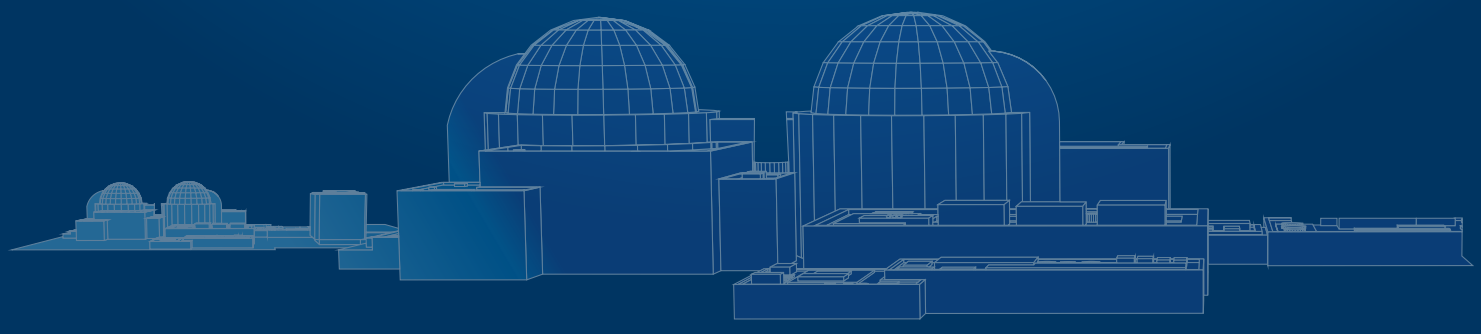
IAEA BULLETIN

INTERNATIONAL ATOMIC ENERGY AGENCY

The IAEA's flagship publication | May 2025 | www.iaea.org/bulletin

STAKEHOLDER ENGAGEMENT IN NUCLEAR PROGRAMMES



IAEA BULLETIN
is produced by the
Office of Public Information and Communication
International Atomic Energy Agency
Vienna International Centre
PO Box 100, 1400 Vienna, Austria
Telephone: (43-1) 2600-0
iaeabulletin@iaea.org

Editor: Kirstie Gregorich Hansen
Managing Editor: Mary Albon
Design & Production: Ritu Kenn

IAEA BULLETIN is available online in all United Nations languages at
www.iaea.org/bulletin

Cover image:
IAEA

Follow us on

IAEA Atoms for Peace and Development

The mission of the **International Atomic Energy Agency** (IAEA) is to help prevent the spread of nuclear weapons and to help all countries — especially in the developing world — benefit from the peaceful, safe and secure use of nuclear science and technology.

Established as an autonomous organization under the United Nations in 1957, the IAEA is the only organization within the UN system with expertise in nuclear technologies. The IAEA's unique specialist laboratories help transfer knowledge and expertise to IAEA Member States in areas such as human health, food, water, industry and the environment.

The IAEA also serves as the global platform for strengthening nuclear security. The IAEA has established the Nuclear Security Series of international consensus guidance publications on nuclear security. The IAEA's work also focuses on helping to minimize the risk of nuclear and other radioactive material falling into the hands of terrorists and criminals, or of nuclear facilities being subjected to malicious acts.

The IAEA safety standards provide the fundamental principles, requirements and recommendations to ensure nuclear safety and reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from the harmful effects of ionizing radiation. The IAEA safety standards have been developed for all types of nuclear facilities and activities that serve peaceful purposes, as well as for protective actions to reduce existing radiation risks.

The IAEA also verifies through its inspection system that Member States comply with their commitments under the Nuclear Non-Proliferation Treaty and other non-proliferation agreements to use nuclear material and facilities only for peaceful purposes.

The IAEA's work is multi-faceted and engages a wide variety of partners at the national, regional and international levels. IAEA programmes and budgets are set through decisions of its policymaking bodies — the 35-member Board of Governors and the General Conference of all Member States.

The IAEA is headquartered at the Vienna International Centre, Vienna, Austria. Field and liaison offices are located in Geneva, New York, Tokyo and Toronto. The IAEA operates scientific laboratories in Monaco, Seibersdorf and Vienna. In addition, the IAEA supports and provides funding to the Abdus Salam International Centre for Theoretical Physics, in Trieste, Italy.

The long-lasting benefits of stakeholder engagement

By Rafael Mariano Grossi, IAEA Director General

When I took the helm of the IAEA in 2019, nuclear energy was not recognized in the world's most important global conversations on energy and climate. Now, five years on, there is a global consensus on the need to accelerate deployment of nuclear power to address climate change and energy security goals.

This took time and effort. At the United Nations Climate Change Conference in Madrid (COP25), the first I attended shortly after becoming IAEA Director General, nuclear energy was still very much an outsider. But young people, politicians, scientists and others who believe in its ability to address pollution, climate change and energy security were making inroads through education, documentaries and social media.

When the energy crisis and the conflict in Europe hit, momentum for nuclear energy was already growing. In 2023 at COP28 in Dubai, for the first time the signatories of the UN Framework Convention on Climate Change included a call to accelerate deployment of nuclear power — along with other clean energy sources — in their Global Stocktake on the Paris Agreement. World leaders agreed with what science had been telling us for years: including nuclear is the only feasible way to achieve deep and rapid decarbonization. More than 20 countries called for tripling global nuclear capacity. Several other countries, companies, international banks and financial institutions later joined that pledge.

In 2024, world leaders built on this momentum at the first-ever Nuclear Energy Summit, affirming the important role of nuclear power. This reflects a fundamental change that would have been impossible without stakeholder engagement.

Countries often identify effective communication with stakeholders as a key challenge when initiating a nuclear power programme or related activities, such as uranium mining. Creating stakeholder awareness and understanding — whether from the nuclear industry, government, the media, local communities or non-governmental organizations — is essential to building mutual trust.

Particularly important stakeholders are those who decide whether to invest in nuclear. They include decision makers and influencers at government treasuries, international financial and development institutions, including the World Bank and regional development banks, as well as investment banks and insurance companies.

Designing and implementing programmes for productive stakeholder involvement starts with communicating energy policies and strengthening stakeholders' understanding of nuclear power. It happens in board meetings of banks and insurance companies, and at public gatherings in cities, towns and villages across the world.

In May, the IAEA will gather many different stakeholders for the first International Conference on Stakeholder Engagement for Nuclear Power Programmes, including dozens of mayors of towns and cities hosting nuclear power plants or other significant nuclear installations, from reprocessing to waste sites. Who better to explain the impact of nuclear power than people from communities that host nuclear facilities!

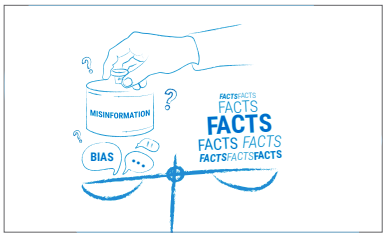
Stakeholder engagement is essential to achieving anything of lasting value, including new power plants that will produce clean electricity, heat, cooling or hydrogen for a century, or repositories that will store spent fuel deep underground for a thousand centuries.

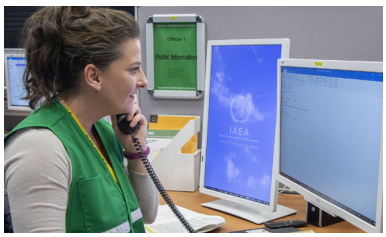
It needs time and patience. Despite recent progress, nuclear power is still struggling to get off the ground in many places. While some 60 reactors are under construction globally, most are in just a handful of countries.

Today, aspirations for nuclear power are higher than they have been in decades. Turning them into the big capacity increases necessary to meet climate and energy security goals requires steadfast commitment. A vital part of the answer is clear: we need to keep engaging our stakeholders.

"Creating stakeholder awareness and understanding — whether from the nuclear industry, government, the media, local communities or non-governmental organizations — is essential to building mutual trust."

— Rafael Mariano Grossi, IAEA Director General





IAEA UPDATES

From protests to partnership

Interview with Gerben Dijksterhuis, Mayor of Borsele, Kingdom of the Netherlands

By Irena Chatzis

The world's first major gathering of representatives of communities hosting nuclear facilities will take place in Vienna, Austria, in May 2025 at the IAEA's International Conference on Stakeholder Engagement for Nuclear Power Programmes. Gerben Dijksterhuis, Mayor of Borsele, Kingdom of the Netherlands, which hosts the country's only operating nuclear power plant, discusses key aspects of stakeholder engagement for nuclear power.

"We believe that as a local community we should have a voice in projects happening in our area."

— Gerben Dijksterhuis, Mayor of Borsele

(Photo: Municipality of Borsele, Kingdom of the Netherlands)

How has stakeholder engagement changed over time?

In the 1960s and 1970s, there were fierce protests and demonstrations against the arrival of the nuclear power plant, but in recent years we have seen almost no demonstrations. Over the years, the plant operator, EPZ, has learned to communicate openly and transparently. This has contributed to a good relationship with the surrounding community, an important element of EPZ's 'licence to operate'. The plant is now seen as a good neighbour.

