

# Capacity Building and Nuclear Knowledge Maintenance for Sustainable Energy Development

## Objective

*To enhance the capacity of Member States to perform their own analyses of electricity and energy system development, energy investment planning and energy–environment policy formulation and their economic implications. To sustain and effectively manage nuclear knowledge and information resources for the peaceful uses of nuclear science and technology. To support Member States interested in including nuclear energy in their national energy mixes by providing nuclear information.*

## Energy Modelling, Databanks and Capacity Building

The Agency publishes annually two updated projections for the global growth in nuclear power: a low projection and a high projection. The 2012 updates for both the low and high projections show growth in nuclear power capacity, by 23% by 2030 in the low projection and by 100% by 2030 in the high projection. However, the growth rate is slower than what was projected in 2011, particularly in the low projection. Most new nuclear power reactors planned or under construction are in Asia, particularly in China and India. Additionally, the Republic of Korea and the Russian Federation plan significant expansion.

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The low and high projections are not intended to identify extremes, but to cover a plausible range. They are developed by an international group of experts assembled by the Agency and are based on a country by country assessment, bottom-up approach reflecting both announced plans by governments and electric utilities, and the judgement of the experts.

Demand for the Agency’s assistance in capacity building for energy system analysis and planning continued to increase. The Agency’s analytical tools for conducting national and regional studies on future energy strategies and the role of nuclear power are now used in more than 125 Member States. During 2012, over 650 energy analysts and planners from 69 countries were trained in the use of these tools. Conventional face to face training was complemented by web based e-learning courses, and the share of e-learning events has steadily increased. More than 200 people (over 30% of those trained in classrooms) were trained using e-learning (Fig. 1). The use of the Agency’s e-learning tools for energy planning also avoided an estimated 1000 tonnes of carbon dioxide (CO<sub>2</sub>) emissions due to the reduced need for air travel.

In Africa, a regional technical cooperation project on ‘Planning for Sustainable Energy Development’ provided comprehensive training to facilitate the preparation of subregional energy plans that are compatible with national development goals. Planning was extended beyond the modellers to government departments that are responsible for the implementation of energy plans. To address the lack of expertise in the region, the project gives priority to a train the trainers programme focusing on the Model for Energy Supply Strategy Alternatives and their General Environmental Impacts (MESSAGE) analytical tool.

In Latin America, the Agency contributed to the preparation of a comprehensive, region-wide analysis of energy demand under a technical cooperation project, which was concluded in 2012. At the national level, the Agency provided advice on energy planning and consumption through technical cooperation projects to Member States in the region. For example, the Agency worked with the Cuban national authorities through a technical cooperation project to assess the environmental impact of the atmospheric pollution generated by energy facilities, using nuclear measuring techniques and modelling/statistical tools, for supporting energy policy decisions. This assessment will be completed in 2013.<sup>1</sup>

<sup>1</sup> A web link was created for information purposes: <http://cub7007.cubaenergia.cu>.

