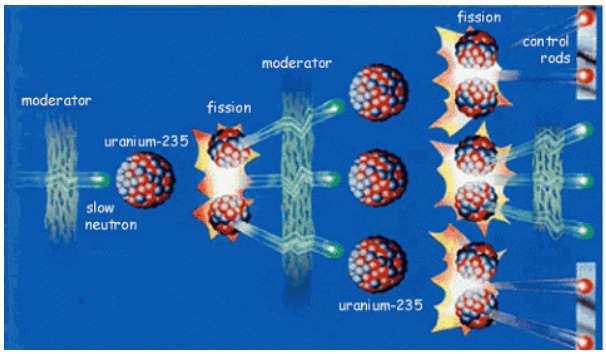
NUCLEAR ENERGY - SIMPLY SPEAKING



This illustration, from the University of Bristol (School of Chemistry), demonstrates a nuclear chain reaction. "Atom bombs (and nuclear power stations) get their energy from fission of uranium-235 atoms. Neutrons can split uranium-235 atoms up (fission) into two smaller atoms and release more neutrons. These three neutrons can go on to split three more uranium atoms, producing nine more neutrons; this can continue to produce a self-sustaining chain reaction."

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, and when, to *stop* the chain reaction.

A *controlled* chain reaction produces energy; an *uncontrolled* chain reaction produces a nuclear explosion. Enrico Fermi, while working at the University of Chicago, discovered how to control a nuclear chain reaction.

In his nuclear reactor - the world's first - a life-changing event took place on the 2nd of December, 1942. Fermi and his team made history when they helped to produce the first self-sustaining, controlled nuclear reaction. Thereafter, nuclear energy (and nuclear weapons) were just over the horizon.

Today, power plants in various countries use nuclear reactors (instead of burning coal) to create electricity. 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 the safe disposal of nuclear waste.

In a sense, a nuclear submarine's power plant (her nuclear reactor) is nothing more than a large boiler which produces steam. That steam runs:

- the turbines (which propel the ship through the water); and

- the generators (which provide the ship's electricity).

The major difference between steam that is produced by a coal-fired boiler, for example, and steam that is generated by nuclear power is what happens inside the nuclear reactor.

In 1939, when Einstein sent his letter to President Roosevelt, scientists were still learning these things about nuclear energy. No one had yet built nuclear power plants, atomic bombs or nuclear-powered submarines.

At the time, people were using hydro-electric power to run their homes and businesses. Hoover Dam - a massive project to boost such power generation for America's southwestern region - was only three years old when Einstein wrote to FDR.

How did the President react to Einstein's concerns? Initially preoccupied with Hitler's invasion of Poland, which started World War II, FDR was proceeding cautiously. By fall, he asked for advice from the newly formed "Advisory Committee on Uranium" which first met on October 21, 1939.

The advice he received ultimately led to the "Manhattan Project" and the world's first atomic bombs.

See Alignments to State and Common Core standards for this story online at:
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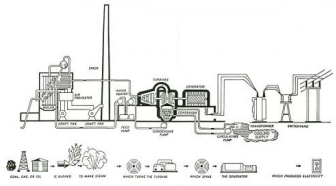
Media Stream



Producing Electricity from Coal, Oil and Gas

Graphic created by the U.S. Department of Energy. Online, courtesy U.S. Department of Energy.
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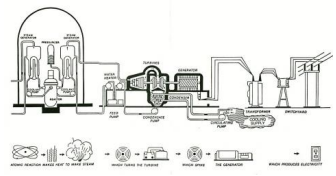

Producing Electricity from Atomic Energy

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FDR and Einstein's Fourth Letter

Photo, U.S. National Archives.
Quoted reference, from Einstein's March 25, 1945 letter, a facsimile of which is at the U.S. National Archives.
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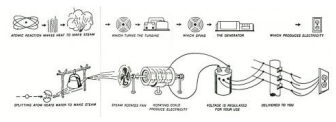

From Atomic Reaction to the Delivery of Electricity

Online, courtesy U.S. Department of Energy.
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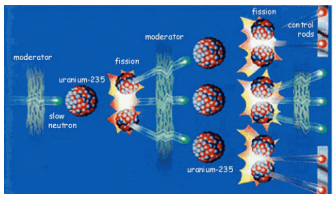

NUCLEAR ENERGY - SIMPLY SPEAKING

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Fermi and His Self-Sustaining, Controlled Nuclear Reaction

Video produced by Argonne National Laboratory. Online, courtesy U.S. Department of Energy.
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Hoover Dam - Building the Dam

Historic footage depicting the building of Hoover Dam from the U.S. Bureau of Reclamation, U. S. Department of the Interior.
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