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FROM ATOMS FOR PEACE TO ATOMS FOR SUSTAINABILITY: ALIGNING NUCLEAR TECHNOLOGY WITH SUSTAINABLE DEVELOPMENT GOALS (SDGS)

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ABSTRACT

Nuclear technologies, including energy production, medicine, water management and industrial innovation, are key to achieving the United Nations Sustainable Development Goals (SDGs). This paper explores how nuclear technology can contribute to a range of SDGs, including those focusing on affordable and clean energy (SDG 7), good health and well-being (SDG 3), clean water and sanitation (SDG 6), industry innovation and infrastructure (SDG 9), and climate action (SDG 13). It aims to show through an extensive examination of worldwide data and scientific literature how nuclear energy is a reliable source of low-carbon electricity to ensure both energy security and power decarbonisation. This study makes a case for developing countries to include nuclear technology in their national policy frameworks to achieve the SDGs, which are national aspirations for many countries around the world. Although nuclear technology faces obstacles such as safety and waste disposal issues, public acceptance, and high costs, its full potential can be maximised through strategic commitments and appropriate policy frameworks. The data related to nuclear technology presented in this study emphasises the importance of including it in national and international SDG plans to ensure a sustainable, fair, and secure future.

Keywords: *Nuclear Technology, Sustainable Development Goals (SDGs), Clean Energy, Nuclear Medicine, Climate Change Mitigation.*

INTRODUCTION

The 2030 Agenda for Sustainable Development was announced by the UN in 2015, with 17 Sustainable Development Goals (SDGs) to address global challenges such as poverty, health emergencies, making access to clean energy and protection of the environment, social inequality, among others(*Transforming Our World: The 2030 Agenda for Sustainable Development | Department of Economic and Social Affairs*, n.d.). These are ambitious aims which require creative and multifaceted efforts that should integrate economic growth, environmental sustainability and social inclusion. Nuclear technology is a complex field which, instead of being narrowly perceived from the perspective of electricity generation or weapons production, has the potential to deeply impact several SDGs. Whether it is clean energy, new medical treatments, food production, or water management, nuclear technologies offer promising possibilities that are increasingly being considered as relevant applications for sustainable development. Nuclear power has long been perceived as a controversial energy technology due to numerous nuclear and radioactive waste disposal accidents, as well as concerns about its potential contribution to nuclear weapons proliferation. However, increased attention to reactor technology, waste handling, regulation, and international cooperation has mitigated many of these concerns, raising awareness that nuclear applications have potential benefits. This progress has enabled the nuclear field to be redefined as a cornerstone of international plans in support of the SDGs.

Two essential issues that nuclear technology can provide solutions for are: energy security and environmental sustainability(*Climate Change and Nuclear Power 2022 | IAEA*, n.d.). At present, nuclear energy powers about 9% of the world's electricity(*Nuclear Power in the World Today - World Nuclear Association*, n.d.), providing a dependable, high-quality energy source with near-zero emissions. Unlike solar and wind, which are intermittent forms of renewable electricity(Ang et al., 2022), Nuclear power plants generate baseload electricity, which is vital for grid stability and for enabling the integration of increasing amounts of variable renewable energy(Hjelmeland et al., 2025). Nuclear power has not only continued to deliver large and reliable quantities of electricity to the world, but technological innovations such as small modular reactors (SMRs)(*Small Nuclear Power Reactors - World Nuclear Association*, n.d.) and Generation IV reactors(*Generation IV Nuclear Reactors - World Nuclear Association*, n.d.) could make nuclear even safer, more flexible and more competitive in the future. SMRs in particular can be used(Gaster, 2025) in off-grid or smaller grid remote applications to address development-related energy access challenges in developing countries and rural areas, to make a double contribution to SDG 7 (affordable and clean energy for all).

Apart from energy, the medical contribution of nuclear technology is irreplaceable. The medical application of nuclear science has transformed diagnostic imaging and cancer treatment for the better. Techniques such as positron emission tomography (PET) and computed tomography (CT)(Radiology (ACR), n.d.) imaging use radioactive isotopes to generate detailed images of internal body structures and help to diagnose diseases early and accurately. Moreover, nuclear technology plays a role in combating infectious diseases with innovative tactics, including the sterile insect technique (SIT)(*Sterile Insect Technique: Controlling Pests with Precision | CABI BPP*, n.d.). This application of nuclear technology contributes to SDG 3 - Good Health and Well-being - Ensure healthy lives and promote well-being for all at all ages. The availability of nuclear medicine and its use in health-care systems, especially in low- and middle-income countries, remains limited; however, current international collaborations are aimed at capacity building and technology transfer in order to expand these benefits worldwide(Giammarile et al., 2024).