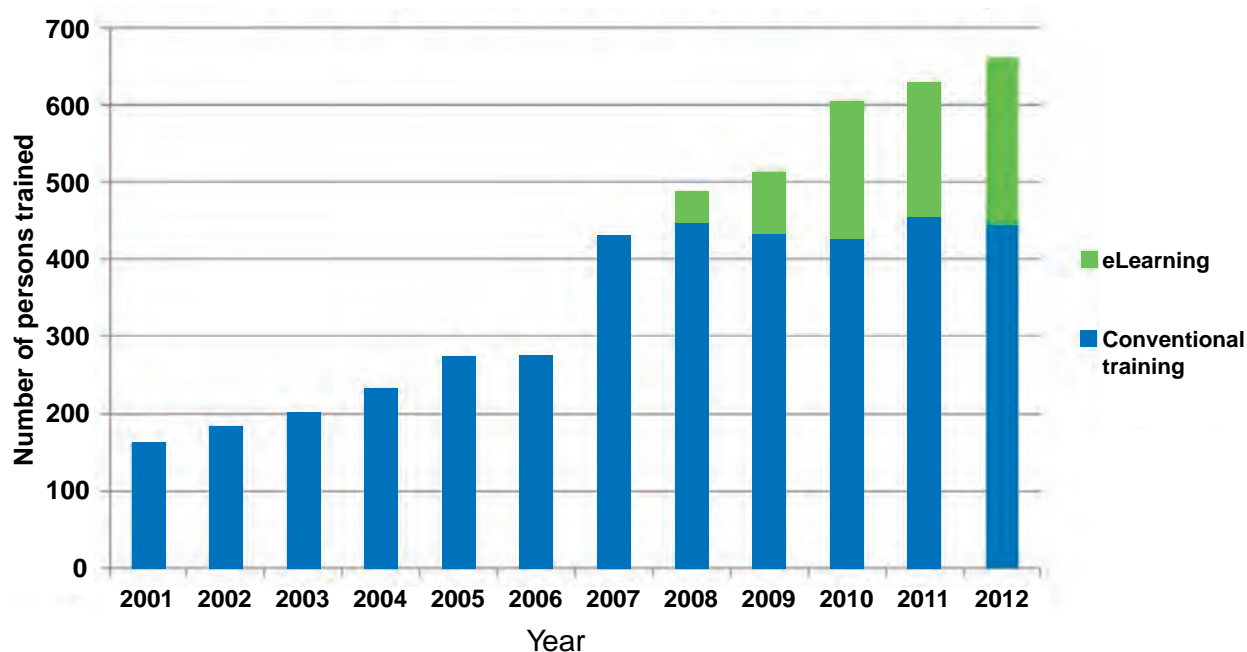


FIG. 1. Growing demand for capacity building in energy system analysis and planning, and increased use of e-learning.

### Energy–Economy–Environment (3E) Analysis

In preparation for the United Nations Conference on Sustainable Development (Rio+20), held in Rio de Janeiro, Brazil, in June, the Agency published *Energy for Development: Resources, Technologies, Environment*. The publication emphasizes the importance of providing modern, safe and efficient energy services for poverty alleviation, sustainable development, climate change mitigation and energy security. The Agency also published a brochure, *Nuclear Technology for a Sustainable Future*, for Rio+20, which describes the reasons for the continuing interest in nuclear power, including increasing global demands for energy, concerns about climate change, volatile fossil fuel prices and security of energy supply. The Agency also organized three side events as well as a learning event on energy planning. An information centre was maintained that presented the Agency's work to government and non-government delegates.

For the 18th Session of the Conference of the Parties (COP-18) to the United Nations Framework Convention on Climate Change, held in Doha, Qatar, in November and December, the Agency published *Climate Change and Nuclear Power 2012*, which emphasizes the importance of nuclear power, in conjunction with hydropower and other renewables, in reducing CO<sub>2</sub> emissions in the electricity sector and summarizes the latest relevant data and information. The main conclusion is that it will be difficult for the world to achieve the twin

goals of ensuring sustainable energy supplies and curbing greenhouse gases without nuclear power. The Agency contributed to the work of the UN High-Level Committee on Programmes Working Group on Climate Change and reported about its work on climate change mitigation and capacity building for energy planning at two UN system side events at COP-18 in Doha. The Agency also maintained an information centre at COP-18 that provided information on the linkages between climate change and nuclear power. Nuclear power continues to be of major interest to delegations from developing countries as they assess their climate change mitigation options.

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The Agency initiated a CRP on financing nuclear investments and began preparation of a publication on managing the financial risks associated with new nuclear plant construction. The objective of both projects is to clarify for those considering new nuclear plants the key concepts of financial risk, the current relationship between financial risk

and financing costs, and potential approaches to minimizing such costs.

The Agency also began a CRP on the impacts of climate change and extreme weather events on nuclear energy installations and the energy sector at large. The CRP will use as source material papers prepared for a special issue of the journal *Climatic Change* about the different ways in which climate change is expected to affect different energy technologies and about possible adaptation options. It will cover impacts due both to gradual changes in climate attributes such as temperature, precipitation, windiness and cloudiness, and to changes in the frequency and intensity of extreme weather events.

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## Nuclear Knowledge Management

Through its technical cooperation programme, the Agency conducted a number of knowledge management assist visits and informational seminars in 2012. In Belarus, the Agency helped develop and install a computer based training system and an education laboratory for physics studies in nuclear power plants. In Estonia, it helped review that country's new programme to educate specialists in nuclear energy and nuclear safety. In Nigeria, it reviewed nuclear education curriculums against international standards and provided advice about the first postgraduate programme in nuclear science and nuclear engineering. In the United Republic of Tanzania, it helped conduct a needs assessment for a national institute of nuclear science and technology. An assistance visit to the Federal Authority for Nuclear Regulation (FANR) in the United Arab Emirates (UAE) analysed the nuclear knowledge management system FANR had developed to capture and localize relevant knowledge and helped identify key achievements as well as gaps. And in Ukraine, the Agency helped install a computer based simulator complex for nuclear engineering education.

