



**IAEA**

International Atomic Energy Agency  
*Atoms for Peace and Development*

# The IAEA INPRO School on Strategic Planning for Sustainable Nuclear Energy

## CERTIFICATE COURSE



*Many countries, faced with sharply rising energy costs and heightened security of supply concerns, are reconsidering nuclear power. They are realizing more and more that nuclear power has a proven ability to reduce greenhouse gas emissions, avoid air pollution, improve energy security and access, mitigate fuel price volatility and power sustainable development.*

*The IAEA works with young people, engaging a new generation of scientists so that they have the opportunities to work together to face these problems and to provide the necessary solutions.*

**Rafael Mariano Grossi**  
IAEA Director General

### MAIN REASONS FOR ATTENDING THIS SCHOOL

- 1** The curriculum covers the most important topics related to strategic planning for sustainable nuclear energy.
- 2** Participants will gain knowledge and practical experience on modelling, analyzing and assessing the sustainability of nuclear energy systems.
- 3** The School offers a unique opportunity for capacity building and career growth by supporting interaction and networking with international nuclear energy experts and peers.

## The International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)

was established in 2000 to ensure that nuclear energy is available to contribute, in a sustainable manner, to the growing energy needs of the current century and beyond.

INPRO is one of several key IAEA programmes. It is a forward-looking project that integrates all areas important to the sustainability of nuclear energy. INPRO's activities are centred on the key concepts of global nuclear energy sustainability and the development of long-range nuclear energy strategies. INPRO promotes technological and institutional innovations in the development and deployment of nuclear energy systems that are safe, secure, economically viable, and environmentally sustainable. INPRO supports Member States' capacity building through its educational and training programmes.



## ACHIEVING A SUSTAINABLE FUTURE

Sustainable development aims to meet the needs of the present generation while ensuring that future generations would have the resources to meet their own needs. Achieving such a future is a complex process that involves balancing economic growth, social equity, and environmental protection in a way that benefits both the present and the future generations. The United Nations sustainable development goals (SDGs) encompass the spectrum of human life and set time-bound targets to achieve sustainable development.

Energy plays a critical role in sustainable development by enabling economic growth, improving social well-being, and reducing poverty. However, the way energy is produced, distributed, and consumed has significant impacts on the environment and climate. The present global energy system relies heavily on fossil fuels, which are not only finite but also cause substantial environmental damage. The use of fossil fuels is also the main source of greenhouse gas emissions (GHGs) causing climate change. A swift transition to reliable, affordable, clean and GHG-free energy systems is vital for achieving sustainable energy development. Nuclear energy is a reliable, clean and competitive source of energy that can support the realization of sustainable

development. Its use, however, requires a comprehensive evaluation of a wide range of issues covering technology, economics, safety, non-proliferation, and waste management. Strategic long-term planning is thus necessary to ensure that the nuclear energy system is fully aligned with sustainable development.

The IAEA's INPRO has developed a set of decision support tools for developing nuclear energy scenarios and conducting studies for formulating national strategies for sustainable nuclear energy systems. INPRO disseminates these tools and conducts specialized training in the IAEA INPRO School on Strategic Planning for Sustainable Nuclear Energy (the INPRO School), to help Member States build local expertise for strategic planning for sustainable nuclear energy development.

## THE INPRO SCHOOL

The IAEA assists Member States in capacity building through various educational and training programmes, including long-term and strategic planning for sustainable nuclear energy. The INPRO School introduces the INPRO concept of nuclear energy sustainability and develop competencies for assessment and analysis of nuclear energy systems to support national decisions on the future use of nuclear energy.

## OBJECTIVE

The INPRO School aims to develop and strengthen the competencies needed for long-term strategic planning of sustainable nuclear energy systems at the national, regional, and global levels. This objective is accomplished by providing knowledge and basic practical experience on the INPRO analytical approaches, methods and tools for assessment and analysis of nuclear energy systems.

## SCOPE

The INPRO School covers all areas of INPRO's concept of nuclear energy sustainability – economics, infrastructure, waste management, environment, proliferation resistance, reactor and fuel cycle safety. The table below highlights the main elements of the course. The School also provides training on the INPRO tools and methods for assessment and analysis of nuclear energy systems.



