

# “LTO Is Not Only Significantly Cheaper Than Nuclear New Build Projects, But Is Actually the Cheapest Option for Power Generation Across the Board”

**Interview with Mikhail Chudakov** | Deputy Director General and Head of the Department of Nuclear Energy, International Atomic Energy Agency



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Mikhail Chudakov is the Deputy Director General and Head of the Department of Nuclear Energy since February 2015. Until his appointment at the Agency, Mr Chudakov served as the Director of the Moscow Centre of the World Association of Nuclear Operators (WANO) since February 2007.

Prior to this, from 1995, he held a number of senior managerial positions in Russia's Rosenergoatom nuclear utility, including being appointed the Deputy Director General of Rosenergoatom and Director of Bilibino Nuclear Power Plant in April 1999. From 1993 to 1995, Mr Chudakov served as Adviser at WANO in Moscow and in London. Between 1983 and 1993, he worked in a variety of roles at the Kalinin Nuclear Power Plant, including Senior Reactor Operator. Mr Chudakov holds a Ph.D. degree in nuclear engineering.

***In recent years nuclear power is being rediscovered in many countries as a suitable path for climate protection. At the same time some countries are phasing out nuclear power and a reasonable number of nuclear power plants is shut down for economic reasons. From your point of view, is nuclear power growing or decreasing worldwide?***

Nuclear power continues to expand. Climate change mitigation and energy supply security are among the key reasons why an increasing number of our Member States are exploring the option of adding this clean, reliable and sustainable source of power to their energy mix. Last year, Belarus and the United Arab Emirates connected their first power reactors to the grid, expanding the number of countries that use nuclear power to 32. While some western European countries are phasing out nuclear power and it faces challenges in North America, Asia has become the center of global nuclear power expansion. Currently, 52 power reactors comprising almost 56 GW(e) are under construction in 19 countries; two-thirds in Asia and four in so-called newcomer countries. Around 30 newcomers are actively embarking on or considering the introduction of nuclear power. Overall, nuclear power has shown a gradual growth trend since 2011, with 23.2 GW(e) of new capacity added by the connection of new units to the grid or upgrades to existing reactors. According to the IAEA's latest projections to 2050, nuclear power will continue to play a key role in the world's low carbon energy mix, with capacity increasing by more than 80 % to 715 GWe in our high case projection. Technological innovations on the horizon, such as small and medium sized or modular reactors (SMRs), may be game changers in terms of offering countries more affordable and flexible options.

***Nuclear power will continue to play a key role in the world's low carbon energy mix.***

***In some studies, e.g. by the OECD Nuclear Energy Agency, long-term operation of nuclear power plants is considered to be the most cost efficient option for decarbonization in electricity generation. What is the international experience with long-term operation and how can this be supported?***

An increasing number of Member States give high priority to the long-term operation (LTO) of their existing nuclear power plants (NPPs). For example, in the United States several NPPs received license extensions to operate between 60 and 80 years. A number of factors need to be considered when deciding about LTO and while some of them have to do with economics, all are grounded in the premise of maintaining plant safety and security. NPP Plant Life Management programmes have been successfully implemented in several countries, and considerable technical experience has been gained. The IAEA develops guidelines to improve Plant Life Management programmes for LTO and delivers related training, technical assistance, expert missions and nuclear safety peer reviews to Member States. Individual projects deal with different aspects of nuclear power Plant Life Management, with the aim of increasing the capabilities of interested Member States in implementing and maintaining sustainable nuclear power.

Climate change mitigation is urgent<sup>1</sup> and NPP LTO represents a cost-effective opportunity to maintain low carbon dispatchable capacity, thereby lowering the cost of the clean energy transition. As the International Energy Agency and the Nuclear Energy Agency said in their joint

<sup>1</sup>) IPCC, 2018: Global Warming of 1.5°C.

*This could have significant consequences for CO<sub>2</sub> emissions.*

report “Projected Costs of Generating Electricity, 2020 Edition”, NPP LTO is not only significantly cheaper than nuclear new build projects, but is actually the cheapest option for power generation across the board. LTO helps establish a bridge between operation of the current fleet and arrival of new types of reactors and contributes significantly and immediately to climate change mitigation. Indeed, Plant Life Management leading to LTO has already delivered significant benefits to efforts to reduce CO<sub>2</sub> emissions and air pollution while ensuring security of electricity supply. Without ongoing LTO, existing nuclear capacity will decline sharply before 2030, particularly in Europe and North America. This could have significant consequences for CO<sub>2</sub> emissions, air pollution and the security of electricity supply.

