

**United Nations Office of the  
High Representative for Least Developed Countries, Landlocked Developing Countries, and Small  
Island Developing States**

**Report of the Secretary-General**

**Implementation of the Vienna Programme of Action for Landlocked Developing  
Countries for the Decade 2014 - 2024**

**I. Introduction**

The International Atomic Energy Agency (IAEA) supports its Member States, including 30 Land Locked Developing Countries (LLDCs)<sup>1</sup>, to build their national capacity in the peaceful, safe and secure use of nuclear science and technology. The assistance rendered by the IAEA is aligned with the national development priorities of Member States and responds to their evolving emergencies and needs. The IAEA technical cooperation (TC) programme is the major vehicle through which the IAEA builds human capacity through long- and short-term training, scientific visits, and expert advice. It also supports establishing and enhancing the institutional capacities through the provision of equipment, networking and partnership and technology transfer. Areas of support cover, inter alia, human health and nutrition, food and agriculture, water and the environment, industrial applications, safety and energy.

This report highlights major IAEA contributions to LLDCs for the year 2021, in the context of the Vienna Programme of Action for Landlocked Developing Countries Roadmap (VPoA), with a focus on those domains that fall within the IAEA expertise, including **ending hunger**; enabling access to **affordable and clean energy**; **building infrastructure** in nuclear applications; addressing issues related to **climate change**; and the special IAEA assistance to help Member States **fight against COVID-19 pandemic**.

**II. An overview of recent socio-economic development in LLDCs including impact of COVID- 19 pandemic**

1. In 2021, the IAEA continued its support to Member States to fight against the COVID-19 pandemic through the TC programme. More than EUR 27 million from extrabudgetary contributions supported more than 300 laboratories in 129 countries and territories, 27 of which were LLDCs. IAEA assistance focused on the provision of real time reverse transcription-polymerase chain reaction (RT-PCR) equipment necessary for the detection of COVID-19 infections, the most accurate and widely used nuclear-derived method to detect specific genetic material from pathogens, including viruses. In addition, the IAEA provided reagents and consumables to laboratories to speed up national testing, biosafety supplies, such as personal protection equipment (PPE) and laboratory cabinets to ensure the safe handling, storage and analysis of collected samples.
2. Strategic planning is key for focused IAEA assistance and delivery to Member States. To this end, six LLDCs Member States, namely **Burundi, Niger, Mali, Malawi, Uzbekistan and Zambia** signed their Country Programme Frameworks (CPFs), which constitutes the mid-term framework of cooperation based on and aligned to the national development goals of each country. Nepal is in the final steps of developing a CPF that will be signed in 2022. The process of formulating this strategic document is based on intensive consultations with high-level officials from Member States, and deep analysis of their national development priorities.

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<sup>1</sup> Afghanistan; Armenia; Azerbaijan; Bolivia (Plurinational State of); Botswana; Burkina Faso; Burundi; Central African Republic; Chad; Eswatini; Ethiopia; Kazakhstan; Kyrgyzstan; Lao People's Democratic Republic; Lesotho; Malawi; Mali; Mongolia; Nepal; Niger; North Macedonia; Paraguay; Republic of Moldova; Rwanda; Tajikistan; Turkmenistan; Uganda; Uzbekistan; Zambia; Zimbabwe.

