

NUCLEAR FOR CLIMATE

POSITION PAPER

2024



Call to Action

As we approach COP29, it is imperative to recognize that the **global fight against climate change cannot be won without nuclear energy**. Nuclear power stands as a vital component of a low-carbon future, offering the stability, scalability, and reliability needed to complement renewable energy sources. To achieve net-zero emissions by 2050, we must accelerate the development and deployment of nuclear technology worldwide.

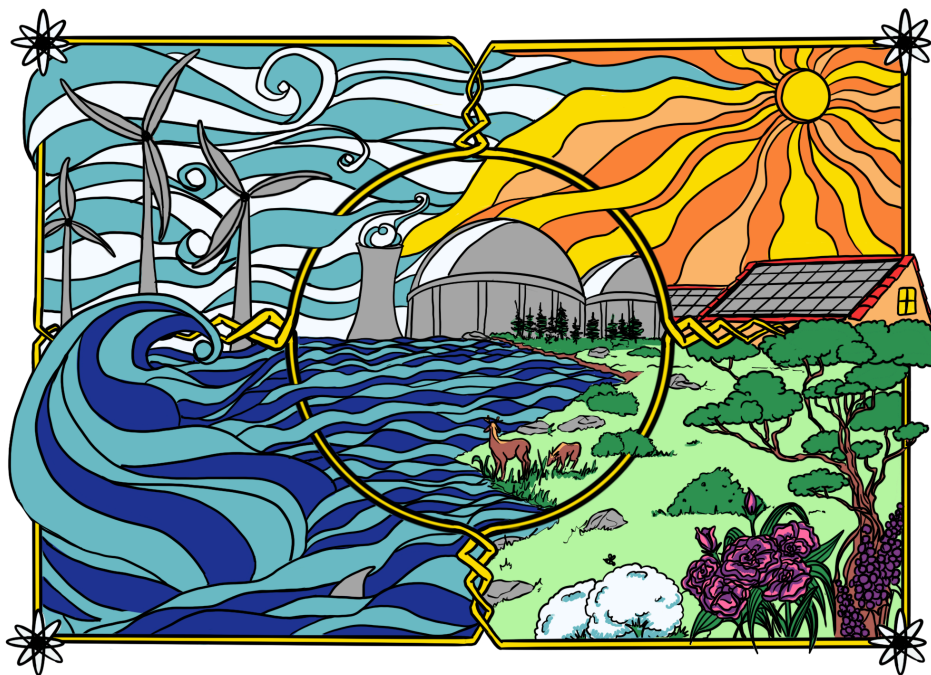
We call on governments, policymakers, and global leaders to:

- **Integrate Nuclear Energy in National Climate Strategies:** Countries must include nuclear energy as a key element in their climate action plans, recognizing its ability to reduce carbon emissions and ensure energy security.
- **Enhance Support for Nuclear Development in the Global South:** The global community must provide technical, financial, and regulatory support to help developing countries harness the benefits of nuclear energy, addressing energy poverty while contributing to global decarbonization efforts.
- **Increase Investment in Nuclear Energy:** Innovative financing mechanisms, including public-private partnerships, green bonds, and international funding, are essential to drive the expansion of nuclear infrastructure. We must prioritise investment in modern, safe nuclear technologies.
- **Promote Public Awareness and Acceptance:** A concerted effort is needed to educate the public on the safety, cleanliness, and sustainability of nuclear energy. Transparent communication and community engagement are key to overcoming misconceptions and building support.
- **Strengthen Global Cooperation on Nuclear Safety and Innovation:** International collaboration is critical to advancing nuclear technology, sharing best practices, and ensuring the highest safety and security standards. We must work together to develop and deploy the next generation of nuclear reactors.

We can make meaningful progress towards a sustainable, net-zero future by embracing nuclear energy as a cornerstone of our climate strategies. Building on the success of COP28, let COP29 be the next step to collectively commit to nuclear energy as a force for global climate action.

Executive Summary

- **Nuclear energy is crucial for achieving global net-zero emissions.** With its low carbon footprint and high energy output, it serves as a reliable complement to renewable energy sources, supporting the global effort to combat climate change.
- **The Global South presents significant potential for nuclear energy development.** Despite challenges, nuclear energy can provide energy security, spur economic growth, and reduce greenhouse gas emissions. International cooperation and innovative financing are key to realising this potential.
- **Modern nuclear power is both safe and clean.** Technological advancements and rigorous safety regulations ensure that nuclear energy remains one of the safest and most efficient energy sources, addressing concerns about safety and waste management.
- **The need for more financing in nuclear energy is urgent.** Current mechanisms are insufficient, requiring innovative solutions like green bonds and public-private partnerships to attract the necessary investments for nuclear infrastructure development.
- **Nuclear energy contributes to several Sustainable Development Goals (SDGs).** It not only supports affordable and clean energy (SDG 7) but also plays a role in climate action (SDG 13), industry innovation (SDG 9), and health and well-being (SDG 3), among others. Nuclear technology is integral to global sustainable development.



