FUSION

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There are many ways to produce energy but they can be very expensive and unsafe, like the nuclear fission. Fission gives us a lot of radioactivity that we do not have room for on earth, but for now it is the best way to produce energy. Scientists are now trying to find a better way to get inexpensive energy. The physicist's dream is the attemt to duplicate a stars fire (fusion) to provide power for the 21st century.

Nuclear fusion is in simple terms the fusing together of two atomic nuclei to make one slightly heavier nucleus. When this happens to the nuclei of light elements, like hydrogen or lithium, large amounts of energy are released. It is this process which occurs in the stars and provides the limitless flow of energy from the sun.

To get the energy you have to get two atomic nuclei to smash into each other in order to fuse. In a gaseous form, they constantly bounce off each other, but under extreme heat and pressure, the collisions become so violent that electrons are knocked away, leaving protons moving alone at high speed. Protons, which are electrically charged, repel one another strongly, but under heat and pressure, they will collide with so much force that they fuse. When this happens, enormous quantities of energy is released.

To make this happen, you must heat the gas to tens of millions of degrees. The gas will then become plasma, which has little more substance than a vacuum. The fusion of hydrogen protons creates a helium atom and gives off energy in the form of a fast moving neutron.

The temperatures are so high that anything which comes in contact with the plasma will melt, so one of the problems is to keep the plasma from leaking in all directions when it is heated. When the plasma leaks, there is little chance the reaction will be successful. Therefore instead of using materials, they use magnetic force, which also is very hard, to hold plasma. Because protons and electrons are electrically charged particles, they are unable to pass through a magnetic field. The neutrons, on the other hand, can pass freely through the field, slamming into and thus heating the surrounding walls, where a coolant such as water would carry off the heat, and convert it into steam to power a turbine to generate electricity.

If the plasma was heated enough, it would "ignite", that is, it would become so hot that enough fusion reactions would take place to keep it hot without outside heating. At that point the reactor could begin to produce more energy than was put into it.

To understand where the energy comes from, you must know Einstein's equivalence formula - energy equals mass times the square of the speed of light, or $E=MC$. The total mass of the helium nucleus and one neutron is less than the mass of the original two deuterium nuclei. The missing amount of mass has been changed into energy. It is not little energy you get. The energy released by nuclear reaction is, on a weight basis, millions of times greater than that released in any chemical reaction.

The main fuel in the fusion reaction, deuterium, is a nonradioactive isotop of hydrogen with just one extra neutron. Deuterium can be produced from seaeater, and the energy you get from the deuterium in a single cubic meter equals that released by burning 2,000 barrels of crude oil. Therefore one cubic kilometer of ocean water contains as much energy as that from the world's entire known oil reserves, and there are more than 1 billion cubic kilometers of seawater in the oceans!

Unfortunately, using deuterium alone to make fusion reactions is extraordinarily hard. A far better fuel is deuterium mixed with tritium, another isotop of hydrogen with two extra neutrons. Not only is more energy released in the reaction, but the combination of deuterium and tritium is 100 times more reactive than a simple mixture of deuterium.

Tritium is found in fairly rich deposits in South Africa and North America and in mineral waters. Using these deposits alone, which amount to about 10 million tonnes, there is enough tritium to release energy for the next 200 to 500 years.

Fusion would eliminate many of fission's drawbacks. Fusion reactions cannot occur in other than the highly controlled atmosphere that forces such reactions. The prospects for accidential fusion reactions, or reactions gone out of control, are therefore none. The fuel is extremely cheap and easy to obtain, and it won't affect either land or sea. Fusion reactors would not give off pollutants, like those power plants that burn coal or oil. It would produce as byproducts only helium, and extremely low-level radioactive tritium that decay within 12 years, and which does not tend either to concentrate or to linger in living organisms.

Some people see fusion as a "dream" source of energy, it is safe, clean, cheap and inexhaustible.

If they finally find a way to make fusion work, the possibilities for energy would be staggering. Fusion would take over the job of generating all electric power. It could directly produce hydrogen and other synthetic fuels to replace certain petrolium-based fuels. It could free hydrocarbons for use as raw material in the manufacture of industrial chemicals, plastics, and fertilizers, and for use as aircraft fuel. The price of energy would be sharply reduced. The need for preventing pollution by fossil and fission fuels would largely be eliminated.

Many scientists believe that if fusion can be harnessed, it could become the major source of energy in the next century.

The development of economically and reliable fusion reactors could cause an international energy revolution. It could shift the wealth of nations by driving them into new heights of productivity, and it could help even the poorest of the third world nations to flourish, but most energy experts don't think fusion will contribute to the world's energy supply until the 2020's and 2030's. They expect that fossil fuels and nuclear fission will continue to provide over 90 percent of the energy through the close of the 20th century. Beyond that they see oil and gas fading in significance as coal, fission, solar energy, and the beginnings of fusion take over the load.

The next, very large, step, after ahcieving deuterium-tritium based power stations, will be to design reactors based on deuterium-deuterium reactions. Then we will have energy reserves for another 10 billion years in the sea.

Nuclear fusion, if we can get it to work, is really the power of the future. All countries should join together, and despite their different political views, work for a common goal. If we could get fusion to work it would make our planet a better world to live in.

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