

ENEN Association : Nuclear disciplines in response to industry, research and regulatory needs

Joseph SAFIEH
ENEN Association, President



FISA 2009, Prague June 24th, 2009

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Plan:

1. ENEN presentation
2. Activities and main achievements
3. Perspectives



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1. ENEN presentation



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STARTING POINT

ECTS (European Credit Transfer and Accumulation System) was introduced in 1989 within the framework of Erasmus.

Bologna Declaration of June 1999

The aim was to create a European Higher Education Area by 2010

The Lisbon 2000 summit proposed the strategic goal for the European Union to become the most competitive knowledge-based economy with more and better employment and social cohesion by 2010.



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A study conducted by OECD/NEA – July 2000

*“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**”.*



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HISTORY and DEVELOPMENT - 1

European Commission – EURATOM
5th Framework programme

ENEN project in January 2002 – December 2003

Following declarations and policies on phasing out nuclear power plants, nuclear sciences and disciplines are facing

- decreasing interest and a reduced numbers of students
- no successors for retiring professors
- discontinuing nuclear related courses and closing faculties

The “European Nuclear **Engineering** Network” project:

- establishes the basis for conserving nuclear knowledge and expertise
- creates a European Higher Education Area for nuclear disciplines
- facilitates the implementation of the Bologna declaration in the nuclear disciplines



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HISTORY and DEVELOPMENT - 2

In order to ensure the continuity of the achievements and results of the ENEN project :

“The European Higher Education Area” in the nuclear field is formalised by creating the European Nuclear **E**ducation Network, the “ENEN” Association under the French law of 1901, on 22nd of September 2003



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HISTORY and DEVELOPMENT -3

European Commission – EURATOM FP6
NEPTUNO project in Jan. 2004 – June 2006

35 partners continued and expanded the ENEN activities started in FP 5

ENEN established and implemented the European Master of Science in Nuclear Engineering

ENEN expanded its activities from education to training

ENEN organised and coordinated training sessions and pilot courses

ENEN expanded its activities to Knowledge Management



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ENEN - Objectives

The main objective is the preservation and further development of expertise in the nuclear fields by **higher** education and training

- Promote and further develop the collaboration in nuclear education and training of students, researchers and professionals
- Ensure the quality of nuclear education and training
- Increase the attractiveness for engagement in the nuclear fields for students, researchers and professionals
- Promote life-long learning and career development at post-graduate or equivalent level

It should be achieved by...

- Support to the Universities (exchange of students, lecturers, materials and information etc.)
- Making a bridge between the Universities and the End-users (industries, regulatory bodies, research centres, etc.)



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ENEN Members

Effective members

- have a legal status in an EU country or a candidate EU member country
- provide **high level** scientific education in the nuclear field, as full time teaching or in combination with research work
 - “**Mutual recognition**”
- use selective admission criteria

Associated members

- have a legal status in an EU country or a candidate EU member country
- have a long term tradition of relations with effective members in the field of research, training or education
- commit themselves to support the ENEN Association

Partners through MoU

- Special case in Europe
- Beyond Europe
- International cooperation



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ENEN Members in March 2009

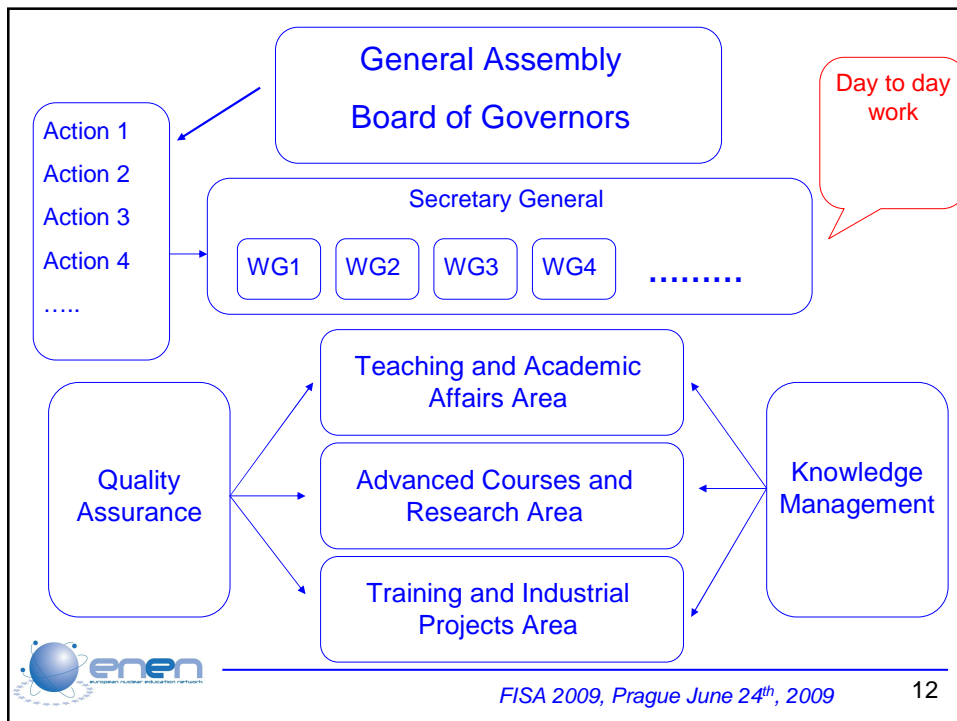
- 50 Universities
- 7 Research Centres
- 1 Multinational Company
located in 17 European Countries
- MoU concluded with
 - European Nuclear Society
 - North West University, Potchefstroom, South Africa
 - Moscow Engineering Physics Institute, Russian Federation
 - Tokyo Institute of Technology, Japan
 - Japan Atomic Energy Agency, Japan
- Memberships/cooperation under discussion with
 - EC Joint Research Centre, Ispra, Italy
 - IAEA for Asian Network (ANENT) and other items
 - Regulatory bodies etc.

