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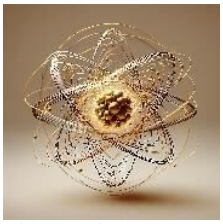
Ministry of Foreign Affairs of the Czech Republic

Czechia an attractive partner in nuclear research



Comprehensive and long-standing nuclear expertise

Nuclear research has a long-standing tradition in Czechia, dating back to the first half of the 20th century. In 1957, former Czechoslovakia became the ninth country in the world to successfully operate a nuclear fission reactor. Building on this legacy, Czechia has developed a robust infrastructure for nuclear research and education. Nuclear research is an integral part of Czechia's comprehensive nuclear expertise. The entire nuclear ecosystem also includes a number of companies that provide cutting-edge nuclear technologies and equipment. Czech nuclear companies have supplied the majority of the equipment used in the six nuclear power plant units currently in operation in Czechia and are involved in various nuclear power plant projects worldwide, ranging from the construction of new reactors to commissioning, life-extension and decommissioning.

Unique Research Infrastructure

Czechia is home to a wide array of advanced nuclear research facilities, **including several research reactors, tokamaks, cyclotrons, linear and circular accelerators, fast neutron sources, experimental loops, and hot cells**. This state-of-the-art infrastructure supports a diverse range of nuclear research activities. As a result, Czech research institutions are among the few globally with the capability to irradiate materials in a nuclear reactor, expose them to controlled conditions in a loop, conduct comprehensive mechanical testing in hot chambers, and analyze the effects of radiation and environmental factors on material microstructure using advanced electron microscopy techniques. Czechia is also actively involved in the field of nuclear fusion. The new COMPASS-U tokamak is scheduled to begin operation in 2027. With its high magnetic field (5 T) and significant plasma current (2 MA), it is expected to play a pivotal role in the collaborative European efforts within the EUROfusion consortium. Additionally, the Extreme Light Infrastructure ERIC (ELI ERIC), particularly the ELI Beamlines Facility, is at the forefront of advancing Inertial Confinement Fusion, driving research that supports the development of laser-driven technologies for future nuclear fusion energy reactors.

In most of the research areas, Czech researchers maintain extensive collaborations with leading research institutions worldwide, including those in the United States, France, and South Korea. Czechia is also a member of large international research projects such as CERN, ESS, and the Jules Horowitz Reactor.

Key research areas for cooperation

research support for the operation of existing nuclear power plants (minimizing downtime, reducing operating costs, automating operations, improving efficiency, new fuel types, nuclear safety, long-term operation) **advance nuclear technologies** (generation IV reactors, small modular reactors, fuel cycle, nuclear fusion)	**treatment and storage of radioactive and hazardous waste** **nuclear fusion** **advanced materials research** **advanced energy technologies** **nuclear medicine/radiopharmaceuticals**

Czech nuclear research ecosystem

The Czech nuclear research ecosystem is primarily driven by universities, the institutes of the Czech Academy of Sciences, and private companies. Additionally, two public research institutions, the National Institute for Nuclear, Chemical, and Biological Protection (SUJCHBO) and the National Radiation Protection Institute (SURO), established by the State Office for Nuclear Safety (SÚJB), focus on nuclear and radiation protection. Research on radioactive waste is conducted by the Radioactive Waste Repository Authority (SURAO).

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Leading Czech Institutions in Nuclear Research (in alphabetical order)

- **Brno University of Technology** - focuses on research in areas such as the reuse of spent fuels, accelerator-driven subcritical nuclear reactors, accelerator-driven systems, and the development of new generations of nuclear reactors.
- **Charles University** - its Faculty of Mathematics and Physics focuses on research related to particle and nuclear theory and experimental physics, neutrino physics, astroparticle physics and particle detectors.
- **Czech Technical University** - its Faculty of Nuclear Sciences and Physical Engineering operates two training reactors and a small tokamak, covering a wide range of nuclear research topics, including nuclear fuels, nuclear pharmaceuticals, nuclear waste, and space reactor technologies.
- **ELI ERIC's ELI Beamlines** is a world-leading research infrastructure operating an extensive array of state-of-the-art high-power, ultra-fast, and high-repetition-rate laser systems to drive pioneering research across various fields including the nuclear fusion energy sector.
- **Institute of Physics of Materials of the Czech Academy of Sciences** - is engaged in research on materials used in the energy sector, including the development of new high-temperature materials, materials for nuclear fusion reactors and additively manufactured materials.
- **Institute of Plasma Physics of the Czech Academy of Sciences** – is the main institution in Czechia dedicated to the research and application of plasma and thermonuclear fusion. It operated the COMPASS tokamak and is currently building the new COMPASS-U tokamak, which is planned to be operational in 2027.
- **Nuclear Physics Institute of the Czech Academy of Sciences** - conducts both experimental and theoretical nuclear physics research, including intermediate-energy physics and heavy-ion physics at the interface of nuclear and subnuclear physics.
- **Research Center Řež** - operates large nuclear research infrastructure including two research reactors, hot cells, and experimental loops, neutron generator for fusion research, covers a wide range of nuclear research topics, and specializes in advanced nuclear technologies and nuclear power engineering, including support for operating units and the preparation of new nuclear units. Another area of focus is nuclear medicine, specifically the development, production, and distribution of radiopharmaceuticals. Moreover, the Research Center Řež operates the Californium source, primarily for nuclear data validation.
- **ÚJV Řež** - provides a wide range of services, including design and engineering activities in the energy, industrial and healthcare sectors. Within nuclear R&D activities ÚJV Řež is primarily focused on LWR SMRs. ÚJV Řež also covers areas of GenIV reactors (e.g., GFR concepts), safety and reliability of nuclear installations, fuel cycles, and radioactive waste repositories and materials.
- **University of West Bohemia in Pilsen** - conducts research in nuclear power systems, safety, radiation protection, and power electronics. It also focuses on advanced nuclear materials, reactor physics, thermal-hydraulic analysis, and diagnostics of nuclear components, supporting nuclear technology and sustainability.

Nonetheless, the research scope is much broader, with other Czech universities also contributing to nuclear-related research, including Palacký University Olomouc, Silesian University in Opava, and Technical University of Liberec which participate in international projects such as CERN and FAIR.

Nuclear Associations

- **Czech Power Industry Alliance** - an alliance of companies specializing in the design, production, supply, and installation of projects related to the construction, operation, modernization, and decommissioning of energy facilities, including nuclear power plants.
- **Czech Nuclear Society** - a professional organization that connects the Czech nuclear community.

Czech Science Diplomacy

For more information related to international collaboration in research and higher education, please contact the Science Diplomacy Unit at the Ministry of Foreign Affairs of the Czech Republic at science@mzv.gov.cz.