NEA
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Advanced Technology Answers to the Climate Challenge: The Vital Importance of Nuclear Science and Technology Education

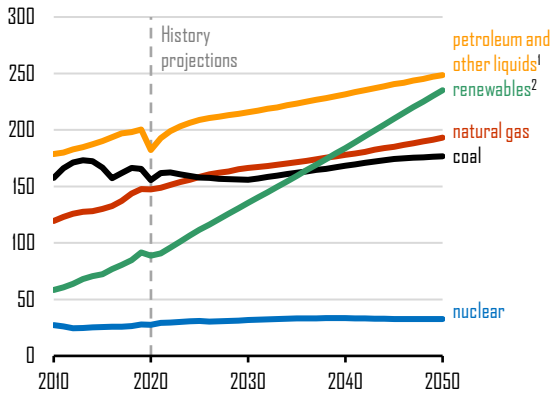
- As demand for energy continues to grow at a rapid pace worldwide and the climate crisis remains one of the main challenges today, nuclear energy plays a crucial role.
- Today's graduates in the nuclear science and technology fields are essential in paving the way for a reliable, affordable and clean energy future.
- The member countries of the NEA are important to ensure the talent pool necessary for the viability of the nuclear sector and to provide solutions to complex and emerging challenges.
- Governments have a decisive role in maintaining the pipeline of skilled and competent workers.

What's the issue?

Global demand for energy is increasing rapidly. The United States Energy Information Administration (EIA) in its *International Energy Outlook 2021* (IEO, 2021) projects that world energy consumption will grow nearly 50% by 2050.

Primary energy consumption by energy source, world

Quadrillion British thermal units



1. Includes biofuels; 2. Electricity generation from renewable sources is converted to Btu at a rate of 8 124 Btu/kWh

Source: US Energy Information Administration (2021).

Rising global energy demand and the need to drastically cut carbon dioxide (CO_2) emissions require a transformation in the way we produce, deliver and consume energy. Mitigating greenhouse gas emissions through low-carbon electricity sources could be one answer to the issue. As the single largest source of non-emitting electricity in OECD countries, nuclear energy will play a very important role in climate change mitigation.

Despite the considerable nuclear energy investments and expansion to meet increasing energy needs that may be seen in the next decades, there has not been a concurrent growth in the workforce needed to staff these new plants due to the declining number of recent nuclear graduates in many countries.

Building and operating nuclear facilities, their decommissioning and nuclear research and development, all require a skilled and knowledgeable workforce. Regardless of each country's national policies and nuclear development status, the distinctive characteristics of nuclear energy give rise to special requirements for education and training. Therefore, training graduates in this field takes substantially longer than other disciplines.

Why is this important?

Today's graduates in the nuclear science and technology fields will play a large role in decarbonising the electricity sector and paving the way for a clean energy future, thus contributing significantly to the fight against climate change.

Ensuring a continuous supply of qualified and competent personnel for the safe, responsible and sustainable use of nuclear technologies is a vital first step. Yet, many NEA member countries are reporting with concern that a growing proportion of high-level nuclear experts are retiring, while the number of recent graduates in the field capable of replacing them is decreasing.

How can the NEA help?

The NEA has been working with its member countries to address these challenges by fostering initiatives to invest in the education and capacity of future experts, and to retain knowledge while also stimulating technological innovation through knowledge transfer. Activities in these areas have thrived in recent years since the NEA launched two main initiatives.

The first, the Nuclear Education, Skills and Technology (NEST) Framework, was launched in February 2019 to help address important gaps in nuclear skills capacity building, knowledge transfer and technical innovation in an international context. Implemented through projects in specific topics relevant to the nuclear sector, it offers young nuclear professionals, NEST Fellows, a chance to develop skills and acquire practical experience under the supervision of mentors at leading organisations. It benefits NEA member countries by establishing links and networks between universities and industries, research organisations and regulators. These interrelationships, in turn, strengthen university education programmes. Academic institutions play an important role by nurturing the next generation of nuclear leaders and professionals, thus developing the talent pipeline necessary for the sustainability of the nuclear sector.

Nevertheless, the NEA has had little direct engagement with academic institutions that are responsible for developing the next generation of nuclear science and technology experts.

To address these gaps, the NEA established, in January 2021, the Global Forum on Nuclear Education, Science, Technology and Policy, an inclusive network of experts from academia who are well-suited through their expertise and knowledge to provide solutions to the complex and emerging issues and challenges that affect the nuclear energy sector – particularly with regard to human resources development.

Further reading

IAEA (2020), *Climate change and nuclear power 2020*, International Atomic Energy Agency, Vienna.

IAEA (2018), IAEA Scientific Forum, www.iaea.org/about/policy/gc/gc62/events/scientific-forum/programme.

NEA (2012), *Nuclear Education and Training: From Concern to Capability*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_14668.

NEA (2004), *Nuclear Competence Building*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_13864.

NEA (2000), *Nuclear Education and Training: Cause for Concern?*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_13390.

OECD (2012), *Energy*, OECD Green Growth Studies, OECD Publishing, Paris, https://doi.org/10.1787/9789264115118-en.

US Energy Information Administration (2021), *International Energy Outlook 2021*.

What should policy makers do?

The policy actions to be undertaken at the national level depend on the needs and requirements of different countries and stakeholders, based on the local context and national policies.

Factors to be considered at the national level include the level of development of the nuclear sector in the country (embarking, advanced or phasing out); the country's increasing or decreasing nuclear use; and the size of the country's nuclear energy capacity.

Bearing in mind the long lead times often required for nuclear education and training, the establishment and preservation of an adequate nuclear workforce supply calls for systematic planning decades in advance. Delays and changes in policies will have detrimental effects on sustaining an effective workforce in the sector.

Timely interventions by governments, industry, universities, and research and development organisations, remain vital for averting the risk of human resource shortages and by maintaining the stock of skilled and competent workers. They are also necessary to ensure a flow of new recruits sustainable over the longer term and capable, in particular, of offsetting impending retirements.

Governments have an important multifaceted role in the nuclear energy field, that of managing the existing nuclear enterprise, preserving nuclear power as a long-term option, sustaining international influence of nuclear safety and security, and enhancing technological competitiveness.

Governments should show a continuous and stable engagement in human resource development planning for the long-term timescales that transcend fluctuations in economic cycles. Government involvement should include regular, active monitoring of demand and supply capacity, as well as allocating the necessary funds to support education programmes that provide a means of developing and maintaining specialist expertise.

Moreover, efforts should be made towards outreach activities starting with secondary school students to ensure a diverse and inclusive intake of STEM and nuclear students at colleges and universities that in turn will provide the required workforce for all the nuclear fields.

Special attention should be directed to the needs of universities for access to relevant nuclear instrumentation and critical facilities – including research reactors – to perform research and enhance education programmes. Infrastructure support should be provided to maintain existing nuclear facilities, if these can be refurbished, or to replace them when they are obsolete.

A general tendency characterising the sector has been a significant and increasing internationalisation. Therefore, governments should strongly encourage and support international initiatives and programmes that foster a consistent quality of education and training being delivered across different countries to enhance human resource development capacities.

One of the biggest remaining challenges for the nuclear industry is the poor public perception of the sector. Governments should therefore ensure that a minimum general knowledge of nuclear energy is taught in schools in order to address common myths and concerns and thereby increase potential student interest.