AN INSIDER'S VIEW

American Nuclear Society

Nuclear Power

Pressurized Water Reactor

Nuclear energy is naturally stored in the "nuclei" (cores) of certain heavy elements. It can be released in the form of heat. The heat can be converted to mechanical energy, which can be used to make electricity or other consumer products, such as synthetic fuels.

The nuclear energy released by "fissioning" (splitting) an atom's nucleus is about 1,000,000 times greater than the chemical energy released by combustion, which comes from the electrons shared by two or more atoms.

How do Nuclear Power Plants Work?

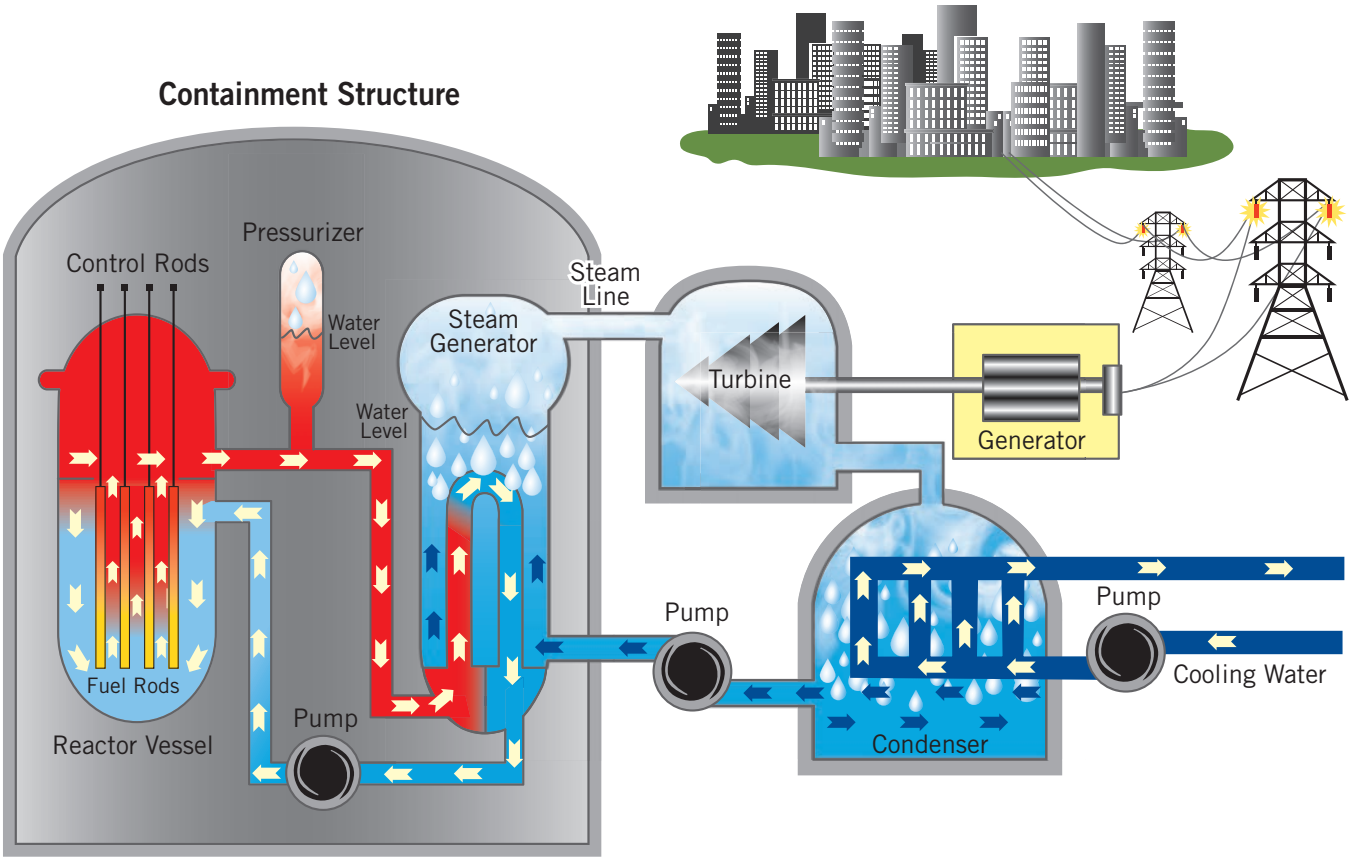
Electricity is produced by using the heat from fission to create mechanical energy, which turns an electric generator. In most cases the heat is used to make steam, which turns a turbine, that then turns the generator.