Borsele organized a unique citizen participation process in 2023 on upcoming large energy projects, including two nuclear power reactors. What prompted you as Mayor, and the local government, to include citizens in the process?

People often have strong opinions either for or against nuclear energy, but the decision about whether new nuclear power plants will be built is ultimately made by the national government. So we've focused on the interests of the local community and asked the question: "If two additional nuclear power reactors are built, what will that mean for our municipality and residents? Under what conditions would we accept such a development?" By having this conversation, we're engaging in a discussion about our shared future and deciding what is needed to keep living, working and enjoying life in our region.

My municipality has over 23 000 residents, so it's not possible to ask everyone personally about their views on these developments. By randomly selecting 100 residents, we thought we would get a fair range of opinions reflecting the views of all residents. This way, we can look at what's coming our way as a community with an open mind, without being too influenced by loud supporters or critics. We also wanted to give a voice to young people, who will live with the impact of new nuclear power plants the longest, and to the 'silent majority' — residents who are generally less likely to speak out in public debates.

Over the course of 5 meetings, these 100 residents came up with 39 conditions under which major developments could take place, ensuring that the environmental impact is properly considered.

We believe that as a local community we should have a voice in projects happening in our area.

What are some of the common concerns local residents have about nuclear energy projects? To what extent are they different from concerns about other large projects?

We are somewhat used to big projects because we live next to a large industrial area and an international seaport. However, there are concerns about the impact of the construction: we see in other countries how long it takes, how large the construction site is, and how many people work there. Residents mainly think about noise, dust and light pollution and an increase in construction traffic. There are also concerns about this development in relation to the landscape we are so proud of here.

Specifically for the nuclear component, people are concerned about the safety of new nuclear power plants and the continuing perception of a lack of a final solution for nuclear waste.

What is the socioeconomic impact of nuclear energy projects on host communities and neighbouring areas, based on the experience of Borsele?

About 400 people work at the existing nuclear power plant, and many more are employed indirectly. If the construction of two new nuclear power reactors goes ahead, thousands of additional workers will be needed for 5 to 15 years. This will not only create jobs in the region but also provide opportunities for local businesses, educational institutions and housing development. It is an opportunity to invest in the future of the region, with innovation and progress at the forefront. It's therefore crucial that, as a government and society, we make timely plans to properly manage these developments. The construction of nuclear power plants affects an entire region, and when new nuclear power reactors are built, cooperation with neighbouring municipalities is essential to prepare for this. This includes planning for housing, infrastructure and education.

In addition to being Mayor of Borsele, you are President of the Group of European Municipalities with Nuclear Facilities (GMF Europe). Why is it important for nuclear host communities to organize in such associations?

Nuclear host communities often face or have faced the same challenges. As a network of host communities in different parts of Europe, GMF allows us to learn from each other and find solutions together. We can help each other by sharing information and lessons learned about how to deal with nuclear initiatives. Together, we can also be a stronger voice that is heard in international politics. I am proud that GMF has been invited several times — including by the IAEA — to contribute to new policy and present our vision to participating countries. Together with mayors in Canada and the United States of America, we have also established the Global Partnership of Municipalities with Nuclear Facilities.

It is equally important to advocate for the position of local communities. They must have a voice in developments that take place in their community.

What is the advice you would give to communities that are newcomers to nuclear?

Take an active role, make sure you are well informed, ask the right questions and ensure that the concerns of your community are heard. This not only helps in understanding the impact of nuclear projects, but also ensures that you can actively contribute to decision making and to the process in a way that is in the interest of your community.

Additionally, it is important to join networks of municipalities. This way, you can jointly influence policy, both nationally and internationally. By working with organizations such as the IAEA, we can ensure that policies take into account the needs of host communities.

Gerben Dijksterhuis, Mayor of Borsele, addresses residents who developed a list of conditions for community acceptance of the construction of new nuclear power plants in the municipality.

(Photo: Municipality of Borsele, Kingdom of the Netherlands)

Engaging for new build

Dialogue and support for a clean energy future

By Matt Fisher

Building a world with clean energy abundance is necessarily a collaborative process. Engaging with stakeholders is at the core of successful nuclear installation projects. Proactive approaches to stakeholder engagement foster trust and promote accountability. They are vital for equitable community development and the long term sustainability of nuclear power, especially for new build projects.

As of March 2025, more than 60 nuclear power reactors were under construction in 15 countries, including 3 countries building their first nuclear power plant. Other newcomers, such as Ghana and Poland, have not yet broken ground on their first power reactors but are steadily advancing to prepare for the start of construction. The IAEA's Milestones approach provides guidance on how to initiate and sustain a nuclear power programme, detailing 19 infrastructure issues, including stakeholder engagement, that are essential for success.

"Transparent engagement with all stakeholders, from host community members to government agencies to site workers, is a best practice that should be pursued, beginning as early in the process as possible," said Liliya Dulinets, Head of the IAEA's Nuclear Infrastructure Development Section. "New build projects impact a diverse range of stakeholder groups, and it's important to hear their perspectives and address their concerns."

Stakeholder engagement is a multifaceted undertaking that is most effective when guided by consideration of the nuanced opinions of everyone involved. Energy policies are influenced by the confidence of stakeholder groups, and building that confidence requires dynamic, ongoing support that facilitates mutual understanding and offers a clear outline of programme plans.

Long reliant on coal, Poland is looking to nuclear power to lower its emissions, meet its climate change objectives and strengthen energy security. The country, which signed an agreement with Westinghouse in 2022 to construct three AP1000 reactors, hosted an IAEA Integrated Nuclear Infrastructure Review mission last year to assess its readiness to introduce nuclear power in line with the Agency's Milestones Approach.

Ghana, meanwhile, is also progressing towards the construction of its first nuclear power plant following the signing of a cooperation and framework agreement between Nuclear Power Ghana and Regnum Technology Group for the deployment of a small modular reactor (SMR) in 2024.

As part of its approach, Ghana is pursuing a comprehensive stakeholder engagement strategy to enhance public understanding and involvement, gain support and build trust in its programme. This involves engaging civil society organizations to address concerns and ensure transparency, conducting workshops for the media to enhance their knowledge and facilitate informed public discourse, and engaging policymakers and government agencies to ensure alignment and support. It

Nuclear Power Ghana engaged extensively with community stakeholders in Obotan, which was chosen as the backup site for Ghana's first nuclear power plant.

(Photos: Nuclear Power Ghana)

also includes educating students in nuclear science and technology to build a diverse workforce. Increasing public awareness of nuclear power is another important component.

"Effective stakeholder engagement shapes public opinion and promotes trust," said Bellona-Gerard Vittor-Quao, Manager of Public Affairs for Nuclear Power Ghana. "From the outset, we have actively included all stakeholders in the engagement process, including educating communities on what the project entails, listening to concerns, and working together to chart a path for sustainable nuclear power in Ghana."

China is building nearly half of the power reactors currently under construction worldwide, with 28 domestic new builds in progress as of March 2025. The country is aiming to build 150 new reactors by the middle of the next decade, targeting a nuclear power share of at least 15 per cent of national power production by 2050.

Zhu Xiaobin, Director of the Qinshan nuclear power plant, said in a 2023 interview in the Guangming Daily: "We have built a nuclear power town around the plant, with beautiful surroundings. The residents here initially had many misunderstandings about nuclear power, but now our economy and ecological environment are improving. Many elderly people in the town have served as volunteer nuclear science popularizers, educating visitors about nuclear safety."

The Russian Federation's first floating nuclear power plant entered commercial operation in 2020. Its two SMR units provide both electricity and district heating to a remote community in the far east of Russia.

"Throughout the entire life cycle of the floating nuclear power plant, Rosenergoatom has maintained active engagement with the local population," said Andrey Alberti, Director of Communications at Rosenergoatom. In 2017, before any ground construction began, public hearings were held in the Chukotka Autonomous Okrug, at the plant's base location in the town of Pevek. "Representatives of Government agencies, environmental organizations, local media and local citizens had the opportunity to raise questions and share their views on the project," Alberti said. "All stakeholders were provided in advance with environmental impact assessments, prepared in compliance with the requirements of the State environmental review process."

Sizewell C, a two-unit nuclear power plant to be deployed in Suffolk, United Kingdom (UK), will eventually fulfil seven per cent of the UK's energy needs. It includes major investments in environmental protection, public forums, and a fund to support local communities.

"Sizewell C is much more than a new nuclear power station — it is an opportunity to deliver a project collaboratively with our stakeholders, joined up, and to provide something great for Britain," said Peter Bryant, Director of Environmental, Social and Governance and Radiation Strategy at EDF. The station, which has an expected lifespan of 100 years, will provide opportunities to people in the region around it and across the UK. "Key to the success of our stakeholder engagement," Bryant added, "has been identifying our wide range of stakeholders, actively 'listening' and understanding their needs, what they want to know, how they want to be engaged, what we can achieve with them, and not making assumptions or doing things to them. Simply put, it has all been about building relationships."

