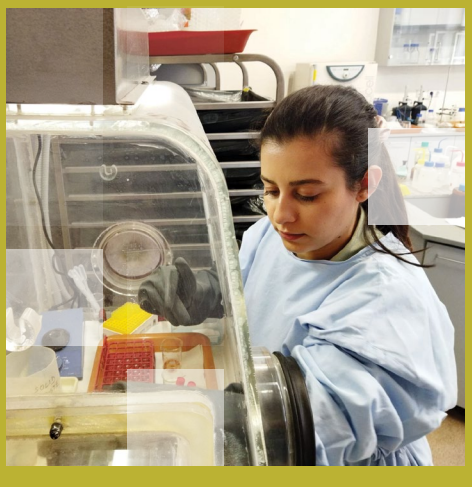
2023

IAEA Technical Cooperation Programme



The IAEA Technical Cooperation Programme

# Selected Highlights

2023

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SUSTAINABLE DEVELOPMENT GOALS

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SUSTAINABLE DEVELOPMENT GOALS

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**www.iaea.org/technicalcooperation**

# Foreword

The IAEA technical cooperation programme is the IAEA's major vehicle for delivering support to Member States for the peaceful application of nuclear science and technology. The programme is designed together with Member States to meet national, regional and interregional development priorities, and contributes to the attainment of the Sustainable Development Goals.

The technical cooperation programme is active in 150 countries and territories, including 35 least developed countries, and provides support in a wide range of areas that address crucial development issues, including: energy; health and nutrition, especially radiation medicine against cancer; food and agriculture; water and the environment; industrial applications; nuclear knowledge development and management; and safety and security.

In 2023, payments to the Technical Cooperation Fund totalled €91.3 million, with a 97.5% rate of attainment on payments and an overall implementation rate of 85.5%. Nearly 4,000 participants were trained in approximately 200 regional and interregional training courses in 2023 on a variety of key topics.

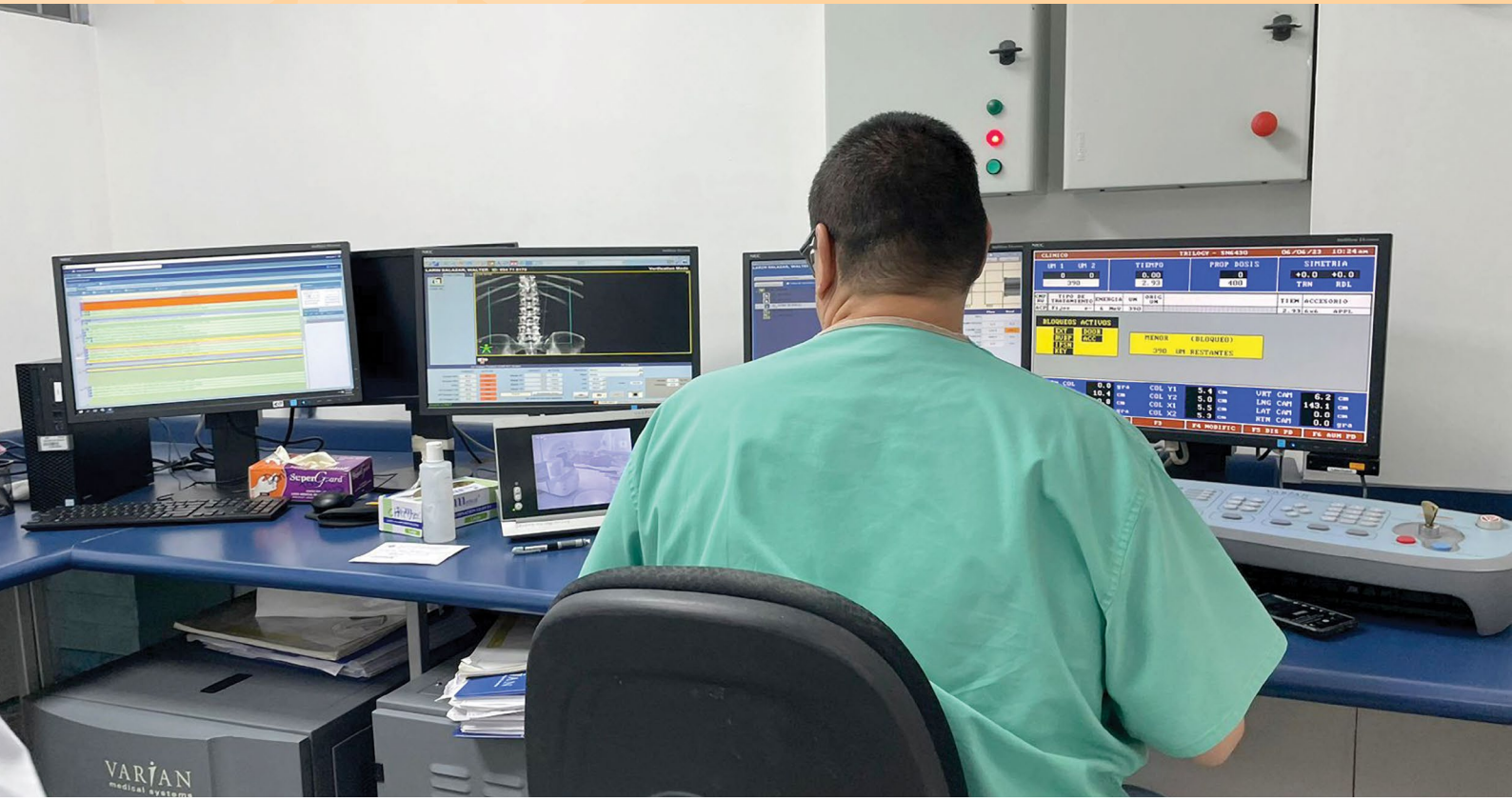
The programme contributes to the delivery of important IAEA initiatives such as ZODIAC, designed to help countries build capacity to detect and control zoonotic outbreaks, Rays of Hope, focused on assisting countries to improve their cancer care capacities, NUTEC Plastics, which supports efforts to address plastic pollution through recycling and marine monitoring, and Atoms4Food, aimed at preventing hunger. Support is also offered to countries interested in small modular reactors — a potential flexible and low-carbon energy source. Regional and interregional projects are used to address common challenges across national boundaries, including the needs of least developed countries and small island developing States.

The technical cooperation programme supports countries through targeted capacity building that includes short and long term training, as well as the provision of expert advice, procurement of equipment and support for the establishment of networks and partnerships.

This brochure showcases a selection of 2023 technical cooperation success stories across Africa, Asia and the Pacific, Europe and Central Asia, and Latin America and Caribbean. I hope this will help readers better understand the technical cooperation programme and the ways in which the programme supports the sustainable development of Member States.

**HUA LIU**

IAEA Deputy Director General and
Head of the Department of Technical Cooperation




The imPACT Review included several visits to cancer care facilities, including the radiotherapy service at the Salvadoran Institute of Social Security. (Photo: G. Saporiti/IAEA)

# El Salvador continues to improve cancer control planning, resources and access

Omar Yusuf, IAEA Department of Technical Cooperation
Ellen Swabey-Van de Borne, IAEA Department of Technical Cooperation
Giovanni Saporiti, IAEA Department of Technical Cooperation

El Salvador has made significant progress in terms of implementing its National Cancer Control Plan, concluded a team of international experts during a recent integrated mission of the Programme of Action for Cancer Therapy (imPACT) Review mission to the country. To continue leveraging earlier achievements, such as the new national law for the prevention, control and care of patients with cancer, however, more work is needed to streamline data collection, harmonize the delivery of diagnostic and therapeutic services across institutions, and estimate costs reliably.

The imPACT Review — carried out from February to June 2023 on request of the Salvadoran Ministry of Health — included a week-long field programme and resulted in a comprehensive set of tailor-made recommendations based on existing cancer control efforts in the country and in line with international quality and safety standards.

Among its population of 6.5 million, El Salvador reports over 9,600 new cancer cases annually, primarily of the prostate and breast. The country's public health system provides full coverage of its services to such patients, who

are typically referred to one of three national hospitals — Benjamin Bloom, Nacional de la Mujer and Rosales.

“The IAEA’s technical cooperation programme with El Salvador has been instrumental to supporting the strengthening of cancer prevention and control initiated by the Government after the imPACT Review in 2015. Therefore, we gladly welcome this important tool, which gives us the opportunity to evaluate the progress made periodically and to develop new strategies that have been adapted to the capacities and needs of the country,” said Adriana Mira, Vice Minister of Foreign Affairs of El Salvador.

The Ministry of Health facilitated visits to 18 hospitals and health clinics by the international imPACT team — comprising 11 cancer professionals appointed by the IAEA, the World Health Organization’s Pan American Health Organization (WHO-PAHO) and the International Agency for Research on Cancer (IARC). These visits included a field trip to the regional hospital of Santa Ana and meetings with more than 100 national health professionals as part of the imPACT Review.

Coupled with the data on the cancer control situation that was collected and analysed in the country between February and May 2023, the findings of these visits led to a full set of recommendations for inclusion in the imPACT report to be shared with the El Salvador Government.

A key recommendation highlighted the need to synergize diagnostic and therapeutic services provided by separate institutions, to foster a more comprehensive, holistic approach to cancer care. The report also recommends standardizing cancer-specific monitoring and evaluation capacities to support the substantial efforts currently underway to create a national Health Information System. This system would enable the government to rely on evidence-based planning and to develop a cost structure of procedures and benefits related to cancer screening, diagnosis and treatment for inclusion in the National Cancer Control Plan.

As part of the review process, key findings were highlighted and presented to representatives of the Ministry of Health.

