European Nuclear Education Network Association

STARTING POINT

“Although the number of nuclear scientists and technologists may appear to be sufficient today in some countries, there are indicators that future expertise is at risk. In most countries, there are now fewer comprehensive, high quality nuclear technology programmes at universities than before. The ability of universities to attract top quality students, meet future staffing requirements of the nuclear industry, and conduct leading-edge research is becoming seriously compromised”.

Taken from

Concerns of Universities

- How can they attract young and brilliant students? Through challenging subjects? Establishing links with research centres?
- How can universities be convinced to recruit new academic members for key areas in nuclear disciplines? What is the impact of lifelong learning?

What can be the role of the EU?

- Promote international co-operation, mobility of students and researchers, including central and eastern Europe
- Provide a new architecture for a nuclear “European Research Area” in search for EU excellence!
- Set the conditions to create added value through university-industry collaboration

Concerns of the Nuclear Industry

- Conserve the nuclear knowledge and improve the expertise
- Define the goals and set up the criteria for professional recognition and recruitment throughout the EU
- Find resources and lecturers for advanced training courses, professional upgrades and continual training programmes
- Identify interesting project works and support for internships

What can be the role of the EU?

- Ensure quality assurance of the courses (accreditation, ranking, etc)
- Construct the nuclear “European Education and Training Area” under competitive conditions of quality and cost
OBJECTIVES

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 integration and sharing of resources and capabilities at the national and international level

The End-users (industries, regulatory bodies, applications)

- To create a secure skills and knowledge base of value to the EU
- To maintain the adequate supply of qualified human resources for design, constructions, operations and maintenance of nuclear infrastructures and plants
- To maintain the necessary competence and expertise for the continued safe use of nuclear energy and other applications of radiation in industry and medicine.

HISTORY and DEVELOPMENT

- 5th Framework EC programme, January 2002
  The “European Nuclear Engineering Network” project
  - establishes the basis for conserving knowledge and expertise
  - creates a European higher education Area for nuclear disciplines
  - initiates the implementation of the Bologna declaration in nuclear disciplines

- 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
HISTORY and DEVELOPMENT

- 6th Framework EC programme, January 2004
  
  The NEPTUNO project with 35 partners continues and expands the Network activities started in FP 5

  ENEN provides assistance for the organisation and coordination of training sessions and pilot courses

  ENEN is expected to organise and coordinate training and knowledge management components in all integrated projects throughout the EC-EURATOM 6th Framework programme

NEPTUNO Expectations

- Sustainability
  - Europe’s excellence in nuclear technology
  - European nuclear knowledge management
NEPTUNO Expectations

- Preservation
  - of competence and expertise
  - for continued safe use of nuclear energy
  - for development of radiation uses in industry and medicine

NEPTUNO Expectations

- Harmonisation
  - within and across the EU Member States
    - safety approaches
    - operational practices
    - regulatory practices
NEPTUNO Expectations

➢ Harmonisation
  ➢ education in nuclear engineering
  ➢ key function qualification in NPPs
  ➢ professional training

NEPTUNO Expectations

➢ Facilitation
  ➢ to obtain nuclear education
  ➢ to exchange visiting lecturers in nuclear disciplines
  ➢ to access international training courses
  ➢ of trans-national access to research infrastructure in governmental organisations and private companies
NEPTUNO Expectations

- Standardization
  - nuclear know-how data bases
  - criteria for training programme certification
  - associated quality monitoring mechanisms

NEPTUNO TRAINING PROPOSALS

- European Utility Requirements for LWR Nuclear Power Plants, Helsinki, Finland, June 2005
- Nuclear Reactor Systems, Saclay, France, March 7-11, 2005
- Improved Professional Performance for Subcontractors, EDF-Framatome training centre CETIC, to be defined
- Advanced training course on Nuclear Safety, Saclay, France, April 2005 and Munich, Germany, 2006
- International School of Radioprotection, Mol, Belgium, to be defined
- Safety of WWER, Bratislava, Slovakia, to be defined
ENEN Mission and Objectives

**MISSION**
- the preservation and further development of higher nuclear education and expertise

**OBJECTIVES**
- to deliver a European Master of Science degree in nuclear engineering
- to encourage PhD studies
- to promote exchange of students and teachers participating in the network
- to establish a framework for mutual recognition
- to foster and strengthen relations between universities, nuclear research laboratories, industries and regulatory bodies
- To ensure the quality of academic nuclear engineering education, training and research.
- To create incentives and increase career attractiveness for the enrolment of students and young academics in nuclear disciplines