Working together to find a home for spent fuel

Insights from Canada

By Matt Fisher

After nearly 15 years of work, Canada's National Waste Management Organization (NWMO) announced in November 2024 that the Wabigoon Lake Ojibway Nation-Ignace area in northwestern Ontario had been selected as the host community for the country's deep geological repository for spent nuclear fuel. This major achievement for nuclear power sustainability in Canada was the result of a transparent, dialogue-driven process centred on the needs and concerns of the 22 potential host communities.

Deep geological repositories for the final disposal of spent nuclear fuel are situated hundreds of metres beneath the Earth's surface. Exhaustive technical assessments are used to determine potentially suitable locations with large rock formations verified to remain stable over many thousands, or even millions, of years. The world's first deep geological repository for spent nuclear fuel — located in Onkalo, Finland, and described by IAEA Director General Rafael Mariano Grossi as a "game-changer" — is expected to commence operations in 2026 after some two decades of construction.

"Managing spent fuel, whether by recycling it or taking interim steps ultimately leading to final disposal, is crucial for nuclear power programme success," said Nora Zakaria, Head of the IAEA's Waste Technology Section. "Technical solutions for the management of spent fuel and radioactive waste have existed for decades, with international collaboration driving progress in geological disposal science. Clear communication and inclusive dialogue are vital for implementation."

Hosting a nuclear facility of any type is a long term commitment requiring the consent and active engagement of all relevant stakeholders, including community members, local governments and legislators. Canada's methodology for selecting the site for its deep geological repository included conducting technical assessments of site suitability in parallel with an open dialogue with all the potential host communities. The process was carefully designed to ensure that the site would be safe and secure, hosted by an informed and consenting community, and operated according to robust technical and ethical standards.

"Over the past decade and a half," said Kim Baigrie, Mayor of Ignace, "our proud community has worked closely with NWMO, its regional stakeholders and most importantly the people of the Township of Ignace to educate ourselves, travel to visit other nuclear sites, dialogue with other nuclear communities, attend conferences and meetings and ensure that we were making an informed decision."

"Connecting with First Nations and municipalities across northwestern Ontario is an important part of our work," said Joe Heil, NWMO's Vice President of Indigenous and Municipal Relations and Transportation. "We've spent ten years talking with groups to make sure they had a strong understanding of the safety case regarding the shipping and storage of Canada's used nuclear fuel. This led to two historic announcements in late 2024, when both the Municipality of Ignace and Wabigoon Lake Ojibway Nation voted in favour of moving forward in the site selection process to be host communities for Canada's deep geological repository." He added that detailed impact assessment and environmental assessment processes would need to be completed, including assessments designed by Wabigoon Lake Ojibway Nation, to ensure that the project can be implemented without a detrimental impact on people or the environment.

Community concerns about environmental stewardship and safety, as well as respect for protected areas, were addressed in the site requirements. These included having enough land for all surface and underground facilities; a location outside of protected areas, heritage sites and provincial and national parks; no risk of impacting groundwater resources that could be used for human consumption or agriculture; no natural resources with economic value; and no geological or hydrogeological features that could pose safety risks.

There are more than 600 First Nations communities across Canada, each with a vast wealth of knowledge that NWMO acknowledged as essential to the site selection process. From the beginning, NWMO sought to ensure that First Nations communities' beliefs and concepts of environmental stewardship were afforded a key role in its decision making. NWMO produced an Indigenous Knowledge Policy to inform its work and provide crucial guidance. The policy underscores the importance of indigenous knowledge and its relevance in decision making, as well as First Nations communities' special relationship with the natural environment. It also highlights NWMO's support for the Council of Elders and Youth, an advisory body established by NWMO in 2012 to provide guidance on the application of indigenous knowledge to Canada's approach to long term spent fuel storage. A previous advisory group, the Elders Forum, had been in place from 2005 to 2012.

Recognizing the unique dynamics of each candidate host community, NWMO published a community wellbeing framework to help ensure that conversations were aligned with specific local and regional concerns. The framework facilitated consideration of how the repository could affect the community's people, economic activity, infrastructure and physical structures, social and cultural assets and natural environment. With these guidelines established from the outset, constructive dialogue on how the project could impact each community became a hallmark of the site selection process.

"We received an outstanding show of strong support from our community to continue forward with our mandate to be Canada's first ever site of a deep geological repository for NWMO," said Baigrie. "We are proud, humbled and excited to move this project forward now with the necessary next steps of licensing and regulation."

"We look forward to creating a legacy, a journey of economic prosperity for our youth and for generations yet to come," she added. "It truly is the beginning of our future in Ignace and we stand behind our slogan: 'solid rock, solid science, solid choice'."

NWMO staff speaking to members of the public at the Northwest Nuclear Exploration Event in Ignace in 2023.

(Photo: NWMO)

Nuclear communities and mayors in focus

The experiences of nuclear communities offer a unique lens into the lived realities of those who coexist with nuclear energy. Their reflections shed light on the complexities of hosting nuclear facilities but also reveal the human values and motivations that drive this powerful field.

"The future needs nuclear energy. As our region seeks more carbon-free electricity, we hope that the Tarapur nuclear power plant will play a role in powering both homes and industry in the future."

UJAWALA KALE
Mayor of Palghar, India

"Rand West City Local Municipality has a high unemployment rate, but nuclear energy facilities create a variety of jobs, requiring a diverse range of skills, thus providing substantial employment prospects within our community. Nuclear energy also contributes to the generation of revenue for infrastructure development and local projects. Engaging and educating local communities is essential in ensuring that they are well informed and involved in exploring nuclear initiatives."

WILLIAM MATSHEKE
Councillor and Executive Mayor of Rand West City Local Municipality, Gauteng Province, South Africa

MARCELO MATZKIN
Mayor of the Municipality of Zárate, Argentina

"Lima, located in the Municipality of Zárate, became a consolidated city thanks to the nuclear energy industry, evolving from a rural town into a nuclear city that hosts two nuclear power reactors and a future modular nuclear reactor. Nuclear power offers the advantage of large scale job creation and opportunities in our municipality, but we also face the constant challenge of adapting city infrastructure for a continuously growing population."

REBECCA CASPER
Mayor of Idaho Falls, United States of America, and Vice Chair of the Energy Communities Alliance

"My city of Idaho Falls owns and operates its electric utility, integrating hydropower, wind, geothermal and emerging hydrogen technologies. We are now planning to add microreactors. As policy makers, we study complex energy markets, transmission and regulations, all so we can provide reliable, cost-effective power to our citizens. And they in turn support nuclear because it offers safe, reliable, carbon-free, baseload energy.

Advanced reactors are the path forward, securing our community's energy future while keeping costs low for generations to come."

"We are the people of the Northern Lights. For us nuclear energy is heat and light in our homes and a secure future for our children. Nuclear energy supports social infrastructure, investment and regional development. It strengthens good neighbourly ties and ensures energy security in our region. Nuclear energy lights the way forward for Chukotka."

LUDMILA DANILOVA
Vice-President of the Association of Indigenous Peoples of Chukotka, Russian Federation

YUEWEN ZHENG
Mayor of Rongcheng, China

"Third- and fourth-generation nuclear power plants have been successfully built in Rongcheng, driving the transition to green energy and a near-zero-carbon city. Nuclear heating and education initiatives have boosted public acceptance, fostering harmonious coexistence between nuclear energy utilization and urban development. We are now actively advancing the expansion of nuclear power projects while establishing a world-class nuclear energy technology demonstration base. We eagerly anticipate sharing our expertise and collaborating with global partners to shape a sustainable future."

"Nuclear communities and the clean energy sector are crucial partners, powering our lives and enhancing our towns. Host municipalities are at the forefront of the global nuclear renaissance, advocating for new nuclear tech. We must educate decision makers with facts to dispel misinformation. Working together, we can light the path to a net zero future and a more resilient planet, recognizing that without willing host communities, there is no nuclear industry."

ADRIAN FOSTER
Mayor of Clarington, Ontario, and Chair of the Canadian Association of Nuclear Host Communities

"In our municipality, nuclear energy generates many jobs, both directly and indirectly, and provides the city council with significant revenue, which we use to subsidize services for organizations and residents. We are in favour of extending the lifespan of power plants, provided that investment is made in safety measures and that information and citizen participation in decision making are encouraged."

ASSUMPCIÓ CASTELLVÍ AUVÍ
Mayor of Vandellós i l'Hospitalet-de-l'Infant, Spain

Energy security to climate goals

Why the future is nuclear for younger generations

By Emma Midgley

From small modular reactors to nuclear powered data centres, the conversation around nuclear energy is changing and bringing new and younger voices to the fore. For them, nuclear energy is a field of innovation, offering solutions to some of the greatest issues the world is facing: energy security, economic development and climate change. The IAEA spoke with young people around the world to learn why they support nuclear power.

"Today, young people grow up in perpetual anxiety over climate and environmental degradation," said Mads Bunch Larsen, 28, of the Danish climate education project Foreningen Atomkraft Ja Tak. "But we also have a lot more scientific evidence that nuclear power is safe and an effective tool to mitigate climate change while ensuring reliable energy."

Across the world, young people have driven protests for action against climate change, and many see nuclear power as a key tool for climate change mitigation. Nuclear power already provides around a quarter of the world's low carbon electricity, offering reliable, dispatchable power that can complement renewables such as wind or solar.

