Regional (Asian) Workshop on Managing Nuclear Knowledge

Nuclear Disciplines in response to Industry and Regulatory Needs through the European Nuclear Education Network Association

Joseph SAFIEH
President
European Nuclear Education Network Association
22 October 2007 in Tokyo, Japan

From ENEN project to ENEN Association

5th Framework EC programme, January 2002

The “European Nuclear Engineering Network” project:
- establishes the basis for conserving nuclear knowledge and expertise
- creates a European Higher Education Area for nuclear disciplines
- initiates the implementation of the Bologna declaration in the nuclear disciplines
- Deliverables and results at http://www.sckcen.be/enen/
ENEN Association

“The European Higher Education Area” is formalised by creating the European Nuclear Education Network, the “ENEN” Association under the French law of 1901, on 22 September 2003.

Effective members: Academic Institutions
Associated members: Research centres, industry, regulatory bodies

ENEN GENERAL GOALS

Towards the Universities

- To develop a more harmonised approach for education in the nuclear sciences and engineering in Europe.
- To integrate European education and training in nuclear safety and radiation protection.
- To achieve a better cooperation and sharing of resources and capabilities at the national and international level.

Towards the End-users (industries, regulatory bodies, applications)

- To create a secure basis of skills and knowledge of value to the EU.
- To maintain an adequate supply of qualified human resources for design, construction, operation and maintenance of nuclear infrastructures and plants.
- To maintain the necessary competence and expertise for the continued safe use of nuclear energy and applications of radiation in industry and medicine.
ENEN : Mission and First objectives

MISSION : the preservation and further development of higher nuclear education and expertise

➢ Deliver a European Master of Science in Nuclear Engineering
➢ Establish a framework for mutual recognition
➢ To encourage and support PhD studies
➢ Foster/strengthen the relationship with research laboratories, industry and regulatory bodies,
➢ Promote exchange of students and teachers
➢ Increase the number of students by providing incentives

Overview of ENEN Members

➢ 43 Universities
➢ 6 Research Centres
➢ located in 17 European countries
Association’s Organization

General Assembly
Board of Directors
(Governing Board)

Management Committee

Chairman Committee 1
Chairman Committee 2
General Secretary Chairman Committee 3
Chairman Committee 4
Chairman Committee 5

Teaching and Academic Affairs Committee
3**+2**

Advanced Courses and Research Committee
3**+2**

Training and Industrial Projects Committee
2**+3**

Quality Assurance Committee
3**+2**

Knowledge Management Committee
3**+2**

Teaching & Academic Affairs Committee

Objectives and tasks

- Awarding the European Master of Science in Nuclear Engineering;
- Promoting student and faculty exchange by encouraging and supporting the organisation of international exchange courses by ENEN members;
- Promoting the harmonisation of nuclear engineering curricula throughout Europe;
- Supporting the organisation of high-quality nuclear engineering courses by ENEN members;
- Awarding the International ENEN Course label, in collaboration with the ENEN QA Committee
EMSNE - ENEN Certification Flyer

European Master of Science in Nuclear Engineering
ENEN Certification

Nuclear Review now in Europe
The EMSNE Nuclear Safety and Security Certification is a worldwide recognized certification in nuclear engineering. It is designed for engineers, safety professionals, and non-engineers who need a thorough understanding of nuclear science and engineering. The EMSNE ENEN Certification is a globally recognized and respected certification in the field of nuclear engineering and related fields.

Contact
ENEN Association
European Nuclear Education Network
www.enenassociation.org

EMSNE Nuclear Core Courses

<table>
<thead>
<tr>
<th>Preferred Nuclear Core Courses</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Reactor Engineering</td>
<td>6</td>
</tr>
<tr>
<td>Reactor Physics</td>
<td>6</td>
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<tr>
<td>Nuclear Thermal Hydraulics</td>
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<tr>
<td>Safety and Reliability of Nuclear Facilities</td>
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<tr>
<td>Reactor Engineering Materials</td>
<td>6</td>
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<tr>
<td>Radiology and Radiation Protection</td>
<td>6</td>
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<tr>
<td>Preferred Nuclear Core Laboratory Course</td>
<td>ECTS</td>
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<tr>
<td>Nuclear Reactor Engineering Laboratory</td>
<td>6</td>
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</table>
**EMSNE Substitute Core Courses**

