NUCLEAR ENERGY

Nuclear energy is the energy that binds the protons and neutrons together in the nucleus (core) of an atom.

There are two ways to release energy from an atom:
• nuclear fusion
• nuclear fission

Nuclear fusion: two small nuclei may join together to make a bigger one.
This is how the sun produces energy we know as solar radiation (ultraviolet light, daylight and infra-red radiation).
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Nuclear fission: a big nucleus splits into two smaller ones, releasing energy in the process. This process is called nuclear fission.
Nuclear power plants use nuclear fission to produce electricity. The energy released is converted into heat, which can be used to drive a turbine and generate electricity

How is electricity generated from nuclear energy?

Nuclear power reactors or nuclear power plants create electricity by combining chemical reactions and heat. The essential parts of a nuclear power station are the reactor, which contains fuel rods, coolant, control rods and shielding; a heat exchanger; a turbine; and a generator. All nuclear power stations currently operating in the world use the process of nuclear fission, and most use uranium as their main fuel. Uranium is non-renewable, though it is a common metal found in rocks around the world.
Natural uranium is made up of two kinds of atoms, U-235 and U-238, but only U-235 is used in nuclear power plants, because its atoms are easily split apart. When the nucleus of a U-235 atom is hit by a neutron, it splits into two smaller nuclei, and in the process releases a large amount of energy and more neutrons. . The energy is absorbed as heat by the coolant, and then produces steam that drives a turbine and electrical generator. As more neutrons are released they bombard

other uranium atoms, and the process of nuclear fission repeats itself over and over again. This is called a chain reaction.

Nuclear plants use the heat given off during fission. Fission takes place inside the reactor of a nuclear power plant. Fission generates heat in a reactor in the same way that burning coal generates heat in a steam boiler. This heat boils water to make steam. The steam turns huge turbine blades, driving generators that make electricity.

THE ADVANTAGES OF NUCLEAR ENERGY

A nuclear power station uses a steam turbine and generator to produce electricity in exactly the same way as any other thermal power station. However, the heat needed to create the high-pressure steam is produced much more efficiently and without the emission of carbon dioxide or other pollutants that are formed when fossil fuels are burnt. In this respect, nuclear energy is cleaner and more environmentally friendly than coal-, oil- or gas-fired power stations.

Nuclear energy is a high energy density resource. The amount of energy that is obtained through nuclear fission is many times greater than the amount of energy that is released through the combustion of fossil fuels. Nuclear fission is 10 million times greater than fossil fuels in this area. This means the amount of fuel that is required to produce the energy we need through nuclear energy is much smaller than what we would need when using fossil fuels.

THE DISADVANTAGES OF NUCLEAR ENERGY

The process of nuclear fission creates radioactive waste. Radioactive waste is extremely toxic and harmful to humans and the environment. Currently, the only safe way to store such waste is to bury it very deep underground in places that are unlikely to ever be populated.

Accidents at nuclear power stations are very rare, but when they do occur, they can be extremely harmful. Events involving radiation from nuclear energy can have long-lasting effects. The best known and most deadly accident occurred at the Chernobyl power plant in the USSR (now Ukraine) in 1986, when a reactor exploded and sent a huge cloud of radioactive material into the atmosphere. The immediate area remains unpopulated to this day, and much of northern Europe was affected by this event.
Steam coming out of the turbine is also still hot, and so adds heat to the environment.

The fuel for nuclear energy is still a finite resource i.e. non-renewable. Eventually the uranium will disappear. The thorium that may be used as its replacement will also eventually disappear. It may take several generations for this to occur, especially if the fuel is properly managed, but it will occur one day because these fuels are a finite resource. This means nuclear energy is really a temporary solution to our modern power needs.