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Upscaling the non-power applications of atomic energy

Working paper submitted by Argentina, Armenia, Bangladesh, Brazil, Bulgaria, Burkina Faso, Canada, Colombia, Denmark, France, Ghana, Greece, Japan, Malaysia, Morocco, Netherlands (Kingdom of the), Norway, the Philippines, Portugal, the Republic of Korea, Singapore, Slovenia, Sri Lanka, Thailand, Türkiye, the United Arab Emirates, the United Kingdom of Great Britain and Northern Ireland, the United States of America and Viet Nam

Background

1. Atomic energy, when channelled for peaceful purposes, can lead to groundbreaking innovations that save lives, lift people out of poverty, transform entire industries and bring to bear novel sustainable solutions to the world's most pressing challenges. However, breakthroughs in science and technology cannot attain their potential benefit unless they are put into practical use and scaled up to achieve the intended multiplier effect. While the power-related applications of atomic energy have already been scaled up and commercialized, non-power applications have not received the same attention and support.

2. Atomic energy has for years been the foundation of new technology in health care, food safety and security, agriculture, heritage conservation, environmental sustainability, education, resource management, and industry. In 2023 alone, the technological cooperation programme of the International Atomic Energy Agency (IAEA) provided support to over 150 countries through 1,100 projects.[1] Such projects tangibly contribute to helping countries in meeting the Sustainable Development Goals. Despite the potential, scaling up these technologies still requires more attention and focus to enhance utilization toward delivering their socioeconomic impact.

3. Bearing in mind article IV of the Treaty on the Non-Proliferation of Nuclear Weapons and actions 47 to 54 of the 64-point action plan of the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, States parties to the Treaty have a crucial role to play in promoting awareness of the many applications of nuclear technology beyond nuclear power. This awareness is expected to flow into interest in applied research and development projects, industrial

[1] International Atomic Energy Agency (2024). Technical Cooperation Report for 2023.

application and upscaling. In this regard, the involvement of industry in technology development, financing, and uptake and utilization is critical. There is a clear need to emphasize the importance of a multisectoral approach that combines the resources of both governments and the private sector as nuclear applications progress through the technological readiness levels and into commercialization.

Objectives

4. This paper is an attempt to advance the narrative on non-power applications of nuclear energy in order to promote awareness, upscaling and commercialization, and financial support. It builds on the side event organized by the Philippines entitled "Peaceful uses of nuclear technology and their socioeconomic impact", held at the first session of the Preparatory Committee for the eleventh Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons. The side event highlighted how nuclear application projects in education, food safety and security, agriculture, health and plastics recycling are moving beyond the proof-of-concept phase and into demonstration and upscaling to benefit the countries or regions implementing them. It is hoped the conversation on non-power applications is carried forward and eventually becomes as mainstreamed as the one on nuclear energy.

5. The conversation is not aimed at promoting nuclear applications at the expense of power applications. Rather, the narrative advocates that non-power applications mutually reinforce power applications in helping nations achieve their sustainable development goals, and that both areas should receive adequate and proportional recognition, promotion and support. In actuality, non-power applications can provide a "soft entry" for nuclear power into a country if there is still a need for building human capital and political will and acceptance.

Notable projects on non-power applications of atomic technology

6. Currently, IAEA is working with its member States in several initiatives aimed at addressing contemporary problems through the peaceful applications of nuclear technology. Some of the most notable initiatives are included in the table below.

Project title	*Application of nuclear technology*
Atoms4Food	Addressing world hunger and attaining food security[a]
Atoms for Heritage	Examination, preservation and restoration of cultural heritage artefacts[b]
Sterile insect technique	Vector management and control[c]
Programme Action on Cancer Therapy and Rays of Hope	Comprehensive assessment and support for improvements in cancer care management[d]
Zoonotic Diseases Integrated Action initiative	Strengthening of the preparedness and capabilities of IAEA member States to rapidly detect and respond in a timely manner to outbreaks caused by bacteria, virus, fungi and parasites[e]
Nuclear Technology for Controlling Plastic Pollution	Monitoring, management and upcycling of plastic waste[f]
Global Network of Isotope Enabled Water Analysis Laboratories	Water analysis and water resource management[g]

Project title	*Application of nuclear technology*
Education	
Asian Network for Nuclear Education and Training in Nuclear Technology	Capacity-building for human resources
International Nuclear Science and Technology Academy	
International Nuclear Science Olympiad	

[a] See www.iaea.org/services/key-programmes/atoms4food.
[b] See www.iaea.org/newscenter/news/preserving-cultural-and-natural-heritage-with-the-help-of-nuclear-techniques.
[c] See www.iaea.org/topics/sterile-insect-technique.
[d] See www.iaea.org/services/key-programmes/programme-of-action-for-cancer-therapy-pact.
[e] See www.iaea.org/services/zodiac.
[f] See www.iaea.org/services/key-programmes/nutec-plastics.
[g] See www.iaea.org/services/networks/glowal.

7. IAEA, as of 2024, is also coordinating 127 coordinated research projects, many of which involve the non-power applications of nuclear energy.

8. There are notable regional coordination projects, such as the Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific, the African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology, the Cooperative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology and the Regional Cooperation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean, that serve to integrate nuclear energy projects, including non-power applications, in various regions.

Financing non-power applications

9. There is a growing need for financing as more countries realize the value of non-power applications in helping to provide solutions to pressing socioeconomic challenges. This has resulted in a proportional growth in the number of non-power applications in various fields that are still at the pilot or early stages of technological readiness and need more support for research and development.[2] Unfunded projects (also known as footnote-a/ projects) at IAEA have been increasing in the past few years, with a significant number of these projects being non-power applications. Moreover, as new projects move from the proof-of-concept stage into demonstration and upscaling, there is a need to ensure that the industry is both aware of these new technologies and are willing to finance them. Non-power applications, in general, are smaller in scale and have relatively low risk and capital expenditure demands.

Food for thought: ways forward through partnerships with industry and financing institutions

10. Maximizing the non-power applications of nuclear technology to achieve the Sustainable Development Goals entails a multifaceted approach. The following measures can be considered to help ensure that projects ultimately end up benefiting end-users at scale:

[2] See www.iso.org/obp/ui/en/#iso:std:iso:16290:ed-1:v1:en.

(a) Work toward raising general public awareness of non-power applications and their potential contribution to socioeconomic development;

(b) Encourage more public-private partnerships to provide support for collaborative regional or interregional initiatives including in coordinated research projects as organized through IAEA;

(c) Promote industrial uptake of novel products, services or solutions generated through nuclear technology;

(d) Utilize a coordinated national approach to nuclear applications, including the use of country programme frameworks to ensure that non-power projects are synchronized with the country's industries, as well as its long-term development goals;

(e) Support and encourage multisectoral participation in international conferences and meetings organized by IAEA and its member States;

(f) Promote the viability and scalability of non-power projects and encourage closer involvement of international financial institutions, development agencies, industry, academia and research institutions, where applicable;

(g) Increase engagement in regional and interregional partnerships dedicated to the peaceful uses of nuclear energy. These can serve as effective encompassing vehicles not only for the promotion of non-power applications, but also for partnership and resource mobilization.