<table>
<thead>
<tr>
<th>Substitute Nuclear Core Courses</th>
<th>ECTS</th>
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<tbody>
<tr>
<td>Nuclear Facilities Environmental Impact</td>
<td>6</td>
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<tr>
<td>Nuclear Fuel Cycle</td>
<td>6</td>
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<tr>
<td>Structural Mechanics – Nuclear</td>
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<tr>
<td>Nuclear Power Plant Technology</td>
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<td>Fluid Mechanics</td>
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<tr>
<td>Reactor Control and Instrumentation</td>
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<tr>
<td>Nuclear Waste Processing and Disposal</td>
<td>6</td>
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<tr>
<td>Reactor Kinetics</td>
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**Substitute Nuclear Core Laboratory Courses**

<table>
<thead>
<tr>
<th>Substitute Nuclear Core Laboratory Courses</th>
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<tbody>
<tr>
<td>Nuclear and Radiation Physics Laboratory</td>
<td>6</td>
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<tr>
<td>Plant Simulation Laboratory</td>
<td>6</td>
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</tbody>
</table>

**Main achievement**

- Architecture of the European Masters of Science in Nuclear Engineering – EMSNE:
  - Full Two Years Program – 120 ECTS,
  - At least 60 ECTS must be “purely nuclear”,
  - 20 ECTS must be obtained from a “foreign” institution, member of ENEN Association
  - Mandatory (common denominator in basic knowledge of nuclear engineering) and optional courses
  - Definition of each course’s curriculum - n° of ECTS
  - Master thesis
EMSNE First Certificates

First three students receiving (Romania & France) the EMSNE certificates during ENC 2005, Versailles December

International Exchange Courses

<table>
<thead>
<tr>
<th>ID</th>
<th>Course Name</th>
<th>Organisation</th>
<th>Domain</th>
<th>Theory</th>
<th>Training</th>
<th>Advanced</th>
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<tbody>
<tr>
<td>1</td>
<td>Eugene Wigner Training Course for Reactor Physics Experiments</td>
<td>BME et al.</td>
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<td>Radiation Protection and Nuclear Measurements</td>
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<td>5</td>
<td>International Seminar on the Nuclear Fuel Cycle</td>
<td>INSTM</td>
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<td>6</td>
<td>Training Course on Nuclear Safety</td>
<td>INSTM</td>
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<td>7</td>
<td>Nuclear Reactions Systems</td>
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<td>Safeguards: Non-proliferation of Nuclear weapons</td>
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<td>Radiation isotope in the BFI Production in an International Context</td>
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<td>Accelerators and time of flight experiments</td>
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Confirmed ENEN Exchange Courses

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<th>ID</th>
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<th>Theory</th>
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<tr>
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<tr>
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<td>e</td>
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Master Thesis Projects
International Exchange Courses

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<td>N</td>
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<td>O</td>
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Proposed ENEN Exchange Courses

Introduction

Within the framework of the European Nuclear Energy Network (ENEN), the project is designed to provide a comprehensive program for training in Nuclear Engineering. The program aims to promote the higher education and research in nuclear energy and to enhance the cooperation between European Higher Education Institutions (HEIs) and Research Centres. The project is supported by the European Commission under the 6th Framework Programme (FP6) of the European Union, through the Nuclear Energy Education and Research Network (NERN).

The project is expected to have a significant impact on the future of nuclear energy in Europe. The project aims to attract and retain the best students in nuclear engineering and to provide them with the necessary skills and knowledge to succeed in a competitive global market.

One of the key components of the project is the International Exchange Courses, which are designed to allow students to gain practical experience in the field of nuclear engineering.

The International Exchange Courses are designed to provide students with a comprehensive understanding of nuclear engineering and to prepare them for a successful career in the field.

Organisation

ENEN is a network of 50 institutions from 16 European countries, which are involved in the education and research in nuclear engineering.

International Exchange course

Course on Nuclear Reactor Theory

Maastricht, Jan. 11 – 28, 2006

Organised by BNIN

BNIN is a network of the Belgian universities:

- Katholieke Universiteit Leuven
- Vrije Universiteit Brussel
- Université de Liège
- Université Catholique de Louvain
- Université de la Cathédrale de Louvain

BNIN is a partner of the NERN Association.

International Exchange course

Travel Information

The hotel is located in the heart of the city, with easy access to public transport and the main tourist attractions.

Accommodation

The accommodation is provided by the host universities and the rooms are well-equipped.

