Chemistry-Energy

Nuclear power

- Nuclear power is generated using Uranium, which is a metal mined in various parts of the world.

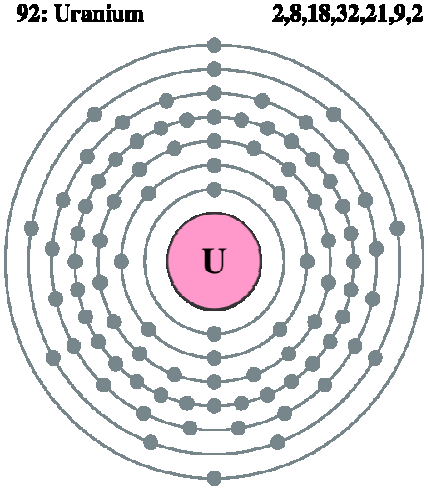
- Nuclear power produces around 11% of the world's energy needs, and produces huge amounts of energy from small amounts of fuel, without the pollution that you'd get from burning fossil fuels.

Element: Uranium(U)

- It was discovered in 1789 by Martin Klaproth, a German chemist, in the mineral called pitchblende.

- Its melting point is 1132°C.

- Uranium is a radioactive element - it is this property which makes it useful to the nuclear industry. Uranium atoms are **unstable** and occasionally disintegrate into smaller pieces with a burst of energy, which can be extremely dangerous to people and the environment. Some forms of radiation can travel right through your body and even through protective materials.



Yellowcake
(Source: http://www.ob.doe.gov/web/energy_tungsten/energy/images/yellowcake1.jpg)

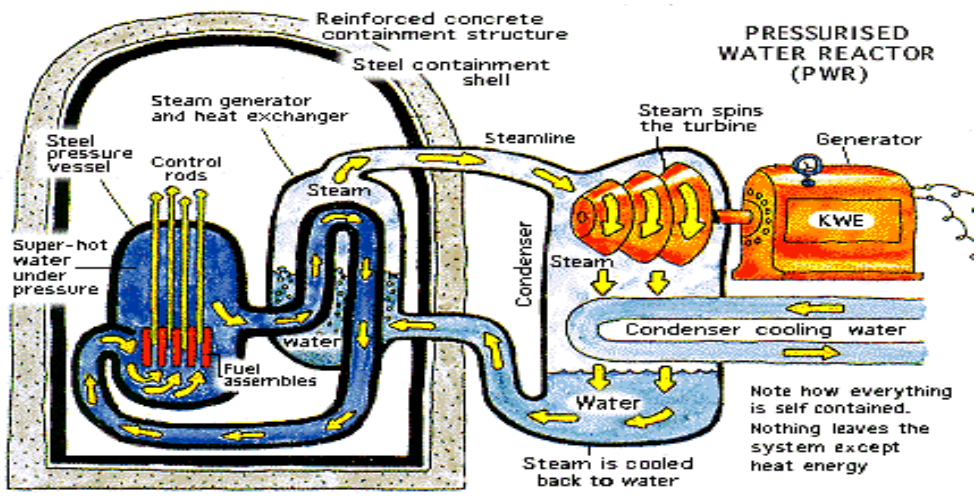
Energy from the uranium atom

- The nucleus of the U-235 atom comprises 92 protons and 143 neutrons (92 + 143 = 235). When the nucleus of a U-235 atom captures a moving neutron it splits in two (fissions) and releases some energy in the form of heat, also two or three additional neutrons are thrown off. If enough of these expelled neutrons cause the nuclei of other U-235 atoms to split, releasing further neutrons, a fission 'chain reaction' can be achieved. When this happens over and over again, many millions of times, a very large amount of heat is produced from a relatively small amount of uranium.
- It is this process, in effect "burning" uranium, which occurs in a nuclear reactor. The heat is used to make steam to produce electricity.

Inside the reactor

- In a nuclear reactor, the heat created by splitting the U-235 atoms is then used to make steam which spins a turbine to drive a generator, producing electricity.
- It requires heat to produce steam to drive turbines and generators. In a nuclear power station, however, the fissioning of uranium atoms replaces the burning of coal or gas.
- The chain reaction that takes place in the core of a nuclear reactor is controlled by rods which absorb neutrons and which can be inserted or withdrawn to set the reactor at the required power level.
- The fuel elements are surrounded by a substance called a moderator to slow the speed of the emitted neutrons and thus enable the chain reaction to continue. Water, graphite and heavy water are used as moderators in different types of reactors.
- Because of the kind of fuel used (ie the concentration of U-235, see below), if there is a major uncorrected malfunction in a reactor the fuel may overheat and melt, but it

cannot explode like a bomb.



Fossil fuels

Coal, **oil** and **gas** are called "fossil fuels" because they have been formed from the organic remains of prehistoric plants and animals.

How it works:

Coal is crushed to a fine dust and burnt.

Oil and gas can be burnt directly.

Coal provides around 28% of our energy, and oil provides 40%.

Burning coal produces sulphur dioxide, an acidic gas that contributes to the formation of acid rain. This can be largely avoided using "flue gas desulphurization" to clean up the gases before they are released into the atmosphere. This method uses limestone, and produces gypsum for the building industry as a by-product. However, it uses a lot of limestone.

Crude oil (called "petroleum") is easier to get out of the ground than coal, as it can flow along pipes. This also makes it cheaper to transport.

Natural gas provides around 20% of the world's consumption of energy, and as well as being burnt in power stations, is used by many people to heat their homes.
It is easy to transport along pipes, and gas power stations produce comparatively little pollution.

Other fossil fuels are being investigated, such as bituminous sands and oil shale. The difficulty is that they need expensive processing before we can use them; however Canada has large reserves of 'tar sands' ,which makes it economic for them to produce a great deal of energy this way.