING THE REACTION



Control rods, commonly made of boron or cadmium, can be lowered into the reactor. They slow the reaction by absorbing neutrons, meaning there are less available to trigger fission.

Moderators help slow neutrons down in the reactor so that they can be absorbed by uranium atoms. Many nuclear reactors use the water in the reactor as a moderator, though some use graphite.

NUCLEAR WASTE

Fission products stay radioactive for many years, and must be safely stored. Weapons-grade plutonium can be produced in reactors which only expose uranium to neutron sources for short periods of time.