INPRO Capacity Building Activities

20th INPRO Dialogue Forum on Challenges and Issues in Capacity Building for Ensuring Nuclear Energy Sustainable Development

Maxim Gladyshev
Carolynn Scherer
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Capacity Building

- The term ‘capacity’ refers to an organization or individual that has both the **competence** (knowledge, skills, attitude) and **capability** (resources, authority, processes, equipment, means of deployment) needed to achieve their desired goal.

- Capacity Building is a systematic and integrated approach that includes **education and training**, human resource development, knowledge management and knowledge networks to develop and continuously improve the governmental, organizational and individual competencies and capabilities necessary for achieving a **safe, secure** and **sustainable** nuclear power programme.

- **Education and training** are fundamental to the capacity building strategy and provide the basis for human resource development, knowledge management and knowledge networking.
INPRO Education and Training Activities

- INPRPRO School on Strategic Planning for Sustainable Nuclear Energy
- Specialized workshops and training on the INPRO Methodology for nuclear energy system (NES) sustainability assessment and INPRO Tools for NES modelling and analysis
- E-learning: self-education and instructor-led courses
- Cooperation with universities and centres of excellence
  - curricula and educational materials (e.g., the Model Curriculum on Strategic Planning for Sustainable Nuclear Energy)
  - training tools and aids (e.g., the nuclear energy system simulators for education and training)
INPRO School on Strategic Planning for Sustainable Nuclear Energy

- The school curriculum covers the most important topics related to the strategic planning for sustainable nuclear energy.
- To develop competences for assessment and analysis of nuclear energy systems to support national decisions on the future use of nuclear energy.
- To gain knowledge and basic practical experience on performing modelling, analysis, and sustainability assessment of nuclear energy systems.
- The School offers a unique opportunity for capacity building and career growth by interacting and networking with international nuclear energy experts and peers.
INPRO School Formats and Locations

- Joint IAEA-ICTP INPRO School in Trieste, Italy
- Regional/Inter-Regional INPRO Schools in Vienna or in Member States
- Regular School: one week
  - **familiarizes** participants with INPRO concept of sustainable nuclear energy systems and their sustainability assessment
  - **introductory training** on modelling and analysis of nuclear energy systems using INPRO tools
- Advanced School: two weeks (school programme is under development)
  - **in-depth examination** of the challenges related to nuclear energy sustainability
  - **hands-on training** on INPRO tools
- Train the trainer events (university teachers)
Model Curriculum on Strategic Planning for Sustainable Nuclear Energy

Cooperation with Universities
Rationale

• The IAEA General Conference 65 in its resolution emphasized the important role that the Agency can play in assisting interested Member States in building long-term national nuclear energy strategies based on the INPRO methodology.

• The need for competent specialists who understand the long-term sustainability aspects of nuclear energy and can apply the necessary knowledge, skills, tools and corresponding methodology for strategic planning of sustainable NE deployment.

• The need for building the foundations for required competence can be met through introducing necessary educational programmes at the university level.

• In this respect, INPRO has initiated an effort to develop a model curriculum for a master’s degree course covering topics related to the strategic planning for sustainable nuclear energy development.
Purpose

• To support capacity building and national human resource development in the nuclear energy sector

• Specific objectives
  – To provide knowledge and practical skills on the planning and modelling of scenarios of the NES evolution and on the use of the INPRO methodology for performing sustainability assessment of NESs;
  – To familiarize the students with the INPRO concept of NES sustainability in different areas, and provisions for further sustainability development and improvement
  – To develop understanding of sustainability issues in a planned NES and ability to perform nuclear energy system analysis and assessment of the selected areas using the INPRO methodology criteria

• To identify, describe and formalize the INPRO subject domain for knowledge transfer and preservation (to make the knowledge explicit)
Target Audience

• Target users of the “Model Curriculum” Guidance
  – Individuals with responsibility for developing and delivering programmes to educate specialists in the nuclear field and in other fields associated with strategic planning for sustainable nuclear energy development