Nuclear in the Global Stocktake

COP28 in Dubai marked a turning point in global climate policy by explicitly recognizing the **need to transition away from fossil fuels and accelerating nuclear technology**, a first in international climate discussions. These landmark statements highlighted the urgent necessity to shift global energy systems to address the escalating climate crisis.

The agreement, referred to as the "UAE Consensus", acknowledged the critical need to move away from fossil fuels. The Conference, **for the first time in history**, openly called on accelerating low-carbon technologies, among them nuclear, in their development and usage, particularly in hard-to-abate sectors and hydrogen production. Furthermore, at the sidelines of COP, leaders from more than 20 countries made **a significant commitment to tripling global nuclear energy capacity by 2050**. The focus on nuclear energy reflects a growing consensus on its importance in decarbonizing energy supply and achieving long-term sustainability goals. This was further shown at **the first Nuclear Energy Summit**, held in Brussels in March 2024, proving broad political support for nuclear energy coming from more than 30 countries worldwide and from the European Union.

Expanding nuclear capacity threefold by 2050 is not without its challenges.

Achieving this ambitious goal will require strengthening international collaboration, establishing supportive policy frameworks, ensuring reliable supply chains, and developing a skilled workforce. Additionally, regulatory and industrial standardisation will be crucial to facilitate the safe and efficient expansion of nuclear power. While these challenges need to be addressed, the recognition of nuclear energy in the Global Stocktake as well as the commitment of world leaders to expand its capacity signal a pivotal shift that lays the groundwork for a future where nuclear plays a more important role in ensuring a sustainable, secure, and low-carbon energy future.

Net Zero Needs Nuclear

Achieving net zero emissions by mid-century is a shared goal that unites countries, organisations, and communities around the world. As we must limit global warming to 2 degrees, and strive towards 1.5 degrees Celsius, the path forward requires a diverse mix of energy sources. Among these, nuclear energy stands out as a critical component that can help bridge the gap to a carbon-free future. **Nuclear power offers a unique combination of benefits that are essential for achieving net zero.** It provides a stable, reliable source of baseload electricity, which is crucial for balancing the variability of renewable energy sources like wind and solar.

Nuclear energy is virtually carbon-free during operation. This makes it an indispensable ally in the fight against climate change, as it can significantly reduce our reliance on fossil fuels without compromising energy security or economic growth. In countries where nuclear power is already part of the energy landscape, emissions are generally lower, and the transition to net zero is more attainable.

However, to fully harness the potential of nuclear energy, we need to invest in infrastructure and advance existing and new technologies. Nuclear reactors currently available on the market offer a ready-to-use option, possibly to be implemented immediately. Small modular reactors (SMRs) and Advanced Modular Reactors (AMRs), when they reach technological maturity, can offer, among others, increased construction efficiency, additional flexibility, industrial usage, and many more. **These current and innovative technologies can play a pivotal role in both developed and developing countries**, providing a scalable solution to meet growing energy demands while adhering to environmental commitments.

By embracing nuclear power as part of a diverse and balanced energy strategy, we can pave the way for a sustainable and secure future, ensuring that our climate goals are met without compromising the needs of the present or future generations. Let's move forward together, recognizing that ***net zero truly needs nuclear.***

Nuclear development in the Global South as a possibility

The Global South is facing a unique challenge as it seeks to balance economic growth with sustainable energy solutions. As these countries look to improve their living standards and industrialise, causing their energy needs to rise rapidly. **Nuclear energy offers a promising solution**, one that is both environmentally sustainable and capable of meeting the growing energy demands. Countries in this region have already begun exploring nuclear energy as a viable option. For example, Argentina, Brazil, China, India, Mexico, and South Africa have long been leaders in the block, with their existing nuclear power plants, and other nations like Bangladesh, Egypt, Turkey, and many others are actively exploring nuclear energy to diversify their energy mix.

The potential for nuclear energy in the Global South lies in its ability to provide a stable and continuous power supply, which is essential for industrial development and reducing energy poverty. **Working with intermittent renewable sources, nuclear power can generate electricity 24/7, ensuring a reliable energy supply that can drive economic growth.** According to the needs of specific countries, the nuclear sector offers products from reactors providing large amounts of electricity and/or heat, to small ones, able to integrate in smaller-scale economies.

However, for nuclear development to truly take off in the Global South, it will require strong international cooperation, knowledge sharing, and investment. Support from international organisations and partnerships with countries that have established nuclear industries can help build the necessary infrastructure, regulatory frameworks, and skilled workforce.