During the in-country mission, two workshops were organized by the Ministry of Health with the support of the PAHO/WHO country office, the Salvadoran Agency for International Cooperation and the imPACT team, to discuss the mission’s findings with national cancer stakeholders and counterparts and validate the preliminary imPACT recommendations. (Photo: Ministry of Health of El Salvador)

“There are not only challenges but also opportunities, emerging from this imPACT Review,” said Giovanni Escalante, WHO-PAHO Representative to El Salvador. “We will support the joint actions with the Ministry of Health in order to reinforce the design and implementation of a National Cancer Control Plan, including the follow-up of strategic lines derived from the imPACT evaluation.”

## A history of cooperation between Salvadoran and IAEA experts

With the support delivered through the technical cooperation programme and two prior imPACT Reviews — in 2010 and in 2015 — cancer experts and health policy makers in El Salvador have made large strides in the development of cancer control infrastructure, the training of qualified personnel and the implementation of effective policies.

Summarizing the achievements realized since the 2015 imPACT Review, Karla de Palma, General Director of the Salvadoran Agency for International Cooperation, pointed to the “recently installed gamma camera at the Rosales Hospital, the enrolment of a cadre of Salvadoran professionals in nuclear medicine and medical physics master’s programmes, as well as the medical staff and nurses of the Rosales Hospital and the National Radiotherapy Centre that contribute to the improvement of nuclear medicine and radiotherapy services.”

This is the third imPACT review mission conducted in El Salvador. Following the recommendations of the previous one in 2015, the Salvadoran government adopted a national law for the prevention, control and care of patients with cancer, launched the construction of a national radiotherapy centre and developed new cancer screening and early detection schemes.

“El Salvador has made important steps towards promoting a system of care that maintains quality standards and is accessible to all,” said Carlos Gabriel Alvarenga Cardoza, Vice Minister of Health Management and Development. “We know that there is still a long way to go, but this review, carried out together with the three agencies, allows us to chart the course and direct the important investments that the government is preparing to further strengthen the health system and more specifically for cancer prevention and control.”


The National Centre for Radiotherapy in San Salvador is just one cancer care institution that has benefitted from support from the IAEA’s technical cooperation programme. (Photo: O. Alonso/IAEA)


Representatives from Senegal participate in an IAEA meeting on bankable documents. (Photo: J. O'Brien/IAEA)

# IAEA supports African countries to develop radiotherapy facilities

Melissa Evans, IAEA Department of Technical Cooperation

Representatives from eight African countries have made important strides in preparing bankable documents that will contribute to helping them secure funding to enhance cancer treatment by establishing or expanding radiotherapy services. The IAEA supported Burundi, the Central African Republic, the Democratic Republic of Congo, Kenya, Rwanda, Senegal, Sudan and Uganda in preparing these bankable documents — a combination of techno-economic feasibility studies and strategic funding proposals for potential donors. Once drafted by national authorities, bankable documents can be submitted to interested donors, including multilateral development banks, to raise the necessary resources to fund infrastructure, capacity building and equipment related to cancer care.

A series of IAEA meetings, held in late 2022 and early 2023, facilitated the development of these documents by providing national experts with technical assessments and advice in relevant areas under the IAEA mandate. These areas include radiation oncology, medical physics, radiation safety and radiation protection related to medical exposure.

"It is our top priority to support the countries participating in these meetings to establish, consolidate and expand radiotherapy facilities. Our experience is that bankable documents play an indispensable role when approaching donors or development banks," said Shaukat Abdulrazak, Director of the Division for Africa in the IAEA Department of Technical Cooperation.

Many countries in Africa have requested support under the IAEA's Rays of Hope initiative in increasing their populations' access to radiotherapy. Preparing for all of the components associated with new radiotherapy facilities is a complex process that encompasses many financial and technical considerations. IAEA staff were joined by official country representatives from the areas of health, finance, public works, medical physics and radiation safety.

"The meeting provided a unique opportunity, bringing key stakeholders together right from the start to ensure alignment," said Mary Nyangasi, Head of the National Cancer Control Programme in the Kenyan Ministry of Health. "We were able to make use of a wealth of resources available through the IAEA and learnt how we can harness them throughout the life cycle of a radiotherapy project."

During the most recent series of meetings, each country team gathered the necessary information to draft their bankable document in advance and presented their suggested cancer control programmes during the meeting to receive feedback on potential challenges and learn from each other's experiences. The integrated mission of the Programme of Action for Cancer Therapy Review missions conducted by the IAEA to assess a country's cancer control situation can feed into this process and provide valuable insight into the current status of cancer control.

"Cancer is becoming a serious burden among the Burundian population," said Alexandre Niyonkuru, a Nuclear Medicine Physician at the University Teaching Hospital of Kamenge. "Following the meeting, the Burundian team continued to work with IAEA experts to finalize the bankable document. Burundi has already identified the site where the radiotherapy facility will be established, and activities related to that project are underway at the Ministry of Health. We do hope that the project will be a success for the benefit of Burundians suffering from cancer diseases and also for people in neighbouring countries."

*"Burundi has already identified the site where the radiotherapy facility will be established, and activities related to that project are underway at the Ministry of Health. We do hope that the project will be a success for the benefit of Burundians suffering from cancer."*

Alexandre Niyonkuru
Nuclear Medicine Physician, Burundi

The IAEA has helped more than 20 countries to gather the necessary information to draft bankable documents, which has resulted in the development of several funding proposals that have been accepted by development banks, and ultimately the establishment of life-saving radiotherapy services.

During the in-country mission, experts from the IAEA, WHO and IARC reviewed plans for the new cancer care centre to be built by the end of 2024. (Photo: I. Veljkovikj/IAEA)

# Prioritizing childhood and cervical cancer in Papua New Guinea

Marianna Nobile, IAEA Department of Technical Cooperation
Ellen Swabey-Van de Borne, IAEA Department of Technical Cooperation

Papua New Guinea has taken important steps to increase access to cancer services since the IAEA carried out its first integrated mission of the Programme of Action for Cancer Therapy (imPACT) Review in 2013 together with the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC).

In response to the mission's assessment and recommendations for cancer control measures, Papua New Guinea is building a new radiotherapy centre due for completion by the end of 2024. Further areas for attention include prevention and early detection efforts (in particular for cervical cancer) as well as the enhancement of the national cancer registration and surveillance system, according to the findings of a team of international experts invited to assess the cancer control situation in the country.

The most prevalent forms of cancer in Papua New Guinea are currently breast and cervical cancer, followed by oral, liver and prostate cancer. Total cancer cases are expected to increase by 79 per cent by 2040, with mortality expected to increase by 86 per cent. Given the scale of the problem, Papua New Guinea's Ministry of Health requested a second imPACT Review to assess cancer needs and provide tailored, evidence based recommendations. The Ministry of Health also indicated Papua New Guinea's interest in participating in the IAEA's Rays of Hope initiative, which aims to increase access to radiation medicine.

"Our government is proactively addressing cancer as a priority health issue," said Minister of Health Lino Tom. "Cancer is prioritized under the current National Health Plan (2021–2030),

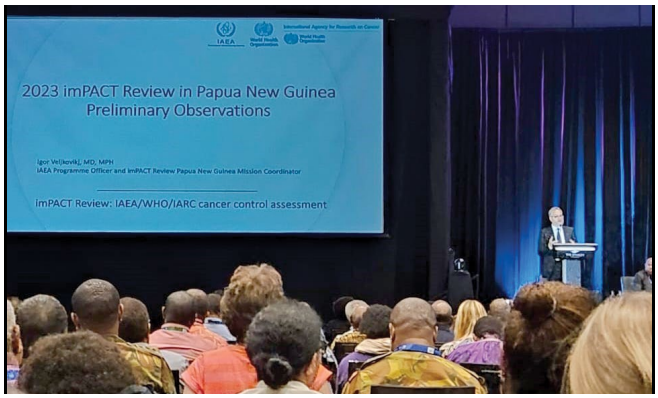
and our goal is to reduce incidence and achieve quality and affordable health care for all by 2030. To do this, we look forward to collaborating with partners such as the IAEA, WHO and IARC to strengthen our health service delivery, focusing on prevention and early detection through the support from global cancer programmes such as the Cervical Cancer Elimination Initiative," he added.

The new imPACT Review mission, carried out from 5–12 September 2023, was conducted by a team of 13 international experts nominated by the IAEA, WHO and IARC.

Over the course of the visit, the team members held meetings with a wide range of national and international cancer stakeholders, including the National Department of Health, provincial health authorities, the national regulatory body responsible for radiation safety, local United Nations agencies, development partners and civil society organizations. They also visited different public and private hospitals and primary healthcare centres and attended the 57th Annual Medical Symposium of the Medical Society of Papua New Guinea, where they led four sessions on cervical and childhood cancer planning, cancer registration and key findings from the imPACT Review Mission.

One such finding highlighted the need to integrate childhood cancer care more fully into the new national plan for cancer control.

Experts from the imPACT Review Mission met with a range of stakeholders and visited different public and private hospitals and primary healthcare centres. (Photo: I. Veljkovikj/IAEA)




Whilst in the country, experts from the IAEA, WHO and IARC attended the 57th Annual Medical Symposium of the Medical Society of Papua New Guinea to present preliminary recommendations from the imPACT Review mission. (Photo: I. Veljkovikj/IAEA)

"Considering its favourable prognosis and potential of life years saved, childhood cancer should be prioritized in national cancer control plans. Focusing on early detection and referral, as well as building capacity at referral centres, can result in more children being diagnosed and cured of their cancer," said Jeremy Slone, paediatric oncologist from St. Jude Children's Research Hospital who was a member of the imPACT Review.

Another recommendation focused on the need for reliable data to support informed decision-making and resource allocation. "A comprehensive cancer registration and surveillance system is essential to evaluate the success of different cancer control strategies," confirmed Les Mery from IARC.

