

Nuclear Power



How Nuclear Power Helps Meet Global Energy Demand The Role of the IAEA

SUMMARY

1. The IAEA fosters international cooperation on global nuclear energy sustainability and innovation, and supports countries in their strategic nuclear energy planning.
2. The IAEA supports countries with operating nuclear power plants in enhancing performance and safe operation.
3. The IAEA assists Member States embarking on nuclear power programmes in planning and developing the required infrastructure.

INTRODUCTION

One of the compelling issues today is how the world can be provided with sustainable energy supply. Nuclear power can be part of the solution and the IAEA provides technical advice and assistance to help Member States plan their future energy mix. At the same time, countries with established nuclear power programmes seek support to share experiences, enhance safety, security, reliability and non-proliferation as well as achieve innovation.

The IAEA approaches this challenge from a multi-dimensional perspective. The services it offers range from energy planning, through infrastructure development, to facilitating collaboration in the development of innovative nuclear power systems.

As of the end of 2016, the 449 nuclear power reactors in operation in 30 countries had a global generating capacity of 392 GW(e). They provided 11 percent of the world's total electricity and over 30 percent of its low-carbon electricity. Of the 61 reactors



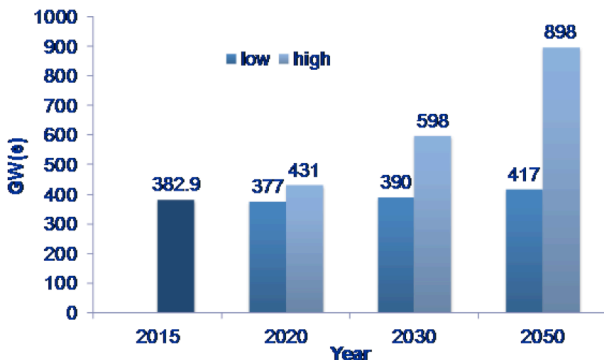
Construction works at the Barakah nuclear power plant, United Arab Emirates.

(Photo: Emirates Nuclear Energy Corporation)

under construction, 40 were in Asia, as were 47 of the 55 reactors connected to the grid since 2005. Furthermore, around 30 countries, many of which are in the developing world, are considering, planning or actively working to include nuclear power in their energy mix. The United Arab Emirates and Belarus are planning to start commercial operation of their first nuclear power plants (NPPs) in 2017 and 2019, respectively.

Nuclear power is expected to expand in nuclear newcomer countries in the coming years, while the overall pace of growth slows in the short run, primarily as a result of competition from low fossil fuel prices and renewable energy sources. According to the IAEA's 2016 projections, the global nuclear power capacity by 2030 will expand by between 1.9% in the low- and 56% in the high-case scenario. The actual new capacity added in this period will be much more than the net

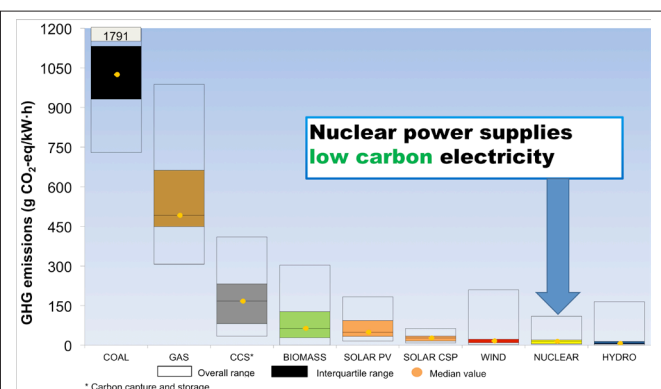
Projections for world nuclear capacity



(Source: Energy, Electricity and Nuclear Power Estimates for the Period up to 2050, IAEA Reference Data Series No. 1, 2016)

increase in global nuclear capacity, considering that many nuclear power reactors will be retired.

Achieving these capacities is challenging because existing plants need upgrades and life extensions to allow for continued operation. Furthermore, retiring reactors have to be replaced, and a wave of new builds is needed to support the growing energy demands of developing economies. Investments at this rate are not unprecedented, but will probably require governmental support, new contractual arrangements to reduce investor risks, and a price on carbon emissions that will improve the economics of low carbon alternatives such as nuclear power.



Hydropower, nuclear power and wind based electricity are the lowest CO₂ emitters, when emissions over the entire life cycle are considered.

(Source: IAEA)

WHAT CAN NUCLEAR POWER DELIVER?

Nuclear power can deliver a steady baseload supply of electricity needed to power a modern economy. It is generally competitive, offers a low cost, reliable long term source of electricity and has a good operational record. NPPs produce virtually no greenhouse gas emissions or air pollutants during their operation and have only very low emissions over their entire life cycle. As a result, the current use of nuclear power avoids the emission of nearly 2 billion tonnes of carbon dioxide every year — the equivalent of taking over 400 million cars off the road per year.

