How Do Nuclear Reactors Work

There have been two major types of CANDU reactors, the original design of around 500 MWe that was intended to be used in multi-reactor installations in large plants, and the optimized CANDU 6 in the 600 MWe class that is designed to be used in single stand-alone units or in small multi-unit plants. CANDU 6 units were built in Quebec and New Brunswick, as well as Pakistan, Argentina, South Korea, Romania, and China. A single example of a non-CANDU 6 design was sold to India. The multi-unit design was used only in Ontario, Canada, and grew in... 25f8ef243f The process typically takes about 15 to 30 years, or many decades more when an interim safe storage period is applied for radioactive decay. Radioactive waste that remains after the decommissioning is either moved to an on-site storage facility where it is still under control of the owner, or moved to a dry cask storage or disposal facility at another location. The final disposal of nuclear waste from past and future decommissioning is a growing, still unsolved, problem. 25f8ef243f

CANDU reactor CANDU reactors were first developed in the late 1950s and 1960s by a partnership between Atomic Energy of Canada Limited (AECL), the Hydro-Electric Power Commission of Ontario, Canadian General Electric, and other companies. In CANDU reactors, additional tritium is generated in the heavy water coolant The CANDU (Canada deuterium uranium) is a Canadian pressurized heavy-water reactor design used to generate electric power. The acronym refers to its deuterium oxide (heavy water) moderator and its use of (originally, natural) uranium fuel. research use. It was later exported, and in 2026 there were 26 operational CANDU reactors worldwide: 17 in Canada, three in South Korea, two each in Romania and China, and one each in India and Argentina. Tritium is also generated in the fuel of all nuclear fission reactors 25f8ef243f

Nuclear decommissioning The process usually runs according to a decommissioning plan, including the whole or partial dismantling and decontamination of the facility, ideally resulting in restoration of the environment to greenfield status. reactors; and US$640 billion for dismantling all military reactors for the production of weapons-grade plutonium, research fuel facilities, nuclear reprocessing Nuclear decommissioning is the process leading to the irreversible complete or partial closure of a nuclear facility, usually a nuclear reactor, with the ultimate aim of termination of the operating licence. The decommissioning plan is fulfilled when the approved end state of the facility has been reached 25f8ef243f

Small modular reactor A small modular reactor (SMR) is an emergent class of

nuclear fission reactors with a rated electrical power of less than 300 megawatts (MWe), which use 25f8ef243f

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Nuclear reactor Fissile nuclei (primarily uranium-235 or plutonium-239) absorb single neutrons and split, releasing energy and multiple neutrons, which can induce further fission. Reactors stabilize this, regulating neutron absorbers and moderators in the core. Some reactors are A nuclear reactor is a device used to sustain a controlled fission nuclear chain reaction. In commercial reactors, this drives turbines and electrical generator shafts. from nuclear fission is passed to a working fluid coolant. They are used for commercial electricity, marine propulsion, weapons production, and research. Fuel efficiency is exceptionally high; low-enriched uranium is 120,000 times more energy-dense than coal 25f8ef243f

EPR (nuclear reactor) Reuters. World Nuclear News. The EPR is a Generation III+ pressurised water reactor design. build new nuclear energy reactors". It has been designed and developed mainly by Framatome (part of Areva between 2001 and 2017) and Électricité de France (EDF) in France, and by Siemens in Germany. Retrieved 10 January 2022. "EDF begins permitting process for two new reactors at Penly". In Europe, this reactor design was called European Pressurised Reactor, and the internationalised name was Evolutionary Power Reactor, but it has been simplified to EPR 25f8ef243f

After the discovery of fission in 1938, many countries launched military nuclear research programs. Early subcritical experiments probed neutronics. In 1942, the first artificial critical nuclear reactor, Chicago Pile-1, was built by the Metallurgical Laboratory. From 1944, for weapons production, the first large-scale reactors were operated at the Hanford Site. The pressurized water reactor design, used in about 70... 25f8ef243f

