

Lectio Magistralis

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In December 1942, on an old squash court beneath the stands of an abandoned American football stadium, an Italian scientist became the first person to light an atomic fire. In that moment, humankind harnessed the vast cosmic reservoir of energy in our sun and our stars.

The pioneering scientist was of course Accademia Nazionale dei Lincei's very own Enrico Fermi. Fermi laid the foundations of his famous experiment with the "ragazzi di via Panisperna" here in Rome.

As the inventor of the nuclear reactor and among the first to warn of its potential military use, Fermi knew that the energy he had unleashed could both harm and benefit us.

Towards the end of his life, he gave a lecture to a group of physicists. He told them: "What we all fervently hope, is that man will soon grow sufficiently adult to make good use of the powers that he acquires over nature."

In 1957, five years after Fermi made that statement, the International Atomic Energy Agency (IAEA) was founded and given a mandate to turn his "hope" into reality.

I have spent much of my adult life in the orbit of the IAEA. This has given me the privilege of seeing the Agency from several different angles: as an Argentinian diplomat; as a staff member, and now as its Director General.

The IAEA is a unique international organization, steeped in technical and scientific knowledge. Our hallways and laboratories echo with the conversations of scientists and public servants from every continent. We are a member of the United Nations family and partner with many of its Agencies. At the same time, we are autonomous. Ultimately, the IAEA answers to its 173 Member States.

Some of these states operate nuclear power plants, others do not; some are rich and others less so. Two wishes unite everyone we serve: the wish to live in peace, and the wish to benefit from the many life-enhancing applications of nuclear science and technology.

It is in meeting these wishes that the IAEA finds its mandate: “Atoms for Peace and Development”.

Like a coin, the IAEA has two sides. On one side, we are the world’s nuclear watchdog. We verify that states do not develop nuclear weapons. On the other, we are the facilitators of scientific and technical progress. We work to ensure that no community is left behind when it comes to benefiting from the safe, secure and peaceful uses of nuclear technology. We assist countries in healing their sick, boosting their crop yields, finding sources of fresh water, making oceans cleaner, and mitigating the consequences of climate change. The uses of nuclear are so wide ranging, that the IAEA alone helps countries achieve 9 of the UN’s 17 Sustainable Development Goals.

To better understand where we are today and imagine what tomorrow might hold, I would like to take you on a journey back to the 1950s.

In Vienna, the wounds of war are still etched into the buildings. It is 1957, and the new home of the IAEA is just emerging from a decade of occupation by the war’s victorious powers.

Here in Italy, things are looking up. The industrial miracle is producing everything from the most desired fashions to the Vespa. Federico Fellini and Sofia Loren are bringing Italian cinema to the world.

In Africa and Asia, countries are forging a new future, independent of colonial rule.

Technology is advancing. A new transatlantic cable enables better communication; the first computer comes to market; and jet aeroplanes herald intercontinental travel. In the Soviet Union and in the UK, the first nuclear power stations are producing electricity, and among nuclear scientists there is a sense of promise of further applications.

But, with the shock of the atomic bomb still fresh in people’s hearts and minds, the spectre of nuclear conflict is casting a dark shadow over all this post-war potential.

To move confidently into the future, the world needs to find a way to prevent the destructive power of nuclear weapons while nurturing the technology’s benefits for peaceful use.

It is in this context that the IAEA is founded, and 13 years later the Treaty on the Non-Proliferation of Nuclear Weapons, known as the NPT, will come into force.

For the past six decades, the IAEA and the NPT have made immense contributions to the safety and well-being of billions of people.

Were it not for this powerful international legal framework and the indispensable role of our inspections, we might well be living in the world the leaders of the 1950s and 60s feared would come to pass.

That the world is not permeated by nuclear weapons states, is a remarkable achievement. We should not take it for granted. As with other treaties and international institutions, the NPT and the IAEA rely on nations respecting international laws and norms. Today, the undermining of international laws and institutions; the closing of borders and the disregard for scientific and other facts, are serious challenges to peace.

Amid these obstacles, it is critical that the IAEA maintain its high level of credibility. To do this, we must remain steadfast in being firm and fair, especially in difficult situations.

Iran's nuclear programme is one of these challenges.