*+ Project partners
beyond
ENEN membership*



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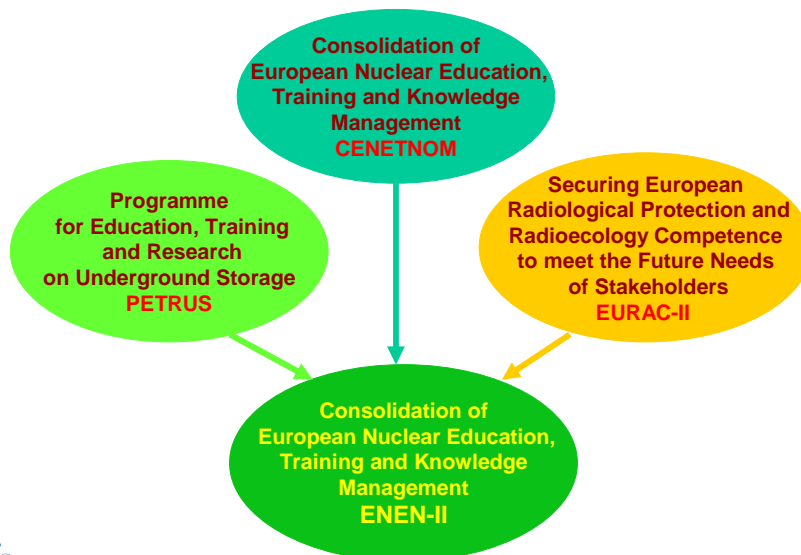
2. Activities in each area and main achievements



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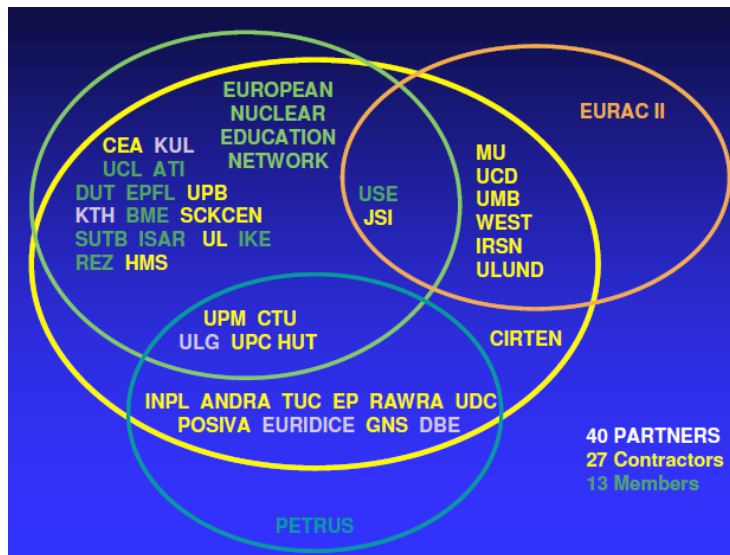
ENEN-II project Oct. 2006 – March 2009



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ENEN partners



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6th FP ENEN-II project in 2006-2009