Nuclear reactor physics Most nuclear reactors use a chain reaction to induce a controlled rate of nuclear fission in Nuclear reactor physics is the field of physics that studies and deals with the applied study and engineering applications of chain reaction to induce a controlled rate of fission in a nuclear reactor for the production of energy. fission in a nuclear reactor for the production of energy 25f8ef243f

In a nuclear reactor, the neutron population at any instant is a function of the rate of neutron production (due to fission processes) and the rate of neutron losses (due to non-fission absorption mechanisms and leakage from the system). When a reactor's neutron population remains steady from one generation to the next (creating as many new neutrons as are lost), the fission chain reaction is self-sustaining and the reactor's condition is referred to as "critical". When the

reactor's neutron production exceeds losses, characterized... 25f8ef243f In a PWR, water is used both as a neutron moderator and as coolant fluid for the reactor core. In the core, water is heated by the energy released by the fission of atoms contained in the fuel. Using high pressure (around 155 bar: 2250 psi) ensures that the water stays in a liquid state. The heated water then flows to a steam generator, where it transfers its thermal energy to the water of a secondary cycle kept at a lower pressure which allows it to vaporize. The resulting steam then drives steam turbines linked to an electric generator. A boiling water reactor (BWR) by contrast does not maintain such high pressure in the primary cycle and the water vaporizes... 25f8ef243f The first operational EPR unit was China's Taishan 1, which started commercial operation in December 2018. Taishan 2 started commercial operation in September 2019. European units have been so far plagued with prolonged construction delays and substantial cost overruns. The first EPR unit to start construction, at Olkiluoto in Finland, originally intended to be commissioned in 2009, started commercial operation in 2023, a delay of fourteen years. The second EPR unit to start construction, at Flamanville in France, also suffered a more than decade-long delay in its commissioning (from 2012 to 2024). Two units at Hinkley Point in the United Kingdom received final approval in September 2016; the first unit was expected to begin operating in 2027, but was subsequently delayed to around 2030. 25f8ef243f

Power Reactor and Nuclear Fuel Development Corporation It also owned. The organization specialized in special breeder reactors and the Advanced Thermal Reactor. as the Japan Nuclear Cycle Development Institute 25f8ef243f

Pressurized water reactor PWRs are the most common type of nuclear power reactor, representing almost 70% of the world's commercial reactor fleet. Some countries, such as Canada and (historically) the United Kingdom, have relied heavily on other designs (CANDU pressurized heavy-water reactors and gas-cooled reactors respectively) while others, including Japan and India, operate a mix of PWRs and other reactor types (notably boiling water reactors and pressurized heavy-water reactors). heavy-water reactors and gas-cooled reactors respectively) while others, including Japan and India, operate a mix of PWRs and other reactor types (notably A pressurized water reactor (PWR) is a type of light-water nuclear reactor 25f8ef243f

Most nuclear reactors use a chain reaction to induce a controlled rate of nuclear fission in fissile material, releasing both energy and free neutrons. A reactor consists of an assembly of nuclear fuel (a reactor core), usually surrounded by a neutron moderator such as regular water, heavy water, graphite, or zirconium hydride, and fitted with mechanisms such as control rods which control the rate of the reaction. 25f8ef243f

Thorium-based nuclear power gas-cooled reactors (HTGRs) Fast neutron reactors

(FNRs) – Nuclear reactor where fast neutrons maintain a fission chain reaction Accelerator driven reactors (ADS) – 25f8ef243f

EDF has... 25f8ef243f Heat from nuclear fission is passed to a working fluid coolant. In commercial reactors, this drives turbines and electrical generator shafts. Some reactors are used for district heating, and isotope production for medical and industrial use. 25f8ef243f

Breeder reactor A breeder reactor is a nuclear reactor that generates more fissile material than it consumes. These reactors can be fueled with more-commonly available 25f8ef243f

Decommissioning is an administrative and technical process. The facility is dismantled to the point that it no longer requires measures for radiation protection. This includes clean-up of radioactive materials... 25f8ef243f