### III. Status of implementation of the priorities of the Vienna Programme of Action

#### Priority area ii: Infrastructure Development and Maintenance: Energy

3. Energy is a key enabler for achieving the sustainable development goals (SDGs). Therefore, the IAEA has made great efforts in building partnerships and contributing to evidence-based decision in energy in its Member States, including LLDCs.
4. In 2021, the dialogue with the United Nations Office of the Special Adviser on Africa (**UN-OSAA**) continued through IAEA participation in the Interdepartmental Task Force on African Affairs (**IDTFAA**). Meetings at the technical and principal level have focussed on the implementation of the African Union-UN framework for the **Joint Implementation of Agenda 2030 and the 2063 Agenda** to maximize the impact of recovery efforts in Africa with **focus on energy**.
5. In its effort to enhance energy planning in Africa, the IAEA has partnered with the EU, African Union Development Agency- **NEPAD**, Power Pools and the International Renewable Energy Agency (**IRENA**) to develop the **African Continental Power Systems Master Plan**. Modelling tools, including IAEA's Model for Energy Supply System Alternatives and their General Environmental Impacts (**MESSAGE**), will be utilized to develop an electricity master plan that promotes access to affordable, reliable and sustainable electricity supplies across the continent. All LLDCs from Africa will benefit from this initiative.
6. In **Lao PDR**, the IAEA supported national capacity building activities for analysing sustainable energy development pathways. Face-to-face trainings, expert missions and fellowships took place to enhance the national expertise for energy demand analysis (**MAED** model) as well as analysis for energy supply options (**MESSAGE** model).
7. **Paraguay** received support to enhance national skills for sustainable energy development and planning. Several training events and expert missions were implemented to strengthen capabilities in the use of IAEA's tools for energy demand and supply analysis (**MAED** and **MESSAGE** models).

#### Priority area iv: Regional integration and cooperation

8. The IAEA continues to strengthen collaboration through South-South cooperation, North-South cooperation and triangular cooperation. These efforts also benefit LLDCs.
9. The IAEA and the **Pakistan Atomic Energy Commission (PAEC)** signed **Practical Arrangements** enabling regulators and users of nuclear technology in other Member States particularly in Africa and Asia to tap into PAEC's long-standing experience in food and agriculture, nuclear medicine, radiation oncology, medical physics, radioisotope applications, and nuclear education.
10. IAEA joined forces with the **China International Development Cooperation Agency (CIDCA)** to scale up action in support of developing countries for the achievement of SDGs and the strengthening of South-South and Triangular Cooperation. The two entities will pursue cooperation in applied research and development and capacity building, including education and training at the graduate and post-graduate levels. The IAEA and CIDCA will exchange expertise and knowledge, and support networking and the placement and participation of training candidates from developing countries.

#### Priority area v: structural economic transformation

11. Accessing quality health services is instrumental for achieving socio-economic development. Nuclear science and technology can address effectively and efficiently communicable and non-communicable diseases and contribute to achieving SDG 3- Good health and well-being.
12. In 2021, **Nepal** was one of the countries that received an imPACT Review<sup>2</sup> to help assist the country draw its national comprehensive cancer control programme (**NCCP**). In addition, **Burundi, Chad,**

<sup>2</sup> imPACT Review is the integrated mission of the IAEA Programme of Action for Cancer Therapy (PACT). It is a unique assessment tool used to support Member States in their efforts to improve comprehensive cancer control in their

**Paraguay, Uzbekistan, Zambia and Zimbabwe** also began receiving expert support from the Agency and its partners to develop comprehensive NCCPs. Recent impACT Reviews also served as a platform for resource mobilization and a planning tool to scale up cancer treatment services in **Paraguay**.

13. In the health domain, the IAEA has assisted **Niger** in establishing its first radiotherapy centre, which started operation in November 2021. The new facility will contribute to the improvement of the quality of life of cancer patients in the country, which suffers from high incidence of cancer. The new centre is expected to provide radiotherapy services to around 600 cancer patients each year from Niger and from neighbouring countries in West Africa.
14. In 2021, **Burkina Faso** opened their first radiotherapy centre. Personnel employed at the centre have received training and education through the IAEA Technical Cooperation programme.
15. **Moldova** has received IAEA assistance to build capacity to improve quality assurance in nuclear medicine, radio-diagnostics and radiotherapy over the past 15 years. In 2021, the Oncology Institute in Chisinau, which is the only centre providing radiotherapy services to patients, was equipped with a new linear accelerator and training provided on its operation through a recently completed IAEA project.
16. In November 2021, **Paraguay's** first public sector PET/CT scanner was inaugurated at the Research Institute for Health Sciences. The PET/CT scanner will contribute to an improved and more effective cancer diagnosis and will in turn help to reduce the number of deaths.
17. Activities aimed at upgrading the physical infrastructure were prioritized in Mongolia to improve the quality of radiotherapy services for common cancers. This was done in response to limitations faced with the implementation of training activities due to the COVID-19 pandemic. The project supported the upgrade of the Treatment Planning System and secured additional funding to purchase a new CT Simulator.