Contact Information

For further information, please contact:

BNIN Secretariat
Maastricht University
The Netherlands

Office Hours: Monday – Friday, 9:00 – 17:00

Email: info@bnin.org

Website: www.bnin.org
Advanced Courses & Research Committee

Objectives and Tasks:

➢ Ensure the link between ENEN members and research laboratories in the European Community
➢ Identify and disseminate topics for internships, master theses and PhDs
➢ Encourage and support student mobility
➢ Define, design and organise advanced courses for students, PhD candidates and young professionals

ENEN Advanced Courses

Topics identified as the result of a questionnaire on needs

➢ Scaling and Uncertainty in System Thermal Hydraulics.
➢ Coupled 3D Neutron Kinetics and Thermal Hydraulics and Application to Nuclear Reactor Theory.
➢ Natural Circulation in Existing Reactors and Innovative Reactor Concepts.
➢ Radiological Protection.
➢ Safety Aspects of WWER Operation.
➢ Eugene Wigner extension. Experimental Training in Reactor Physics on LW critical Assembly.
➢ MSc Design Study (Project).
➢ Reactor Physics for Accelerator Driven Systems.
➢ Nuclear Fusion Technology.
➢ International Course on Advanced Thermal Hydraulic Advanced Course on Pressure Vessel Aging
**IP EUROTRANS**

**Objective**

Design and feasibility assessment of an industrial prototype Accelerator Driven System (ADS) dedicated to transmutation, together with the definition of a design backup solution, to perform

**“Nuclear Incineration of Long-lived Radioisotopes”** after their partitioning from high level waste streams.

**Course credits**

At the end of the two-week course, the student is expected to:

- Identify the most important characteristics of the different nuclear reactors.
- Understand the design and operation principles of a nuclear reactor.
- Know the main nuclear reactor parameters.
- Be familiar with the latest developments in nuclear reactor technology.
- Be able to discuss the main problems associated with the operation of nuclear reactors.
- Be prepared to work in a multidisciplinary team on the design of a nuclear reactor.

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**Budget**

2005-2008 (EC Contribution)

<table>
<thead>
<tr>
<th>Total</th>
<th>23 Mio €</th>
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</thead>
<tbody>
<tr>
<td>Education and Training</td>
<td>1.8 Mio €</td>
</tr>
</tbody>
</table>
ENEN in IP EUROTRANS

- 17 EU Universities participate to IP EUROTRANS through the ENEN Association
- the ENEN Association
  - Represents them at the EUROTRANS Coordination Committee and other governing bodies
  - Facilitates interaction and cooperation between research scientists and PhD students
  - Organises 10 specialised (advanced) courses on project related topics

ENEN in IP EUROTRANS

- **October 5-8, 2005 – KTH – Stockholm**
  ADS: objectives, context, concepts, challenges (scientific and technical)
  9 PhD students
- **June 7-10, 2006 – Universidad Santiago de Compostela**
  Nuclear data for transmutation: status, needs and methods
  15 PhD students
- **March 21-23, 2007 – Université Catholique Louvain**
  ADS thermal-hydraulics: system codes, models and experimental validation
  9 PhD students
- **May 10-11, 2007 – SCKCEN, Mol**
  in cooperation with Goethe Universität Frankfurt
  Particle Accelerator Technology
  9 PhD students
- **September 24-27, 2007 – University of Pisa**
  Fuels and Structural Reactor Materials
Training & Industrial Projects Committee

Objectives and Tasks:

- Identify industrial needs for continuous professional development
- Organize continuous training courses on subjects of common interest for the affiliated associated members
- Maintain and disseminate a database on third cycle advanced courses and continued professional development sessions
- Support professional training, mobility of professionals and access to large nuclear infrastructures
- Integrate European industrial and national projects

E. Wigner Course on Reactor Physics Experiments

Fourth edition of a 17 days’ course: September, 2006

- Main organiser: Institute of Nuclear Techniques of the Budapest University of Technology and Economics (BUTE)

Together with:

- Slovak University of Technology in Bratislava (STUB)
- Vienna University of Technology, Atominstitut (AI)
- Czech Technical University in Prague (CTU)

Courses, lectures & experiments on three reactors
Training Course on Nuclear Safety

NEPTUNO Project

The NEPTUNO project is an integral part of the 7th Framework Programme of the European Commission, as a key action to support research and training in nuclear safety and related disciplines. NEPTUNO aims to address the need for high-quality and flexible training and education in nuclear safety, including assessment and evaluation of training and education processes.

The project is divided into three main activities:
1. Development of training modules and curricula for nuclear safety and related disciplines.
2. Implementation of training and education programs in collaboration with partner institutions.
3. Evaluation of training effectiveness and improvement of the training process.

