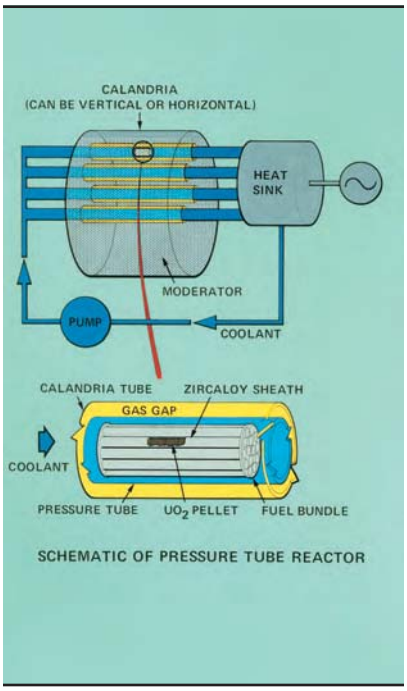
NUCLEAR *facts*

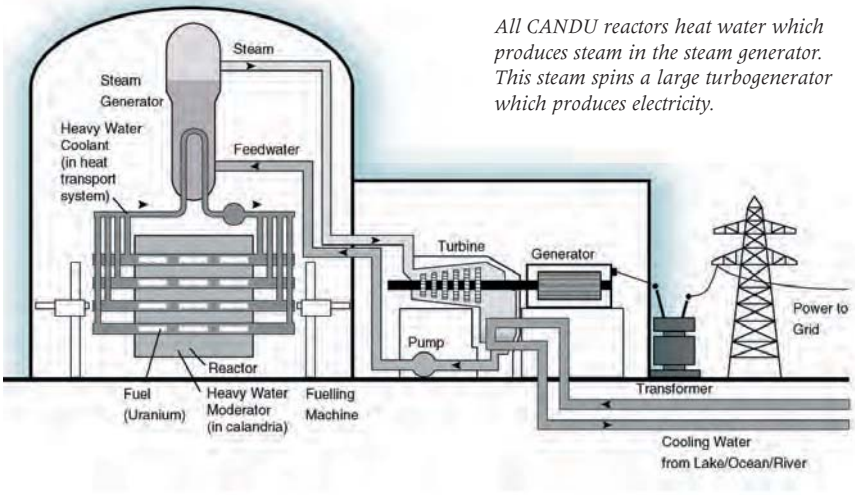
How does a nuclear reactor work?

SIMPLY PUT, A NUCLEAR REACTOR IS A DEVICE THAT PRODUCES HEAT. IN A NUCLEAR POWER STATION, THE REACTOR PERFORMS THE SAME FUNCTION AS A BOILER IN A CONVENTIONAL COAL, GAS OR OIL-FIRED STATION.

Whether from a conventional boiler or a nuclear reactor, heat is required to turn water into steam. This steam is needed to spin large turbines, which in turn drive generators that produce electricity. A major difference between a nuclear power station and a conventional fossil-fuelled station is that there is no release of combustion products to the environment from a nuclear station.



SCHEMATIC OF PRESSURE TUBE REACTOR



All CANDU reactors heat water which produces steam in the steam generator. This steam spins a large turbogenerator which produces electricity.

All nuclear reactors operate on the same basic principle, although there are different kinds of nuclear reactors in use throughout the world. A nuclear reactor creates heat by splitting uranium atoms. This "fission" of uranium atoms is called a "nuclear reaction."