***On the flip side of the coin, does the IAEA support countries phasing out nuclear power e. g. with regard to the decommissioning of power plants?***

Yes. The IAEA supports countries on the implementation of all stages of the lifecycle of nuclear installations used for peaceful purposes, including facility decommissioning and associated spent fuel and waste management at the end of the lifecycle. Many of the 443 nuclear power reactors currently in operation will phase out of service over the next few decades, in addition to closures of some research reactors and nuclear fuel cycle facilities, leading to significant increases in the scale of decommissioning projects being undertaken around the world. The Agency is committed to supporting Member States in implementing these programmes, in addition to supporting emerging nuclear power programmes, i.e. to establish strategies for future decommissioning and to put in place the necessary legal and institutional arrangements to support future decommissioning.

We assist Member States in efforts to plan and implement decommissioning projects through a range of mechanisms, including development of *safety standards* and *Nuclear Energy Series* publications and other reports on technical and safety related aspects. We also organize meetings of experts, collaborative projects, scientific exchanges, training courses and workshops. We have a dedicated peer review service called ARTEMIS (Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation) that supports countries in strengthening their work in these areas; indeed, Germany hosted an ARTEMIS review in 2019. And all these Agency activities are supported by resources including an *eLearning platform* and the *International Decommissioning Network (IDN)*, which provides a forum for interaction among experts who can also share knowledge via a *wiki-based information resource*. The Agency promotes the adoption of *circular economy* principles for decommissioning and related waste management considerations.

Currently, we are carrying out a major initiative to catalogue and analyse the status of decommissioning programmes worldwide, including challenges being faced and experiences gained in addressing them. The Global Status of Decommissioning project report, expected to be published next year, will be an important resource

for those with policy responsibility for decommissioning programmes as well as for other stakeholders interested in the future management of liabilities from nuclear activities.

***For a substantial contribution of nuclear power to mitigate climate change, new-build of power plants is necessary, not least in emerging economies. How does the IAEA support countries that are starting the peaceful use of nuclear power?***

The IAEA offers comprehensive support to its Member States that are considering or embarking on new nuclear power programmes, including guidance, advice, training and peer review services. As I previously mentioned, around 30 countries currently belong to this group, two of which (Belarus and the UAE) recently achieved the major milestone of connecting their first power reactors to the grid after about a decade of working with the Agency in developing the necessary infrastructure for nuclear power. Two other newcomers, Bangladesh and Turkey, are currently building their first plants. When we talk about nuclear infrastructure, we mean things like establishing competent institutions, nuclear regulatory and legal framework or human resources development, which support a nuclear power programme throughout its life cycle. The adherence to international legal instruments, internationally accepted nuclear safety standards, security guidance and safeguards requirements is also essential. Based on the principles of these instruments, the development of a nuclear programme and the introduction of nuclear power remain national responsibilities.

Experience shows that the time from the initial consideration of the nuclear power option by a country to the operation of its first nuclear power plant based on evolutionary current designs is about 10 to 15 years. During this period the IAEA Milestones Approach provides countries with a sound and internationally accepted methodology for developing their nuclear power programme and create an enabling environment for the introduction of nuclear power, helping them to understand and prepare for the commitments and obligations associated

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with a safe, secure and sustainable civil nuclear programme. The IAEA also offers training and expert advice, as well as peer review services like the Integrated Nuclear Infrastructure Review (INIR) for each phase of the programme, which assesses the status of national infrastructure for the introduction of nuclear power; since INIR's introduction in 2009, 30 such reviews have been conducted in 21 Member States. The IAEA also offers peer reviews and advisory services in other critical areas like the Site and External Design Events (SEED) review in the field of site selection and external events, IRRS in the field of nuclear safety, IPPAS in the field of nuclear security, ISSAS in the field of safeguards, EPREV in the field of emergency preparedness and response and pre-OSART in the field of readiness for operation. Drawing on such reviews, the IAEA develops country-specific integrated work plans to assist newcomers in addressing gaps in their nuclear infrastructure and conducts follow-up reviews to track their progress. We also provide cross-the-board training for countries to make informed commitments about nuclear power and to build their capacities. Between 2016 and 2019, the IAEA

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provided direct support to 50 Member States on all these issues, training 1250 participants through courses, scientific visits, workshops and fellowships. 17 institutions in 12 Member States hosted these events.

