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FACT SHEET:

Nuclear Energy

In 1934, an Italian scientist named Fermi and his colleagues bombarded uranium with slow moving neutrons and he realized that it produced much higher radioactivity than any other element treated the same way. Five years later Fermi discovered that the nucleus of uranium 235, if hit by a neutron, would split down the middle in two very similar fragments. This process was to be known as nuclear fission and it resulted in strong energy emission at the expense of the nucleus' initial mass.

The use of nuclear fission for civilian uses bases itself on the ability of controlling the chain reaction of such a process. In nuclear plants, the process of fission is tightly controlled through the use of special materials such as cadmium that are able to absorb neutrons and regulate the heat produced.

Nuclear Power Plants in Use Today

Slow Nuclear Reactors

These are the most common kind and are based on the nuclear fission principle; they are used in thermo-nuclear power plants and on air carrier ships. These reactors are built around a large cylinder where thousands of combustible pastilles (uranium 235) are inserted; controlled nuclear fission is then created and energy is produced in the form of heat that makes the water contained in the reactor evaporate and makes a turbine rotate thus producing electric energy through an alternator or making the propeller blades of a ship move.

Fast Nuclear Reactors

Fast nuclear reactors are called self-fertilizing because they are able to use the 99% of uranium that is not fissionable and which used to be disposed of in previous nuclear plants. These reactors are able to produce waste in the form of an artificial fissionable element named plutonium 238 or uranium 238. The first prototypes of these reactors entered service in 1974 in England and France. By using fast reactors uranium reserves could last for almost one thousand years.

From Fission to Fusion: Is Clean Nuclear Energy a Possibility?

Hydrogen is the lightest element in nature and is found in great quantity in water. Nuclear fusion theory rests on fusing two lighter atoms of hydrogen to obtain heavier ones (helium).

Specifically, nuclear fusion is achieved from two isotopes of hydrogen, deuterium and tritium, to obtain a nucleus of helium and a neutron. The construction of nuclear fusion reactors is very difficult: hydrogen atoms only fuse at temperatures above 100 million centigrade, and no known material can withstand such temperatures.

By fusing small quantities of hydrogen within a metal container (reactor) one could produce a regular and controlled energy flux; heat would be transferred to water by an independent circuit and the vapor would activate numerous turbines, thus producing energy.

There are currently two possible techniques that are being experimented with in laboratory settings:

Magnetic confinement based on a deuterium/tritium reaction.

The nucleus at the plasma state is enclosed in a reactor and separated from its sides by an incredibly powerful magnetic field. This reaction causes no radioactive waste, but radioactivity is produced in the reactor and causes noticeable neutron emissions.

Inertial confinement based on a deuterium/deuterium reaction.

This reaction is cleaner. By shooting lasers at small masses of deuterium and causing small fusion explosions in rapid succession, one could achieve a continuous energy flux.
If nuclear fusion is ever achieved, humanity's energy problems will be solved as hydrogen is readily found in waters across the world's surface.

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