## MAIN ELEMENTS

1	Energy planning and strategies for sustainable development
2	Planning for nuclear energy sustainability
3	INPRO methodology for assessing sustainability of nuclear energy systems
4	The role of innovations for sustainability of nuclear energy systems
5	INPRO methods and tools for modelling and analysis of nuclear energy systems
6	Application of INPRO tools for strategic planning of nuclear energy systems
7	Projects and exercises

Participants are encouraged to work with colleagues from diverse national, cultural, and professional backgrounds on team projects. For these projects, participants will explore some aspects of nuclear energy that may be different from their normal work or educational focus. At the end of the course, participants will present results of their projects and take a computer-based test. After successful completion of the course, they will receive a certificate.

The INPRO School is offered as a regular school and an advanced school.

- The regular school familiarizes participants with the INPRO concept of sustainable nuclear energy systems and their sustainability assessment. It also provides introductory training on modelling and analysis of nuclear energy systems using INPRO tools.
- The advanced school provides participants with a more in-depth examination of the challenges related to sustainability of nuclear energy systems and develops competencies necessary for sustainable nuclear energy strategic planning. The school strengthens their knowledge and skills through hands-on training on the INPRO tools.

Upon request, the INPRO School can be adapted to the specific needs of Member States. For example, the school programme can be customized to meet the needs of senior level professionals who already have experience in the nuclear energy field and have responsibility for managing nuclear energy facilities and/or for planning and developing of nuclear energy in their country.

## OUTCOMES

On completion of the INPRO School, the participants should be able to:

- explain the UN concept of sustainable development and the role of sustainable energy development
- demonstrate knowledge and understanding of the INPRO concept and approaches for analysis of sustainable nuclear energy systems, including the INPRO methodology for sustainability assessment
- perform basic or advanced modelling and analysis for strategic planning of nuclear energy systems using INPRO tools
- describe the innovation process and articulate the role of technological and institutional innovations in the nuclear energy sector in achieving sustainability.



## ORGANIZATION

### Target Audience

The INPRO School is primarily intended for persons pursuing a professional career in strategic planning of nuclear energy systems.

The INPRO School is also beneficial for:

- present and future managers of nuclear energy organizations
- energy planning professionals
- university faculty and instructors of centres of excellence
- nuclear engineers, researchers and analysts
- experts in international relations involved in energy planning

### Prerequisites

- University degree or equivalent
- Work experience in the field of nuclear energy is desirable
- Excellent verbal and written command of English

### Language

- English

### Admission Process

- The admission process may vary depending on the host organization of the school.
- Applicants may be given the option to submit an abstract for a poster presentation, and will be given priority to attend the School.
- A recommendation letter from the applicant's employer should be attached to the application form or sent to the IAEA school director.
- Shortlisted applicants will be invited to an online pre-training, telephone interview or his/her references will be contacted.

### Duration/Location

- The duration is one week for regular schools and two weeks for advanced schools. The school duration may be extended to accommodate technical tours/visits to nuclear facilities.
- To ensure the participation of persons from a broad range of IAEA Member States the school may take place in various locations.