In a typical U.S. plant, water inside a thick steel reactor vessel passes over a reactor core constructed of long cylindrical fuel rods. Inside each fuel rod is a stack of ceramic fuel pellets that contain fissile elements.

The energy of the fission reaction inside these rods is transferred to the water as heat. In this Pressurized Water Reactor (PWR), the core water is kept at high pressure by the pressurizer to prevent boiling. The core water flows through tubes in a Steam Generator. Water outside the tubes evaporates, producing steam.

The amount of energy produced is controlled — and can be shut off entirely — by small changes in the position of control rods inside the core that absorb the neutrons which fission the fuel.

The high temperature, high-pressure steam rapidly expands between turbine blades, causing the turbine to turn and rotate an electric generator. This produces electricity.



The steam exits the turbine and then passes through a condenser, where it is cooled by cold water from a cooling tower or another source, such as a lake. When cooled, the steam condenses to liquid water and is returned to the reactor core to begin the process again.

A Pressurized Water Reactor is shown. In a Boiling Water Reactor there is no Steam Generator. Steam is produced in the reactor core and flows to the turbine. There are more Pressurized Water Reactors in the U.S. than Boiling Water Reactors.

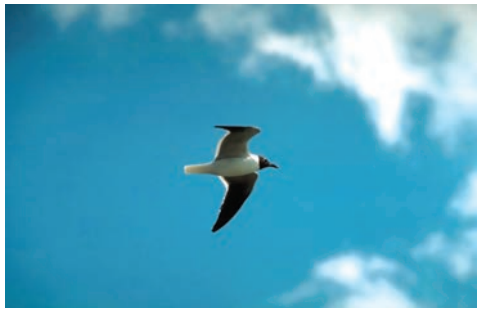
Nuclear Power
Pressurized Water Reactor

Why are Nuclear Power Plants Important to Us?

Byron Nuclear Generating Station, Illinois

As the global need for clean energy grows, nuclear power is the only energy source with near-zero carbon emissions that has been proven capable of reliably and sustainably delivering the energy needed by our industrial society.

- Increasing nuclear power's share in the national energy mix will improve air quality, reduce dependence on foreign oil, decrease volatility in electricity prices, and save hydrocarbons for other uses.
- One nuclear power plant produces enough electricity 24 hours a day to meet the electricity demands of a city the size of Boston or Atlanta. This power plant provides competitive salaried jobs and contributes to the local tax base.
- Nuclear energy will power the switch to sustainable transportation technologies, such as plug-in electric and electric hybrid vehicles.
- Nuclear plants work with environmental groups to preserve and protect the land, water, plants, and animals near the plant. Also, many nuclear power plants are habitats for protected species.
- The energy from nuclear fission is nearly inexhaustible, just like the energy from sources traditionally considered "renewable."

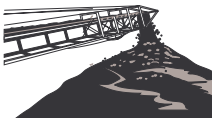


Source Energy Equivalents

1 Uranium Fuel Pellet, without being reprocessed and recycled, has about as much energy available in today's light water reactor AS...

Uranium Fuel Pellet
(actual size)

3 Barrels of Oil
(42 gal. each)



1 Ton of Coal

17,000 Cubic Feet of Natural Gas

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Established in 1954, the American Nuclear Society (ANS) is a professional organization of scientists and engineers devoted to the applications of nuclear science and technology.

For more information on nuclear science and technology, please visit **NuclearConnect.org**, **ansnuclearcafe.org**, or contact the ANS outreach department at **outreach@ans.org**.

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