"This review is very timely, as we expect its findings to inform the development of Papua New Guinea's new cancer control programme," said Javier Romero, IAEA Programme Management Officer for the country. "We also look forward to seeing some of our recommendations implemented under the next cycle of projects that are supported by the IAEA," he added.

The IAEA has been providing Papua New Guinea with assistance in the field of radiation medicine through the IAEA technical cooperation programme since 2012, including through the earlier 2013 imPACT Review.

By applying improved nutrient, water and soil management practices, farmers in several African countries were able to double and even triple the yields of cassava, Africa's most produced cash crop and an important part of local cuisines. (Photo: M. Zaman/IAEA)

# Africa's major crop: How climate-smart agriculture is enabling farmers to reap record high cassava yields using nuclear science and technology

Artem Vlasov, IAEA Office of Public Information and Communication

One of the most important food security crops in Africa is cassava — a root vegetable eaten by around half a billion people every day. Africa produces nearly 200 million tonnes of cassava every year, around 60 per cent of the world's total production. However, due to climate change, water scarcity and declining soil fertility, cassava yields are being adversely affected across the continent, causing many people to face food shortages and malnutrition. Experts from the IAEA and the Food and Agriculture Organization of the United Nations (FAO) are working to help African farmers mitigate these effects of climate change by sharing sustainable and efficient nutrient, water and soil management practices.

"Thanks to the knowledge we have gained here about climate-smart agricultural practices, we are now more informed and better equipped about cassava production and hope to use this knowledge to improve our yields," said Misses Unu, a farmer from Nigeria, as he sat on the field after the harvest, looking at the piles of large cassava roots. He and many other local farmers in over a dozen African countries participated in field demonstration trials run by the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture. These trials were aimed at training farmers to grow more and better quality cassava using nuclear and related climate-smart agricultural techniques. The trials were

conducted from 2021 to 2023 and continue to take place in a number of countries.

Cassava is a starchy root vegetable that looks like a sweet potato. It is the third most important source of calories in the tropics after rice and maize. First brought to Africa by Portuguese merchants from Brazil in the 16th century, over the years it has become the continent's most produced cash crop, deeply embedded in local cuisines. Literally, every part of this crop can be used. While the leaves are rich in protein, the root can be boiled, steamed, fried and cut into chips or turned into starch, flour or animal feed. Cassava is also relatively easy to grow as it adapts well to harsh environmental conditions, including high temperatures and drought. Due to its hardiness, farmers often think there is no need to apply nutrients and water to grow cassava, but after a few years, this leads to nutrient mining and low crop productivity.

## Nuclear science gives clues to best farming practices

To enhance food security and increase the incomes of cassava farmers, the IAEA launched a technical cooperation project in 2020 in collaboration with local research institutes and farmer associations in Africa. Farmers in several African countries were able to double and even triple their cassava yields by applying nutrient, water and soil management practices, developed by experts from the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture.

As part of the project, researchers and farmers in Africa were trained in the application of nuclear techniques for cassava production. For healthy plant formation, growth, photosynthesis and metabolism, cassava requires 17 essential nutrients, including nitrogen, potassium and phosphorus in a specific ratio.

Deficiencies in these nutrients in the soil result in poor yields, while excessive application of fertilizers containing these nutrients can pollute surface and ground water and increase emissions of greenhouse gases. Isotopic techniques can help assess plant uptake of added fertilizers and track their movement in the soil, plant, water and atmosphere.

"Nuclear science helps us better understand the exact amount of nutrients cassava needs and helps farmers apply fertilizers in the most effective way at the right stage of the plant's life cycle," said Mohammad Zaman, a soil scientist at the Joint FAO/IAEA Centre.

The training provided through the IAEA technical cooperation programme also included sessions on isotopic techniques using Nitrogen-15 (15N) to measure the efficiency of fertilizer, and on using cosmic ray neutron sensors to help determine precisely how much nutrients and water cassava crops need to thrive. "The data collected through these methods can guide farmers on how to apply nutrients and water more efficiently to minimize their wastage," added Zaman.

## A farmer's guide to climate-smart agriculture

By applying climate-smart agricultural practices, cassava yields can be significantly improved. For example, around 13 per cent of improvement in yields comes from planting clean and healthy root cuttings, 17 per cent comes from enhancing soil fertility and 16 per cent comes from controlling insect pests and diseases.

To help farmers achieve better results, experts from the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture prepared step-by-step production guidelines that include information on selecting improved cassava varieties, preparing planting materials, managing soil and water resources, applying fertilizers and nutrients, controlling pests and diseases, and harvesting and postharvest processing.

Subsequently, several training sessions on the application of these methods and local trials were organized for farmers in Burundi, the Central African Republic, Ghana, Nigeria and Rwanda.

In Ghana, cassava is the most important staple crop. Its production contributes about 22 per cent of agricultural gross domestic product and employs over 70 per cent of all farmers, making the country one of the top five cassava producers in Africa. The vegetable is traditionally cultivated by smallholder farmers, who use it to prepare a variety of traditional cassava dishes, including fufu, cassava dough or banku, a mixture of cassava and corn doughs.

A farmer in the Central Africa Republic is transporting cassava tubers after harvest. (Photo: M. Zaman/IAEA)

The average yield in Ghana is 14–21 tonnes per hectare. Through the technical cooperation project, the application of climate-smart agricultural practices recommended by the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture helped more than triple the yields, depending on the farming site, the variety and the amount of organic and chemical fertilizers applied. Field demonstration trials showed an increase from around 20 tonnes per hectare to over 70 tonnes.

Similar and even higher results were observed in other countries. In Burundi, where conventional farming yields around 12 tonnes per hectare, nuclear-based methods helped farmers to reap over 37 tonnes per hectare. In Rwanda, the use of climate-smart agriculture increased yields from less than 15 tonnes to almost 62 tonnes per hectare. In the Central African Republic, the field trials made it possible to harvest around 50 tonnes per hectare, compared with an average of 10 tonnes.

Cassava helps generate income, create jobs and guarantee food security for millions of Africans. “The IAEA will continue to help countries in applying nuclear-science-enhanced farming techniques for growing cassava to strengthen economies, spur development and reinforce food security on the African continent,” said Shaukat Abdulrazak, Director of the IAEA’s Technical Cooperation Division for Africa.

Isotopic techniques help Azerbaijani researchers and farmers to obtain key information on how to optimize fertilizer use and increase the efficiency of cotton production while maintaining soil health. (Photo: M. Zaman/IAEA)

# Climate-smart agriculture shows promise in improving Azerbaijan's cotton productivity

Artem Vlasov, IAEA Office of Public information and Communication

By implementing climate-smart agricultural practices based on nuclear and related techniques, researchers and farmers in Azerbaijan have been able to more than double their yields of cotton production in a project supported by the IAEA in partnership with the Food and Agriculture Organization of the United Nations (FAO). Through the use of a new variety called 'cotton super', combined with carefully implemented climate-smart agricultural practices that help to increase agricultural productivity sustainably, the pilot project has seen yields increase from the country's average of three tonnes per hectare to eight tonnes per hectare.

The pilot was implemented in 2021 as part of an IAEA technical cooperation project and focused on developing climate-smart agricultural guidelines for cotton production, training Azerbaijani researchers and progressive farmers in climate-smart agricultural practices, and designing field demonstration trials. A further project was initiated in 2022 to focus on strengthening best practices in soil, nutrient and water management practices for cotton production. The project aims to help improve cotton productivity, as Azerbaijan's land is particularly vulnerable to climate change and soil degradation. The country's average annual

temperature has risen by 0.4 degrees Celsius since 1991, with decreasing rainfall and more frequent extreme weather events, such as floods, droughts or heat waves.

*"Applying improved soil, nutrient and water management practices along with using the 'cotton super' variety has led us to increase our cotton productivity, quality and profit."*

Sakhavat Mammadov, a farmer from Azerbaijan

"Generally speaking, 60 per cent of improvements in crop productivity come from capitalizing on the strategic application of soil nutrients and water management," said Mohammad Zaman, a soil scientist at the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture and Technical Officer of the project. "It's about applying the right amount, in the right way, at the right growth stage."

Climate-smart agricultural practices involve the use of isotopic techniques to obtain essential information on how to optimize fertilizer use and increase the efficiency of agricultural production while maintaining soil health.

"When we started, Azerbaijan's soils were heavily degraded and the fertility was very poor, so the soil did not have the capacity to provide all the essential nutrients required for cotton growth," Zaman said. To address this, IAEA experts developed a complete package of nuclear and related farming techniques: from preparing soil and selecting the best cotton varieties to applying nutrients and irrigation to cotton fields and ensuring weed, pest and disease control.

"Applying improved soil, nutrient and water management practices along with using the 'cotton super' variety has led us to increase our cotton productivity, quality and profit," said Sakhavat Mammadov, a farmer from Azerbaijan who took part in the pilot project and has been using climate-smart agricultural practices on his farm for the last two years.

Nuclear and related techniques help not only in increasing agricultural productivity but also in building the resilience of agriculture systems to climate change. In Azerbaijan, the researchers used a technique involving nitrogen-15 (N-15), a stable isotope. Nitrogen plays an important role in plant growth and photosynthesis — the process whereby plants convert carbon dioxide and sunlight into food. Zaman explained that a lack of nutrients in the soil, such as nitrogen, leads to lower and less nutritious yields. The excessive or incorrect application of nitrogen fertilizers, on the other hand, contributes to greenhouse gases emissions and the pollution of ground and surface water.

"Cotton in Azerbaijan is expected to be one of the crops experiencing the greatest yield decline due to climate change and rapid soil degradation," Zaman said. "Taking advantage of isotopic techniques, such as the use of N-15, can help farmers adapt to this situation, making the cotton sector more competitive, ensuring employment and improving the welfare of the rural population."