<table>
<thead>
<tr>
<th>ENEN Members</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effective members</strong></td>
</tr>
<tr>
<td>- have a legal status in an EU country or a candidate EU member country</td>
</tr>
<tr>
<td>- provide high level scientific education in the nuclear field, as full time teaching or in combination with research work</td>
</tr>
<tr>
<td>- use selective admission criteria</td>
</tr>
<tr>
<td><strong>Associated members</strong></td>
</tr>
<tr>
<td>- have a legal status in an EU country or a candidate EU member country</td>
</tr>
<tr>
<td>- have a long term tradition of relations with effective members in the field of research, training or education</td>
</tr>
<tr>
<td>- commit themselves to support the ENEN Association</td>
</tr>
</tbody>
</table>
ENEN Structure

<table>
<thead>
<tr>
<th>Advisory Committee</th>
<th>General Assembly Board of Directors (Governing Board)</th>
<th>Honorary Members Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Management Committee)</td>
<td>Secretary General</td>
<td></td>
</tr>
<tr>
<td>Chairman Committee 1</td>
<td>Chairman Committee 2</td>
<td>Chairman Committee 3</td>
</tr>
<tr>
<td>Teaching &amp; Academic Affairs Committee</td>
<td>Advanced Courses &amp; Research Committee</td>
<td>Training and Industrial Projects Committee</td>
</tr>
<tr>
<td>3*+2**</td>
<td>3*+2**</td>
<td>3*+2**</td>
</tr>
</tbody>
</table>

FIVE ENEN COMMITTEES

- **Teaching and Academic Affairs Committee**: implements a clear roadmap on how to obtain the European Master of Science Degree in Nuclear Engineering (and other degrees….)
- **Advanced Courses and Research Committee**: ensures the link between ENEN members and research laboratories in the European Union.
- **Training and Industrial Projects Committee**: is responsible for integration of industrial and national projects and for the organization of continuous professional training.
- **Quality Assurance Committee**: takes care of QA processes to be applied in the design and delivery of education and training courses by the members of ENEN.
- **The Knowledge Management Committee**: identifies and monitors deficiencies in scientific knowledge relevant to nuclear technology and safety.
### European Master of Science in Nuclear Engineering

<table>
<thead>
<tr>
<th>Undergraduate Engineering Study (years)</th>
<th>ENG 3y</th>
<th>ENG 4y</th>
<th>ENG 5y</th>
<th>ENG 5y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering (nuclear / non nuclear)</td>
<td>any</td>
<td>any</td>
<td>nuclear</td>
<td>nuclear</td>
</tr>
<tr>
<td>Years to complete (typically)</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>ECTS accumulated to complete</td>
<td>180</td>
<td>240</td>
<td>300</td>
<td>300</td>
</tr>
</tbody>
</table>

#### 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>
</tr>
<tr>
<td>Nuclear Thermal Hydraulics</td>
<td>6</td>
</tr>
<tr>
<td>Safety and Reliability of Nuclear Facilities</td>
<td>6</td>
</tr>
<tr>
<td>Reactor Engineering Materials</td>
<td>6</td>
</tr>
<tr>
<td>Radiology and Radiation Protection</td>
<td>6</td>
</tr>
</tbody>
</table>

**Preferred Nuclear Core Laboratory Course**

<table>
<thead>
<tr>
<th>Nuclear Reactor Engineering Laboratory</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>
### EMSNE Substitute Core Courses

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

### EMSNE Substitute Nuclear Core Laboratory Courses

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

### ENEN Partners November 2004

- 21 Universities
- 6 Research Centres

located in 17 European Countries

taking advantage of mutual recognition within the philosophy of the Bologna declaration and of operational exchange schemes for teachers and students (ERAMUS) within the European Union and worldwide (ERASMUS Mundus)
ENEN Partners November 2004

- Austria: Atomistit der Österreichischen Universität, Vienna.
- Belgium: Katholieke Universiteit Leuven, Leuven.
- Belgium: Université Catholique de Louvain, UCL, Louvain-la-Neuve.
- Belgium: Universiteit Gent, University of Gent, Gent.
- Czech Republic: Czech Technical University, Prague.
- Finland: Helsinki University of Technology, Helsinki.
- Finland: Lappeenranta University of Technology, Lappeenranta.
- France: CEA - Institut National des Sciences et Techniques Nucléaires, Saclay.
- Germany: Technische Universität München, Munich.
- Greece: National Technical University of Athens, Athens.
- Great Britain: University of Manchester, Manchester.
- Hungary: Budapest University of Technology and Economics, Budapest.
- Italy: Consorzio Interuniversitario per la Ricerca Tecnologica Nucleare, Torino.
- Netherlands: Delft University of Technology, Delft.
- Romania: "Politehnica" University of Bucharest, Bucharest.
- Slovak Republic: Slovak University of Technology, Bratislava.
- Spain: Universitat Politècnica de Madrid (UPM), Madrid.
- Slovenia: University of Ljubljana, Ljubljana.
- Sweden: Kungl Tekniska Högskolan, Royal Institute of Technology, Stockholm.
- Switzerland: Swiss Federal Institute of Technology (EPFL), Lausanne.

