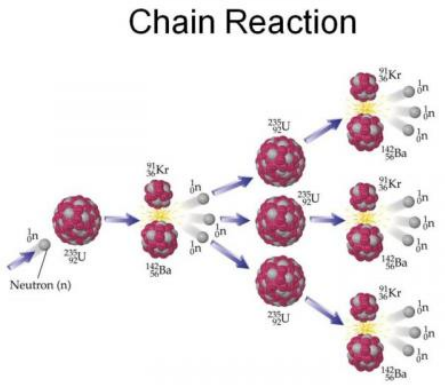
HOW NUCLEAR ENERGY WORKS



This diagram depicts what happens when fission splits the uranium atom. Image online via SteadyRun.

All matter is made up of atoms. The central body of an atom is called a nucleus. The nucleus consists of protons (positively charged particles) and neutrons (particles with no electrical charge). Electrons (negatively charged particles) are located outside the atom's nucleus.

In some types of atoms (like uranium which can be mined, reconstituted to form a substance known as "yellowcake," and then enriched [by chemical process] to create more U-235 atoms), the nucleus is unstable and capable of breaking up, thereby releasing that atom's neutrons. When those "on-the-loose" neutrons hit other atoms (more uranium atoms, for example), they ALSO split.

The splitting of those atoms is called "fission." Fission (in a chain reaction) releases more neutrons, plus heat. Heat can be used for many different purposes.

Parenthetically ... the discovery of fission by German scientists, in 1938, led Einstein and his colleagues to worry that Germany could create a new type of bomb. Concerned, Einstein sent a letter to President Roosevelt.

Although FDR created a commission, as a result of the letter, not much was initially done. Ultimately, however, Einstein's observations led to the "Manhattan Project" and the Hiroshima and Nagasaki bombs.

Splitting atoms—or nuclear fission—produces energy (in the form of heat) called nuclear energy. The key to controlling the splitting of atoms, thereby managing the power of nuclear energy, lies in knowing how to stop the chain reaction. Enrico Fermi, at the University of Chicago, discovered how to do that. His nuclear reactor was the first in the world.

Today, power plants in various countries use nuclear reactors (instead of burning coal) to create electricity. Such plants can produce energy with boiling water reactors (BWR) or with pressurized water reactors (PWR). In either process, safety concerns remain paramount.

The same concept applies to nuclear-powered submarines, where the energy produced from nuclear reactions (not fossil fuel) powers the ship. Always at issue, among other things, is properly controlling the chain reactions (not to mention the safe disposal of nuclear waste).

On 29 August 1949, the Soviet Union detonated its first nuclear (atomic) bomb at the Semipalatinsk test site in Kazakhstan. The Cold War, with its threats of mass destruction and political domination, had begun.

With the arrival of *K-19*, in 1961, both the U.S. and the Soviet Union possessed nuclear-powered submarines equipped with nuclear-tipped ballistic missiles. The arms race, it is often said, can be directly traced to those submarines.

See Alignments to State and Common Core standards for this story online at:
http://www.awesomestories.com/asset/AcademicAlignment/HOW-NUCLEAR-ENERGY-WORKS-K19-Widowmaker

See Learning Tasks for this story online at:
http://www.awesomestories.com/asset/AcademicActivities/HOW-NUCLEAR-ENERGY-WORKS-K19-Widowmaker

Media Stream

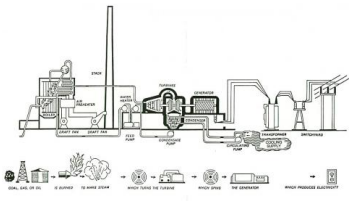
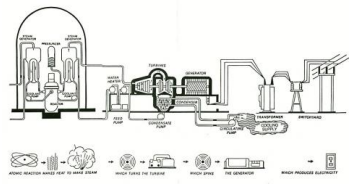


Diagram of Coal Burning Plant

Diagram of coal-produced electricity by the U.S. Department of Energy. Graphic online, courtesy Dept of Energy.
View this asset at: http://www.awesomestories.com/asset/view/Diagram-of-Coal-Burning-Plant



Turning Nuclear Energy Into Electricity

Diagram of nuclear-produced electricity by the U.S. Department of Energy. Graphic online, courtesy Dept of Energy.
View this asset at:
http://www.awesomestories.com/asset/view/Turning-Nuclear-Energy-Into-Electricity

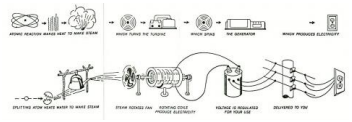
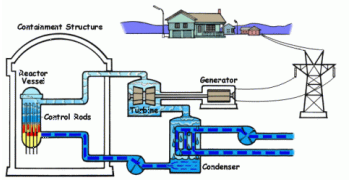


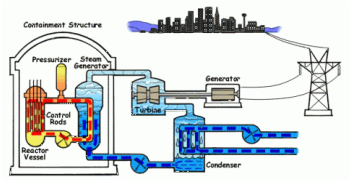
Diagram of Transfer of Electricity to the End User

Diagram created by the U.S. Department of Energy. Graphic online, courtesy Dept of Energy.
View this asset at:
http://www.awesomestories.com/asset/view/Diagram-of-Transfer-of-Electricity-to-the-End-User



Nuclear Power Animation - Boiling Water Reactors

Animation graphic by the U.S. Nuclear Regulatory Commission. Online, courtesy NRC.
View this asset at:
http://www.awesomestories.com/asset/view/Nuclear-Power-Animation-Boiling-Water-Reactors



Nuclear Power Animation - Pressurized Water Reactor

Animation graphic by the U.S. Nuclear Regulatory Commission. Online, courtesy NRC.
View this asset at:
http://www.awesomestories.com/asset/view/Nuclear-Power-Animation-Pressurized-Water-Reactor