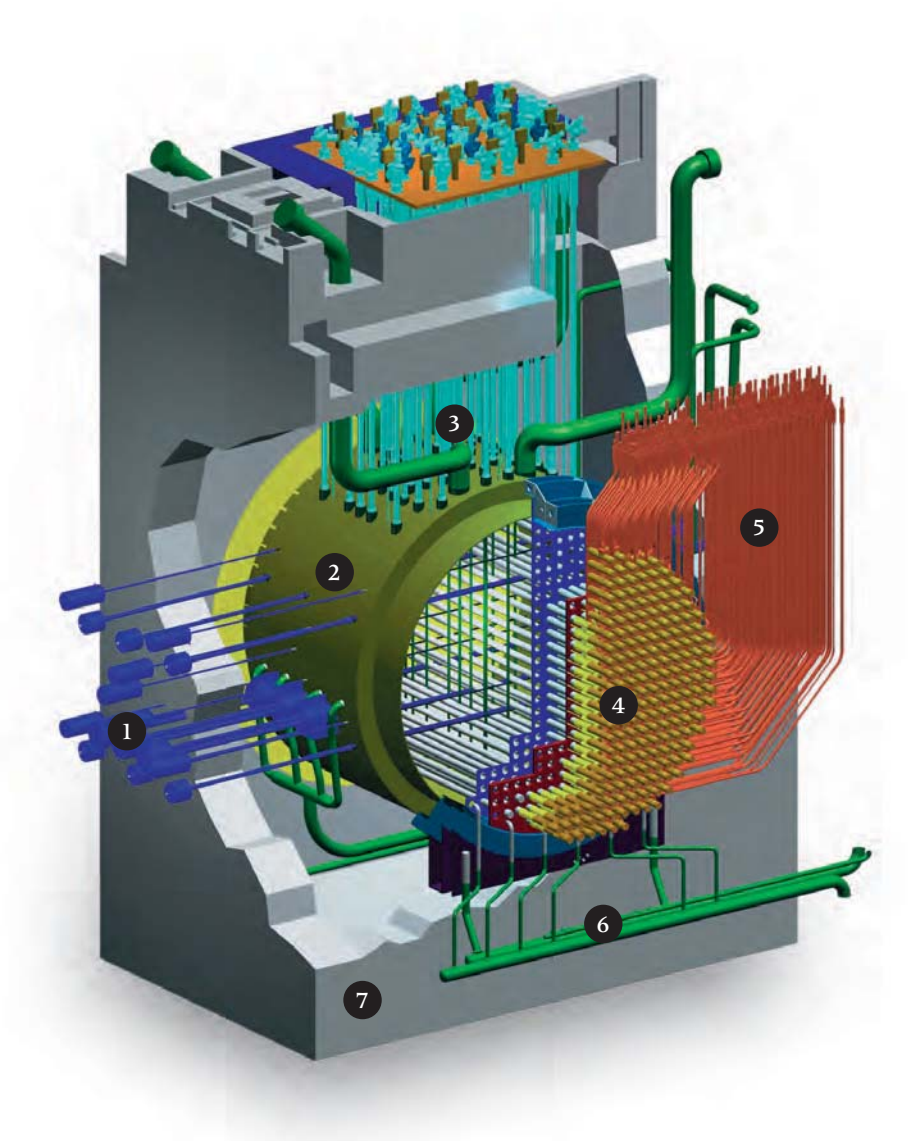
When the centre or nucleus of a uranium atom is struck by a neutron traveling at the right speed, it splits into fragments that separate rapidly and generate heat. It also gives off new neutrons. To sustain a continuous nuclear reaction, the speed of these neutrons must be slowed down or moderated. Canadian nuclear reactors use heavy water as the neutron moderator. Chemically, heavy water is called deuterium oxide. Thus the Canadian reactor is named CANDU, for CANada Deuterium Uranium.

Because of the heavy water moderator, CANDU reactors can use natural uranium as the source of fuel to create the nuclear reaction.

Each of the fuel channels in a CANDU reactor is filled end to end with fuel bundles containing the uranium oxide nuclear fuel.

What is the core of a CANDU reactor?

The core of a CANDU reactor is contained in a large, horizontal, cylindrical tank called a "calandria" which contains the heavy water moderator. Several hundred fuel channels run from one end of the calandria to the other. Each channel has two concentric tubes. The outer one, called the calandria tube, forms the inside boundary of the calandria. The inner one, called the pressure tube, holds the fuel and the pressurized heavy water coolant. The fuel, in the form of bundles of rods containing uranium pellets, is inserted into the pressure tubes by remotely operated fuelling machines, which can function while the reactor is operating.



1. Emergency shut down system
2. Calandria
3. Adjuster rods
4. Fuel channels and end fittings
5. Inlet feeder pipes
6. Moderator inlets
7. Reactor vault

In a closed circuit, the heavy water coolant is pumped through the tubes containing the fuel bundles to pick up heat generated from the nuclear reaction, then to steam generators to produce steam from ordinary water and back to the reactor. The steam is piped outside the reactor containment building to conventional turbines and generators that produce electricity. In this way, the nuclear reactor is separate from the equipment used to produce electricity.

How do Canada's nuclear reactors compare?

Very well.

Most other reactors in the world use light or ordinary water, or graphite as a moderator. These are less efficient moderators than heavy water, and the fuel has to be enriched with fissionable atoms of uranium. Currently CANDU reactors use natural uranium, resulting in better fuel efficiency and lower fuel cost.

See also the pages on nuclear power at the Web site of Ontario Power Generation Inc. www.opg.com and the Web site of Atomic Energy of Canada Limited www.aecl.ca

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