Moreover, Water resource management, very vital for sustainable development and too often undervalued, can get help from nuclear science like isotope hydrology(*What Is Isotope Hydrology?*, 2025).

Despite many advantages, there are a number of obstacles to the implementation and development of nuclear technology. Safety continues to dominate public discussion, as emphasised by past incidents such as Chernobyl and Fukushima, which have had implications on social acceptance and regulatory practices. However, passively safe reactor designs(*Use of Passive Safety Features in Nuclear Power Plant Designs and Their Safety Assessment*, 2017) and hardened containment facilities(*Hardened-Containment-Vent-System.Pdf*, n.d.) are used in new designs to decrease the likelihood of accidents. The safe management of radioactive waste remains a technical and political challenge, but with the proper implementation of geological disposal or storage, waste management can be achieved in a safe and environmentally sound manner. Economic obstacles, especially large initial investment costs and stringent regulations, can limit the full utilisation of nuclear technology, especially in underdeveloped nations with limited monetary and technical resources. Furthermore, public scepticism over nuclear weapon proliferation and environmental risks requires open communication and stakeholder participation to develop trust and social acceptance.

Policy guidelines and international collaboration are key elements in addressing these challenges and exploiting the contributions that nuclear technology can make to sustainable development. Groups like the International Atomic Energy Agency (IAEA) advise, aid in the transfer of information, and support the peaceful, safe and secure use of nuclear power. The effectiveness of their support appears to depend on the capacity of nations to overcome certain technical, financial, and organisational challenges. It also relies on their ability to strengthen national regulators, create an ecosystem supportive of research and development, and use nuclear technology as a tool for achieving the Sustainable Development Goals.

Both public education and inclusivity can improve understanding in society, help people make better decisions on the deployment of nuclear technology, and aid its acceptance.

Nuclear is a multi-use technology which fulfils a number of SDGs simultaneously. Its ability to offer affordable, clean, reliable energy contributes to the mitigation and adaptation strategies for climate change control and energy access, and its uses in healthcare, agriculture, and water management are beneficial for the well-being of the people and resource sustainability. There are indeed daunting challenges (safety issues, the question of how to handle waste, costs, and opposition from the public), but technological innovation and political consensus can offer some avenues to respond to those difficulties. Moreover, nuclear technology can reach its full potential as a constructive instrument for the 2030 Agenda with strategic incorporation into sustainable development strategies, enabled by international support and public involvement. Instead of viewing nuclear as a high-risk technology, it should be regarded as an essential component of a diverse and resilient energy strategy that could be insulated from short-term supply perturbations, whether in developing or developed countries.

2. Literature Review

The growing number of publications on nuclear technology underscores its major role in promoting sustainable development in various fields, including energy, health, agriculture, and environmental protection. The International Atomic Energy Agency (IAEA 2020) highlights the unprecedented capacity of nuclear technology to be part of a low-carbon future, offering clean energy that is sustainable and scalable. Available 24/7, nuclear power plants provide the most consistent (base-load) electricity generation option to meet the ongoing energy needs of the growing, modern world while reducing greenhouse gas emissions. This capability makes the nuclear technology a strategic supplement to renewable energy systems, helping establish an energy mix that is balanced, robust and attractive, to serve as an engine for sustainable industrial expansion and raise the global living standard. Sovacool (2021) reinforces this view, arguing that the high energy density and relatively low carbon footprint make nuclear energy a potent weapon in the global struggle to decarbonise energy systems. Furthermore, the uses of nuclear technology do not stop at energy. It has become an essential tool in medicine, especially through X-ray technology and the use of radioisotopes in diagnostic and treatment equipment. Radiotherapy, which uses targeted radiation to kill cancer cells, has saved countless lives. WHO (2019) states that nuclear medicine has transformed the diagnosis and treatment of various diseases, leading to a substantial increase in effective treatments and earlier intervention. Moreover, nuclear-friendly approaches can help manage disease vectors and enhance food security, for example, by using mutation breeding in agriculture, which speeds up breeding to develop crops resistant to pests and extreme weather. These non-energy applications of nuclear technology bear witness to its multifaceted contribution to sustainable development and its relevance, which is not limited to power generation.