Nuclear Energy: A Safe and Clean Choice for the Future

Over the past few decades, **the nuclear industry has made significant advancements** in technology and safety protocols, making it one of the most reliable low-carbon energy sources available today. In order to ensure the highest standards of safety and reliability, the reactors in operation today are designed with multiple layers of protection, including advanced containment systems and automated shutdown procedures, as well as highly optimised maintenance and outage processes. For instance, in the United States, nuclear power plants are producing electricity at their maximum capacity more than 92% of the time, which is higher than any other energy source. This reliability underscores the stringent measures that ensure these plants operate without incident and unnecessary stops.

It is worth to note that **nuclear energy is one of the cleanest energy sources, with a high level of efficiency**. Nuclear energy does not involve emitting air pollution and it produces zero carbon emissions during operation, making it a key player in the fight against climate change. A typical nuclear plant prevents the emission of approximately 3 million metric tons of CO₂ annually compared to a coal-fired power plant. Globally, **nuclear power currently avoids more than 440 million metric tons of CO₂ emissions each year**, which is equivalent to taking 100 million cars off the road (Office of Nuclear Energy, 2024). In addition to being clean, nuclear energy is highly efficient. A single uranium fuel pellet, which is about the size of a gummy bear, produces as much energy as one ton of coal or almost 150 gallons of oil (Nuclear Energy Institute, 2024). This efficiency means that nuclear plants require significantly less fuel and generate far less waste compared to fossil fuels. **The waste that is produced is carefully managed and stored in secure facilities**. Advanced technologies are also in place and in further development, serving to recycle spent nuclear fuel, further minimising its environmental impact. Finally, nuclear power plants, out of all electricity sources, require the least land per energy unit produced, sparing space for nature and people.

Increasing Investment in Nuclear: A Key to a Sustainable Future

To fully realise the potential of nuclear energy in achieving global climate goals, we need to significantly increase investment in this critical technology. While nuclear energy is one of the most efficient and low-carbon sources of power, the financial mechanisms currently available are insufficient to meet the growing demand for clean energy and to support the expansion of nuclear infrastructure. Globally, **nuclear power contributes about 10% of the world's electricity and nearly one-third of all low-carbon electricity**. However, to meet the ambitious targets set by the Paris Agreement, the International Energy Agency (IEA) estimates that nuclear capacity needs to at least double by 2050 (IEA-Nuclear, 2023). This expansion requires substantial financial means, as building a nuclear power plant involves significant upfront costs. Despite these costs, the long-term benefits are immense, as nuclear plants provide stable, low-cost electricity for decades.

One of the key challenges is the lack of sufficient financing mechanisms specifically tailored for nuclear projects. Unlike renewable energy projects, which often benefit from a wide range of subsidies, tax incentives, and green financing options, nuclear energy has historically faced more stringent financial and regulatory hurdles. To address this gap, there is a pressing need for innovative financing options, such as green bonds and climate bonds, that can attract investment from both the public and private sectors. In 2021, the global green bond market exceeded \$500 billion, but only a small fraction was allocated to nuclear projects (Climate Bond, 2022). Public-private partnerships (PPPs) also offer a promising avenue for increasing investment in nuclear energy. By combining public support with private investment, PPPs can help distribute financial risks and mobilise the capital needed to kickstart large-scale nuclear projects. For instance, the Hinkley Point C project in the United Kingdom, a major nuclear power station currently under construction, is funded through a combination of public and private investment, demonstrating the potential of PPPs in this sector. Also, the surging electricity demand from AI-driven data centers and microchip production is intensifying the need for reliable, carbon-free power sources. Recent Public-Private Partnerships in the U.S. highlight nuclear energy's role in this area. For example, the **Constellation-Microsoft deal** to reopen the Three Mile Island plant, alongside agreements to co-locate data centers at nuclear facilities, illustrates how nuclear power can support the growing energy needs of the tech sector. These partnerships help meet the vast power requirements of data centers while ensuring low-carbon energy solutions, further reinforcing the necessity of nuclear power in addressing both technological growth and climate goals.

In addition to financing new projects, there is also a need to invest in research and development (R&D) for advanced nuclear technologies, such as SMRs and AMRs. Increased R&D funding can accelerate the deployment of these technologies, making nuclear energy more accessible and attractive to investors.

Nuclear: A Player in the Journey Towards the Sustainable Development Goals (SDGs)

No Poverty (SDG 1) Nuclear energy has the potential to reduce poverty by providing stable, high-paying jobs in the nuclear industry and related sectors. For example, the construction and operation of nuclear power plants create employment opportunities in engineering, maintenance, and safety, leading to increased income and improved living standards in communities near these facilities.