"While many policymakers advocate for renewable energy, they often overlook its intermittency — solar and wind power depend on weather conditions and require a stable back-up source when they are not generating electricity," said Nicole Mikly, a 30-year-old stakeholder engagement and environmental officer at a nuclear research facility in Colombia.

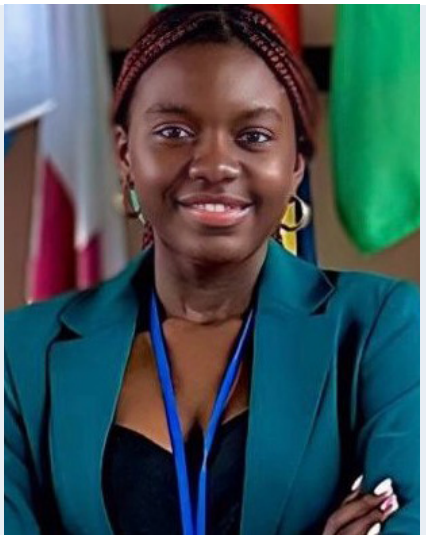
Larsen said he was particularly excited about non-electric applications of nuclear technology, such as decarbonizing heating and heavy transport. "Nuclear energy is uniquely positioned to potentially deliver heat and hydrogen for such applications," he said.

In the past 5 years, interest in nuclear has surged. Since 2020, the IAEA outlook for nuclear power has steadily increased and world nuclear capacity is now projected to increase by 2.5 times from 2023 levels by 2050 in the IAEA's high case scenario.

The challenge? Building a nuclear workforce where younger generations can play a central role. The 2025 Global Energy Talent Index report, a survey of people working in the nuclear sector across 150 countries, shows that the proportion of respondents aged under 35 has decreased to 37 per cent in 2025 from 48 per cent in 2023.

(Photo: Foreningen Atomkraft Ja Tak)

(Photo: N. Mikly)



(Photo: IAEA)

Women make up only around a quarter of the nuclear workforce, according to a 2023 Nuclear Energy Agency report. The IAEA is trying to change that through initiatives such as the IAEA Marie Skłodowska-Curie Fellowship Programme (MSCFP), which provides financial support to women studying for master's degrees in nuclear-related subjects, and the Lise Meitner Programme, which supports mid-career women working in the nuclear field.

Flora Mbouyom from Cameroon studied nuclear energy at France's IMT Atlantique Bretagne-Pays de la Loire with support from the MSCFP. The 24-year-old plans to work in waste management once she completes her doctorate. "I am always surprised to see how people fear radioactive waste more than all the problems caused by a lack of energy," she said.

Fear and misinformation are among the biggest barriers to the global expansion of nuclear energy, according to many of the younger people the IAEA spoke to.

"As a child I vividly remember being terrified of radiation after seeing a TV news segment about Chornobyl," said Larsen.

Emmanuel Montwedi, 37, a nuclear engineering analyst at the South African Nuclear Energy Corporation, agreed. "The previous generation made the subject of nuclear energy seem overly serious and frightening," he said.

Larsen realized nuclear energy's transformative potential while studying macroeconomics at university. "I remember being shocked at how much clean energy was being produced in countries such as Sweden, France and Switzerland, which all rely a lot on nuclear energy and some hydropower," he said. All three countries have largely decarbonized their electricity production thanks to nuclear energy and hydropower.

Climate activist Ia Aanstoot, a 20-year-old from Sweden, identified a lack of large scale financing solutions as a major barrier to the adoption of nuclear energy, both in Europe and the Global South. However, both Montwedi and Aanstoot described the future of nuclear energy as "exciting", with Aanstoot singling out the "massive potential" of nuclear energy in tackling the world's most pressing challenges, from poverty to the climate crisis.

Attitudes to nuclear energy are changing. Beyond reducing emissions, nuclear power creates jobs, strengthens economies and drives innovation. As the industry evolves, it appeals to and needs a new generation of thinkers, problem solvers and advocates to build a more resilient future.

(Photo: South African Nuclear Energy Corporation)

(Photo: R.Millenaar)

Young nuclear advocates
from left to right:
Mads Bunch Larsen, 28;
Nicole Mikly, 30;
Flora Mbouyom, 24;
Emmanuel Montwedi, 37;
Ia Aanstoot, 20.

Strengthening nuclear dialogue

IAEA services supporting stakeholder engagement

By Irena Chatzis

Effective stakeholder engagement is crucial for building public trust and confidence in nuclear power projects, leading to better outcomes and long term sustainability. Without sufficient engagement, opposition, misinformation or unaddressed concerns about safety or environmental impacts can hinder nuclear power programmes. A lack of trust can result in project delays, increased costs and difficulty in securing public support. Missed opportunities for collaboration and partnerships can stifle innovation and the project's success.

To address the growing demand from countries seeking to improve nuclear communication and stakeholder engagement, the IAEA has established a set of capacity building activities. Most recently it launched the Nuclear Stakeholder Engagement School in November 2024 in collaboration with the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy.

The school is designed to enhance skills in stakeholder engagement throughout the nuclear fuel cycle. It aims to deepen understanding of the importance of integrating stakeholder engagement into an organization's management processes and core values. Participants learn about the psychology of human decision making; tools and methods for engagement; design and implementation of stakeholder engagement programmes; crisis and emergency communication strategies; and tactics for countering disinformation, misinformation, rumours and fake news. The school also explores how to monitor and evaluate engagement strategies to ensure sustained stakeholder engagement in the long term.

"As Indonesia progresses toward its first nuclear power plant, the knowledge I gained from the IAEA–ICTP Nuclear Stakeholder Engagement School will be instrumental in fostering informed discussions and building public confidence," said Veri Trisnawan, a researcher at Indonesia's National Research and Innovation Agency. "This experience will help my organization implement global best practices in stakeholder engagement, ensuring a smooth and well supported nuclear energy transition."

The inaugural school brought together professionals from governments, regulatory bodies, industry and research organizations in 25 countries, including nuclear newcomer nations constructing their first reactors, as well as countries with decades of experience in operating nuclear power plants.

"By applying the best practices I learned, I can contribute to fostering open dialogue with the public, government institutions

Participants in the inaugural ICTP–IAEA Nuclear Stakeholder Engagement School held in Trieste, Italy, in November 2024, working together on a group project.

(Photos: A. Andriushina/IAEA)

and industry stakeholders to ensure informed decision making and regulatory clarity," said Ramy Afifi, Senior Strategic Communications and International Cooperation Specialist at the Egyptian Nuclear and Radiological Regulatory Authority. "Strengthening stakeholder confidence in the regulatory process is crucial for the successful and safe development of the national nuclear power programme, and the skills I acquired at the school will support this objective."

"The experience I gained in the school will directly contribute to ensuring the successful implementation of South Africa's nuclear expansion programme by improving communication strategies, fostering stakeholder trust and aligning with global standards for transparency and engagement," said Roseth Senosi, a research assistant at the South African Nuclear Energy Corporation. "The training also provided strategies for managing misinformation and addressing the concerns promptly, which will be crucial in maintaining public and political support for our nuclear programme."

The pilot edition of the Nuclear Stakeholder Engagement School was supported by the US Department of Energy through the IAEA Peaceful Uses Initiative. The next editions will be hosted by the Russian Federation in September 2025 and by the United States of America in November 2025.

In addition to the school, the IAEA regularly holds national and regional workshops on stakeholder engagement, including through its technical cooperation programme, and integrates this topic in its review missions.

The IAEA has recently stepped up its support to Member States in this area by establishing a Stakeholder Engagement Advisory Service for Nuclear Power Programmes that guides countries through a comprehensive assessment of their stakeholder engagement efforts and provides them with advice on how to enhance their efforts.

Additional guidance on communicating and engaging with various stakeholder groups is provided in IAEA publications such as *Stakeholder Engagement in Nuclear Programmes* and *Communication and Stakeholder Involvement in Radioactive Waste Disposal*. The IAEA Safety Standards also provide recommendations and guidance to regulatory bodies on communication and consultation with the public and other interested parties.

"Over the past years, we have witnessed growing public support for nuclear energy, but we must not become complacent," said Mikhail Chudakov, IAEA Deputy Director General and Head of the Department of Nuclear Energy, which leads the Agency's stakeholder engagement activities for nuclear power programmes. "It is crucial for the nuclear industry, policy makers and communication professionals to work together and ensure transparency and openness, especially as we enter a new era of advanced nuclear energy, including small modular reactors. We cannot afford a setback if we are to enable more clean and reliable energy for the world."

Moving forward: Repurposing nuclear facilities after decommissioning

By Anastasiia Andriushina

By 2050, a significant number of the more than 400 nuclear power reactors currently in operation may be decommissioned. Decommissioning represents not just the end of the facility's use, but the beginning of a multifaceted technical, socioeconomic and environmental transformation. Successful decommissioning is therefore not only about dismantling nuclear facilities but about rethinking their future use for the local community's benefit.

