Nuclear energy is the energy stored inside an atom by the forces that hold together the nucleus of the atom. Scientists have learned how to capture large amounts of energy from these forces that can then be used to generate electricity.

**E = mc2**

When working on his theory of relativity, Albert Einstein discovered the mathematical formula E = mc2. This formula demonstrated that matter could be converted into energy. Although this sounds like a simple concept, it demonstrated that a large amount of energy could be generated from a very small amount of matter. This could be done by splitting an atom in a process called nuclear fission.

**Nuclear Fission**

Nuclear fission is the process of splitting of a large atom into two or more smaller atoms. When an atom is split a huge amount of energy is released. When the energy is released in a slow controlled manner, it can be used to generate electricity to power our homes. When the energy is released all at once, a chain reaction occurs causing a nuclear explosion.

**Nuclear Power Plants**

One of the major applications for nuclear fission is nuclear power. Nuclear power plants use nuclear fission to generate heat. They use this heat to create steam from water which, in turn, powers electrical generators.

Around twenty percent of the electricity in the United States is generated by nuclear power plants. There are 104 commercial nuclear generating units in the U.S.

Nuclear power plants use the element uranium as fuel. Control rods of uranium are used to make sure that the chain reaction of atoms splitting proceeds at a controlled pace. Radioactive Waste One of the byproducts of nuclear energy is radioactive waste. This is leftover material from the nuclear reaction. Radioactive material can be dangerous to humans and animal life.

**Other Uses of Nuclear Power**

Nuclear power has other applications in addition to power plants. One application is nuclear propulsion in ships and submarines. Nuclear powered submarines can stay under water and travel at high speeds for a long time. Nuclear power has also been used in naval ships, ships used for breaking ice in the polar seas, and space ships.



These ships of the U.S. Navy are nuclear powered

**Nuclear Fusion**

Another form of nuclear energy is nuclear fusion. Fusion occurs when two or more atoms are joined together to make a larger atom. Stars get their power from nuclear fusion. Deep inside a star, hydrogen atoms are constantly being converted by fusion into helium atoms. It's this process that generates the light and heat energy given off by the stars including the Sun.

Scientists have not figured out how to control fusion to create usable energy. If they could it would be great news as fusion produces less radioactive material and would give us a virtually unlimited supply of energy.

**Interesting Facts about Nuclear Energy and Fission**

* The top three states for generating nuclear energy are Illinois, Pennsylvania, and South Carolina.
* The United States generates more nuclear energy than any other nation.
* In the history of nuclear energy there have been three major nuclear power plant disasters including Chernobyl (Russia), Three Mile Island (United States), and Fukushima Daiichi (Japan).
* The first nuclear powered submarine was the U.S.S. Nautilus which put out to sea in 1954. One uranium pellet can generate the same amount of energy as around 1,000 kilograms of coal.
* The "smoke" you see coming from a nuclear power plant is not pollution, but steam.