In the past Azerbaijan has been a leading producer and major exporter of cotton. In the 1980s it harvested more than 830 000 tonnes, which provided up to a quarter of the country's income. However, the transition to a free market and the rapid growth of other industries in the 1990s contributed to cotton losing its key role in Azerbaijan's economy, with production falling to a record low of 31 000 tonnes in 2009.

Using a stable isotope, nitrogen-15, scientists collect quantitative data about how much nitrogen fertilizer cotton needs and how effectively it is taken up by the plant. (Photo: M. Zaman/IAEA)

The project outcome shows the significant potential of climate-smart practices in increasing agricultural productivity.

"Considering the total cotton growing areas of 105 000 hectares in Azerbaijan, a 10 per cent adoption of the IAEA climate-smart agricultural practices would produce 84 000 tonnes of cotton compared to 31 500 tonnes, representing a 166 per cent increase over conventional cotton farming practices," Zaman said. "Seeing the extraordinary success in applying climate-smart agricultural practices in this project provides an exciting indication and tremendous promise on how it can help Azerbaijan to increase their cotton production significantly and thus positively impact the Azerbaijani economy."

The IAEA, through its technical cooperation programme and the Joint FAO/IAEA Centre, assists countries in applying climate-smart agricultural methods to increase productivity, adapting agricultural systems to climate change and reducing their impact on the environment. The Joint Centre also supports research in this area. In a coordinated research project focused on the use of climate-smart nuclear solutions to help minimize farming impacts on climate change, scientists from Brazil, Chile, Costa Rica, Iran and Pakistan reported a 50 per cent reduction in greenhouse gases. Other climate-smart agricultural practices are helping to develop balanced diet solutions for livestock amid recurring droughts in Angola, improve water use and soil nutrient management in Kenya and combat soil erosion in Tunisia.


IAEA Deputy Director General and Head of the Department of Technical Cooperation Hua Liu addresses participants at the COP28 OPEC Fund pavilion. (Photo: OPEC Fund)

# From seed to table: IAEA and OPEC Fund support establishment of seed bank in Arab region

Melissa Evans, IAEA Department of Technical Cooperation
Linda Eid, IAEA Department of Technical Cooperation

At a jointly organized side event on the margins of the United Nations Climate Change Conference (COP28), the IAEA and the OPEC Fund discussed the establishment of a seed gene bank in the Arab region as part of the Practical Arrangements recently signed between the organizations. The seed bank would make a wide variety of seeds available to farmers in the region, with the aim of helping to preserve biodiversity and strengthen food security in the face of increasingly harsh climatic conditions.

Side event participants heard about the crucial role played by plant mutation breeding in climate-smart agriculture. Plant mutation breeding has been a key area of IAEA research and development for six decades and involves irradiating seeds or plant tissues to induce genetic diversity to breed new, improved crop varieties.

In addition to the storage and provision of improved seed varieties, the seed gene bank would support research and development to discover new crop varieties for the Arab region that are better suited to climate change induced environmental conditions, such as increased temperatures, salinity, drought and soil erosion. Seeds that are drought tolerant or resistant to pests can produce higher crop yields and enhance food security.

“The proposal to establish a seed gene bank through the Cooperative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology (ARASIA) is exceptional in that it addresses both climate adaptation and food security. It builds on a baseline of many success stories in the region achieved through IAEA—ARASIA technical cooperation over the past 20 years,” said IAEA Deputy Director General and Head of the Department of Technical Cooperation, Hua Liu.

ARASIA brings together ten IAEA Member States to tackle key regional challenges using nuclear techniques.

“One essential and core motivation for the seed bank is the limited presence of an advanced seed bank in the region and the limited cooperation in the exchange of seeds between countries,” said Bilal Nsouli, ARASIA Chair and Director of the Lebanese Atomic Energy Commission.

Under the framework of ARASIA, the regional seed bank will enable countries to join forces to share their agricultural successes. Many food crops, particularly grains, are currently imported to the Arab region, and the seed bank would be a first step in the direction of ensuring regional self-sufficiency in agriculture through South-South cooperation.

“Seeds are the guardians of our food security,” said Adebayo Babalola, Director of the OPEC Fund Strategic Planning Unit, at the dedicated COP28 side event. “The regional seed bank embodies a shared responsibility for our crops and ensures that no community is left behind in the face of environmental uncertainties,” he continued.

The IAEA and OPEC Fund were joined at the side event by country and industry experts, including representatives from the Emirates Food Security Council, and the Crop Trust. The Crop Trust is a non-profit organization that supports the development of seed banks worldwide.

Crop Trust representative Stefan Schmitz described the utility of seed banks at the COP28 side event: “Seed banks are the right nucleus for agricultural development — they are a ‘one stop shop’ for breeders and researchers and can provide the basis for that kind of research to make our food systems better adapted to climate change, more productive and more sustainable.”

The IAEA has a long history of supporting its Member States in the areas of food and agriculture, including through its longstanding practical partnership with the Food and Agricultural Organization of the United Nations (FAO). Nuclear techniques offer a comparative advantage in many phases of the journey from seed to table, including in plant mutation breeding, soil and water management and food safety. Through plant breeding, scientists can produce new crop varieties that have more favourable traits, such as drought and heat tolerance, among others, to help increase crop yields and reduce food insecurity.

Panellists at the OPEC Fund pavilion discussed topics related to plant breeding, food security and IAEA support to its Member States (Photo: OPEC Fund).


Regional food safety specialists came together at the launch of the RALACA Data Sharing Committee. (Photo: SENACYT)

# IAEA-supported new Data Sharing Committee to improve food safety for public health in Latin America and the Caribbean

Melissa Evans, IAEA Technical Cooperation Department
Nicola Schloegl, IAEA Technical Cooperation Department

A new Data Sharing Committee in Latin America and the Caribbean, supported by the IAEA, will help ensure food safety in national and regional markets and facilitate the international trade of food products. Launched on the margins of the Latin American Congress on Pesticide Residues hosted in Panama by the Ministry of Agriculture on 25 May 2023, this new initiative will enable the official food safety laboratories of 17 countries in the region to share analytical data for public health with the long term goal of establishing a regional preparedness system for food safety.

"Reliable data from analytical tests for residues, pesticides, contaminants, additives and other substances in food for human consumption, carried out by food safety laboratories, will allow informed decision making in accordance with the realities of the Latin American and Caribbean region. In addition, it will strengthen the participation and contribution of our region to international fora, such as the Codex Alimentarius," said Yajaira Salazar Chacón, Head of the Food Safety Department of the National Veterinary Services Laboratory of the National Animal Health Service and Representative of Costa Rica to the Data Sharing Committee.

Food safety laboratories use nuclear and related techniques to analyse food samples, providing valuable information that can shed light on the safety of food that is traded and

consumed.  Properly functioning laboratories and strengthened controls and inspections can help scientists identify types of hazards in food and contribute to minimizing opportunities for food fraud and contamination. Improved testing and access to comprehensive and accurate data will enable authorities throughout the region to manage and mitigate risks and improve risk based monitoring programmes.

Based on national needs and requirements, a database for food residues and contaminants was created, which is securely housed at the IAEA. Officially nominated and authorized users can input national data and view aggregated data for subsequent risk assessment exercises. A review process has been put in place to ensure that data submissions are standardized, and a data input tool has been established to harmonize data collection.

The IAEA, through the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, has supported the development of a new legal framework to allow countries participating in the Data Sharing Committee to manage the database independently. Harmonized data will increase opportunities for conducting regional statistical analyses and encourage regional collaboration, including in response to crises. The intention is to expand the Data Sharing Committee initiative to include countries in the Caribbean, which will improve food safety for trade and public health purposes.

"In the context of an increasing population and an increasing need for food safety, better food safety starts with better data. Through this initiative, we will start to think together with the countries in the region, and our regional and international partner organizations, about how to overcome common challenges, and how we can ensure safe and sufficient food for all," said Britt Maestroni, IAEA Food Safety and Control Laboratory Training Officer, in her introductory remarks.

The Data Sharing Committee will operate under the umbrella of RALACA (Red de Latino America y el Caribe). Formed in 2006 to improve food monitoring systems and ensure food safety, RALACA brings together 76 food safety organizations from 20 countries in the region. Over the past 30 years, the IAEA, together with the Food and Agriculture Organization of the United Nations, has supported countries in Latin American and Caribbean in capacity building in food safety through more than 40 national projects and 16 regional and interregional projects.

*"In the context of an increasing population and an increasing need for food safety, better food safety starts with better data."*

Britt Maestroni
Training Officer
IAEA Food Safety and Control Laboratory

Training course participants practice taking water samples. (Photo: INVEMAR)

# Addressing microplastics pollution: IAEA training course in Colombia supports marine laboratories in Caribbean

Magali Zapata Cazier, IAEA Department of Technical Cooperation

Scientists and researchers from marine laboratories in the Caribbean have learned the latest techniques and methods for monitoring microplastics in marine ecosystems at an IAEA-sponsored training course, hosted by Colombia's Institute for Marine and Coastal Research (INVEMAR) from 27–31 March 2023.

Plastic pollution is a growing threat to the ocean and to marine life. Microplastics — tiny plastic particles smaller than 5 millimetres in size — are of particular concern in the ocean, as they can accumulate and cause harm to organisms. The IAEA launched the Nuclear Technology for Controlling Plastic Pollution (NUTEC Plastics) initiative in 2021 to enhance the capacity of Member States to monitor and manage plastic waste, including microplastics, in the marine environment.

The training course, held in Santa Marta under NUTEC Plastics, brought together participants from nine Caribbean countries: Antigua and Barbuda, the Bahamas, Belize, Dominica, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago. The course focused on using nuclear techniques for the separation, identification and counting of microplastics. Participants practiced field sampling techniques and learned analysis methods for different matrices monitored in coastal environments. With their newly acquired

skills, the marine scientists will be better able to monitor and report on the presence of microplastics in the ocean.