"Repurposing nuclear sites requires a shift in mindset," said Gloria Kwong, Head of the IAEA's Decommissioning and Environmental Remediation Section. "By prioritizing future use, resource efficiency and redevelopment, former nuclear sites can be transformed into hubs of innovation, economic growth and sustainability, supporting clean energy and resilient communities."

In Argentina, for instance, the decommissioning and remediation of the Malargüe industrial complex in Mendoza Province — which was used for uranium mineral processing for over three decades before closing in 1986 — gave rise to Parque El Mirador, a green space developed with and for the local community. Launched in 2017 as part of the Malargüe Strategic Plan 2020 and led by the National Atomic Energy Commission (CNEA), this project exemplifies how inclusive planning can lead to lasting transformation. Co-designed by citizens, civil society organizations and the municipality, the park features recreational areas, sports facilities and spaces for environmental education.

"This project stands as a milestone for Argentina, successfully integrating social development, economic growth and environmental responsibility," said Juan Leandro Ferrer, CNEA's institutional relations manager. "Its success reflects a strong stakeholder engagement policy, involving provincial and local governments, regulatory bodies, educational institutions and civil society organizations. Additionally, we must underline the $30 million loan provided by the International Bank for Reconstruction and Development, which highlights the strategic role multilateral credit agencies can play in supporting high impact nuclear projects."

Such a future-oriented approach requires comprehensive stakeholder engagement at the very early stages of a nuclear facility's life cycle, even before the operational phase begins.

According to the IAEA's guidebook on stakeholder engagement, various stakeholders — including operators, regulators, host communities, workers and environmental organizations — have their own unique perspectives and concerns, which should be heard, balanced and taken into account in the decision making process. However, effectively addressing

Local residents in Malargüe, Argentina, were consulted by CNEA and the municipality during the design phase for Parque El Mirador.

(Photo: CNEA)

and integrating these diverse views can be complicated.

The highly technical nature of the decommissioning process can be challenging for the public to understand, resulting in concerns about transparency and accountability, according to Kwong. She stressed that prioritizing clear communication when discussing safety measures, clean-up criteria and long term site monitoring plans can build trust and foster greater public understanding. In the end, the success of decommissioning and repurposing depends on public confidence, and a lack of trust or awareness can lead to opposition and delays.

Public confidence influences community decisions on clean-up standards. Although regulatory bodies set basic requirements, the community may call for higher clean-up standards. Despite higher costs, the community may wish to bring the site to 'greenfield' status for unrestricted use to eliminate risks and any stigma associated with the former nuclear facility. Conversely, some stakeholders may support a partial clean-up if it allows for industrial or commercial redevelopment, and may accept controlled contamination if exposure risks are minimized through restrictions and monitoring, allowing for a faster transition to new use.

These decisions should be guided by the local community, which bears the main burden associated with the transition. Nuclear facilities tend to be drivers of regional employment and economic development, so their closure can result in severe job losses and even economic recession if poorly managed. This underscores the importance of a future-oriented strategy and community involvement to mitigate negative socioeconomic effects.

At the United Kingdom's Dounreay nuclear site, for example, where decommissioning is ongoing, the risks of economic displacement were recognized and addressed early in the decommissioning process. Site planners implemented comprehensive workforce transition strategies, including retraining and redeployment programmes, to support affected personnel. This helped workers shift into emerging sectors and stabilized the local economy during a period of uncertainty, preserving both jobs and community resilience.

Children playing at Parque El Mirador on the park's opening day.

(Photo: CNEA)

Repurposing decommissioned nuclear sites, for example into small modular reactors, or redeveloping them for industrial, scientific, recreational or community purposes, can boost local economies and create long term benefits. To succeed, these undertakings should reflect local needs and preferences and include input from the private sector, educational institutions and community members. Such collaboration ensures that redevelopment efforts are grounded in reality and pave the way for future growth. Collaboration can facilitate a smooth, cost-effective transition, attract investment and maximize community benefits.

Nonetheless, technical complexity, conflicting priorities, miscommunication and economic constraints can make stakeholder engagement challenging. Embedding good practices into stakeholder engagement strategy could mitigate these challenges. Simple, non-technical explanations can significantly improve public understanding, while responsiveness to stakeholder feedback, even when full agreement cannot be achieved, builds trust. Likewise, economic transition planning can substantially mitigate negative socioeconomic impacts.

Ultimately, if nuclear decommissioning is considered an opportunity for community renewal rather than simply the end of a facility's operational life, it can become a catalyst for sustainable regional development and community resilience. "Continuous stakeholder engagement ensures that diverse perspectives are heard, contributes to informed decisions about the safe repurposing of sites, and helps to secure lasting economic, social and environmental benefits for generations to come," said Anna Clark, Head of the IAEA's Waste and Environmental Safety Section.

Watch a video about **decommissioning and restoring former nuclear sites**

Countering nuclear misinformation

What works and why

Zion Lights is an award-winning science communicator based in the United Kingdom and known for promoting clean energy, especially nuclear power. In this interview with the IAEA, she addresses misinformation and disinformation about nuclear energy.

Misinformation and disinformation, in one form or another, have been around for a long time. What makes the situation different today?

History is full of examples of disinformation, which is shared with the intent to deceive, from Roman emperors shaping public perceptions through inscriptions on coins to Nazi propaganda using radio and cinema. And we've all seen the harmful effects of misinformation, which the United Nations defines as the unintentional spread of inaccurate information shared in good faith by people unaware that they are passing on falsehoods.

The biggest difference today is social media. It spreads false information globally and instantly. As a major news platform, social media has reshaped how we access and trust information. To counter it, we must understand why we are so susceptible.

Why are people so susceptible to misinformation?

At least 188 cognitive biases that influence people's perception have been identified. These biases —shaped by past experiences and emotions and acting as mental shortcuts — make it easier for us to process information. However, they often reinforce our existing beliefs, leading us to accept falsehoods as truth.

Can you give examples of these cognitive biases?

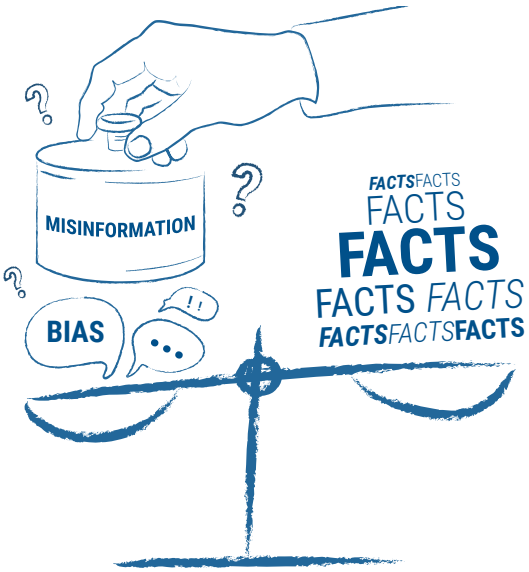
Examples of cognitive bias include:

- **Confirmation bias**: Seeking information that supports our beliefs.
- **Anchoring bias**: Relying too heavily on initial information.
- **Availability bias**: Believing what's easiest to remember.
- **Familiarity bias**: Accepting something as true because we hear it often.

What else contributes to misinformation?

Repetition strengthens misinformation. The more a falsehood is repeated, the more credible it appears. In psychology, this is known as 'fluency for truth', and it makes a lie easier to remember than complex scientific information. Framing plays a crucial role as well. Opponents of nuclear power have fuelled fears about nuclear waste for decades. Memorable but misleading slogans can shape opinion more effectively than nuanced facts.

Memorable but misleading slogans can shape opinion more effectively than nuanced facts.



(Graphic: A. Barber Huescar/IAEA)

How have you addressed nuclear misinformation in your own work?

I use concise, catchy phrases such as "it's only waste if you waste it" and "meanwhile, fossil fuel waste is stored in the Earth's atmosphere." These slogans are both accurate and 'sticky' and have become widely used.

Initially, some scientists resisted my slogans, preferring scientific papers over simple messages. However, when grounded in truth, slogans are effective. Phrases like "nuclear saves lives" and "nuclear energy is clean energy" contribute to shifting perspectives.

Why don't facts alone change minds?

Science communication is a distinct field, but many scientists aren't trained in it. As a result, they often rely on an outdated approach known as the 'information deficit model', assuming more facts will change minds. But beliefs are shaped by cognitive, social and emotional factors. Simply providing more data is often ineffective.

What is pre-bunking and how does it help counter misinformation?

Pre-bunking is one approach to countering misinformation. Think of it as a 'cognitive vaccine' against propaganda. It was first proposed by psychologist William J. McGuire in the 1960s. McGuire hypothesized that people could learn to spot propaganda if they were warned about it beforehand through this technique known as 'pre-bunking.' With a few caveats, this approach largely works.

Pre-bunking involves presenting factually correct information along with a pre-emptive correction or a generic warning about misinformation before the person encounters the misinformation. This requires thinking about what objections might be raised to the factually correct information in order to dilute the power of counter-messaging.

How do more advanced techniques such as inoculation theory work?