***It has become increasingly difficult to finance new-build nuclear power plants in some areas despite the availability of enormous amounts of investment capital. Are there international best practice examples for supporting the financing of nuclear new build?***

Financial institutions consider nuclear projects challenging to finance because of the large outlay of capital required, relative long construction times and overall construction costs associated with some of the First Of A Kind projects. These uncertainties decrease with Nth Of A Kind projects.

Recent experience shows that construction costs can be effectively contained through multiunit construction programmes. These allow plant developers, vendors, work crews and regulators to gain experience over time. The continuous nuclear construction programme in China or Russia demonstrate how this experience helps deliver projects on budget and on time. South Korea, which leveraged standardized plant design to build out its fleet, is another example.

A key element in financing nuclear power is managing and sharing the risks associated with nuclear projects. Governments have a major role to play here. Historically, NPPs have relied more often on governmental financing than on corporate financing where the investment is financed from the company's balance sheet.

One case study in financing nuclear projects is the Finnish Mankala model, a form of corporate financing by several parties such as energy intensive industries, municipalities and energy wholesalers. It is not specific to nuclear, and it has been used also to finance capital-intensive energy projects.

Other mechanisms such as Power Purchase Agreements (PPA), or Contracts for Differences (CfD) are a key factor for fostering investments in nuclear projects by providing certainties on future revenues.

***In recent years the nexus between financial regulation and climate policy came into focus, using the former to foster the latter. From the IAEA perspective, how should nuclear power be treated in financial regulation with regard to climate change?***

Government policies to support low carbon electricity generation have materialized as direct subsidies, feed-in tariffs, quota obligations and energy tax exemptions. Carbon pricing is one of the measures widely used, and it can make all low carbon sources more competitive in the long term.

*Investments in low carbon technologies can be key to the success of the energy transition.*

nuclear power is recognized as a clean and sustainable technology, meeting Environmental, Social and Governance (ESG) criteria. It should therefore be eligible for "green" (or "sustainable") financing.

In the context of the post-COVID-19 recovery, investments in low carbon technologies can be key to the success of the energy transition and the economic recovery. In that

respect, investments in nuclear projects, including LTO of existing nuclear power plants, can be beneficial in several respects. LTO investments lead to the lowest electricity production costs according to the IEA and are critical to get the energy transition back on track.

***In the early years of nuclear power there was much hope for close international cooperation of the peaceful use of nuclear energy. Is more support and commitment desirable to proceed and extend this objective and what has to be done or is desirable?***

Enhanced international cooperation is essential for the full potential of nuclear energy to be realized. And that potential is truly impressive: nuclear power is a highly reliable source of 24/7, low carbon electricity that already provides 10 % of the world's electricity and can be quickly scaled up to meet growing energy needs and ensure energy security for decades to come. But getting to where we need to be means working together for our mutual benefit.

When we talk about comprehensive decarbonization, it must be acknowledged that this is a task requiring a truly global effort. Establishing a stable yet flexible low carbon energy supply is vital to achieving the Sustainable Development Goals, and there is a growing consensus that nuclear power must be a central component of these efforts.

To be sure, there has been, and continues to be, significant cooperation in nuclear power. From knowledge sharing to technical cooperation to financing mechanisms, nuclear power programmes thrive when the considerable wealth of global expertise in nuclear energy is effectively leveraged. We at the IAEA feel a sense of pride but also great responsibility in our role as the global forum for cooperation on the peaceful uses of nuclear energy. Our work takes on many

forms. The Agency plays a fundamental role in the application of nuclear safeguards worldwide. But we also develop the internationally accepted standards for nuclear safety and act as a catalyst for innovation in nuclear power through our support to Member States including technical guidance such as the Nuclear Energy Series publications that my Department of Nuclear Energy produces, as well as technical meetings, international conferences, trainings, peer review services and our many professional networks.

All this international support and cooperation is vital to the present and future of nuclear power. Indeed, if we are to achieve our climate and sustainable development goals, we would have an opportunity to further expand and build on these already robust collaborative efforts to facilitate the clean energy transition our world needs.

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*All this international support and cooperation is vital to the present and future of nuclear power.*

Interviewer



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