Deuterium Fusion

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The most practical source of inexhaustible energy is D-D-T fusion. D-D-T fusion requires the abundant, non-radioactive isotope of hydrogen, deuterium, which has one proton and one neutron in its nucleus. Deuterium occurs in the seas at a rate of 1 part in 6500 of hydrogen. It can be transported to the fusion power plant as heavy water (D2O). It is estimated that at current power consumption levels, there's enough deuterium on Earth to supply 50 million years of electric power.

Fusion power plants consist of a reactor and an AC generator. The reactor is a magnetic confinement torus known as a tokomak. The tokomak confines deuterium plasma at 400 million degrees kelvin in order to fuse deuterium as per the following reactions:

(1) $D + D \rightarrow He^3 + n + 3.27meV$

(2) $D + D \rightarrow T + H + 4.03meV$

The first reaction releases the non-radioactive isotope of helium, He^3, whereas the second reaction releases standard hydrogen. The tritium reaction product in equation (2) is reabsorbed by the plasma, and reacts with the deuterium as follows:

(3) $D + T \rightarrow He^4 + n + 17.6meV$

It is possible to regulate the reactions so that Eq.(2) occurs more often than Eq.(1). This is called autoflux fusion. The result is that Eq.(3) occurs more often, resulting in a significant power upgrade.

The tokomak requires extensive computer controls in order to confine a deuterium plasma. High-speed supercomputers are used here. One of the reasons why D-D-T fusion wasn't available in the past was because these computers weren't available. Now that Multipeg Towers of Chicago has been solved, these computers are available (the Multipeg puzzle provides a massive computer speed boost). These computers are petaflop computers, meaning 10^15 calculations per second (quantum computers). In order to reach the Lawson criterion for self-sustaining D-D-T fusion, such computers are needed to model the deuterium plasma.