My team and I have maintained an open dialogue with Iran to verify, without bias, its nuclear programme. In the past months, we have worked tirelessly with Iran to ensure there is no break in the IAEA's collection of data while diplomatic negotiations towards an agreement between Iran and the five permanent members of the UN Security Council, plus Germany and the EU, continue.

This constructive and respectful approach does not mean we have shied, or will shy, away from telling the truth. We have made it clear that Iran has not yet answered our questions. And I have publicly stated my concern regarding this lack of clarity, especially as this ambiguity comes amid the backdrop of a continuously growing level of nuclear activity.

Also deeply concerning is the situation in North Korea. Satellite imagery indicates a reprocessing campaign may be underway. The situation is a cautionary tale of what happens when a country turns its back on established norms and its cooperation with the IAEA.

Even though inspectors cannot enter North Korea, the IAEA continues to monitor its programme and we stand ready to re-engage. Every day we are reminded that diplomacy requires patience. This is true also in the IAEA's role in establishing a nuclear-weapons-free zone in the Middle East.

The process of establishing such a zone is, of course, led by the states in the region, and it is not easy. We will continue our consultations and engagement.

Over the past sixty years, our long-term goals of peace and prosperity have not changed. However, the political interests of nations have fluctuated amid constant geopolitical shifts, from the dawn and dusk of the Cold War, to terrorism and regional conflicts.

In coming decades, the pace of geopolitical and technological change is unlikely to slow. It will be vital that the IAEA remains strong throughout.

Member states are wise to keep supporting our work, financially, by helping strengthen safeguards, security and safety norms, and by furthering the scientific collaborations that help us support peace and prosperity around the world.

A robust regime of safeguards, including Additional Protocols, is essential. The Additional Protocol strengthens the IAEA's safeguards mandate. Without it, what inspectors can do is limited. A little like a man looking for his keys under a lamp post, not because he dropped them there, but because this is the only illuminated place on the street, it is not good enough for the IAEA to look for nuclear activity only where a member state declares it is. The Additional Protocol gives inspectors the authority to search thoroughly, thereby more confidently being able to reassure the world that no nuclear materials are unaccounted for, nor have any been diverted. The international community granted the IAEA this authority after the revelation in 1991 of the extent of Iraq's hidden weapons programme.

A similarly important lesson came a decade later amid the September 11 terrorist attacks in the United States. These made clear to the world that the threat of nuclear proliferation had changed since the 1950s. With the spread of nuclear material across all continents and the rise of non-state actors, it was high time to sharpen the international focus on security.

The Convention on the Physical Protection of Nuclear Material and its 2005 Amendment make it legally binding for countries to protect a wide range of peaceful nuclear material wherever it is located, whether in facilities, in transit or in storage. Through peer reviews, shared databases, and training, the IAEA assists countries across the world in meeting that obligation. We help them understand how to keep their nuclear material safe and secure, whether it is located in a hospital treatment room, at a power plant, or in a university laboratory. The amendment also provides for strengthened international cooperation. Italy plays an important role in this. For example, it funds the International School of Nuclear Security, organized by the IAEA and the International Centre for Theoretical Physics in Trieste. Our 10th session was held last month, updating early-career professionals from developing countries on the latest in nuclear security.

Nuclear safety and nuclear security are closely related. Without them, nuclear will not be able to deliver on its beneficial potential. Today, we have a strong international safety culture in no small

measure because of the lessons we learned from the Chernobyl accident. International conventions and a robust network of cross-border cooperation exists, with the IAEA at their centre. Principles to guide countries in their implementation of these objectives, further strengthened that safety culture following Fukushima. This is important, not only for those countries pursuing nuclear power programmes, but also for those, like Italy, that have decided to decommission their nuclear power reactors.

Globally, nuclear power plants provide around a third of our low-carbon electricity. Nuclear energy is here to stay. Countries in Asia and even in the oil-rich Middle East are looking to it to meet their growing energy needs. More than 50 reactors are under construction and 27 countries are actively considering, planning or embarking on a nuclear power programme. The IAEA is helping many of them lay the legal, organizational, human and technical foundations that will allow them to fulfil their ambitions in a safe, secure and efficient way.