#### IV. Follow-up and review

##### Structural Economic Transformation

#### **Promote sustainable development of the agriculture sector in LLDCs including increased agricultural productivity and industrialization of agriculture**

18. A strategic priority in Europe and Central Asia, including **Kazakhstan, Kyrgyzstan, the Republic of Moldova and Tajikistan**, is overcoming the negative impact of unfavourable environmental conditions on plant productivity and developing tolerant genotypes in main crops including legumes, cereals and others. Member States in the region received training on plant mutation breeding and efficiency enhancing techniques to increase resilience to climate change and enhance understanding and research laboratory capacities in basic aspects of crop mutation breeding, specifically in mutation induction, mutant population development and phenotyping methods and advanced molecular and bioinformatics tools for mutant trait discovery and marker-assisted selection.
19. With IAEA assistance, **Zimbabwe** established a new bull station and expanded artificial insemination service for improving cattle breeds and productivity. The Mazowe Bull Centre and semen production laboratory has become operational following installation and commissioning of new equipment.

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country. This is done in partnership with the World Health Organization (WHO) and International Agency for Research on Cancer (IARC).

20. **Mongolia** has enhanced its livestock production through improved diagnosis and prevention of transboundary animal diseases with IAEA assistance. Thanks to IAEA's support through capacity building activities, Foot and Mouth Disease (FMD) vaccine technology was developed and formally registered on the drug registration list of Mongolia in 2021. The industrial production of the vaccine was accelerated by the construction and operationalization of a formulation facility with capacity to produce 50000 doses of vaccine in a shift. The commercial contract with the Biocombine facility to supply 500 000 doses of FMD vaccine annually was signed in 2021. This achievement directly contributes to supporting Mongolia in addressing Transboundary Animal Diseases, thereby contributing to enhanced food security in the country.

**Encourage development of national science, technology and innovation policies and infrastructures in LLDCs and support capacity development of LLDCs in research and innovation**

*Human Capacity Building*

Human resource development and nuclear knowledge management are essential factors for the successful application of nuclear science and technology for socioeconomic development. In 2021, human resource development activities in Member States were affected by the COVID-19 pandemic and its concomitant travel restrictions. Where possible, fellowships, particularly long-term, continued to be implemented. Virtual meetings and training courses were used to continue capacity building as far as possible.

21. Albeit the constraints posed by the pandemic, three Postgraduate Educational Courses in Radiation Protection and the Safety of Radiation Sources were successfully organized in Ghana, Morocco, and Belarus in English, French and Russian respectively. The courses accommodated (50 participants from African LLDCs (Benin, Botswana, Burkina Faso, Burundi, Central Africa Republic, Chad, Ethiopia, Mali, Niger, Rwanda, Togo, Zambia, and Zimbabwe) and 11 participants from Azerbaijan, Kyrgyzstan, Tajikistan and Uzbekistan. The candidates are earmarked to work as radiation protection officers supporting the national regulatory authorities to ensure the safe and secure use of radioactive sources.
22. In addition, long term PhD education was provided to one student from **Mongolia** in Radiation Disaster Medicine at Hiroshima University; 13 students from 13 LLDCs were trained in isotope hydrology in 2021 and 17 students from 5 LLDCs including Burkina Faso, Chad, Ethiopia, Malawi and Zambia were trained through a PhD sandwich programme.
23. The first qualified radiopharmacists in **Burkina Faso** were awarded an MSc degree in radiopharmacy within the framework of an IAEA established programme in Morocco. Additional radiopharmacists from **Ethiopia, Uganda and Zambia** also completed their academic MSc education in South Africa.
24. In the area of radiotherapy, more than 260 medical practitioners from **LLDCs in Europe and Central Asia** were provided with continuous learning opportunities through 13 virtual trainings on specialized topics. These trainings were offered through partnership with the European Society for Radiotherapy and Oncology (ESTRO) and Inholland Academy. The IAEA is providing technical and financial support to **Afghanistan** in areas related to radiation protection of workers and patients as a first step in the establishment of radiotherapy services. In 2021, 3 Afghani fellows were trained in Ege University, Turkey (2 fellows on full scope radiology and 1 fellow in the area of Radiation Oncology) while a 12 month-long fellowship for 4 Afghani clinical medical physicists for training on radiation therapy started in Tehran University of Medical Sciences.