IAEA Workshop Knowledge Management ICTP Trieste 2004/11/8-12
Enhance ENEN Visibility

- Available by end of June 2004
  - ENEN logo
  - ENEN Information Leaflet
  - ENEN Website
ENEN Activities

- Eugene Wigner course on Reactor Physics yearly – completed in 2003 (pilot) and 2004
- Nuclear Thermohydraulics October 2003
- Nuclear Reactor Theory November 2003
- International Seminar on Nuclear Fuel Cycle November-December 2004
- Participation to EU 6th Framework Programme
  - NEPTUNO 2004-2005 (35 partners)
  - IP TRANS 2005 – 2009 (32 partners +17 universities)
- Radioprotection (training project)
- Waste management (training project PETRUS)

ENEN International Seminar on the Nuclear Fuel Cycle 29/11-10/12, 2004

Topics
- An overview of the nuclear fuel cycle
- Transport of nuclear fuel cycle materials
- Fuel element and its alteration
- Fuel: metallurgical design and thermal-mechanical design
- Fuel cycle
- Spent fuel management
- Irradiation of fuel and irradiation of materials
- R&D in the field of the spent fuel nuclear waste management

Technical visits (indicative)
- HPC fuel fabrication plant (MARMOLEANS)
- Irradiation test stand (COMAREX)
- Uranium enrichment plant (EURIDIS)
- PWR VYV (SSR)
- Irradiated fuel recycling to 5 workshops (EDSMA)
- Additive refabrication and fuel underground research laboratory (AMIRAH)
- La Lega spent fuel reprocessing plant (EDSMA)
ENEN International Seminar on the Nuclear Fuel Cycle 29/11-10/12, 2004

Participants First Edition 2004

- Belgium 2
- China 3
- Czech Republic 1
- France 2
- IAEA 2
- India 2
- Israel 1
- Korea 2
- Romania 1 (student)
- Russia 2
- Slovenia 1 (student)
- Spain 1
- South Africa 1

IP EUROTRANS

Objective

Design and feasibility assessment of an industrial prototype Accelerator Driven System 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.

Budget 2005-2008 (EC Contribution)

Total 23 Mio €
Education and Training 1.8 Mio €
ENEN in IP EUROTRANS

- 17 Universities would participate to IP EUROTRANS under the ENEN umbrella
- ENEN would
  - Represent them at the EUROTRANS Coordination Committee
  - Provide links between research scientists and doctoral students (13 to 20 PhDs foreseen)
  - Organise / Facilitate lectures, scientific visits, joint experiments, specialised training (10 courses)
- Requirements
  - ENEN Membership or
  - Letters of Intent from Universities received

ENEN in IP EUROTRANS

- Party P13.1: AGH Krakow, University of Science and Technology, Poland,
- Party P13.2: TUW, Vienna University of Technology, Austria,
- Party P13.3: CIRTEC, Inter University Consortium for Nuclear Technological Research, Italy,
- Party P13.4: IAP-FU Frankfurt, J.W. Goethe-Universität, Germany,
- Party P13.5: IQS, Institut Quimic de Sarria, Spain,
- Party P13.6: KTH Stockholm, Kungl Tekniska Högskolan, Sweden,
- Party P13.7: RUB-LEE Ruhr-Universität Bochum, Germany,
- Party P13.8: TU Delft, Delft University of Technology, The Netherlands,
- Party P13.9: UCL, Université Catholique de Louvain, Belgium,
- Party P13.10: ULG, University of Liége, Belgium,
- Party P13.11: USE, Universidad de Sevilla, Spain,
- Party P13.12: USIC, Universidad de Santiago de Compostela, Spain,
- Party P13.13: UP, Universidad Politécnica de Valencia - Instituto de Ingeniería Energética, Spain,
- Party P13.14: Uppsala University, Sweden,
WORLD NUCLEAR UNIVERSITY

- Commitment signed by ENEN in September 2003
- Individual support by Member States
- Meeting held June 10-11, 2004
  - Action plan 2005-2006
  - Summer Institute
  - Trans-regional cooperation with ENEN and ANENT
  - Support from IAEA
- Memorandum of understanding with ENEN in preparation on common activities and principles of cooperation

THANK YOU FOR YOUR ATTENTION

AND

WELCOME TO JOIN AND SUPPORT THE

EUROPEAN NUCLEAR EDUCATION NETWORK