• Intended audience of the course
  – Master level students of Nuclear Science, Nuclear Technology and Nuclear Engineering
  – The course is also useful for students studying international relations, political science and management, as well as a base for training on nuclear energy strategic planning and sustainability assessment (as part of a continuing education programme) for managers and technical professionals working in the nuclear industry
Prerequisites for the course

• Bachelor degree in nuclear sciences or engineering

• It is recommended that the course be included in the master programme, when a basic or intermediate level of nuclear knowledge has been acquired — at this point the student should be able to comprehend the value of managing this knowledge as asset

• There are specific requirements for each educational modules
Competency Areas

1. Energy planning and strategies for sustainable development
2. Planning for nuclear energy sustainability
3. Innovations in nuclear energy sector in meeting sustainable energy development challenges
4. Nuclear energy systems modelling and analysis
5. The methodology for assessing sustainability of nuclear energy systems (the INPRO Methodology)
Curriculum Structure

CORE MODULES

Module 1
Energy planning and strategies for sustainable development

Module 2
Planning for nuclear energy sustainability

Module 3
Innovations in the nuclear energy sector in meeting sustainable energy development challenges

ADVANCED MODULES

Module 4
Introduction to the INPRO methodology for assessing sustainability of nuclear energy systems

Module 5
Methods and tools for planning sustainable energy development

Module 6
Methods and tools for modelling and analysis of nuclear energy systems

RESEARCH PROJECT MODULE

Module 7
Research projects on planning and assessment of energy and nuclear energy systems
Structure of the Educational Modules

• Short description
• Learning objectives
• Prerequisites
• Learning outcomes (based on the Bloom’s taxonomy)
• Outline of module topics
• Suggested teaching delivery methods and student performance assessment
• Bibliography

**Learning objective**
A very general statement about the larger goals of the course or programme

**Learning outcome**
A very specific statement that describes exactly what a student will be able to do in some measurable way
Short Description – Main Topics

Module 1. Energy planning and strategies for sustainable development

- Concept of a sustainable energy system
- Global energy supply-demand trends
- Energy resources
- Energy economics
- Energy technologies (technical, economic and environmental characteristics)
- Energy security
- International energy trade and prices
- Climate change
- Social aspects of energy
- Geopolitical considerations for energy
- Methods and tools for planning sustainable energy development
Learning Objectives and Prerequisites

Module 1. Energy planning and strategies for sustainable development

• Learning Objectives
  – Establish an understanding of the technical, economic, environmental, social and geopolitical considerations in the development of sustainable energy strategies for a country or a region
  – Familiarize students with an evaluation of potential roles of various energy resources and technologies in meeting future energy needs for sustainable development

• Prerequisites
  – The students are expected to possess a basic knowledge of mathematics, physics and energy technologies. An engineering background is advantageous but not mandatory.
Learning Outcomes

Module 1. Energy planning and strategies for sustainable development

1. Explain the main aspects that need to be considered in evaluating the energy choices for national energy strategies for sustainable development plans

2. Express familiarity with energy resources, energy technologies and their technical, economic and environmental characteristics

3. Demonstrate understanding of energy economics and methodology for economic comparison of various energy options

4. Illustrate awareness of the geopolitical considerations for energy security and international energy trade

5. Demonstrate familiarity with the methods and tools available for conducting evaluation of various energy technologies in terms of their technical, economic and environmental characteristics, and for developing sustainable energy strategies
The course implementation

- The suggested educational modules provide a basis for different master’s degree courses
- IAEA support for the Curriculum implementation
  - IAEA tools for energy analysis and planning
  - Training on IAEA methods, models and software tools in the subject field
  - Providing training/teaching materials for educational organizations for developing, using, customizing or adapting teaching material employing the model curriculum
  - Designing of educational courses using the model curriculum, and in the development or customization of teaching material
  - Piloting selected parts of educational courses that employ the model curriculum
  - Implementing educational courses with the model curriculum (e.g. through involving experts in specialized areas)
  - Organizing internships at the IAEA for practical study of subjects associated with the model curriculum
  - Performing scientific visits and fellowships
  - Developing e-learning courses and using IAEA Learning Management System
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Thank you!