“This course has provided us with the knowledge and skills to assess microplastic contamination levels in various environments, such as the sea and beach sand,” said Indira Constant, a participant from the Ministry of Agriculture, Food and Fisheries of Dominica. “Having a harmonized protocol among Caribbean countries to assess microplastic contamination will allow consistent and comparable data to be collected. With this information, policy makers and stakeholders can develop effective management strategies to mitigate the causes of microplastic pollution, such as reducing plastic use and improving waste management practices.”

*“Having a harmonized protocol among Caribbean countries to assess microplastic contamination will allow consistent and comparable data to be collected.”*

Indira Constant, Ministry of Agriculture, Food and Fisheries of Dominica

The participants were encouraged to apply the standardized protocols for sampling and analysis that have been developed by the Research Network of Marine-Coastal Stressors in Latin America and the Caribbean (REMARCO) and thus contribute to harmonizing data in the Latin American and Caribbean region. Their work will contribute to national efforts to meet United Nations Sustainable Development Goal indicator 14.1, which aims to prevent and reduce marine pollution.

“NUTEC Plastics offers an opportunity for the Latin American and Caribbean region to join the global efforts of marine laboratories to share experiences and best practices,” said Research Scientist from the IAEA Marine Environment Laboratories, Carlos Alonso Hernandez, who participated in the design and implementation of the training course.

Regional specialists from REMARCO, INVEMAR and Mexico led the training course. It highlighted the importance of regional and South-South cooperation in addressing the common challenges faced by Caribbean countries in managing their marine resources. The course also underscored the need for a comprehensive and collaborative approach to monitoring microplastics at the national level to contribute to global efforts to address the growing threat of plastic pollution in the ocean.

REMARCO unites 18 marine laboratories in the Latin American and Caribbean region and intends to expand to also include marine laboratories in English-speaking countries in the Caribbean. The REMARCO network is a key partner in the NUTEC Plastics initiative, as its laboratories are responsible for developing and applying nuclear and isotopic techniques to monitor marine pollution, including microplastics.


The IAEA attended the UN High-Level Political Forum to present the benefits of nuclear science in helping Member States achieve the SDGs. (Photo: M. Evans/IAEA)

# IAEA showcases SDG support at UN High-Level Political Forum

Melissa Evans, IAEA Department of Technical Cooperation

The IAEA participated in the 2023 United Nations High-Level Political Forum at UN Headquarters in New York from 10–19 July, emphasizing the critical contributions made by nuclear science and technology towards the achievement of the Sustainable Development Goals (SDGs).

"We face an uncertain future at a time of converging water, energy and climate crises. We must work together to find viable solutions to address countries' priorities, increase their resilience, and reduce global inequalities," IAEA Deputy Director General and Head of the Department of Technical Cooperation, Hua Liu, said.

The IAEA is focused on helping countries to reach their SDGs targets, and the 2023 High-Level Political Forum featured in-depth reviews of five SDGs, including clean water and sanitation (SDG 6) and affordable and clean energy (SDG 7). The IAEA promotes the use of nuclear science and technology to create clean, reliable and affordable energy and the use of nuclear techniques such as isotope hydrology to increase water security.

2023 marks the midpoint for the implementation of the 17 SDGs, interconnected goals intended to address the global challenges the world is facing, with the aim of achieving these goals by 2030. The forum is an opportunity to assess what has been achieved and what is needed, ahead of the upcoming SDG Summit at the UN General Assembly in September 2023.

The IAEA participated in plenary sessions, hosted an exhibition and organized a side event

that focused on improving access to clean water and energy through South-South and triangular cooperation. The event provided a platform for Member States and UN organizations to engage in substantive and constructive discussions.

In her opening remarks, United Nations Office for South-South Cooperation Director, Dima Al-Khatib, underscored the importance of this approach. “South-South and triangular cooperation is proving itself as an innovative way of enhancing capacity and alleviating the challenges countries of the South are grappling with — be they water management, energy, digitalization or poverty. South-South cooperation is an invaluable collaborative mechanism with impact at all levels,” she said.

Ambassador Xolisa Mabhongo of South Africa emphasized the importance of South-South cooperation in energy planning due to the high level of technical competency required. With the support of the IAEA, South Africa has hosted several sessions of the Nuclear Energy Management School, to help experts from African countries to build their knowledge and skills on the nuclear energy life cycle.

In her side event remarks, Director Cassie Flynn of the United Nations Development Programme’s Climate Hub, stated that “we cannot achieve the SDGs without energy — it powers schools, it powers hospitals. It is energy that is one of the levers by which we can achieve the Goals.”

Although access to clean energy has improved globally, 675 million people still lack access to electricity, and 2.3 billion people do not have access to safe fuel sources for cooking, according to the 2023 SDG Special Edition report. The IAEA assists countries in their attainment of the SDGs through its technical cooperation programme. Capacity building and transferring technology enables the generation of key scientific data that can be used by countries in decision making.

Intervening at a United Nations Educational, Scientific and Cultural Organization side event on


At a side event organized jointly with partners, the IAEA intervened on IAEA support to countries to improve their access to clean water and energy. (Photo: M. Evans, IAEA)

science-based water assessments, IAEA Deputy Director General and Head of the Department of Technical Cooperation Hua Liu highlighted that “using a science-based assessment, scientists can provide policymakers with the information that is necessary to manage, protect and preserve water resources. Making clean water available to everyone would be ground-breaking for sustainable development.”

Globally, 2.2 billion people still have no access to safe water and 3.5 billion lack sanitation services. Climate change and conflict have worsened water scarcity issues in some regions. The Permanent Representative of Tajikistan to the UN, Ambassador Jonibek Hikmat, described how Tajikistan is currently experiencing water availability challenges that are being exacerbated by climate change. The IAEA has provided bespoke technical cooperation support to Tajikistan to assess groundwater resources in the Aral Sea basin, and a national project on glaciers has just begun.

Member States and UN partners provided new insights and fostered awareness of science-based tools that could accelerate progress in key areas. On the margins of the High-Level Political Forum, the IAEA met with UN organizations to explore possibilities to enhance cooperation and leverage the contribution of nuclear technology to support countries’ attainment of the SDGs.

An IAEA event on building resilience in food and water systems using conventional and nuclear technologies was held 2 December 2023 at COP28 in Dubai. (Photo: N. Jawerth/IAEA)

# New IAEA climate adaptation project launched at COP28

Melissa Evans, IAEA Department of Technical Cooperation

A new international IAEA technical cooperation project, launched on 2 December 2023 at a United Nations Climate Conference (COP28) side event, will catalyze the IAEA's existing climate adaptation activities in food and water security to harness an already expansive interregional networks of laboratories and facilitate international collaboration. The new climate adaptation project aims to support national efforts to ensure successful and sustainable solutions to the impacts of climate change.

Attendees at the side event heard panellists describe how extreme weather events around the world are affecting key natural resources. Floods and droughts, and the near disappearance of essential bodies of water, mean that populations everywhere are having to do more with less.

Nuclear techniques can be used in combination with conventional techniques to help countries tackle harsh climatic conditions, providing accurate data that allows decision makers to assess the evolving situation and offering a range of effective adaptation options.

"Without isotope hydrology we would know nothing about the effects of climate change on water resources. The same is true for greenhouse gas emissions — if we want to develop targeted mitigation methods, we need to identify where they are coming from," explained Professor Christoph Müller of Justus Liebig University, speaking at the event.

Participants at the IAEA COP28 side event also heard how the IAEA has been able to help

farmers in Namibia to identify precise moisture levels in their fields using nuclear technology, enabling the successful deployment of drip irrigation techniques. By connecting nuclear technology with conventional agricultural techniques, participating farmers have been able to increase water use efficiency by 80 per cent. The IAEA also helps countries to apply other nuclear techniques for food treatment, insect pest control and plant breeding. 146 countries are now working with the IAEA on technical cooperation projects that address climate change adaptation.

Panellists at the event lauded the importance of partnerships in implementing sustainable and far reaching solutions to climate change challenges, including through the provision of funds for technical cooperation efforts.