The **Paris Agreement** calls to limit the increase in global average temperature to well below 2°C from pre-industrial levels. Nuclear power has reduced the world’s carbon footprint and can help to mitigate climate change and contribute to the **United Nations Sustainable Development Goals**.

ENHANCING PERFORMANCE AND SAFE OPERATIONS

The 2011 Fukushima Daiichi accident in Japan led to a renewed global focus on safety. Nuclear safety is the responsibility of individual countries, but the IAEA brings its Member States together to agree on international safety standards and share practical experience. The safety record of NPPs has improved in many respects but being vigilant is critical when using nuclear technology.

The IAEA and other organizations are interested in continuously improving the performance, safety and security of NPPs throughout their life cycles. Thus the IAEA’s support complements the efforts of operators, regulators and industry organizations.

All Member States benefit from safe operation and secure nuclear installations, and most seek assistance from competent and independent outside sources. This is true for both countries with operating nuclear facilities as well as for those with nascent nuclear power programmes.

IAEA SUPPORT TO NEWCOMERS

A nuclear power programme is a demanding enterprise and a long term commitment. A country that wishes to introduce nuclear power into the national energy mix has to develop a sound infrastructure based on an international framework of safety, security and safeguards. The nuclear fuel cycle encompasses many facilities and activities, ranging from mining raw materials all the way to managing radioactive waste, for which global legal and regulatory policies and procedures need to be followed.

The IAEA provides assistance and information to countries that want to introduce nuclear power. It helps interested Member States to develop their energy planning capabilities and establish the necessary infrastructure for a safe, secure and sustainable nuclear power programme.



About 30 countries, mostly from the developing world, are interested in adding nuclear power to their energy mix.

(Photo: IAEA)

The IAEA's **Milestones** approach was developed to assist countries that are considering or planning their first NPP. The IAEA assists them through peer review and expert missions, training courses and modelling tools that systematically cover the 19 nuclear infrastructure issues of the Milestones approach. These issues are: national position, nuclear safety, management, funding and financing, legislative

framework, safeguards, regulatory framework, radiation protection, electrical grid, human resource development, stakeholder involvement, site and supporting facilities, environmental protection, emergency planning, security and physical protection, nuclear fuel cycle, radioactive waste management, industrial involvement and procurement.

The IAEA also makes available information to wider audiences involved in decision- and policy-making on energy, environmental and economic issues. It provides tools, models and publications to assist Member States with their energy planning.

CAPACITY BUILDING, REVIEWS AND OTHER SERVICES

The IAEA's guidance and assistance to countries starting nuclear power programmes complement, but are offered independently of, vendors of nuclear equipment and services, governments, consulting firms and other international organizations. The IAEA works to increase coordination among all parties to add efficiency without diminishing the advantages of variety.

The IAEA provides assistance, training and advice on best practices and strategies in knowledge management for a sustainable nuclear power programme. Peer reviews and expert missions help Member States share knowledge, experience and lessons learned. The IAEA's publicly accessible databases on nuclear facilities and operating experience provide authoritative information. Data on operational and outage records can be analysed by Member States, the IAEA and others, enabling potential improvements and the adoption of best practices.

The IAEA's assistance helps Member States undertake cost-effective replacements, improvements, upgrades, licence renewals and decommissioning. Courses offered by the IAEA range from those based on NPP simulators to courses on managing human resources, information security and nuclear knowledge.

The IAEA coordinates certain projects undertaken in Member States on areas such as testing and improving computer codes, validation techniques and benchmarking methods.

RECOMMENDATIONS FOR CONSIDERATION

1. Member States are encouraged to make use of the IAEA's planning and modelling tools to assess their future energy systems and electricity supply options.
2. Member States interested in introducing nuclear power are encouraged to assess the nuclear technologies available and the supporting infrastructure required.
3. Member States are encouraged to use nuclear power safely and securely and have all the necessary global legal and regulatory standards and procedures in place during the entire life cycle of a nuclear power plant and related activities.



Since 2010, more than 800 young nuclear professionals have graduated from IAEA's Nuclear Knowledge Management and Nuclear Energy Management Schools.

(Photo: IAEA)

REFERENCES

1. The IAEA Milestones approach: *Milestones in the Development of a National Infrastructure for Nuclear Power* (IAEA Nuclear Energy Series No. NG-G-3.1 (Rev. 1))
2. IAEA Nuclear Infrastructure Bibliography: <https://www.iaea.org/NuclearPower/Infrastructure/Bibliography/index.html>
3. IAEA Nuclear Energy Series: <https://www.iaea.org/OurWork/ST/NE/NESeries/ClickableMap/>
4. *Climate Change and Nuclear Power 2016*: <http://www-pub.iaea.org/books/iaeabooks/11090/climate-change-and-nuclear-power-2016>
5. *Nuclear Power and the Paris Agreement*: <https://www.iaea.org/sites/default/files/16/11/np-parisagreement.pdf>
6. *Nuclear Power and Sustainable Development*: <http://www-pub.iaea.org/books/IAEABooks/11084/Nuclear-Power-and-Sustainable-Development>

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