The project is coordinated by the European Union and involves partners from several European countries. The NEPTUNO project is expected to contribute significantly to the development of high-quality training and education in nuclear safety.

Training Course on Nuclear Safety

Saclay, France
April 4th - 8th, 2005

Course on Nuclear Safety of WWER Bratislava

The course on Nuclear Safety of WWER Bratislava is organized by the Slovak Nuclear Safety and Security Authority (ZSSS) and is co-organized by the European Nuclear Safety and Security Agency (ENSA). The course is intended for participants from nuclear power plants, regulatory authorities, research institutions, and other stakeholders in the nuclear sector.

Registration & Information

Contact: nuclearsafety@zsss.sk
Website: www.zsss.sk

Course on Nuclear Safety of WWER
Bratislava, Slovakia, May 2 - 6, 2008

Co-organized by the Slovak Nuclear Safety and Security Authority (ZSSS) and the European Nuclear Safety and Security Agency (ENSA)
Course on Nuclear Safety
Munich, March 12-23, 2007

The ENEN Training Courses

The ENEN Training Courses are a concept for providing training in nuclear safety and radiation protection. The courses are designed to meet the needs of regulatory agencies, industries, and other organizations involved in nuclear safety.

The courses cover a wide range of topics, including the principles of nuclear safety, the effects of radiation, and the management of nuclear facilities. They are delivered by experienced instructors and are designed to be flexible and adaptable to the needs of the participants.

ENEN – EUR Training Course

Levelling the Playing ground for New Nuclear Power Plants in Europe

Helsinki June 6-10, 2005
Objectives and Tasks

- Develop and implement QA processes to be applied in the design and delivery of education and training courses by the ENEN members
- Collect information and harmonise rules for selection, training and certification of teachers
- Evaluate and monitor the quality of current and newly proposed members of the ENEN Association
- Evaluate courses and award the International ENEN Course label, in collaboration with the ENEN Teaching and Academic Affairs Committee
Knowledge Management Committee

Objectives and Tasks

- Identify and monitor deficiencies in scientific knowledge relevant to nuclear technology and safety
- Prepare, maintain and implement an action plan by academia in order to preserve valuable scientific knowledge
- Ensure efficient use of ICT for dissemination of knowledge, teaching and learning, databases, use of simulators
- Publish books, produce CDs and DVDs of interest to ENEN members
- Integrate and operate the ENEN web sites and communication systems

NEPTUNO Communication System

Status

- Is in full operation since August 2004
- Provides a platform for a common knowledge base for nuclear fission
- Merges classical database driven information systems with role-based research and education functionalities to a common knowledge system

http://www.neptuno-cs.de/
Courses in Nuclear Disciplines

- Courses arranged in
  - 4 types: education, training, education and training, others
  - 14 categories covering different nuclear disciplines

- Total number of courses
  497 collected from various sources and data sheets

- Approved courses confirmed and implemented by the organising institution: 230 courses

- Not (yet) approved nor confirmed: 267 courses

ENEN-II Perspectives

- Project on Education, Training and Knowledge Management running since October 2006 under the name ENEN-II

- New 2 years’ Coordination Action under FP6:
  - starting date 1st October 2006,
  - ENEN is the contractor for the EC
  - Integration of PETRUS (waste disposal) and EURAC (radioprotection) projects
  - budget ~ 1,2 M€
  - Coordinator ENEN General Secretary
Objectives – 5 WPs

WP 1 - Integration of nuclear education, training and end user networks
WP 2 - Development, Harmonisation and Consolidation of Academic Nuclear Education
WP 3 – Facilitating and Supporting Research
WP 4 – Professional Training Programmes
WP 5 – Nuclear Knowledge Management

ENEN Perspectives

- Expand activities from the academic and research environment into the industrial and regulatory organisations and attract their membership
- Promote international mutual recognition of professional training for key functions in nuclear industries, regulatory bodies and nuclear applications
- Participate to EC framework projects, in particular in the European Higher Education and European Research Areas
- Expand into nuclear disciplines outside nuclear engineering like radioprotection, radiochemistry, waste management
- Continue to support and strengthen cooperation with the World Nuclear University and the regional nuclear education networks in Asia, North America and elsewhere.
New ENEN Web Site - Home page
http://www.enen-assoc.org

THANK YOU FOR YOUR ATTENTION

EUROPEAN NUCLEAR EDUCATION NETWORK ASSOCIATION

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Fax +33 1 6908 9950
Email sec.enen@cea.fr
http://www.enen-assoc.org