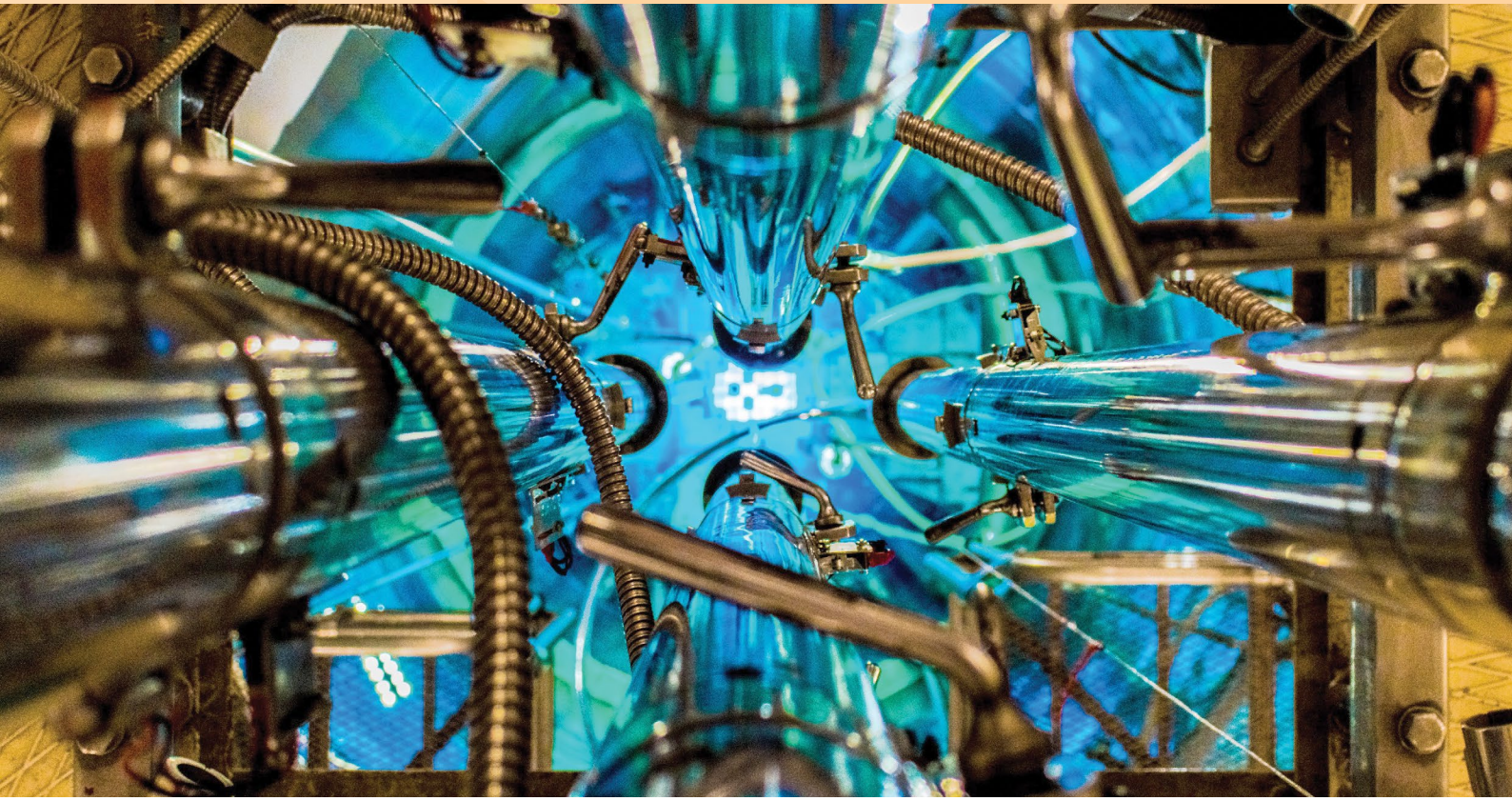
“We recognize that we need to scale up our engagement in the development sector and that we need to use technology to make crops more resistant to drought and other things,” said Zamir Iqbal, Islamic Development Bank Vice President of Finance. “We believe in the technology being promoted by the IAEA — we can make good use of it and our member states can benefit from it for sustainable development,” he added.

Najat Mokhtar, Deputy Director General of the IAEA’s Department of Nuclear Science and Applications, described the IAEA’s partnership with the Food and Agriculture Organization of the United Nations (FAO) as a tried and tested example of in-depth cooperation.

“We are teaming up with the FAO through the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture and the #Atoms4Food initiative to scale up the data and proof of concept to ensure food security when dealing with climate change,” said Mokhtar. “We cannot do this alone — we need to partner with academia, with financial institutions, with UN organizations. The challenge ahead of us is so big that we cannot tackle it alone,” she elaborated.

The new four-year IAEA technical cooperation project began in January 2024 and requires in-kind and financial contributions from new partners to realize its global scope. The project aims to provide support to IAEA Member States in the areas of food and water availability.


Deputy Director General Najat Mokhtar joins panellists at a COP28 side event to discuss the IAEA’s support to countries to improve water and food availability. (Photo: K. Vargas/IAEA)



Research reactors can be used for training and development, as well as research. (Photo: L. Gauna Pereira/CNEA)

# New network aims to strengthen research reactor services in Latin America and the Caribbean

Facundo Deluchi, IAEA Department of Technical Cooperation

A new IAEA-facilitated network of research reactors and related institutions will help meet growing demand in the Latin American and the Caribbean region for the analytical and technological services of research reactors, as well as for the radioisotopes and radiopharmaceuticals they produce. The Regional Network of Research Reactors and Related Institutions in Latin America and the Caribbean (RIALC) was launched both virtually and in Vienna on 28 February 2023 in the presence of representatives from Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Jamaica, Mexico and Peru.

Nine countries are taking part in a regional IAEA technical cooperation project set up in response to increased demand for the products and services of nuclear research reactors. Such reactors are used for research and development, education and training. In addition, they are used to produce neutrons for use in sectors ranging from medicine and agriculture to industry and forensics. Because of their important role in research and development, many research reactors are located on university campuses and in national institutions, where a significant community of stakeholders can benefit from their applications.

“This project seeks to strengthen existing capacities in the region, building on the experience of its professionals and technicians, and maximizing the use of their skills and the important equipment and infrastructure of which the research reactors are a central element,” said Raúl Ramírez, Section Head in the IAEA’s Technical Cooperation Division for Latin America and the Caribbean. “We are focusing on satisfying demand in the region for research reactor products and services to the greatest extent possible. For this, it is essential to have a platform for the exchange of information, and this is why this network has been set up.”

Seven countries in Latin America and the Caribbean have research reactors of different types and power. For more than 70 years, these facilities have been centres of production and innovation for nuclear science and technology, thanks to their contribution to multidisciplinary research. This has included new developments in the production of radioisotopes for medical and industrial uses, research with neutron beams, materials development and component testing and qualification. In total, there are 16 operational research reactors in the region (five in Argentina, four in Brazil, two each in Mexico and Peru, and one each in Chile, Colombia and Jamaica) with a further three under construction in Argentina, Bolivia and Brazil. The RIALC Network seeks to provide a forum where the professionals working in these facilities can share information, coordinate efforts and promote their services and products, with the goal of supporting efficient and effective solutions for the health, environment, industry and medical sectors.

“The IAEA has supported the creation of several regional networks of research reactors, some of which have a very important role in coordinating collaborative actions related to access to and use of research reactors,” said Nuno Pessoa Barradas, Research Reactor Specialist at the IAEA. “RIALC is the first network that covers the entire Latin American and Caribbean region. With the commitment of its members, we hope that it will significantly contribute to improving the sustainability and utilization of the region’s research reactors.”

The launch of the new network was a milestone in an ongoing regional project aimed at meeting regional demand for products and services relating to nuclear research reactors and was attended by authorities from RIALC’s counterpart institutions.

Regional project participants met in Vienna to launch RIALC (Photo: J. O’Brien/IAEA)

During the PGEC, young professionals participated in practical exercises and learned about emergency preparedness and response. (Photo: I. Ivanisic/University Hospital Osijek)

# Young professionals in Europe and Central Asia build professional expertise in radiation protection and safety

Emina Alic, IAEA Department of Technical Cooperation

A group of young professionals from Europe and Central Asia have gained the technical knowledge and practical skills required to help protect people and the environment from the harmful effects of ionizing radiation, through the successful completion of an IAEA course. The IAEA's Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources (PGEC) in Europe, hosted by the Greek Atomic Energy Commission (EEAE) in Athens, Greece, concluded in March 2023. A total of 19 participants completed the comprehensive five-month training course, organized as part of an ongoing technical cooperation project.

"From my participation in the PGEC, I gained an overall picture of the framework of radiation protection and the safety of radioactive sources. That knowledge was acquired through interesting lectures, demonstrations and technical visits that were crucial for the understanding of the framework in general," said Iva Ivanisic, University Hospital Osijek, Croatia. "We also got a chance to experience stressful real life situations through simulated exercises, through which we improved our teamwork skills and capabilities. That type of teaching method gave us the possibility to work with colleagues from different fields and the opportunity to practice quick-thinking under pressure," she said.

Targeting early-career professionals, the PGEC is based on a rigorous syllabus, which was published as part of the IAEA's Training Course

Series. This series of publications supports a range of established capacity building programmes for professionals across a wide range of nuclear-related topics.

“Through a combination of lectures, technical demonstrations, field visits and hands-on activities, participants learned the technical foundation upon which international radiation protection standards and recommendations are built, the key requirements of those standards and how they can be applied in practice,” said Liz Grindrod, IAEA Radiation Safety Training Officer. “At the conclusion of the course, participants also completed a ‘train the trainers’ module to enable and encourage them to impart their new knowledge and skills to colleagues in their home countries,” she added.

Radiation is used daily around the world in healthcare, agriculture, energy production, industry and research. To ensure the safety of radiation sources, and the protection of workers, patients and the public from potential radiation risks, a framework of legislation and regulations as well as a strong safety culture and expert personnel working across a range of disciplines are required. The PGEC participants were drawn from a wide variety of technical disciplines, including radiation protection, regulatory activities, medical physics dosimetry, radiochemistry and waste management.

“In the north of Tajikistan, we have a problem with radioactive uranium waste, and information that I received will help us in our area to work with this problem,” said Muzafarov Avzalshokh, Department of Radiation Safety and Security, Tajikistan. “Namely, storage of radioactive waste, disposal of radioactive waste and safe handling of radioactive waste. Communicating with colleagues from different countries  to learn about their experiences and how they coped with various difficulties in their work gave me great pleasure.”

In the Europe and Central Asia region, the PGEC is offered in English and Russian at designated IAEA regional training centres. The EEAE in Athens conducts the PGEC in English, while the International Sakharov Environmental Institute of the Belarusian State University in Minsk organizes the Russian language PGEC. In Europe and Central Asia, 123 aspiring radiation protection professionals have received training in English, and a further 178 have completed the course in Russian.

“The PGEC helps to prepare the next generation of radiation protection leaders and has a long term impact on the regulatory activities of IAEA Member States,” said Eve-Külli Kala, Director of the IAEA’s Department of Technical Cooperation Division for Europe.