The Agency published *Knowledge Management for Nuclear Research and Development Organizations* (IAEA-

TECDOC-1675), which highlights techniques for transferring and preserving knowledge, exchanging information, establishing and supporting cooperative networks, and training the next generation of nuclear experts. It also describes basic concepts, trends and key drivers for nuclear knowledge management relevant to nuclear R&D organizations.

To support sustainable and high quality nuclear education, the Agency continued to facilitate three important regional educational networks, the Asian Network for Education in Nuclear Technology, the AFRA Network for Education in Nuclear Science and Technology, and the Latin American Network for Education in Nuclear Technology. It also completed *Nuclear Engineering Education: A Competence-based Approach in Curricula Development*.

A central element of the Agency's support for the three regional networks is a 'Cyber Learning Platform for Nuclear Education and Training' (CLP4NET). CLP4NET helps Member States to ensure high standards for nuclear education and training and to establish a framework for e-learning. In addition to the existing installations at the Agency, in the Republic of Korea and the UAE, pilot versions of CLP4NET were installed in 2012 in Argentina and Ghana.

Nuclear Energy Management Schools were held at the Abdus Salam ICTP in Trieste, Italy, and in Japan and the UAE (Figs 2 and 3). Intended for young professionals from the nuclear sector, the schools covered the world energy balance, nuclear power and nuclear power economics, materials and research reactors, climate change, Agency activities in nuclear power, the nuclear fuel cycle and waste management, nuclear safety and security, nuclear law, nuclear safeguards, nuclear leadership and management, human resource development and nuclear knowledge management.



FIG. 2. The 2012 Nuclear Energy Management School in Japan.



FIG. 3. Visit to the full scope simulator at the Krško nuclear power plant in Slovenia by participants of the Nuclear Energy Management School at the Abdus Salam ICTP in Trieste.

Nuclear Knowledge Management Schools were conducted in Italy, the Russian Federation and Ukraine. Each provided a forum to share experience and best practices in addition to specialized training on implementing knowledge management programmes in nuclear organizations and on knowledge loss risk management to support innovative developments in the nuclear industry.

In cooperation with the Karlsruhe Institute of Technology in Germany, the Agency trained 14 university teachers from 13 Member States on implementing standardized curriculums for nuclear knowledge management in their universities. The training is part of the Agency's multi-year initiative in cooperation with universities in Member States to address future workforce demands by providing appropriate nuclear curriculums and fostering improvements in nuclear education.

### Collecting and Disseminating Nuclear Information

The Agency's International Nuclear Information System (INIS) is operated with the collaboration of 128 States and 24 international organizations. It comprises almost 3.5 million bibliographic records and more than 314 000 full-text non-conventional publications, making it the Agency's largest document database. It is fully indexed and

searchable on the Internet using the INIS Collection Search (ICS), a Google based web application developed originally by the Agency in 2011. A new version of ICS that integrates the various INIS databases was implemented in 2012. Users are now able to use ICS in one of eight languages: Arabic, Chinese, English, French, German, Japanese, Russian and Spanish. Using advanced search, users can also obtain the results from other languages, irrespective of the language used to perform the search. Over 90 000 bibliographic records from the IAEA Library catalogue were incorporated into the INIS collection in 2012, making the ICS a single access point for both the IAEA Library catalogue and the INIS collection.

In 2012, an average of 47 000 INIS searches and 2700 downloads were performed each month. Assistance and on the job training were provided to a number of national INIS centres, improving all aspects of their INIS operational capabilities. The INIS/ETDE Thesaurus is available cost free through the INIS web site ([www.iaea.org/inis](http://www.iaea.org/inis)) in eight languages — Arabic, Chinese, English, French, German, Japanese, Russian and Spanish.

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The IAEA Library has continued to ensure that information resources and services are timely, cost effective and easily accessible. The number of electronic journals available through the Library increased from 7724 in 2011 to over 16 000 in 2012. Visitors to the Library grew to 15 540, and loans rose from 20 000 to 25 241. Responding to customer demands for tailored packaging of products and services, personalized user profiles increased from 511 to 1018, and 58 987 information packages were delivered in 2012 compared with 41 379 in 2011. Fulfilling the Agency's mandate of fostering information exchange, membership in the International Nuclear Library Network, coordinated by the Agency, grew from 35 partners in 2011 to 42 in 2012.