More advanced pre-bunking techniques use 'inoculation theory', which exposes people to weaker forms of persuasion, enabling them to understand how misleading persuasive techniques are used and to build immunity against more persuasive arguments by using critical thinking. This technique has been shown to increase the accurate detection of misinformation. Understanding how misleading persuasive techniques are used enables a person to develop the cognitive tools needed to ward off future misinformation attacks, as research has also found that this type of inoculation on one topic can help people spot misinformation in other areas as well.

What role does education play in building resistance to misinformation?

It can and should play an important role. To counter the propensity to believe fake news, information and media literacy should be integrated into education. Information literacy helps people assess information effectively. Media literacy helps them navigate platforms and sources.

Have you ever personally changed your mind due to better information?

We have all been influenced by misinformation at some point, and we remain vulnerable. It took me many years to change my perspective on nuclear energy, shifting from opposition to support through exposure to better sources and different perspectives. Countering misinformation requires patience and persistence. It's about engaging with people correctly to foster deeper understanding. No one is an empty cup.

"Countering misinformation requires patience and persistence. It's about engaging with people correctly to foster deeper understanding. No one is an empty cup."

— Zion Lights

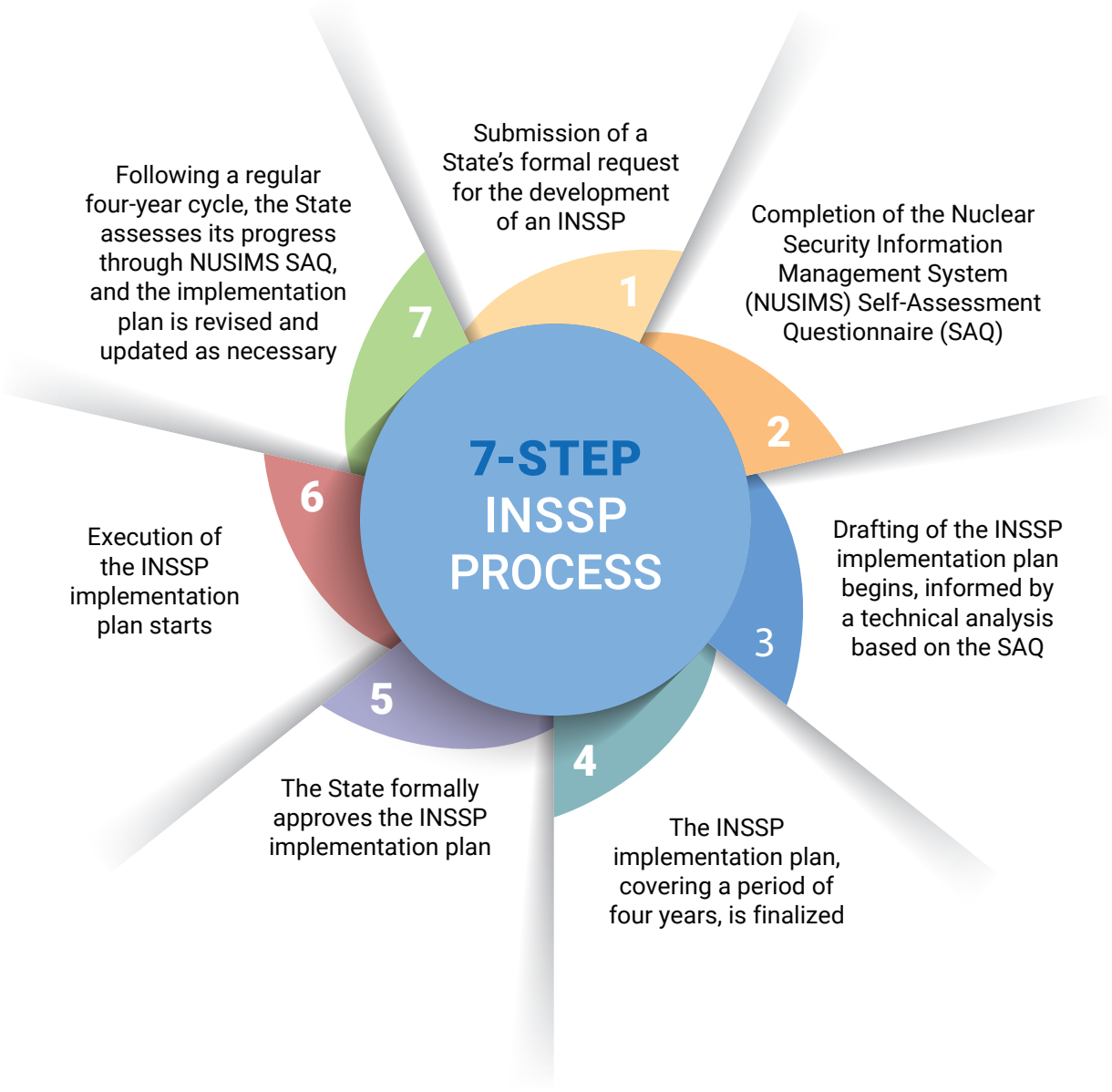
Planning for sustainable nuclear security

The Integrated Nuclear Security Sustainability Plan (INSSP) is a key component of IAEA assistance to countries in establishing, strengthening and sustaining their national nuclear security regimes, that the Agency provides upon request. It delivers a systematic framework based on the IAEA's nuclear security guidance.

Given the crosscutting nature of nuclear security, a wide range of national stakeholders are involved in developing and implementing a country's INSSP. These national stakeholders play a vital role in identifying and prioritizing areas for improvement and resource allocation, regardless of the status (existing, new or planned) of the country's nuclear security regime.

INSSP offers:

- Tailored support for all countries.
- Identification of responsibilities for national stakeholders, along with action strategies and timelines.
- A flexible and dynamic strategic planning mechanism that adapts to the evolving needs of the national nuclear security regime.
- Continuous improvement, coordination and ownership at the national level, optimizing the use of resources and preventing duplication of efforts.



The INSSP provides countries with a framework to assess and address their needs as part of efforts to strengthen national nuclear security, with a focus on sustainability and stakeholder involvement. Pictured here are recent discussions about the INSSP in Venezuela, Panama, Bolivia and Australia.

(Photos, top to bottom:
Venezuela: Ministry of Science and Technology;
Panama: V. Rouillet-Chatelus/IAEA;
Bolivia: V. Rouillet-Chatelus/IAEA;
Australia: Australian Safeguards and Non-Proliferation Office)

Potential National Stakeholders

involved in the development and implementation of an INSSP

INSSP in figures

as of March 2025

110 **INSSPs approved**, under implementation and under development

4 years

General review cycle of an INSSP and its implementation plan

18-20

INSSP missions per year on average

Strengthening public trust in crises

The key role of effective communication

By Anne-Sophie Faivre Le Cadre

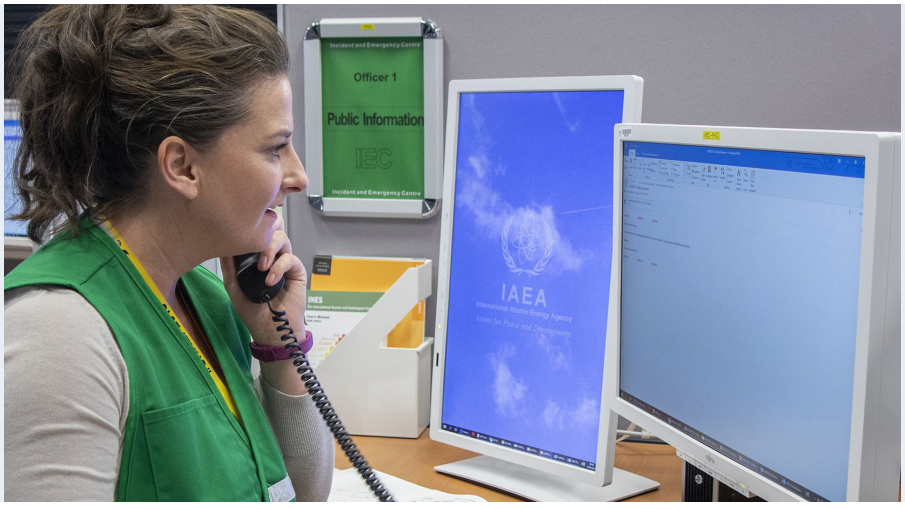
During public emergencies, fear spreads within minutes. Locally and globally, people turn to social media, whispers in the street and whatever scraps of information they can find. The problem is that those scraps are often wrong. As rumours mutate and misinformation or even disinformation spreads, panic sets in and trust in officials evaporates.

The fact of the matter is that trust cannot be built in a crisis — it must already be in place. In Chornobyl in 1986 and in Fukushima in 2011, misinformation spread rapidly, exacerbating confusion and delaying response. In these and other incidents, the response was hampered by a lack of verified official information in the early stages, and sometimes also by conflicting information. This was further complicated by the challenge of explaining to the public complex radiation protection concepts and the basis for decisions on protective actions. Despite efforts to address public concerns, there were situations where people took action in the belief that they were protecting themselves, but this may not necessarily have been the best thing to do.