## CURRICULUM

	Main Elements	Topics
1	<b>Energy planning and strategies for sustainable development</b>	<p>Concept of sustainable energy system</p> <p>Global energy supply-demand trends</p> <p>Energy resources and technologies</p> <p>Energy economics</p> <p>Energy security</p> <p>Climate change</p>
2	<b>Planning for nuclear energy sustainability</b>	<p>INPRO concept of sustainable nuclear energy systems</p> <p>Nuclear power reactors and fuel cycles</p> <p>Economics of nuclear power</p> <p>Role of nuclear power in combating climate change</p> <p>Non-electrical applications of nuclear energy</p> <p>Public acceptance of nuclear energy</p> <p>Geopolitical considerations for nuclear energy</p> <p>International obligations and norms for peaceful uses of nuclear energy</p>
3	<b>INPRO methodology for assessing sustainability of nuclear energy systems</b>	<p>Overview of INPRO methodology for assessing the sustainability of nuclear energy systems covering the areas of economics, infrastructure including physical protection, waste management, environment, proliferation resistance, safety of reactors and safety of nuclear fuel cycle facilities</p>
4	<b>The role of innovations for sustainability of nuclear energy systems</b>	<p>Technological and institutional innovations in nuclear energy:</p> <ul style="list-style-type: none"> <li>• the innovative process and the need for technological and institutional innovations</li> <li>• main technical features of early and current nuclear energy technologies and their fuel cycles</li> <li>• distinct features of future nuclear energy technologies and their fuel cycles, along with their impact on sustainability</li> <li>• past and current institutional innovations in the nuclear energy sector</li> <li>• the need for future institutional innovations and enhanced cooperation to improve sustainability of nuclear energy systems</li> </ul>
5	<b>INPRO methods and tools for modelling and analysis of nuclear energy systems</b>	<p>Introduction to the INPRO methods and tools:</p> <ul style="list-style-type: none"> <li>• Simulators for scenario analysis of nuclear energy systems</li> <li>• NEST – Nuclear energy system assessment (NESA) Economics Support Tool</li> <li>• MESSAGE-NES – a method for modelling nuclear energy systems with MESSAGE</li> <li>• KIND-ET – a tool for multicriteria comparative analysis of nuclear energy systems</li> <li>• ROADMAPS-ET – an analytical decision support tool for structuring, unifying and visualizing data on issues related to long term nuclear energy planning</li> </ul>
6	<b>Application of INPRO tools for strategic planning of nuclear energy systems</b>	<p>Hands-on training on using the INPRO tools</p> <p>Application of INPRO analytical approaches for modelling and analysis of nuclear energy systems</p> <p>Guidance on input data preparation, execution of the tool and interpretation of the results</p>
7	<b>Projects and exercises</b>	<p>Group and/or individual projects and exercises on selected topics relevant to strategic planning for sustainable nuclear energy development and deployment</p>

## PARTICIPANTS' FEEDBACK AND IMPRESSIONS

*"This School has enhanced my capacity regarding energy systems modelling and simulation. The instructors provided in-depth knowledge and real-life examples of subjects under consideration. I am happy to be one of the students that participated in the first Joint ICTP-IAEA School on Nuclear Energy Strategic Planning. I encourage fellow engineers, scientists, and allied professionals within the nuclear industry to take advantage of this programme when the opportunity avails."*

Edward Essel Blankson  
Nuclear Regulatory Authority, Ghana

*"The School gave me a new point of view on the planning of nuclear energy systems. It also provided me with the INPRO methodology for assessment and decision-making competencies that would be essential for decisions on development of new Nuclear Power Plants in the future."*

Ariel Alejandro Chavez  
Comisión Nacional de Energía Atómica, Argentina

*"By joining this School, I expanded my skills, especially about those aspects considered essential when designing nuclear reactor and fuel cycles technologies for sustainable nuclear energy systems. I recommend more professionals apply to this programme."*

Florencia Renteria del Toro  
Harbin Engineering University, China

*"The school helped me better understand various aspects of nuclear fuel cycle, nuclear power, global energy system issues, and learn the use of INPRO tools. The knowledge gained really helped me in the preparation and completion of NESA assignments in Indonesia. Hopefully, I can join the INPRO School again next year to further improve my knowledge to support my career and to support net zero emission transition to affordable and clean energy."*

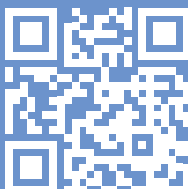
Nelsa Rahmita  
National Research and Innovation Agency (BRIN), Indonesia



The IAEA offers a wide range of educational and training activities. For additional information, please visit the IAEA website at: [www.iaea.org/services/education-and-training](http://www.iaea.org/services/education-and-training)

### International Atomic Energy Agency

Department of Nuclear Energy  
International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)  
Email: [inpro.contact-point@iaea.org](mailto:inpro.contact-point@iaea.org)  
Website: [www.iaea.org/inpro](http://www.iaea.org/inpro)



### For more information on the INPRO School:

