

Nuclear Power as a Reliable, Affordable and Sustainable Energy Source for All

Facts you may not know about nuclear power

- * Nuclear power is a reliable source of power that can play a role in energy supply diversification, as well as foster a more resilient power supply.
- * 1kg of uranium-235 will generate as much energy as 3000 tons of coal without CO₂ emissions.
- * The carbon-neutral baseload power from nuclear can complement intermittent renewable options to ensure a reliable low-carbon electricity supply.
- * Nuclear power remains amongst the most cost-effective ways to generate electricity and provides long-term certainty over electricity costs.
- * As a reliable, affordable and sustainable energy source nuclear power contributes to Sustainable Development Goal 7.

What is the IAEA Milestones Approach?

- * The Milestones Approach is a comprehensive framework developed by the International Atomic Energy Agency (IAEA) to support Member States in the consideration, preparation and construction of their first nuclear power plant (NPP), with the goal of helping countries understand the associated commitments and obligations of a nuclear power programme.
- * It provides a framework for the development of the infrastructure necessary for a nuclear power programme, which considers 19 specific infrastructure issues, three phases of development and three milestones. These infrastructure issues cover the areas of nuclear safety, security, safeguards, legal framework, human resources, funding and financing.
- * The IAEA offers its Integrated Nuclear Infrastructure Review (INIR) service to both embarking countries and those countries that are expanding an existing nuclear power programme to evaluate their progress based on the Milestones Approach.
- * The INIR review methodology describes, for each infrastructure issue, conditions that should be met to achieve the milestone in the specific phase before progressing to the next phase of development. Countries typically request INIR missions before they reach the end of a specific phase.

Introducing Nuclear Power



Country experiences

Nigeria

Nigeria first decided to introduce nuclear power in 2005 in an attempt to make up for a more than 20,000 megawatt per year deficit in electricity generation. Originally projected for 2025, Nigeria now estimates that it will be producing nuclear power by 2030. This delay has been primarily due to the underestimation of the amount of time it would take to train the large number of people needed to implement a nuclear power programme.

With the support of the IAEA and other international partners, human resource development challenges are being addressed through fellowships, expert missions, scientific visits, and education and training. Nigeria attained its first milestone in 2009 and the IAEA conducted an INIR phase 2 mission in 2015. The Nigerian government has approved the acquisition of an NPP from the Russian Federation.

Nigeria is party to all major international legal instruments governing the peaceful uses of nuclear energy, including the Convention on the Physical Protection of Nuclear Material (CPPNM) and its Amendment. Nigeria implements measures set out in IAEA security guidance and safety standards.

Bangladesh

Bangladesh has a consistent annual economic growth rate of 7% and the current power source is no longer sufficient to meet the growing electricity demand. Nuclear power will provide diversification and enhance energy security. Bangladesh concluded a bilateral agreement with Russia, in terms of which construction started on two reactors at Rooppur in 2017 and 2018 respectively. Bangladesh has entered the third phase of the development of its nuclear power programme. The construction is expected to be completed in 2024.

Bangladesh has faced similar challenges to other embarking countries such as the development of a skilled workforce to handle a project of this nature and ensuring regulatory compliance on the use of nuclear energy. Support to address these challenges is being provided by the IAEA, individual countries, such as Russia, India, the US, and Japan, and non-governmental organisations such as the VCDNP. The support includes personnel training and exchange of expertise and experience. The IAEA conducted an INIR phase 1 and 2 mission in 2011 and a follow-up mission in 2016.

Bangladesh is party to many major international legal instruments governing the peaceful uses of nuclear energy, including the CPPNM and its Amendment. Bangladesh implements measures set out in IAEA security guidance and safety standards.

 **United Arab Emirates (UAE)**

The UAE's efforts towards complete operational transparency and the highest standards of nuclear safety, security and non-proliferation in the development of its nuclear power programme have been hailed as the gold standard for countries interested in exploring nuclear energy for the first time.