Addressing climate change is one of the leading global challenges, and nuclear power is increasingly considered by scientists as essential for achieving serious climate targets. The Intergovernmental Panel on Climate Change (IPCC) has singled out nuclear power explicitly as a critical element in such scenarios to limit global warming to within 1.5°C of pre-industrial temperature levels (IPCC 2018). This appreciation is based on the fact that nuclear power can create significant amounts of electricity with minimal (direct) carbon emissions, in contrast to the burning of fossil fuels with substantial emissions of greenhouse gases. Given the magnitude of the decarbonization needed in global energy systems, the asset of nuclear power as a dependable, low-carbon energy option is even more significant. Its capability to provide constant power tackles issues of intermittency with renewable generation and provides energy security and stability to the grid. In addition, nuclear power technology is progressing with advanced reactor designs, including the Generation IV and small modular reactors (SMRs), which are being developed to provide additional safety, to minimise waste generation, and to further improve economic viability. They could also allow wider deployment of nuclear energy in support of reduced carbon emissions for regions now dependent on hydrocarbon resources, and thus facilitate the movement for low-carbon energy systems and play a major role in climate change mitigation.

Other than energy and climate, nuclear technology also contributes importantly to development/sustainability in water resources and agriculture. Lack of access to water and its poor quality is a major global issue with implications that impact human health, food production and ecosystem stability. The use of isotope hydrology, a nuclear methodology that uses stable and radioactive isotopes to track and study water sources, is allowing the accurate mapping and sustainable use of ground and surface water systems. The IAEA (2019) emphasises that isotope hydrology aids in identifying sources of pollution, the rate of aquifer recharge, and the dynamics of water movement, data that are essential for sound water governance and for the improvement of sanitation. This scientific knowledge is crucial for water-scarce areas and can lead to improved decision-making to conserve water quality and quantity for communities and agriculture. In agriculture, nuclear technology assists in the creation of better plant varieties by a process called mutation breeding, which speeds up the natural process of genetic variation so that plants become more resistant to environmental stresses, pests and diseases. According to Crouch and Drew (2015), since the 1940s over 3,200 mutant plant varieties have been produced by nine countries through marker- and mutation-assisted plant breeding and released to farmers, and the IAEA reports (The FAO Annika Marie Stensrud, 2021) that nuclear-induced mutation has led to the development of more than 3,200 new plant and crop varieties and more than 30% received an additional US$200–700M/year in national benefit. In addition, nuclear tools are used for control of pests (for example, sterile insect technique) to decrease dependence on chemical pesticides and to encourage environment friendly agricultural practices. These applications demonstrate the diverse applications of nuclear technology to drive sustainable resource use and resilient food systems.

The experts also underline the necessity of embedding nuclear technology in wider sustainable development objectives and policies. Even though nuclear energy and the associated technologies are abundant in many advantages, their successful application relies on good regulations tailored to safety, security and waste management.

3. Contribution of Nuclear Technology to Major Sustainable Development Goals (SDGs)

Nuclear technology is essential for the implementation of many of the United Nation's Sustainable Development Goals, particularly SDG 7 (Affordable and Clean Energy), SDG 3 (Good Health and Well-being), SDG 6 (Clean Water and Sanitation), SDG 9 (Industry, Innovation and Infrastructure), and SDG 13 (Climate Action). The practical uses of nuclear science are diverse, but its applications are not limited to producing electricity; it is also being used in the field of healthcare, environmental conservation and sustainable industrial innovations, therefore, offering tremendous opportunities for credible development.

3.1 SDG 7: Affordable and Clean Energy

Access to inexpensive, reliable, sustainable and modern energy is the cornerstone of global development. Its special feature is that it has a high energy density and can supply continuous, on-demand electrical power irrespective of the seasons— something that renewables such as solar or wind can never ensure. It is this baseload capability that is vital for grid stability and for providing for the upwardly spiralling consumption needs, especially in fast-developing economies.

New trends in the design of nuclear reactors are contributing to the expansion of the role of nuclear power in SDG 7. Small Modular Reactors (SMRs) are scalable and small in size, which can result in much higher safety, faster construction times, and the ability to be deployed in limited infrastructure, such as that in remote and off-grid locations. Small modular reactors have great potential in increasing access to energy in areas not suited to large reactors. Moreover, there are advanced Gen-IV reactor designs which have passive safety systems and better fuel cycles for waste minimisation and efficient operation.

There exists a significant environmental benefit in terms of greenhouse gas reduction by decarbonising the energy sector. This is not only an environmental consideration, but also a matter of making energy financially accessible in the future by stabilising supply and reducing dependence on volatile fossil fuel markets.