The first PGEC was hosted in 1981 by Argentina for participants from Latin America and the Caribbean, and in 2018 the PGEC celebrated its 100th edition. Over the past 40 years, the course has helped more than 2 000 young graduates and experts from over 120 countries to develop or refresh their knowledge of radiation safety.

Early-career professionals recently completed the PGEC in Athens, learning practical and technical skills (Photo: I. Ivanisic/University Hospital Osijek).


Participants in the IAEA interregional workshops on Technology Development and Applications and Generic User Requirements for Small Modular Reactors. (Photo: CNNP)

# Interregional workshops on technology development and applications of small modular reactors take place in China

Mingye Niu, Department of Technical Cooperation

Two interregional IAEA workshops, one on Technology Development and Applications, and the other on Generic User Requirements for Small Modular Reactors (SMRs), have brought together 142 participants from 51 IAEA Member States to learn more about SMRs, and technological advancements in this field, with the aim of building understanding of the role of SMRs and supporting eventual decision-making on their potential deployment. Small Modular Reactors, including microreactors (MRs) have small footprints, built-in safety features and minimal carbon emissions, and are transportable and adaptable to various power grids.

The workshops, hosted by the Government of the People's Republic of China through the China Atomic Energy Authority, China National Nuclear Corporation and Hainan Nuclear Power Company Limited, opened in Sanya, China, on 4 September 2023.

In his opening address, Liu Jing, Vice Chairman, China Atomic Energy Authority, explained that Small Modular Reactors have become a key element in the transformation of nuclear energy technology and industrial development within the context of global climate change. Liu Jing stressed China's commitment to the safe development of nuclear energy and to promoting

nuclear technology innovation and noted China's pioneering role in the development and deployment of Small Modular Reactors.

The workshops were organized under the IAEA Practical Arrangements signed with China in 2023, which focus on cooperation in nuclear power infrastructure development and deployment of SMRs. Attendees included energy decision-makers, experts in nuclear power design and operation, regulators, Ministers, Directors-General and general managers. Hua Liu , IAEA Deputy Director General and Head of the IAEA's Department of Technical Cooperation, thanked China for its generous financial in-kind support for the event, and reminded participants of the important role that nuclear power can play in achieving zero-carbon economies. He said that an interregional IAEA technical cooperation project has been providing assistance and support to Member States considering the deployment of SMRs since January 2022. Fifty-seven IAEA Member States are taking part in the project, with the support of 17 donor countries.

"The project aims to build understanding among national stakeholders of the key characteristics and applications of SMR and MR technologies, and to address SMR and MR safety and security by helping Member States to establish appropriate legal and regulatory frameworks in line with international safety standards," Deputy Director General Hua Liu said. "SMR development and eventual deployment rely heavily on standardization and harmonization of the regulatory and industrial approaches. The technical cooperation project, therefore, also aims to collate generic user requirements and criteria for SMR technologies. This effort is closely aligned with the aims of the Nuclear Harmonization and Standardization Initiative launched by IAEA Director General Rafael Mariano Grossi in June 2022."

Stressing the importance of safety at every step, Ana Gomez Cobo, Section Head of the IAEA's Safety Assessment Section, said that "addressing safety and security from the very beginning of any SMR project, and working together internationally, are essential for enabling the development and deployment of SMRs worldwide."

Hua Liu also noted that the IAEA has established a Platform on Small Modular Reactors and their Applications, which serves as a comprehensive resource for Member States and stakeholders.

On the second day of the workshops, the course participants visited the Changjiang Nuclear Power Plant in South China's Hainan Province. This facility is the basis for the construction of the Linglong-1 — the world's first commercial small modular reactor. Installation of the SMR project in Changjiang began at the end of 2023. Qu Yong, Deputy Chief Engineer of Hainan Nuclear Power, informed the workshop participants that the project will transition to the commissioning stage in the second half of 2024.

The IAEA also facilitated technical visits in Chengdu, with the goal of offering tailored insights into SMR research and development centres and manufacturing facilities.

The workshop participants had the opportunity to take part in a site visit to Hainan SMR construction site. (Photo: CNNP)


Hua Liu, IAEA Deputy Director General and Head of the Department of Technical Cooperation, speaking at the opening ceremony. (Photo: CNNP)

Experts from different international organizations met on the margins of the 67th IAEA General Conference to discussion African energy needs and how to meet them through a harmonized and integrated approach. (Photo: J. O'Brien/IAEA)

# Meeting Africa's growing energy needs in a sustainable, affordable and efficient way

Imen Bentouhami, IAEA Department of Technical Cooperation
Ellen Swabey-Van de Borne, IAEA Department of Technical Cooperation

According to the African Union Development Agency, the energy needs of the African continent are expected to more than triple by 2040. To help countries address this growing demand for energy and meet socioeconomic needs in a clean, sustainable and affordable way, the IAEA and International Renewable Energy Agency (IRENA) have been supporting the development of the Continental Power System Masterplan (CMP) in Africa since 2021 as official modelling partners. On the margins of the IAEA's 67th General Conference, experts from different international organizations, including the European Union which has been backing the initiative, shared the vision behind the CMP. They discussed its key deliverables, which were adopted by the African Ministers of Infrastructure and Energy earlier in September 2023 and are due to be presented to the African Union Assembly in 2024 for final endorsement by African heads of state.

Power systems in Africa are organized into four subregions or 'power pools,' each of which faces different challenges based on available resources, infrastructure and needs.

"These power pools are the building blocks of the future African Single Electricity Market, because by connecting neighbouring countries from different power pools, the result will be a

fully integrated electricity market," said Stephen Dihwa, Executive Director of the Southern Africa Power Pool. This process has already started by connecting the electricity grids of Tanzania and Zambia, Dihwa went on to explain, resulting in the integration of the East African and South African power pools.

Going forward, the CMP will act as the 'blueprint' for the African Single Electricity Market and act as a central pillar in solving Africa's energy challenges. "We are proud of this unique initiative, which is the result of a bottom up, collaborative approach involving representatives from the Regional Economic Communities, power pools and energy stakeholders on the continent working together with international partners and organizations towards a common goal," said Towela Nyirenda-Jere, head of the African Union Economic Integration Division, speaking at the event. "It shows what can be achieved when we all work together to achieve the aspirations of the Agenda 2063 and Sustainable Development Goals," she added.

## How will the CMP work?

The CMP will create a common and harmonized platform to support project decision making regarding the location, size and timing of investments in generation and transmission infrastructure. The priority generation and transmission projects that emerge from the CMP will make it possible for countries to take advantage of complementarities between national systems, with surpluses from some countries offsetting deficits in others, leveraging national and regional diversity in resources and demand.


Neil Jarvis, Section Head in the IAEA's Technical Division for Africa, introduced the speakers and moderated the successful event. (Photo: J. O'Brien/IAEA)

Energy planning is key to understanding how to achieve cross-border power exchanges and inter-power pool trade. "An energy plan compares energy development scenarios using modelling tools such as the Model for Energy Supply Strategy Alternatives and their General Environmental Impacts and the System Planning Test , analysing all aspects of energy demand, production, conversion, transformation and distribution in order to reach conclusions on the most suitable long-term plan for energy production (which may include nuclear energy)," explained Mario Tot, IAEA Energy Systems Analyst.

Given the undeniable effect that climate change is already having on the continent, the CMP is an opportunity for Africa to compare different energy scenarios, pooling resources to invest in green and sustainable sources of energy to solve its growing energy challenges.

"Africa needs to take full advantage of its rich energy resources to achieve an affordable and sustainable clean energy transition," said Wei Huang, Director of the IAEA's Division of Planning, Information and Knowledge Management. "Proper and timely energy planning to support decision making is key to meeting the objectives in terms of energy sourcing, distribution and storage." The IAEA, in cooperation with other partners, has been supporting countries in Africa in building energy planning capacity and will continue to do so in their pathway towards a low carbon future.

The development of regional energy infrastructure is expected to catalyze the creation of large and competitive markets by reaping the benefits of economies of scale. The development of cross-border energy infrastructure would culminate in the development of a fully integrated continental electricity market that could enhance trade and increase access to electricity for Africa's 600 million people without connections to the power grid. It aims to enhance the socioeconomic development of the African continent by providing low cost and carbon-free

energy for agriculture, industry, communications and trade under the Agreement Establishing the African Continental Free Trade Area.

Together with IRENA and other international organizations, the IAEA has actively supported the development of the CMP since 2021 by sharing training, expertise and resources with regard to energy planning and modelling.

“Our contribution to the development of Africa’s Continental Master Plan is a great milestone,” shared Shaukat Abdulrazak, Director of the IAEA’s Technical Cooperation Division for Africa. “There is a pressing need for clean, dependable energy to fuel further socioeconomic growth in the continent, and the IAEA stands by to support it,” he added.

Following the presentation of key points by each speaker, a lively discussion between panellists and the audience ensued. Attended by more than 30 people, the event was a demonstration of what can be achieved when governments, international organizations and other key stakeholders come together to solve pressing regional issues.


Shaukat Abdulrazak, Director of the IAEA’s Technical Cooperation Division for Africa, addressed members of the audience and the high-level panellists from the IAEA, the African Union Development Agency, the European Union and the South African Power Pool. (Photo: J. O’Brien/IAEA)

Vice-Chancellors of African universities and AFRA-NEST National Coordinators in Johannesburg, South Africa. (Photo: IAEA)

# African regional Vice Chancellors agree on a roadmap to establish new nuclear science and technology programmes on the continent

Salma Khalil, IAEA Department of Technical Cooperation
Mickel Edwerd, IAEA Department of Technical Cooperation

Participants at the 2023 Regional Meeting of Vice Chancellors, held from 14–16 August 2023 in Johannesburg, South Africa, agreed on a comprehensive roadmap to establish and implement post-graduate academic programmes in nuclear science and technology in accredited universities in Africa. Vice Chancellors of 27 African universities agreed on concrete measures to enhance collaboration between universities to increase opportunities in tertiary education and to maximize the contribution of nuclear science and technology to socio-economic development in the region. IAEA participants also presented the IAEA's human resource development strategy.