In 2008 the UAE projected that demand for electricity will increase three-fold by 2020. Whilst the UAE is pursuing an aggressive solar energy strategy it remains heavily reliant on oil and natural gas. The UAE decided that nuclear power could make a significant baseload contribution to its economy and future energy security. A priority for the UAE was to identify a feasible schedule for construction. A consortium led by Korea Electric Power Co. won the bid in 2009 for the construction of four nuclear reactors based largely on their track record of meeting construction deadlines. In 2012 concrete was poured at the first reactor site and today there are four nuclear reactors all in advanced stages of construction. The UAE has made a substantial investment in human capacity and views "on the job training" as an essential, ongoing investment.

The UAE has worked closely with the IAEA and gathered extensive expertise from the international community. The IAEA conducted an INIR mission in 2011, and an INIR phase 3 mission in 2018. The UAE is party to all major international legal instruments governing the peaceful uses of nuclear energy, including the CPPNM and its Amendment. The UAE implements measures set out in IAEA security guidance and safety standards.

 **Pakistan**

Pakistan has a mature nuclear power programme, having begun construction of its first NPP in 1966. With five operational NPPs and two more under construction, Pakistan has safely and securely operated a nuclear power programme under IAEA safeguards for more than four decades.

The national legislative, regulatory and administrative frameworks of Pakistan are well-established. Elements of nuclear security include a robust command and control system led by the National Command Authority (headed by the Prime Minister), a rigorous regulatory regime, and international cooperation.

Pakistan's nuclear power programme benefited from a strong government commitment at the outset, which was essential for success, especially in terms of securing financing, providing sovereign guarantees, ensuring implementation of grid developments, amending legislation and providing mechanisms for compensation for nuclear damage. The total initial training for Pakistan's first NPP was 2,000 man-months. Building subsequent plants was easier as much of the experience and the skills were already in place. As its programme expands the IAEA is providing support for Pakistan to fully indigenise its nuclear power programme by integrating local domestic industry and developing further industrial support infrastructure.

Pakistan is party to many major international legal instruments governing the peaceful uses of nuclear energy, including the CPPNM and its Amendment. Pakistan implements measures set out in IAEA security guidance and safety standards.

For more information, see the VCDNP panel discussion report at: <https://vcdnp.org/wp-content/uploads/2019/04/Nuclear-Power.pdf>.

 **Key takeaways**

- * The highest standards of nuclear safety, security and safeguards have to be fully integrated into the planning for nuclear power and maintained throughout the life of a nuclear power programme.
- * Effective interface between safety, security and safeguards is essential for the sustainability of a nuclear power programme.
- * Embarking countries benefit from the support of the IAEA and the experiences of other countries.
- * It takes 10 to 15 years of preparation, on average, for a country to build its first nuclear power plant and a commitment of at least 100 years.
- * The Milestones Approach of the IAEA is a sound three-phase process for developing the necessary infrastructure for a nuclear power programme.
- * While the IAEA provides support and guidance to embarking countries, the development of the necessary nuclear infrastructure and the implementation of the project remain the responsibility of the country.
- * Strong national leadership and commitment must be present to ensure human resource development, funding and financing, stakeholder coordination, the development of legislation and the provision of sovereign guarantees.
- * The development of a skilled workforce to handle a project of this nature requires substantial investment in human capacity.
- * All major nuclear reactor vendors offer safe technology and their designs meet current safety requirements. Choice of a vendor is influenced by national priorities such as the financial and training packages provided.

 **For more information**

- * IAEA Milestones Approach: <https://www.iaea.org/sites/default/files/18/01/developing-the-national-nuclear-infrastructure-for-nuclear-power.pdf>.
- * IAEA Country Nuclear Power Profiles: <https://cnpp.iaea.org/pages/index.htm>.
- * World Nuclear Association: <http://www.world-nuclear.org/>.