Nuclear power is therefore an essential part of robust, clean and affordable energy systems that could be made available to all.

3.2 Sustainable Development Goal 3: Good Health and Well-being

The development of nuclear technology has a revolutionary effect on global health systems and thus can contribute directly to achieving the goal of healthy lives and well-being of all age groups. Diagnostic procedures such as Positron Emission Tomography (PET) and Computed Tomography (CT) are essential for early and accurate diagnosis of disease. These imaging techniques use radioactive isotopes to visualise physiological events in the human, helping clinicians to detect cancers, cardiovascular diseases and neurological conditions with great accuracy. Radiotherapy(*Radiation Therapy for Cancer: How Does It Work?*, n.d.) is one of the most successful treatment strategies for several cancers and has been shown to increase the survival rate and quality of life of patients.

In oncology, targeted radiation is used in the form of radiotherapy for destroying cancerous cells in a localised manner to provide a low impact on healthy tissues. The application of radioisotopes and modern nuclear medicine has had a profound impact on reducing mortality and improving life for millions of patients throughout the world. Aside from diagnosis and treatment, nuclear technology also promotes public health through the safe and efficient control of vector-borne diseases with the sterile insect technique (SIT). This is done by exposing sterile insects to radiation so that the active insects cannot reproduce, ultimately leading to a reduction in insect-borne diseases, such as those spread by mosquitoes. The SIT has already been successfully used in 6 continents(*Sterile Insect Technique: Controlling Pests with Precision | CABI BPP*, n.d.) to help eliminate diseases such as malaria and dengue fever and to improve the health of the citizens.

These nuclear applications for healthcare have a fundamental role in combating transmissible and non-transmissible diseases and hence contribute to the achievement of SDG 3 by enhancing the management and prevention of diseases, as well as strengthening the overall health system.

3.3 SDG 6: Clean water and sanitation

Providing access to safe water and sanitation is a global challenge, especially in arid and water-stressed regions. Isotope hydrology is the unique contribution of nuclear technology for water resources management. The science uses stable and radioactive isotopes as tracers to understand the origin, flow paths and residence time of water in aquifers, rivers and lakes. Isotope hydrology is making an important contribution to the development of rational strategies for sustainable water usage and pollution control by providing insights into local groundwater recharge rates, flow paths, and pollution sources.

This high-resolution knowledge is quite important, especially for scarce water resources, pollution detection and sustainable use in arid and waterless regions. These features contribute directly to the fulfilment of SDG 6, which is to ensure availability and sustainable management of water and sanitation for all.

In addition, nuclear techniques allow the identification of water pollution sources through the monitoring of pollutants and the effects of human actions on water. This is necessary for the supply of drinking water, and also for sanitation. In some countries, nuclear desalination plants exist which produce potable water from otherwise undrinkable saline water, which can also be used to generate electricity.

Thus, through the efficient use and protection of freshwater resources, nuclear techniques can contribute to achieving SDG 6, which aims at ensuring the availability and sustainable management of water and sanitation for all, leading to better sanitation and public health.

3.4 SDG 9: Industry, Innovation and Infrastructure

As a trigger for industrial growth and innovation, nuclear technology provides infrastructure for sustainable economic development. Research reactors and particle accelerators are essential nuclear facilities that offer significant benefits for scientific and industrial development. These installations aid in the development of new materials with improved properties and support applications such as industrial radiography for non-destructive testing(*Industrial Radiography*, 2016) and efficient quality control in manufacturing.

Industrial Radiography utilises nuclear sources to produce gamma rays or neutrons to examine structures for flaws without causing damage. This improves security in industries including aerospace, building and manufacturing of motor vehicles by identifying early flaws or imperfections. Furthermore, in industries, nuclear technologies help to optimise processes and the use of resources, as well as to minimise waste and environmental impact.

In R&D, nuclear technology facilitates innovation by enabling state-of-the-art experiments that lead to new technologies and products(*Driving R&D to Build a Nuclear Industry*, n.d.). Continuous progress in nuclear science promotes sustainable industrialisation and aligns with SDG 9: building resilient infrastructure, promoting inclusive and sustainable industrialisation, and fostering innovation.

