Linking Nuclear Power and Environment

Safe, Secure, Sustainable Nuclear Power

IAEA

Access to affordable energy is essential for reaching any development goals. Producing this energy, while respecting the environment, is a global challenge. The IAEA helps Member States using or introducing nuclear power to do so not only safely, securely and economically, but also in an environmentally friendly manner.

Photo: IAEA

To meet the needs of a growing population and to raise the living standards of billions of people, a 75% expansion in global primary energy supply by 2050 will be required. Producing this energy safely and securely, at a reasonable cost, and while respecting the environment, is a goal for many countries.

Electricity generation produces about two fifths of the global energy-related CO_2 emissions. Nuclear power produces virtually no greenhouse gas emissions during electricity generation. It is also among the lowest in CO_2 emissions, along with hydro and wind power, throughout its life cycle.

Many countries are interested in introducing or expanding nuclear energy programmes because they consider nuclear power to be a clean and stable source of electricity that can contribute to mitigating climate change.

Good waste management begins before the waste is generated, by avoiding or minimizing waste generation at its source. Nuclear activities and operations must be planned in a way that eliminates the need for excessive remediation measures at the end of operations.

The IAEA assists Member States, whether or not they have an interest in nuclear power, in evaluating their energy supply and demand, so they can make their own informed decisions about future electricity supply. The IAEA's energy planning models are used by 125 countries and 13 international organizations.

Nuclear energy can deliver reliable low carbon electricity at stable prices for decades and can significantly enhance the energy security of countries. The IAEA's guidance, training, publications and other tools help Member States to increase their understanding of nuclear power's role in mitigating climate change and air pollution.

The IAEA helps Member States that opt for nuclear power to use it in a safe, secure and sustainable manner. It provides guidelines, standards and reviews for a systematic approach to nuclear power and helps Member States to build capacity to meet national needs.

The IAEA helps Member States to adopt appropriate practices to promote the safe management of radioactive waste and to resolve current or avoid future environmental liabilities. As a hub of international cooperation, the IAEA provides information and guidance on waste, decommissioning and remediation strategies and technologies.

The IAEA's activities and technical cooperation projects support Member States
in developing and using nuclear power
in a safe, secure and sustainable way.

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Strengthening Nuclear Safety and Security

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To protect people and the environment from the harmful effects of ionizing radiation, the IAEA develops and establishes nuclear safety standards and security guidance, and serves as the depository for several international conventions. It helps Member States to assess the effectiveness of nuclear regulators, the operational safety of nuclear power plants, emergency preparedness and response, and security infrastructure.

Photo: IAEA

Countries using or planning for nuclear energy need effective regulation of nuclear safety and security.

Strengthening nuclear safety involves an integrated approach to the development, promotion and application of safety assessments and evaluations at all stages of establishing and operating a nuclear power programme.

Investing in preparedness for a nuclear or radiological emergency significantly reduces the risk to people and the environment from such emergencies.

A robust nuclear security infrastructure should be considered at all stages of the life cycle of a nuclear power programme.

The IAEA provides regulatory review services aimed at developing, reinforcing and maintaining nuclear regulatory infrastructure in Member States. Mission experts assess existing national regulatory approaches against IAEA safety standards and security guidelines and global best practices.

Through its design, site, external events, and safety assessment review services, the IAEA helps Member States to build capacity in safety analysis of design, severe accident management and site safety against natural hazards.

The IAEA helps Member States to establish an effective emergency response capability and infrastructure through its safety standards and guidelines, training, and emergency preparedness and response review services.

The IAEA nuclear security peer reviews and advisory services assist Member States in establishing or strengthening effective and sustainable national nuclear security infrastructure based on international instruments and on IAEA guidance documents.

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Building Nuclear Infrastructure

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The IAEA's 2012 projections for nuclear power generating capacity show a steady rise in the number of nuclear power plants in the world by 2030. Many developing countries continue to show keen interest in introducing nuclear power. The IAEA helps Member States to understand the commitment needed to develop or expand a nuclear power programme and become knowledgeable customers.

Nuclear power growth is expected to continue in the coming decades. Many countries with existing programmes plan to expand them. Many other developed and developing countries plan to introduce nuclear power.

A nuclear power programme is a long-term commitment of at least 100 years, from planning, through construction, to operation, waste management and eventually decommissioning.

Recruiting a high-calibre nuclear workforce is a growing challenge, even for existing nuclear power programmes. Human resource and knowledge management is important in newcomers and in countries that already operate nuclear power plants.

Radioactive waste is an unavoidable by-product of the use of radioactive materials and nuclear technology. To ensure the safety of people and the environment, spent fuel and radioactive waste must be managed carefully and responsibly. The world has over half a century of experience in managing spent fuel and radioactive waste — the characteristics of the waste are well known, and it can be safely managed.

The IAEA supports Member States with new or expanding nuclear power programmes in national nuclear infrastructure development. The IAEA offers independent know-how on siting, construction, commissioning, start-up and operation of nuclear power reactors, including sustainable human resources and knowledge management.

Through its Milestones approach, the IAEA provides rational, structured guidance to Member States on introducing nuclear power. Member States can use the approach to mark progress during the planning stages and to demonstrate their commitment to nuclear safety, security and control of nuclear materials.

The IAEA helps Member States to face the challenge of developing and maintaining a competent nuclear workforce. It offers wide-ranging guidance and support services in capacity building, planning and knowledge management.

The IAEA promotes the safe management of spent fuel and radioactive waste generated by the use of nuclear technologies, including nuclear power. By developing standards and promoting safe and proven technologies in managing spent nuclear fuel and radioactive waste, the IAEA fosters the global nuclear safety regime.

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Boosting Innovative Technologies

Safe, Secure, Sustainable Nuclear Power

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For nuclear energy to play a substantial role in a sustainable global energy supply, both technical and institutional innovations are needed. Through various international cooperation activities, the IAEA promotes innovation that will lead to more efficient, more affordable and more sustainable advanced reactor technologies.

Nuclear energy can make a significant contribution to meeting the world's future energy needs. Both technical and institutional innovations are needed for nuclear energy to play a substantial role in a sustainable global energy supply.

Concerted and coordinated research and development is needed to drive innovation to ensure that nuclear energy can help meet energy needs sustainably in the 21st century.

Closed fuel cycle technology has the potential to produce energy from uranium 100 times more efficiently than with existing reactor designs. It can reduce the amount, toxicity, and heat of the radioactive waste and shorten its hazardous lifetime.

Small and medium sized reactors (SMRs) may provide an attractive and affordable option for many developing countries with small electrical grids, limited infrastructure and investment capability.

The IAEA's International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) helps nuclear technology holders and users to coordinate national and international studies, research and other activities to support innovations in nuclear reactor designs and fuel cycles.

INPRO's holistic approach provides a global view of nuclear energy systems. The INPRO methodology, INPRO collaborative projects, and the INPRO Dialogue Forum help Member States to understand the challenges, develop options and implement solutions in the areas of innovation and global nuclear energy sustainability.

The IAEA has been supporting fast reactor technology for more than 50 years. It is a forum for knowledge preservation, information exchange and coordinated research for ensuring continued progress in fast reactor technology.

The IAEA coordinates efforts to facilitate the development of various types of SMRs. It identifies key enabling technologies to achieve competitiveness, and addresses common infrastructure issues that could facilitate their deployment.