Nuclear for Hunger-Free World (SDG 2) Nuclear technology enhances agricultural productivity through techniques like radiation-induced mutation breeding, which helps develop crop varieties that are more resistant to pests, diseases, and climate change. This ensures a stable food supply, reducing hunger and food insecurity in vulnerable regions.

Nuclear for Better Health (SDG 3) Nuclear medicine plays a critical role in diagnosing and treating various diseases, including cancer. Techniques such as radiotherapy and nuclear imaging improve healthcare outcomes, leading to longer, healthier lives. Additionally, nuclear technologies help in sterilising medical supplies, ensuring the safety and hygiene of medical procedures.

Empowering Education with Nuclear Science (SDG 4) Nuclear energy supports education by fostering scientific research and innovation. Universities and research institutions involved in nuclear science offer specialised programs that train the next generation of scientists and engineers, contributing to a well-educated workforce capable of addressing global challenges.

Nuclear in Gender Equality (SDG 5) The nuclear industry is actively working to close the gender gap by promoting the inclusion of women in science, technology, engineering, and mathematics (STEM) fields. Initiatives aimed at increasing female participation in nuclear energy roles help empower women and ensure gender equality in the workforce.

Clean Water Solutions through Nuclear Tech (SDG 6) Nuclear technology aids in the detection and treatment of water pollution. For instance, isotopic techniques are used to trace the sources of water contamination, enabling targeted clean-up efforts. Additionally, nuclear desalination processes provide a sustainable method to produce fresh water from seawater, essential for arid regions.

Nuclear for Affordable and Clean Energy (SDG 7) Nuclear energy is a reliable and low-carbon source of electricity, crucial for achieving affordable and clean energy for all. By reducing reliance on fossil fuels, nuclear power helps lower greenhouse gas emissions, contributing to a sustainable energy future.

Economic Growth Aided by Nuclear Energy (SDG 8) The nuclear sector contributes to economic growth by generating significant economic activity. From the supply chain to the final operation, nuclear projects involve a range of industries, driving innovation and supporting economic development. The sector also provides stable, long-term employment opportunities.

Industry Innovation with Nuclear (SDG 9) Nuclear energy drives advancements in various industries, from the development of new materials to innovations in energy storage. The construction and operation of nuclear power plants require sophisticated infrastructure, which, once established, can also support other sectors such as healthcare and manufacturing.

Nuclear Energy: A Tool for Equality (SDG 10) By providing reliable energy access, nuclear power can help reduce inequalities, particularly in energy-poor regions. The expansion of nuclear energy in developing countries ensures that all populations, regardless of location, have access to the electricity necessary for economic and social development.

Sustainable Cities Powered by Nuclear (SDG 11) Nuclear energy supports the development of sustainable cities by providing a consistent and clean source of power. This is especially important for urban areas, where the demand for energy is high. Additionally, nuclear plants occupy relatively small land areas, minimising the environmental footprint compared to other energy sources.

Responsible Consumption and Production (SDG 12) Nuclear technology contributes to responsible consumption and production by enabling sustainable industrial practices. For example, radiation technology is used in the food industry to improve food safety and extend shelf life, reducing waste and ensuring that food production is efficient and sustainable.

Nuclear 4 Climate (SDG 13) Nuclear energy is a key tool in the fight against climate change. It provides a substantial amount of low-carbon electricity, helping to reduce global greenhouse gas emissions. As countries work toward meeting their climate goals, nuclear energy will play a critical role in limiting global temperature rise.

Nuclear and Life Below Water (SDG 14) Nuclear energy helps tackle ocean acidification by preventing CO₂ emissions. Furthermore, we can monitor the health of water ecosystems thanks to nuclear techniques.

Nuclear and Life on Land (SDG 15) Nuclear energy supports biodiversity preservation, thanks to its uniquely small physical footprints. Thanks to nuclear techniques, it is possible to develop efficient soil management and crop production methods, as well as track and prevent contaminants from harming the environment.

Nuclear, Peace, Justice and Strong Institutions (SDG 16) Civil nuclear programmes require the development of strong national institutions, robust regulation & international conventions, like the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). Beyond that, nuclear techniques can also help enhance daily security in other fields, with applications in airport security, forensics and crime scene investigation.

Nuclear and Partnerships for the Goals (SDG 17) Nuclear sector creates multi-level networks to share skills, and expertise, and achieve common goals, while collaborating with international organisations to support development worldwide. Finally, many nuclear institutions and associations support programmes to facilitate the share of knowledge and experience with developing countries.

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a key source of
clean energy**


About N4C

Nuclear for Climate is a grassroots initiative co-founded in 2015 after the COP21 conference in Paris. It gathers over 150 associations, professionals, scientists and enthusiastic volunteers from all around the globe with the goal of educating policymakers and the public about nuclear energy and encouraging its use for those cases where it can be helpful as one of the solutions as a carbon-free energy for the energy transition and to mitigate climate change.


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