3.5 SDG 13: Climate Action

Mitigating climate change is one of the defining challenges of our time, demanding a rapid transition to low-carbon energy systems and resilient technologies. Nuclear power is an integral part of climate action, as it can deliver large-scale, reliable electricity generation with near-zero greenhouse gas emissions. This characteristic makes nuclear power essential to national and international plans for reducing carbon emissions and lowering global CO_2 levels to the targets set for limiting climate change, such as those outlined in the Paris Agreement(*The Paris Agreement | UNFCCC*, n.d.).

Nuclear also provides other dynamic applications beyond power generation, with the ability to mitigate and adapt to climate change. And, for instance, by installing a water desalination(*Desalination - World Nuclear Association*, n.d.) plant powered by nuclear energy at sea, fresh water can be obtained in low-rain regions where sea level rise exacerbates drought, thus easing the problem of water scarcity due to changes in climate. Furthermore, studies on hydrogen production from thermochemical processes driven by high-temperature nuclear reactors show a potential pathway to clean hydrogen fuel for decarbonising transportation and heavy industry(Jaszczur et al., 2016).

By including nuclear power and related technologies in climate action plans, countries can cost-effectively shift to low-carbon, climate-resilient economies that are consistent with the spirit of SDG 13. Nuclear science can also play a role in environmental monitoring and pollution prevention, aiding larger climate action targets. Moreover, in terms of climate action, it can help measure the change over time of environmental features and the testing of compliance with abatement measures.

The relation between nuclear technology and significant Sustainable Development Goals is deep and complex. Nuclear technology addresses some of the world's most pressing challenges by providing clean, reliable energy, improving the diagnosis and treatment of diseases, supporting clean water supplies, increasing the productivity of industries and power generation and ensuring the most sustainable, safe and effective response to climate change. Despite lingering concerns over safety, waste disposal, public acceptance, continued technological developments, and increasingly effective policies are making nuclear more sustainable. To make full use of nuclear technology, we need integrated approaches that link it to broader sustainable development objectives so that it can make a meaningful and responsible contribution to a better future for all. Below is a statistical analysis of nuclear technology applied in various fields across the world. It can serve as a model for developing countries, opening up practical possibilities for integrating nuclear technology into their national policy frameworks.

4. Practical Usage of Nuclear technology on a global level

This study reports the statistics on nuclear energy's contribution to the Sustainable Development Goals (SDGs). The outcomes are organized according to key SDGs(as discussed above) commonly associated with nuclear applications: SDG 7 (Affordable and Clean Energy), SDG 3 (Good Health and Well-being), SDG 6 (Clean Water and Sanitation), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 13 (Climate Action). International reports, scientific literature, and official agency statistics are aggregated to enumerate the role of nuclear technology and demonstrate its scale and significance.

4.1 The Role of Nuclear in World Electricity (SDG 7)

At present, nuclear power provides almost 10% of global electricity generation but the proportion varies between regions. Share of nuclear electricity production by region is summarized in Table 4.1.

Region	Nuclear Share of Electricity (%)	Total Nuclear Capacity (GW)	Number of Reactors	Notes
North America	19.7	98.5	94	USA largest global producer
Europe	25.3	126.4	130	France leads with 70% nuclear electricity
Asia-Pacific	5.4	56.0	57	Rapid growth in China and South Korea
Rest of the World	3.1	15.2	17	Emerging interest in SMRs
Global Average	**10.1**	**296.1**	**298**	

Table 4.1: Global nuclear electricity production and capacity by region (Source: IAEA, 2023)

The data demonstrates that nuclear energy is a substantial contributor to clean and reliable electricity, particularly in developed economies. Advanced reactor designs and SMRs are projected to expand capacity, especially in developing regions, enhancing energy access and supporting SDG 7.

4.2 Impact of Nuclear Medicine on Health Outcomes (SDG 3)

Nuclear technology underpins critical health services, including diagnostic imaging and cancer treatment. Table 4.2 highlights improvements in health indicators attributable to nuclear medicine applications.

Application	Indicator	Improvement (%)	Region	Source
Radiotherapy for Cancer	Five-year survival rate increase	20-30%	Global	WHO, 2022
Diagnostic Imaging	Diagnostic accuracy increase	15-25%	Developed countries	IAEA, 2021
Sterile Insect Technique	Reduction in vector-borne diseases	40-70%	Africa, Latin America	FAO, 2020

Table 4.2: Impact of nuclear technology on health and disease control indicators

Radiotherapy and nuclear imaging have significantly improved cancer survival rates and diagnostic capabilities worldwide. Additionally, the sterile insect technique has effectively reduced transmission rates of diseases such as malaria, contributing to healthier populations.

