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Pros and cons of nuclear technology for the 21st century

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Nuclear technology is a highly discussed topic nowadays clue to the events happening in our country. In our article I'd like to dwell upon the history of Nuclear energy, types of reactors, pros and cons of nuclear power.

The history of nuclear power has its origins in the distant 1930, when in 1934, physicist Enrico Fermi conducted experiments in Rome that showed neutrons could split many kinds of atoms. In the fall of 1938, German scientists Otto Hahn and Fritz Strassmann fired neutrons from a source containing the elements radium and beryllium into uranium (atomic number 92).

By the early 1942's, the world learns of the first self-sustaining fission chain reaction conducted by the University of Chicago. In the late 1950s the use of nuclear energy for electricity generation began and it grew strongly until 1990. Although its growth since then has been much slower, it is today a major source of energy, supplying about 14% of the world's electricity, and 21% of the electricity in OECD countries [1].

Throughout its history nuclear technology has developed several types of reactors. The first type is known as pressurized water reactor where ordinary water is used both as a coolant and a moderator. The coolant is kept at high pressure (about 15.5 MPa or 2 250 psi) to keep it as a liquid. Heat is transferred within steam generators to a separate, secondary coolant

circuit, where water is boiled to create steam. This steam drives the electricity producing turbine generators.

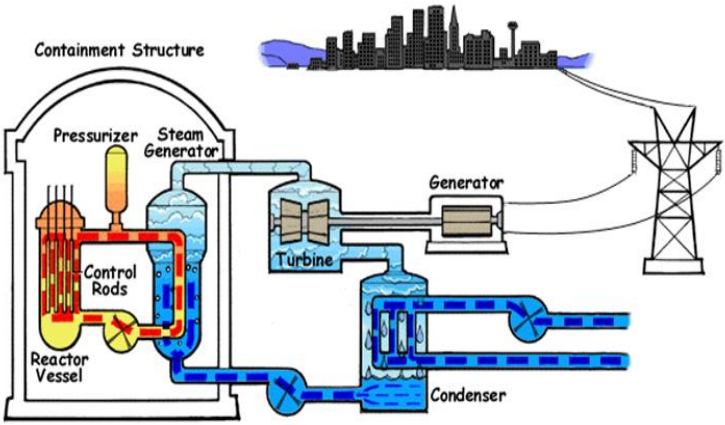

Fig. 1- Pressurized water reactor

The second type of reactors is boiling water reactors. As in PWRs, ordinary water acts as both coolant and moderator. The coolant is kept at a lower pressure than in a PWR (about 7 MPa or 1 000 psi) allowing it to boil as it absorbs heat from the reactor. The resultant steam is passed directly to the turbine generators to produce electricity.

The most commonly used type of reactors is Graphite moderated light water-cooled. Water is used as the coolant and graphite as the moderator. As with a BWR, the coolant boils as it passes through the reactor and the resultant steam is passed directly to the turbine generators. The accident at Chernobyl in Ukraine in 1986 occurred at a reactor of this type.

The next type of reactors is pressurized heavy water reactors (PHWRs). They use heavy water as both coolant and moderator.

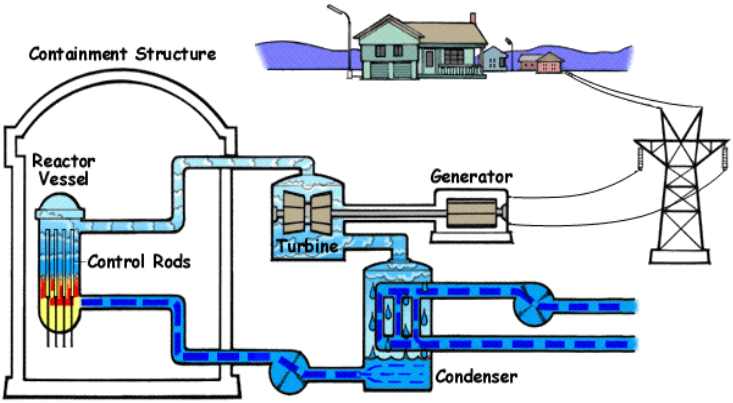

Fig. 2 - Pressurized heavy water reactors

There is also such a type of a reactor as gas-cooled reactors. Which use carbon dioxide as the coolant and graphite as the moderator.

The reactor types described above are thermal reactors, i.e. most of the fissions are due to thermal neutrons. Fast reactors are designed to make use of fast neutrons with much higher kinetic energies. They create more neutrons per fission than thermal reactors, and can also make more efficient use of them [2]. This process is known as "breeding", and fast reactors that include this process are often referred to as fast breeder reactors (FBRs).

As any technology nuclear technology has both advantages and disadvantages. The advantages are the following: clean, safe, reliable, compact, competitive and practically inexhaustible.

- Nuclear energy produces almost no carbon dioxide, and any sulfur dioxide or nitrogen oxides whatsoever. These gases are produced in vast quantities when fossil fuels are burned;
- One gram of uranium yields about as much energy as a ton of coal or oil - it is the famous "factor of a million". Nuclear waste is correspondingly about a million times smaller than fossil fuel waste, and it is totally confined;

- Nuclear power is safe, as proven by the record of half a century of commercial operation, with the accumulated experience of more than 12,000 reactor-years;
- There have been only two serious accidents in the commercial exploitation of nuclear power: Three Mile Island in 1979 (in Pennsylvania, USA) and Chernobyl in 1986 (in the Soviet Union, now in Ukraine);
- The cost of nuclear power is competitive and stable;
- It should be noted that a moderate amount of radiation is natural and beneficial for the body.

The disadvantages are environmental impact, radioactive waste disposal, nuclear accidents, uranium is finite, hot target for militants. The radioactive waste produced can pose serious health effects on the lives of people as well as the environment. The Chernobyl accident that occurred on 26 April 1986 at the Chernobyl Nuclear Power Plant in Ukraine was the worst nuclear accident in the history. Its harmful effects on humans and ecology can still be seen today. Then there was another accident that happened in Fukushima in Japan. Although the casualties were not that high, but it caused serious environmental concerns [3].

Although ideas of a nuclear technology are contradicting the future of nuclear power looks promising. With new generations of reactors, potential major breakthroughs such as nuclear fusion, the methods we use to harness nuclear energy will get better in the next coming years. So nuclear power is our key to the future.

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