Because every time a nuclear power plant replaces a coal mine, the world can breathe more easily – quite literally. Today, 8 million people a year die because of the health effects of fossil fuel emissions.

With the technical challenge of long-term nuclear waste disposal having been overcome by sites like Finland's Onkalo repository, experts have concluded there is no science-based evidence to suggest nuclear does more harm to human health or the environment than other green technologies backed by the European Union.

Of course, each country has its own unique circumstances, and each chooses its own energy mix. But if we are to reach net-zero emissions anywhere close to 2050, the world will need to harness all available low-carbon energy sources. The Intergovernmental Panel on Climate Change models four pathways to achieving our critical 1.5°C degree goal. These require nuclear power generation to increase between 59% and 501%. This projection by leading international environmental scientists is higher even than the IAEA's top estimates.

It is clear that we will have to come up with new technologies across all low-carbon solutions. In nuclear, for example, Small Modular Reactors (SMR) could offer an option for smaller electricity grids, including those in developing countries. If SMRs are used to produce hydrogen, we could reach tough-to-decarbonize sectors, including transport and industry. Further in the future, tangible progress in fusion will bring with it the prospect of safe, reliable and abundant carbon-free energy. In all of these cases, the IAEA is laying the groundwork to contribute to their safe development and deployment.

If we are to hand this world to the next generations better than we found it, we must invest in science.

Newspaper headlines may tend to focus on our safeguard work, but many countries join the IAEA because they want our help in safely applying nuclear science and technology to a myriad of peaceful endeavours. The following specific examples illustrate the IAEA's unique mandate.

The SESAME international research centre in Allan, Jordan is a notable achievement in which the IAEA is involved. Countries in the Middle East with deep political differences came together to build the facility at whose heart is a synchrotron light source allowing scientists from across the Middle East and beyond to collaborate, teach and advance nuclear science. These days, as the conflict in Gaza rages on, this example reminds us of what can be done when scientists work together.

Whereas the SESAME project was a long time coming, my next example shows just how quickly the IAEA can move in a crisis. Over the past year, we have done our part to help fight the Covid-19 pandemic. To date, the agency has sent RT-PCR testing kits to 128 countries, enabling the testing of more than 28 million people.

While we were mounting the largest emergency response operation in our history, we were also devising a coordinated, long-term initiative to combat the reoccurring challenge of viral outbreaks like that of Covid-19. Zoonotic Disease Integrated Action, the IAEA initiative we call ZODIAC, is nuclear's contribution to helping developing countries spot zoonotic diseases and stop them from spreading. The programme builds on decades of experience and is an example of the IAEA joining partners, such as the World Health Organization, the United Nations Food and Agricultural Organization, and the World Organization for Animal Health, under the "One Health" approach to soothe and to cure, and to rebuild communities.

There are many medical uses of nuclear technology beyond combating zoonotic diseases. Cancer is a big one. Through nuclear medicine and therapy, the IAEA has been working hard to open access to life-saving pharmaceuticals, equipment and knowledge to countries that lack them. The projected increase in cancer cases over the coming decade will be distributed unevenly. The number of new cases is forecast to rise more than 80% in low-income countries, double the rate richer countries will experience. Today, cervical cancer kills more than 300,000 women every year – nine out of ten of them in low- and middle-income countries. Many of these deaths would be preventable if it weren't for the fact that

people living in nearly 70 countries, 28 of them in Africa, still do not have access to radiotherapy. Setting up a cancer centre is not an easy task, which is why the IAEA has helped countries such as Zambia on their journey to do so. For many public professionals and policy-makers, the agency serves as a key resource for learning and sharing best practices, and to ensuring these life-saving treatments are available and carried out safely and effectively.

The next examples I would like to give are of nuclear science offering solutions to the challenges of climate change and pollution that go well beyond decarbonizing electricity production.