To strengthen public confidence in the highly unlikely scenario that disaster strikes, governments and nuclear safety agencies must establish and implement clear, transparent communication strategies. People must become familiar with institutional sources to know where to turn for information that they can trust. Communication on what to do in an emergency should be undertaken regularly and not begin only during a crisis. Accuracy is essential but not enough; consistency is also key, because when different agencies send mixed messages, confusion follows and public confidence crumbles. Coordination between stakeholders is therefore crucial and should be tested regularly.

"In times of crisis, trust in authorities can be the deciding factor between chaos and effective response," said Carlos Vidal Torres, Director of the IAEA's Incident and Emergency Centre (IEC). "At the IEC, we work tirelessly to ensure that governments are prepared to communicate swiftly, clearly and credibly, because in a radiological emergency, every second counts. Strengthening public confidence through preparedness is not just a best practice, it is a necessity."

Recognizing this, the IAEA works with countries to improve crisis communication. The IEC provides training, workshops and simulation exercises designed to test and strengthen national emergency plans. For example, emergency exercises such as ConvEx-2g allow authorities to practice crisis response in a controlled setting, identifying weaknesses so that they can be addressed before they can develop into real-world problems.



During an emergency exercise at the IAEA's Incident and Emergency Centre, public information officers and technical experts work together using a variety of platforms to manage crisis communications.
(Photos: IAEA)

One of the biggest challenges in crisis communication is ensuring that accurate information reaches the public quickly. The IAEA's Unified System for Information Exchange in Incidents and Emergencies helps governments share real-time updates, providing an essential tool to counter misinformation and coordinate response efforts. In a fast-moving emergency, having a unified communication system is critical.

Misinformation and disinformation spread rapidly, often faster than facts. Social media amplifies speculation, making it crucial for authorities to respond immediately. Governments must not only deliver timely updates but also ensure that their messages are fact based and clear. Engaging with communities, building relationships with journalists and providing regular updates in non-crisis periods can help establish trust before it is needed most.

Building resilience against misinformation and disinformation is not just about leveraging the latest technology; it is about fostering public confidence. People are less likely to fall for misleading narratives when they already trust official sources. That trust is built through consistency, transparency and engagement over time.

Looking ahead, the IAEA is taking further steps to improve emergency communication worldwide. "Emergency communication is constantly evolving," said Nayana Jayarajan, Outreach Officer at the IEC and scientific secretary of a technical meeting scheduled for June 2025 on new developments in emergency communication and misinformation mitigation, including the role of artificial intelligence. "We need to stay ahead of challenges like misinformation and disinformation, learn from how other sectors tackle it, and make use of new opportunities — from artificial intelligence to targeted training. Our goal is to help Member States build the skills, systems and confidence they need to communicate clearly and effectively when it matters most."

Public communication will also be a key topic at the International Conference on Nuclear and Radiological Emergencies, set to take place from 1 to 4 December 2025 in Riyadh, Saudi Arabia. This conference will bring together experts, policymakers and communication professionals to exchange insights and strategies. As the landscape of crisis communication evolves, international cooperation will be critical in ensuring that best practices are shared and implemented globally.

The stakes are high. In any emergency, uncertainty fuels fear. By investing in preparedness today, governments and international organizations can ensure that should a crisis arise, public trust is not a casualty of the disaster, but a pillar of the response that also helps save lives.

Revolutionizing plastic recycling through irradiation

Plastic from household waste is hard to recycle because it contains different types of plastic. Irradiation can help turn this waste into high performance plastics. (Photo: M. Gaspar/IAEA)

"The world's commitment to ending plastic pollution is clear and undeniable," said Inger Andersen, Executive Director of the UN Environment Programme, as the fifth negotiation session for an international legally binding instrument on plastic pollution, including in the marine environment, came to a close in Busan, Republic of Korea, in December 2024.

As representatives from more than 170 nations and observers from hundreds of organizations roll up their sleeves for the next session in Geneva, Switzerland, scientists and technologists are making headway in research to tackle the global crisis of plastic pollution. Recycling and upcycling efforts are intensifying as the most viable options for managing plastic waste, with radiation technologies emerging as an innovative, clean and efficient tool to convert used plastic, together with biomass, into new products.

The scourge of plastic pollution is nothing new. Belgian chemist Leo Baekeland invented the first wholly synthetic plastic, Bakelite, in 1907. By the mid-20th century, global plastic production per year reached about 2 million tonnes. Today, with annual production surpassing 400 million tonnes, it is nearly impossible to go a day without coming across some form of plastic. If business continues as usual, global production of primary plastic is forecast to almost triple, reaching 1.1 billion tonnes by 2050.

Challenges in conventional recycling

Despite recycling efforts, less than 10 per cent of the 7 billion tonnes of plastic waste generated globally to date has been recycled. Plastic is not biodegradable. Instead of decomposing, it fragments into smaller pieces, resulting in microplastics. These can be found literally everywhere, from the air we breathe to the oceans of Antarctica.

Mechanical and chemical recycling are the two major recycling techniques currently in use. Mechanical recycling is the most common method, salvaging similar plastics to produce raw materials that can be reintegrated into plastic production. The process involves collecting, sorting, washing and grinding the plastic, which is then melted and reprocessed into new materials.

While relatively cheap, this type of recycling requires the sorting of different polymers, making it difficult to process multilayered or mixed plastics. Additionally, the process cannot be used more than twice, as the quality of recycled materials degrades with each cycle, and it only applies to thermoplastics (those that can be remelted and reshaped into products).

Chemical recycling can process a wider variety of mixed plastic waste, including contaminated and low quality waste, by breaking it down into its molecular components, thereby transforming it into substances that can be used to produce new plastics or other products such as fuel. This method is rather costly as it requires high energy inputs, and developing large scale chemical recycling facilities requires significant investments in infrastructure.

How can irradiation help?

Radiation technology using gamma and electron beams offers unique advantages to reduce plastic waste by offering a cleaner production and recycling process, avoiding the use of potentially harmful additives, and improving energy efficiency.

"The main benefit of irradiation in plastic recycling stems from its ability to alter the chemical structure of plastics at a molecular level," said Azillah Binti Othman, a radiation processing officer at the IAEA. "Irradiation can help reduce plastic waste volumes in two ways: by increasing the repurposing of hard-to-recycle plastics into valuable products, and by developing bio-based plastics to reduce reliance on petroleum-based plastics."

Irradiation is a very effective tool for sorting polymers in recycled plastic that has already been washed and ground. This improves the purity of the recycled plastic, thereby enhancing its value.

Irradiation can also complement and enhance traditional recycling methods. When combined with a chemical recycling method known as pyrolysis, which results in radiolysis, plastic waste polymers can be broken down and converted into fuel or chemical components to create new products without adding virgin (non-recycled) polymers.

Beyond traditional recycling, irradiation also paves the way for innovative approaches, allowing plastic waste to be blended with other materials to create more durable products. This facilitates the manufacturing of high performance material with applications in the automotive or construction industries. For instance, construction materials made from recycled plastic — such as tiles, bricks, lumber and boards — are irradiated in the Philippines to improve their tensile and sheer strength, abrasion resistance and other mechanical properties.

Radiation-assisted technology is also showing promise in making more durable final products when using biomass, a renewable resource. This allows the creation of bio-based plastic and other high value compounds to produce, for example, novel packaging materials that would replace conventional petroleum-based plastics.

NUTEC Plastics: From recycling to monitoring microplastics

The IAEA is harnessing the power of radiation technologies through its NUTEC Plastics initiative to assist countries in dealing with plastic pollution on two fronts: at the point of source, by introducing new technologies to improve plastic recycling; and in the ocean, where the bulk of plastic waste ends up.

"The focus on the first front is on reducing plastic waste volumes through innovative upcycling, increasing the repurposing of hard-to-recycle plastics into valuable products and developing bio-based plastics," said Celina Horak, Head of the IAEA Radiochemistry and Radiation Technology Section. "With the help of the NUTEC Plastics initiative, nine countries across Asia, Latin America and Africa are in the process of establishing radiation-assisted pilot plants."

— By Evalyne Ndirangu, Ayhan Evrensel

IAEA kicks off 2025 cooperation with G20 under South Africa's Presidency

A side event on the role of nuclear power in clean energy transitions hosted by the South African G20 Presidency and the IAEA.
(Photo: B. Carpinelli/IAEA)

For the second year in a row, the IAEA has been invited to collaborate with the Group of 20 (G20) on work related to nuclear power. The cooperation resumed under South Africa's G20 Presidency at meetings held in Cape Town at the end of April, kicking off with a side event hosted by the IAEA and South Africa on the role of nuclear energy in clean energy transitions. This was one of the technology dialogues that the Presidency will be featuring throughout the year-long process.

Building on its first ever collaboration on nuclear power with the G20 in 2024 under Brazil's Presidency, the IAEA's engagement this year will include publications tailored to inform the group on topics such as the prospects for nuclear power in Africa and repurposing coal-fired plants for nuclear power, such as small modular reactors (SMRs), as well as participation in the G20 Ministerial Meeting on Energy, set to be held from 23 to 26 September.