25. In the area of training personnel on research reactor applications, researchers from **Azerbaijan** and **Mongolia** benefited from the IAEA's Internet Reactor Laboratory through connection to live experiment conducted in research reactors.

***Building Nuclear and Radiation Protection Infrastructure***

26. The IAEA is supporting the operational safety and lifetime extension of the **Armenian** Nuclear Power Plant Unit (ANPP) 2 in accordance with international standards. In 2021, a SALTO (Safety Aspects of Long-Term Operation) follow-up mission was conducted to assess the ANPP's preparedness for safe Long Term Operational (LTO) Safety following the 2018 SALTO recommendations. In particular, the ANPP progressed in developing a proactive approach to prepare for LTO; improving and updating its Safety Analysis Report to support LTO; and improving the methodology for defining the scope of components designated for ageing management. Furthermore, the IAEA provided a thyroid uptake probe system and four contamination monitors for radiation protection, including the on-site installation and the necessary training for the operating staff. The IAEA is also supporting the strengthening of the national nuclear and radiation safety regulatory framework for licensing the lifetime extension of the ANPP Unit 2.
27. In the area of safety radioactive sources, **Ethiopia** and **North Macedonia** participated in an Interregional Training Course on Safety Assessment and Safety Cases for the Predisposal Management of Radioactive Waste. **Ethiopia, North Macedonia, Uganda and Zimbabwe** are benefiting from the procurement of equipment to improve interim storage of category 3 to 5 disused sealed radioactive sources. **Moldova** is benefitting from a high level source removal action. The procurement contract was initiated in 2021 and will be awarded in 2022.
28. Through a regional project, the IAEA supported countries including **Armenia, Azerbaijan, Kazakhstan, Kyrgyzstan and the Republic of Moldova** to establish lacking regulatory framework elements and facilitated the exchange of experience to accelerate the process of sustaining regulatory infrastructure. Specialists were trained on how to self-assess the status of their national regulatory infrastructure for safety against the relevant IAEA Safety Standards using the Self-Assessment of Regulatory Infrastructure for Safety (SARIS) and how to develop an action plan for establishing or improving their legal, governmental and regulatory framework.

**Means of implementation and international support**

**Enhance efforts of LLDCs to mobilize adequate domestic and international resources**

29. Under the IAEA/IsDB Women's Cancers Partnership Initiative, a bankable document from **Uzbekistan** was approved by the Islamic Development Bank (IsDB) for financing in the amount of about USD 80 million. The project will improve access to and quality of oncology services in Uzbekistan. In 2021, the second *Call for Innovation* to find and reward solutions for strengthening national health systems in breast and cervical cancer prevention and control was launched under the initiative.
30. A bankable document for **Chad** developed with IAEA technical assistance was approved by the Kuwait Fund for Arab Economic Development for financing in the amount of approximately US\$23 million. The project will focus on the establishment of the first radiotherapy facility in Chad.
31. The IAEA in partnership with UNIDO is working on implementing two projects on food safety and climate resilient crops. The organisations will work together to mobilize resources for the implementation of these projects which will support Member States in Africa including LLDCs.

## Other areas

Enhance climate change mitigation and adaptation and disaster risk reduction efforts and support resilience building of LLDCs to the adverse impacts of climate change, natural, manmade, technological, biological and environmental hazards and environmental degradation, including desertification, land degradation, biodiversity loss, drought and receding glaciers