For farmers in Vietnam, for example, radiation processing turns casava root starch polymers into water-absorbent pellets, which are used to help irrigate rubber plantations. In Latin America, Asia and Africa, IAEA experts help countries use ionizing radiation to breed new crop varieties so farmers reap harvests that can better survive droughts and disease and offer higher nutritional value. This not only boosts yields, but also conserves water and reduces the need for pesticides and fertilizer. From Afghanistan to Argentina, the IAEA helps communities use isotopes to trace and assess the availability of fresh water, allowing them to use this precious resource prudently. Isotopes also allow scientists to trace microplastics across the oceans, and through the food chain from the bellies of shrimp to those of fish to ours. This means governments can rely on accurate information as they seek to overcome an increasingly global problem. Of all the plastic we have used to date, 70% is already waste. Less than 10% has been recycled, with much of the rest eventually landing in our waterways. One of the problems is that plastic is difficult to recycle, and here too, nuclear techniques can help, in this case by breaking down long and complex polymers. Like a discarded plastic bottle washed onto a distant shore, many challenges do not respect national borders. The IAEA enables scientists and professionals to reach across their borders to share their experiences and data. A powerful example of this comes in a rather small body – that of the Mediterranean fruit fly, one of the world's most destructive agricultural pests. The IAEA helps many countries eradicate the medfly by using radiation to sterilize males. In the Middle East, this little insect flies without challenge across borders and through military no-fly zones. But it met its match when Israeli, Palestinian and Jordanian policy-makers, scientists, farmers and technicians came together and – aided by the IAEA – used the sterile insect technique to eradicate them. The agency has adopted the same approach to help Senegal and other countries combat the deadly tsetse fly.

In these endeavours, member states receive our assistance on the ground, at our laboratories near Vienna and in Monaco, and at the conferences and training events we host and facilitate. Knowledge like this is shared through our virtual platforms and reports, and through our partnerships with research facilities around the globe.

In all we do, we seek to empower the people we serve, and this is especially true of women. I am determined we do our part to boost the number of women benefiting from and participating in nuclear science.

The American physicist, Leona Woods, was the only woman in Fermi's team that built and experimented with the world's first nuclear reactor. There are far too many women scientists who have received far too little credit for their important work.

I opened my remarks with Enrico Fermi, and as I approach the end of them, I want to name some of the women scientists who worked around Fermi's time. Their contributions in many cases were not only important to science, but also to him.

- Tatiana Ehrenfest-Afanaseva, who together with her husband laid the foundations of statistical mechanics and statistical thermodynamics.
- Emmy Noether, who solved problems key to the theory of relativity and whose mathematical formulations, including those surrounding the principle of the conservation of energy, contributed to our understanding of physics.
- Marietta Blau, the first physicist to show that proton tracks could be separated from alpha-particle tracks in emulsion.
- Irène Joliot-Curie, whose work offered an important clue for the discovery of the neutron, and who discovered induced radioactivity.
- Lise Meitner, who discovered radiationless atomic transitions and later discovered nuclear fission. Her mastery of experimental physics underpinned and facilitated some of the most important scientific advances made by her fellow scientists, including Fermi's nuclear reactor.
- Ida Tacke Noddack, a chemist, who suggested that the radioactivity Fermi observed resulting from neutron bombardment of uranium might be caused by disintegration of the uranium nucleus into several heavy fragments. Had Fermi taken note, he would have sooner understood the process we now know as fission.
- Maria Goeppert Mayer, who proposed the nuclear shell model of the atomic nucleus.

My hope is that young scientists will research these great scientists' discoveries and take inspiration from their perseverance and determination. And that we more senior leaders will remember the equally vital contribution women and men make in helping us achieve our goals.

Today, it is our job to clear the path of women scientists of their historical and current obstacles. This is why I launched the Marie Skłodowska-Curie Fellowship, whose inaugural group of 100 women fellows is already receiving financial support to study for their Master's degrees in nuclear subjects around the world.

We have come a long way since the hopes and fears of the mid-1900s led to the IAEA's founding. As you can perhaps tell, I am fiercely proud of this unique organization's accomplishments and of the work its women and men continue to do every day. But we cannot do it alone. In closing, I want to thank the Accademia Nazionale dei Lincei for the great honour of being with you in this magnificent setting today. And I want to thank Italy, its policy makers and its scientists, for helping the IAEA to make Fermi's hope a reality. I call on all of us to redouble our efforts to use wisely, justly and always peacefully the incredible power he and the women and men who worked alongside him unleashed 80 years ago.