"Education and training in nuclear science is crucial to enabling Africa to maximize the full potential of nuclear technology for its development. The establishment of these new academic programmes in nuclear science and technology at African universities will ensure we train a critical mass of young graduates for this purpose," said Zizamele Mbambo, Deputy Director General of the Department of Mineral Resources, at the opening of the meeting. Other key speakers at the event included Lerato Makgae, South African National Liaison Officer to the IAEA, and Shaukat Abdulrazak, Director of the IAEA's Technical Cooperation Department's Division for Africa.

Meeting participants examined the status of postgraduate academic programmes in nuclear science and technology at the country level. The attending Vice Chancellors presented overviews of their institutions' academic offerings to identify any gaps in coverage. The development of curricula in agriculture and radiopharmacy were highlighted as priority areas for collaboration.

"For many countries in Africa, the ability to apply nuclear science and technology to address development challenges is limited by a shortage of qualified professionals. These gaps in capacity are due in part to a lack of relevant accredited academic programmes in African universities," explained Shaukat Abdulrazak, Director of the IAEA Technical Cooperation Department's Division for Africa.

Key recommendations from the meeting included keeping universities informed of open applications for post-graduate academic programmes and providing Vice Chancellors with examples of IAEA-developed curricula and the opportunity to have proposals for new curricula reviewed by international experts. This support will enhance the region's academic landscape by both fostering the creation of new postgraduate nuclear science programmes at accredited universities in Africa and supporting existing efforts.

Since 2018, the IAEA has brought together the vice chancellors of African universities through a series of regional meetings, organized to encourage the development of more market and research oriented academic curricula and training programmes. These programmes would allow tertiary academic institutions to respond more effectively to the pressing human resource development demands on the continent.

*"Education and training in nuclear science is crucial to enabling Africa to maximize the full potential of nuclear technology for its development."*

Zizamele Mbambo
Deputy Director General, Department of Mineral Resources, South Africa

The last session of the 2023 meeting included a visit to South Africa's North-West University, where delegates learned more about South Africa's available academic programmes, and were able to reflect further on the suggestions and plans for improvement that were discussed during the assembly.

In the United States, INI participants visited a number of technical institutions, including the Harvard Belfer Centre, the University of Massachusetts open-pool Research Reactor and the Massachusetts Institute of Technology Test Reactor. (Photo: INI)

# Preparing the next nuclear generation: 7th Annual Session of the Intercontinental Nuclear Institute concludes, with IAEA support

Omar Yusuf, IAEA Department of Technical Cooperation
Christoph Henrich, IAEA Department of Technical Cooperation

Following nearly a month of hands-on training, technical site visits and theoretical lectures spread across two continents and three countries, IAEA and international experts presided over the graduation of 23 young professionals from 16 countries, whose expertise in nuclear power management and related areas has now been certified by the Intercontinental Nuclear Institute (INI).

For the last decade, the development of a sustainable workforce has been a priority for the nuclear power sector. Among embarking countries, the challenge lies in establishing an academic pipeline and building professional networks; and in countries with a long tradition of nuclear power generation, ageing workforces and ongoing retirements present a growing threat.

The Intercontinental Nuclear Institute responds to these sector-wide challenges by bringing together an international cadre of young nuclear power professionals — including engineers, energy and power grid planners, lawyers and reactor operators — to engage in an intensive four-week training programme.

The 2023 session of the INI was attended by 23 young professionals, representing all four technical cooperation regions. (Photo: INI)

"Understanding how nuclear power plants function, not only in theory but also in practice, is perhaps the most important thing I can bring back to my country following my participation in INI," said Kevin Alvanez Umaña, a course participant and an Energy Planner and Analyst in El Salvador's Directorate of Energy, Hydrocarbons and Mines. "Moreover, by meeting nuclear professionals from other countries that are facing different challenges, I can transmit the lessons they learned to my colleagues."

The INI programme is supported through the IAEA technical cooperation programme, with funding from the Peaceful Uses Initiative, and through a joint initiative between the U.S.-Czech Civil Nuclear Cooperation Centre in Prague and the University of Massachusetts Lowell.[1]

"My country, Ghana, is planning to add nuclear energy to its energy mix and, by 2030, we will start running our first nuclear power plant," explained Ethna Adzokpa, an INI 2023 course participant and a nuclear engineering student at the University of Ghana. "I hope to share the new knowledge acquired here in order to make a significant contribution to the Ghana Nuclear Power Programme."

In addition to implementing the course's traditional itinerary — which includes nuclear power plant site visits hosted by the Czech Technical University, through NuclearHub Prague and the University of Massachusetts in Lowell — in 2023, the INI programme was expanded to include human resource development and nuclear knowledge management topics, as well as a visit to the IAEA's headquarters in Vienna and the Zwentendorf nuclear power plant in Austria.

"The INI programme participants are among the best and the brightest, representing geographical, nuclear energy jobs and gender diversity," said Radek Skoda, a Professor at the Czech Technical University in Prague and one of two INI Co-Directors.

The training course supports Member States in the development of both long-term national nuclear energy strategies and more sustainable nuclear energy infrastructure, based on the highest levels of safety and security, all while simultaneously meeting long-term energy needs.

During the third week of the programme, INI participants travelled from Czechia to the United States, where they visited the Harvard Belfer Centre, the University of Massachusetts open-pool Research Reactor and the Massachusetts Insitute of Technology Test Reactor. They also attended lectures and inspections tours, and lastlydeveloped group projects designed to reflect their new understanding of nuclear power plant management dynamics. Fellows also participated in several hands-on exercises in radiochemistry, radiation dosimetry, nuclear security and safeguards during the four-week programme.

"In 2023, for the first time, the number of women participants was greater than men; we are happy to see that gender balance among our cohorts," explained Professor Sukesh Aghara, INI Co-Director.

The 2023 cohort of the Intercontinental Nuclear Institute benefitted from the attendance of students from Armenia, Bulgaria, Czechia, Egypt, El Salvador, Estonia, Ghana, Hungary, Indonesia, Jordan, Philippines, Poland, Romania, Slovakia, Türkiye and Ukraine.

INI's four-week curriculum provides both theoretical lectures and practical guidance related to nuclear power production, to give students the best possible foundation for their continuing nuclear careers. (Photo: INI)

1 RER2017. 'Assessing the Role of Low Carbon Energy Technologies for Climate Change Mitigation"


IAEA representatives held an awareness meeting in Congress by Mark Cojuangco, Congressman and Chair of the Special Committee on Nuclear Energy of the House of Representatives of the Philippines. (Photo: PNRI)

# Strengthening the legal framework of the Philippines for its nuclear power programme

Chenchen Liang, IAEA Office of Legal Affairs

The Philippines is working to establish its national nuclear infrastructure, following its decision in 2022 to include nuclear power in the country's energy mix. A critical piece of this infrastructure is the needed legal framework for the safe, secure and peaceful use of nuclear energy.

To support the country in strengthening its legal framework, and at the request of the Government, an IAEA Legislative Assistance Mission was conducted from 2–5 May 2023. A series of awareness raising meetings with decision makers, policy makers, senior officials and parliamentarians, provided an opportunity to raise awareness of the importance of the Philippines joining and implementing the instruments adopted under IAEA auspices in the areas of nuclear safety, security, safeguards and liability.

During the three-day national workshop on nuclear law, Carlo Arcilla, Director of the Philippine Nuclear Research Institute (PNRI) said that, "the Philippines has signed but not yet ratified the Convention on Nuclear Safety, the Joint Convention and the Convention on Supplementary Compensation (CSC)."

"Through highlighting the rights, obligations, benefits and costs arising from joining these instruments, the mission has strengthened our resolve to become party to them and to continue pursuing the strengthening of our legal framework," Arcilla said.

The mission engaged 62 participants from 18 different governmental bodies, organizations and parliamentarians, including the Congress of the Philippines, PNRI, the Department of Energy and the Department of Science and Technology


Carlo Arcilla, Director of PNRI at the three-day national workshop on nuclear law. (Photo: PNRI)

During the bilateral discussions on the national nuclear law, Congressman Mark Cojuangco and Chair of the Special Committee on Nuclear Energy of the House of Representatives said, "this legislative assistance mission comes at an important time for us. Significantly, the mission provided a forum to bring together senior officials and representatives of congress to discuss the elements of a comprehensive national nuclear legal framework."

Countries such as the Philippines that are embarking on a nuclear power programme follow the IAEA Milestones Approach for the development of national infrastructure for nuclear power. The legal framework is one of the 19 specific infrastructure issues that need to be addressed during the three progressive phases of infrastructure development. In 2018, the IAEA was already requested to conduct an Integrated Nuclear Infrastructure Review (INIR) mission to assess the status of the Philippines' nuclear power infrastructure development.

Head of the IAEA's Nuclear and Treaty Law Section, Anthony Wetherall, highlighted that "for an embarking country, such as the Philippines, the timely establishment of an adequate and comprehensive legal framework for planned facilities and activities, as well as existing ones, is a must. We will continue providing legislative assistance, upon request, to help the country join the instruments and strengthen its national nuclear legal framework."

This mission, implemented in the framework of the IAEA Legislative Assistance Programme, is one of many activities conducted under the IAEA technical cooperation programme to support Member States in establishing and enhancing their national legal frameworks. The Philippines has received legislative assistance since 2009, and representatives from the Philippines visited the IAEA in Vienna in 2017 and 2018.

IAEA staff and experts together with representatives from the Philippines. (Photo: PNRI)

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