32. **Burundi** has been challenged with low livestock productivity due to a high prevalence of transboundary animal and zoonotic diseases, low genetic performances, and inadequate animal feeding. Given the importance of livestock in supporting the livelihoods of farmer and consumers, improving laboratory diagnosis has helped the veterinary services of Burundi to develop and maintain safe, effective, and efficient animal health-management systems. Through IAEA assistance, Burundi has upgraded the capacity of the national veterinary laboratory and a number of technicians have been trained in laboratory diagnostics, laboratory management and epidemiology. Sample analyses have increased from 1000 samples per year to above 5000 samples per year. During the first outbreak of Peste des petits ruminants (PPR) in Burundi, the laboratory was able to analyse more than 4000 samples in two weeks for post vaccination sero-monitoring.
33. **Kyrgyzstan** capabilities are being strengthened for ensuring an effective testing and systematic monitoring of residues and food contaminants as well as of transboundary animal diseases. In 2021, laboratory equipment and materials were purchased for the Center for Veterinary Diagnostic and Expertise for the Northern Region and for the National Food Testing Laboratory under the Department on Disease Prevention and the State Sanitary and Epidemiology Control of the Ministry of Health (DGSEN). In addition, DGSEN was procured with an UHPLC-MS/MS and a radio receptor assay tool and kit.
34. Support was provided to Member States in Europe and Central Asia including LLDCs in the use and integration of sterile insect technique (SIT) in area-wide insect pest management in selected countries, to address the vector-borne diseases due to the increasing impact of climate change.
35. With the IAEA assistance, the **Republic of Central Africa** has developed the first ever isotopic maps for water resource management in the country. It has been shared with national stakeholders to enable an informed decision taking in water resource management. The Atlas of Isotope Hydrology compiles all results of IAEA activities in isotope hydrology in the country over the last decade. Isotopic data were used to produce thematic maps which provide insight into the quality, availability, and origin of water resources – key information for future decision-making on the sustainable use of water resources. The Atlas was presented to the Ministry of Water Resources for consideration in the ongoing draft of a new water law.
36. Twenty-seven countries in the Europe and Central Asia, including **Armenia, Republic of Moldova, Tajikistan and Kazakhstan**, are cooperating to enhance evidence-based decision making in integrated water management by improving the monitoring and characterization of groundwater resources using isotopic tracing techniques. Within the framework of seven case studies, pressing regional and transboundary problems, such as the impact of climate change on karst aquifers and groundwater–surface water interactions in the Western Balkans, nitrate contamination of aquatic systems in Eastern Europe and Caucasus, the vulnerability of stratified transboundary aquifers to over-abstraction and pollution, contamination problems of selected Europe’s coastal aquifers, and water balance and quality control in Central Asia, among other challenges, are being studied. The IAEA supported participating countries with equipment enabling sample campaigns that started in the summer of 2021. Furthermore, through scientific visits, fellowships, and virtual training courses, knowledge was transferred within the region in the use of isotope hydrology techniques. The project

continues until the end of 2023 with the aim of having clarified persisting issues related to the sustainable management of water resources.

37. In Africa, the IAEA Water Availability Enhancement (IWAVE) approach is being mainstreamed into projects and planning. Under the regional programme, IWAVE has been implemented in nine African countries including **Mali and Niger**. A tritium map was developed in these countries to indicate water vulnerability areas in the Sahel.
38. The application of isotopic tracing techniques in promoting the understanding of groundwater dynamics and the need for improved knowledge on the sustainability of groundwater abstraction are top priorities for **Zimbabwe**. Zimbabwe National Water Authority (ZINWA) as well as the University of Zimbabwe received technical assistance that enabled them to include isotope hydrology in characterising groundwater resources in the Save Catchment, Nyamandlovu Aquifer and the urban area of Harare. In 2020, through IAEA support, Zimbabwe resuscitated the Global Network of Isotopes in Precipitation (GNIP) stations in Harare, Bulawayo, and Mutare.
39. The Central American Dry Corridor experienced water shortages which led to crop failure and food scarcity, affecting 3.5 million people over the past five years. Lack of access to adequate water supply systems was exacerbated by economic instability. A better understanding of linkages between rain, surface runoff, and groundwater recharge is crucial to improve water management plans. Reliable and up-to-date hydrological information is required to implement public water policies and measures. In 2021, the laboratories' network in Latin America and the Caribbean performing isotope analysis was expanded through the delivery of laser spectrometry equipment for a number of countries including **Paraguay** which should be installed in early 2022.

