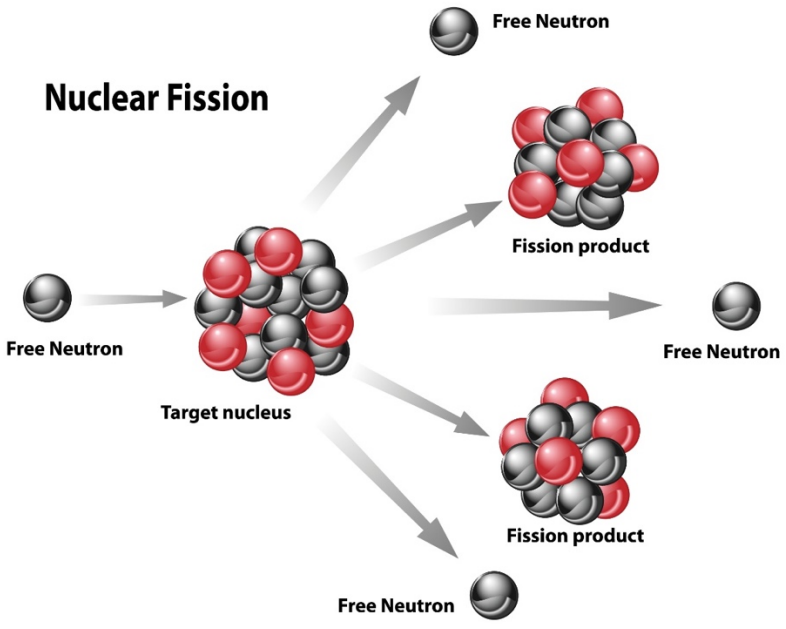
S6 Nuclear Fission & Fusion

The foundation of nuclear energy is taming the power of atoms. Both fission and fusion are nuclear processes which create energy by altering atoms. How do they differ? Fission is the division of one atom into two, and fusion is the combination of two lighter atoms into a larger one.

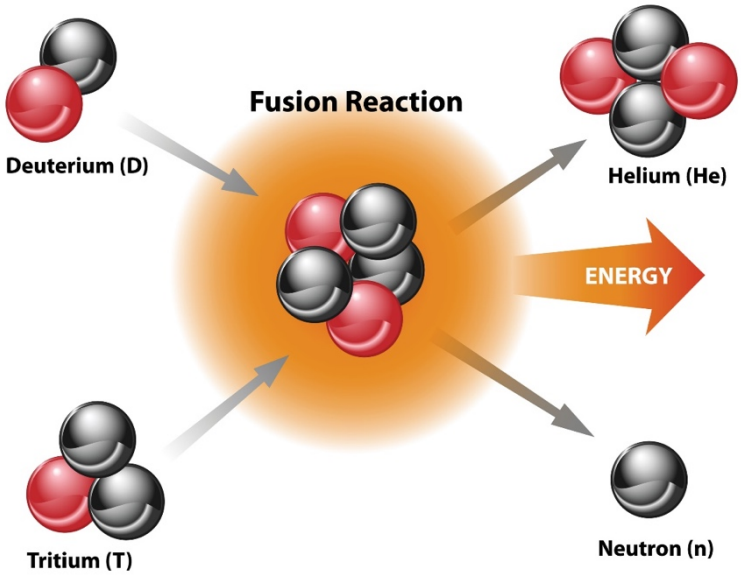
What is nuclear fission and how does it happen?

The word fission means "a splitting or breaking up into parts". Nuclear fission releases heat energy by splitting atoms. When large isotopes are hit with high-speed particles (neutrons) causing the isotope to fission (break into smaller particles). During the process, a neutron is accelerated and strikes the target nucleus, which in most nuclear power reactors today is Uranium-235. This splits the target nucleus and breaks it down into two smaller isotopes (the fission products), three high-speed neutrons, and a large amount of energy. This energy is then used to heat water in nuclear reactors and ultimately produces electricity. The high-speed neutrons that are ejected become projectiles that initiate other fission reactions, or chain reactions. (see diagram below)



What is nuclear fusion and how does it happen?

The word fusion means "a merging of separate elements into a unified whole". Nuclear fusion refers to the union of atomic nuclei to form heavier nuclei resulting in the release of enormous amounts of energy. Fusion takes place when two low-mass isotopes, typically isotopes of hydrogen, unite under conditions of extreme pressure and temperature.



Scientists are working on controlling nuclear fusion to make a fusion reactor to produce electricity. Some believe there are opportunities with such a power source because fusion creates less radioactive material than fission and has a nearly unlimited fuel supply. However, it is difficult to control the reaction in a contained space and this makes progress slow.

Both fission and fusion are nuclear reactions that produce energy, but the applications are not the same. Fission is used in nuclear power reactors as it can be controlled, while fusion is not used to produce power as the reaction is not easily controlled and is expensive to create the needed conditions for a fusion reaction. Scientists continue to research way to control the power of fusion, but research is in experimental stages. Though different, the two processes have an important role in the past, present and future of energy creation.