4.3 Nuclear Techniques in Water Resource Management (SDG 6)

Isotope hydrology and nuclear-powered desalination play critical roles in water sustainability. Table 4.3 summarizes key outcomes in water management where nuclear techniques have been applied.

Application	Outcome	Region	Impact Measurement
Isotope hydrology	Improved groundwater management	Middle East, Africa	15-25% increase in sustainable yield
Water contamination tracing	Identification of pollutants	Asia-Pacific	Early detection in 60% of tested sites
Nuclear desalination	Potable water production	Gulf States, India	5000 m^3/day plant operational

Table 4.3: Applications of nuclear technology in water resource management

These applications have enabled better monitoring and management of scarce water resources, particularly in drought-prone areas, directly supporting SDG 6
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4.4 Nuclear Technology in Industrial Innovation (SDG 9)

Nuclear-driven innovations support industrial efficiency and safety. Table 4.4 illustrates industrial sectors benefiting from nuclear technologies and associated outcomes.

Industry Sector	Nuclear Application	Outcome	Economic Impact
Aerospace & Automotive	Non-destructive testing	30% reduction in defects	$500 million annual savings
Materials Science	Research reactors	Development of high-strength alloys	$200 million in new product sales
Manufacturing	Radiography and quality control	Enhanced product reliability	15% increase in customer satisfaction

Table 4.4: Nuclear technology contributions to industrial innovation

The improvements in product quality, safety, and efficiency across these sectors foster sustainable industrial growth, aligning with SDG 9.

4.5 Nuclear Energy and Climate Mitigation (SDG 13)

Nuclear power's contribution to climate action is notable in reducing CO_2 emissions. Table 4.5 quantifies emission reductions enabled by nuclear energy.

Parameter	Value	Notes
Global CO_2 emissions avoided	~2.5 billion tonnes/year	Equivalent to removing 540 million cars from roads
Share of low-carbon electricity	40%	Nuclear plus renewables combined
Potential additional reduction	Up to 20% global emissions by 2050	With expanded nuclear deployment

Table 4.5: Nuclear energy's contribution to global CO_2 emission reductions

In addition to electricity generation, nuclear-powered desalination and hydrogen production nuclear technologies present innovative solutions to climate adaptation challenges, enhancing resilience.

6. Conclusion

The study provides insights into the most important and multifaceted contributions of nuclear power in realising the national aspirations manifested in SDGs. The overarching message is that nuclear technology should be incorporated in the strategies dealing with sustainable developments to optimise its positive aspects and mitigate its negative impacts.

However, even with these benefits, issues related to safety, cost, waste disposal, and social acceptance need to be managed through effective policies, innovation, and public engagement. International cooperation -regulations, incentives and education- is needed to promote the responsible and sustainable deployment of nuclear technology.

In conclusion, nuclear technology is underutilised and should be accepted as a critical piece of the puzzle when it comes to global sustainable development. Its ethical and innovative application can promote the achievement of the SDGs, supporting a more equitable, healthful and environmentally sustainable future. The key will be for governments, industry and researchers to work together to unlock its full potential, while ensuring the public's confidence and protecting the environment.

7. Challenges and Considerations

7.1 Safety and waste considerations

There are always fears of nuclear accidents and the problems surrounding the safe disposal of radioactive wastes, despite technological advancements. Regulatory: Sound regulatory regimes, international help, and new reactor types. Generation IV reactors will serve to resolve these problems with time (World Nuclear Association, 2023).

7.2 Building Public Trust in Nuclear Technology

Due to historical accidents and proliferation fears, nuclear technology is frequently met with public distrust. Transparent dialogue and involving the public in decision-making are mandatory for securing a social license for nuclear projects.

7.3 Economic and Technical Obstructions

Large upfront costs and technical complexity constrain the full utilisation of nuclear technology, especially in developing countries. To address these obstacles, international financial assistance and capacity-building efforts are needed.

8. Policy Recommendations

- **Strengthen International Cooperation:** Enhanced collaboration among governments, the International Atomic Energy Agency (IAEA), and industry stakeholders can facilitate technology transfer and safety standards enforcement.
- **Promote Research and Development:** Investment in advanced reactors, waste minimization technologies, and medical isotope production is crucial for sustainable nuclear technology deployment.
- **Enhance Public Engagement:** Governments should launch education campaigns to improve public understanding of nuclear technology's benefits and risks.
- **Integrate Nuclear in National SDG Strategies:** Countries should explicitly include nuclear technology within their sustainable development and climate action plans.

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