#### Help LLDCs deal with the impacts of the COVID-19 crisis

40. As stated above, the IAEA has continued its assistance to its Member States including LLDCs in addressing the pandemic. For example, in 2021 additional support was extended to Mongolia, where five sets of mobile X ray units were despatched.
41. Throughout the year, outreach efforts with UN and other international organisations in the context of the 2030 Agenda and of the Building Back Better after COVID-19, the IAEA together with FAO, organized side events as part of the UN STI Forum (From COVID-19 Emergency Response to Integrated Action to Address Zoonotic Diseases), and of the UN High-Level Political Forum (HLPF) (Nuclear Science and Technology in Support of Integrated Actions to Enhance Countries Post-Pandemic Recovery). Together with WFP and UNFPA, the IAEA also participated in a side event of the UNGA 76 to address COVID-19 Response and Approaches to Strengthen Health Systems.

#### Support LLDCs to remove the barriers to achieving gender equality and the empowerment of women and girls

42. The IAEA strongly encourages the expansion of female participation in the TC programme, and Member States are encouraged to nominate female National Liaison Officers (NLOs), meeting and workshop participants, fellows and scientific visitors, and counterparts.
43. In 2021, the IAEA supported the establishment of the Women in Nuclear (WiN) national chapters in 11 Member States in Africa including 3 LLDCs namely **Lesotho, Niger and Uganda**. Support was also provided to the activities of the Global WiN.
44. As part of an IAEA initiative to help close a persistent gender gap in the nuclear field, LLDCs benefited from the Marie Skłodowska-Curie Fellowship Programme (MSCFP). The overall objective of the MSCFP is to encourage young women to pursue a career in the nuclear field. Selected students receive a scholarship for Master's programmes in nuclear related studies at accredited universities.

They are also provided with an opportunity to pursue an internship facilitated by the IAEA for up to 12 months. The MSCFP has successfully entered its second year of implementation. Over the last two years MSCFP received 1042 applications. The selected students are 210 representing 93 different nationalities and they pursue their studies in 53 states around the globe. Since December 2021, 24 have already graduated and 10 have started internship facilitated by IAEA.

## **V. Conclusions and recommendations**

Nuclear science and technologies offer a wide range of solutions to the socio-economic development priorities of Member States. The IAEA has been offering important assistance to all LLDCs Member States to help them build their national capacities to achieve their sustainable development goals (SDGs).

Partnership and coherent coordinated efforts by all stakeholders are important for the delivery of the assistance. Regional cooperation and strategic partnership proved to be particularly important for building their capacities.

## Statistical Annex

<b>IAEA LLDC Member States</b>	<b>Assistance Provided in 2021 in Euro</b>
<b>Afghanistan</b>	<b>125 457</b>
<b>Armenia</b>	<b>632 902</b>
<b>Azerbaijan</b>	<b>263 317</b>
<b>Bolivia, Plurinational State of</b>	<b>272 449</b>
<b>Botswana</b>	<b>542 657</b>
<b>Burkina Faso</b>	<b>635 914</b>
<b>Burundi</b>	<b>451 565</b>
<b>Central African Republic</b>	<b>495 533</b>
<b>Chad</b>	<b>356 147</b>
<b>Eswatini</b>	<b>153 847</b>
<b>Ethiopia</b>	<b>1 113 859</b>
<b>Kazakhstan</b>	<b>211 299</b>
<b>Kyrgyzstan</b>	<b>570 912</b>
<b>Lao People's Democratic Republic</b>	<b>356 551</b>
<b>Lesotho</b>	<b>550 477</b>
<b>Malawi</b>	<b>524 555</b>
<b>Mali</b>	<b>368 243</b>
<b>Mongolia</b>	<b>986 154</b>
<b>Nepal</b>	<b>489 900</b>
<b>Niger</b>	<b>805 727</b>
<b>North Macedonia</b>	<b>1 334 159</b>
<b>Paraguay</b>	<b>860 041</b>
<b>Republic of Moldova</b>	<b>1 494 650</b>
<b>Rwanda</b>	<b>410 930</b>
<b>Tajikistan</b>	<b>685 945</b>
<b>Turkmenistan</b>	<b>70 873</b>
<b>Uganda</b>	<b>650 019</b>
<b>Uzbekistan</b>	<b>977 493</b>
<b>Zambia</b>	<b>364 777</b>
<b>Zimbabwe</b>	<b>565 1</b>