"At a time when energy access and security of supply are issues of global concern, the role of nuclear energy in low carbon, resilient and affordable energy systems remains indispensable," said IAEA Director General Rafael Mariano Grossi. "Continuing the work that the IAEA began under the Presidency of Brazil, we are now looking forward to working with South Africa."

The first African country to assume the G20 presidency, South Africa is pursuing an Africa-wide approach, emphasizing energy security, a just and inclusive clean energy transition, and regional energy cooperation. While South Africa remains the only country on the continent to have nuclear power and aims to expand its programme, several African countries have expressed interest in or are embarking on its introduction. Egypt is building four large reactors, and other countries such as Ghana and Kenya are working with the IAEA to establish the necessary infrastructure for a nuclear power programme, with a particular interest in SMRs.

The side event opened with special remarks by Kgosientsho Ramokgopa, Minister of Electricity and Energy of South Africa. Delegates from the G20 Energy Transitions Working Group (ETWG) attended the event, which featured discussions on the state of nuclear power in South Africa as well as the IAEA's outlook on nuclear power and the publications that the IAEA will release as part of its G20 collaboration this year. This was

followed by a session on nuclear power project financing issues, moderated by the Head of the Clean Energy Ministerial Secretariat, which featured panellists from the IAEA, the International Energy Agency, France and South Africa discussing ways to unlock financing for nuclear power projects and pave the way for faster deployment.

"In the wake of the world aiming to reach net zero by 2050, there has been a return to realism, where it is globally accepted that nuclear technology has a huge role to play in the energy mix as a key source to ensure countries achieve their energy security, energy sovereignty and energy justice in the transition," said Mr Ramokgopa. "The expansion of the nuclear programme gives South Africa energy security and sovereignty that enable the country to move its economy into a digital era, engage in new research frontiers and take its rightful place amongst leading nations."

During the event, delegates from G20 members and invited countries delivered remarks from the floor and offered their national perspectives.

"Italy is working to relaunch the use of sustainable nuclear energy as part of its net zero emissions path by 2050. We have created the National Platform for Sustainable Nuclear, involving R&D centres and industrial capabilities, and nowadays our Government is strongly committed to work on enabling a favourable legislative and regulatory framework aimed at promoting the use of safe and innovative nuclear at the national level, including small modular reactors and Generation IV advanced modular reactors," said Alberto Pela, Head of Delegation and Senior Advisor on International Activities at the Department of Energy in Italy's Ministry of Environment and Energy Security.

The United Arab Emirates (UAE), an invited country, recently began operating four large nuclear power reactors.

"In the UAE, nuclear energy is more than a power source — it's a cornerstone of our clean, safe and sustainable energy future," said Nawal Yousif Alhanaee, Director of the Future Energy Department at the UAE's Ministry of Energy and Infrastructure. "With the Barakah nuclear energy plant meeting up to 25 per cent of our electricity needs, we affirm our commitment to a carbon-free tomorrow powered by peaceful and reliable nuclear technology."

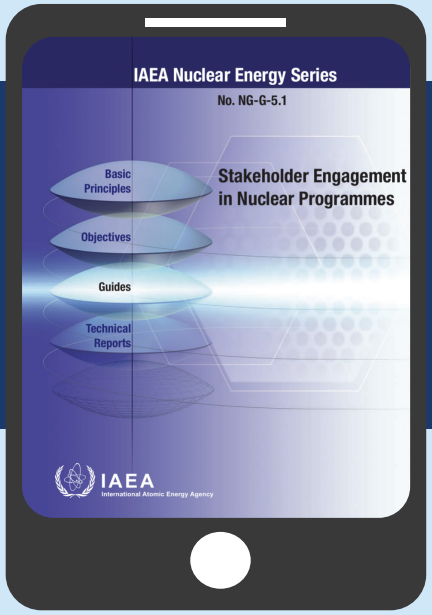
— By Matt Fisher and Bianca Carpinelli

Minister Kgosientsho Ramokgopa delivering his opening remarks at the nuclear energy side event hosted by the IAEA and South Africa during the G20 ETWG meetings. (Photo: B. Carpinelli/IAEA)

Did you know

that stakeholder engagement is essential throughout the life cycle of all nuclear facilities?

Scan to learn more



Browse all IAEA Publications

free online

www.iaea.org/publications

To order a book, write to
sales.publications@iaea.org

IAEA Publications

Partner With Us

for a better future

The IAEA welcomes
Member States, industry, financial institutions and other stakeholders
to partner with us on our flagship initiatives and contribute
their expertise, modelling tools, industrial knowledge, advocacy and financial resources.

HEALTH

IAEA PIACT

IAEA RAYS OF HOPE
CANCER CARE FOR ALL

WOMEN IN NUCLEAR

IAEA Lise Meitner PROGRAMME

IAEA Marie Skłodowska-Curie FELLOWSHIP PROGRAMME

ENERGY

IAEA ATOMS 4 NET ZERO

IAEA NHSI NUCLEAR HARMONIZATION & STANDARDIZATION INITIATIVE

ENVIRONMENT

IAEA NUTEC PLASTICS

FOOD & AGRICULTURE

FAO & IAEA ATOMS4FOOD
GROWING FOOD SECURITY

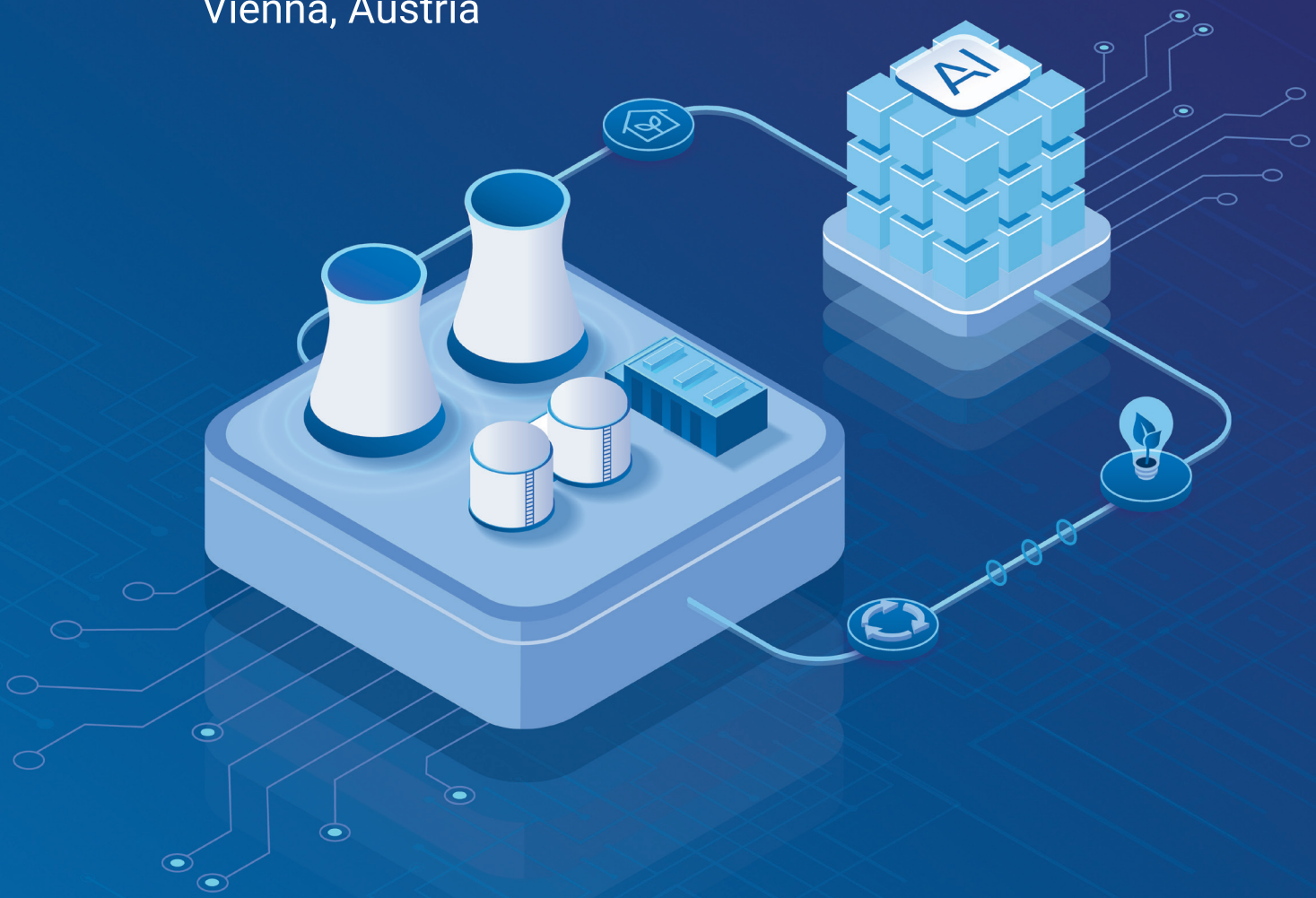
Learn more about the IAEA's
flagship initiatives

IAEA
Atoms for Peace
and Development

International Symposium on

AI and Nuclear Energy

3—4 December 2025
Vienna, Austria



ISSN 0020-6067
25-01327

IAEA

#NuclearAI