

NUCLEAR ENERGY

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The study of the energy released during nuclear fission is a complex and challenging task in the context of the current energy realities. In the context of the global drive for environmental sustainability, nuclear power generation is again considered a promising option. However, the use of this approach is associated with serious concerns regarding the safety of facilities and as well as the introduction of efficient, reliable and environmentally friendly burial methods.

At the current stage of energy development, nuclear power plants occupy an important place in the global energy supply system. According to information provided by the International Atomic Energy Agency (IAEA), a number of countries operate nuclear reactors that generate a significant share of the required electricity [1].

This technological approach has become especially widespread in countries that set goals to diversify energy sources and reduce dependence on fossil fuels, for example France, Slovakia, Hungary and Ukraine. The most common reactor designs, such as pressurized water reactors (VVERs) and boiling water reactors (BWRs), use enriched uranium as fuel and water to slow down the neutrons and remove the heat generated.

Nuclear power has a number of advantages that make it an attractive choice for many countries. First, nuclear power plants do not produce greenhouse gases during the generation of electricity, which helps reduce emissions and combat global warming. Second, nuclear fuel is extremely dense, meaning that a small amount of fuel can produce a large amount of energy. This reduces the amount of fuel that must be transported and stored compared to fossil fuels. Third, nuclear power plants are capable of operating in a constant power mode, which means that they can provide stable electricity generation regardless of the time of day, weather, and other variables that affect other energy sources, such as solar and

wind. This property is important for ensuring the reliability of energy supply in energy systems.

However, nuclear energy has significant disadvantages and is associated with various hazards. The Chernobyl and Fukushima accidents clearly showed the world the enormous damage that such incidents can cause. Despite the fact that modern reactors are equipped with a large number of protective systems, the possibility of an accident, even a minimal one, always remains, and its consequences can be very serious.

In addition, nuclear energy produces radioactive waste that will pose a threat to future generations. Safely containing and disposing of this waste is a difficult and costly task that requires constant monitoring. There is also a threat of the proliferation of nuclear technology, which can potentially be used to create nuclear weapons.

Despite these risks, there is currently a renewed interest in nuclear energy, driven by the need to reduce carbon emissions and ensure energy independence.

Great hopes are placed on new generations of nuclear reactors, which are expected to be more reliable and stable. These include fourth-generation reactors, which are being developed using advanced materials and designs, and small modular reactors (SMRs), which are smaller and can be manufactured in a factory and then transported to the operating site, resulting in lower costs [2].

In conclusion, nuclear energy is a controversial issue that requires serious analysis of its advantages and disadvantages. It has great potential to meet global energy needs, but also poses significant risks to environmental safety and human health. Further study of nuclear energy should aim for the highest level of safety and responsible management of radioactive waste. Only if these conditions are met nuclear energy will be able to make a huge contribution to creating a safe energy future for all of humanity.

References

1. Power Reactor Information System (PRIS) // International Atomic Energy Agency (IAEA). – URL: <https://pris.iaea.org/> (date of access: 19.03.25).
2. Nuclear Power Reactors // World Nuclear Association. – URL: <https://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/nuclear-power-reactors> (date of access: 19.03.25).