Work packages

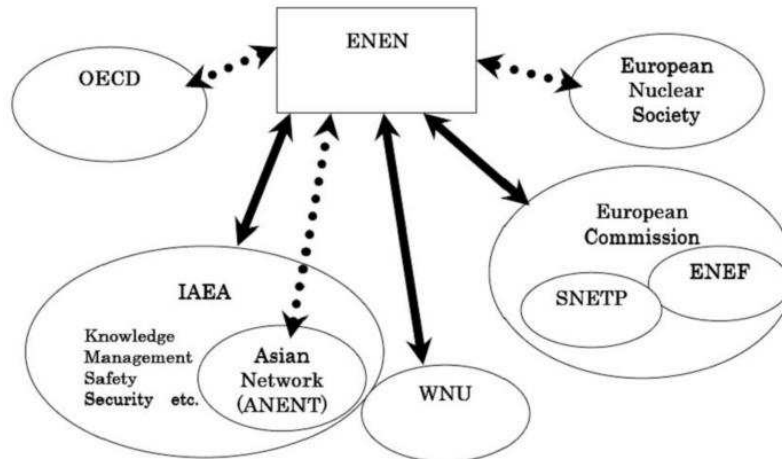
- WP1: Integration of the Nuclear E&T and End User Networks - Networking
- WP2: Development, Harmonization and Consolidation of Academic Nuclear Education.
- WP3: Facilitating and Supporting Research
- WP4: Professional Training Programs
- WP5: Nuclear Knowledge Management



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ENEN II WP1 : European and International cooperation



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Master level : European MSc in Nuclear Engineering

- Established under the European Commission – EURATOM 5th FP **ENEN project** and 6th FP **NEPTUNO project**
- Common reference curricula and mutual recognition among ENEN members
- Promotes and facilitates mobility of students and teachers
- Definition and assessment of ENEN international exchange courses
- Implemented since 2005
- “ENEN Certificate” recognised among ENEN Members



European Master of
Science in Nuclear
Engineering
ENEN Certification

Nuclear Education by
the European Nuclear Education Network



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Master level :European MSc in Nuclear Engineering

➤ List of topics

- Reactor engineering
- Reactor physics
- Nuclear thermal hydraulics
- Safety and reliability of nuclear facilities
- Reactor engineering materials
- Radiology and radiation protection
- Nuclear fuel cycle and applied radiochemistry

➤ Requirements

- 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 the ENEN Association
- Mandatory and optional courses
- Master thesis



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EMSNE Certificates 2006-07



Student receiving the ENEN EMSNE certificate during ENS conference on E &T NESTet Budapest May 4-8, 2008



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Master level

Possible expansion of EMSNE in 2009

Revision of the EMSNE is currently under discussion in order to cover other nuclear disciplines

- Radiological Protection, Radiochemistry, Radioecology (under FP6 **ENEN II project**)
- Radioactive Waste, Geological Disposal (under **ENEN II project**)
- European Master in Radiation Protection (EMRP, led by CEA/INSTN Grenoble)
- Needs for Safeguards and Nuclear Security (IAEA, EC JRC Ispra, ESARDA) etc.



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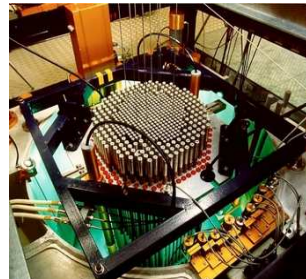
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Master level : New Master in Switzerland

- A new program for a Master of Science degree in Nuclear Engineering

Started in September 2008

- Offered jointly by the Swiss Federal Institutes of Technology, EPF Lausanne and ETH Zurich.
- One semester course at each of the two university (Lausanne, Zurich),
- Master's research project will generally be carried out at the Paul Scherrer Institute (PSI)



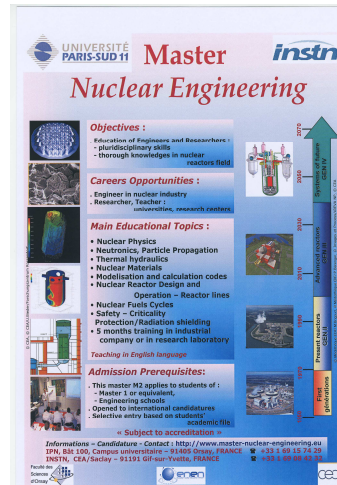
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..... in France

From September 2008

- A new program for Master of Science degree in Nuclear Engineering
- Offered jointly by Paris XI – Orsay University and CEA-INSTN
- 8 modules' course, over 7 months equivalent to 40 ECTS, courses are taught in English
- Master's research project will generally be at University, CEA research centres or Industry equivalent to 20 ECTS



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International Exchange course

„Eugene Wigner” Training Course for Reactor Physics Experiments 2008
with special emphasis to enhance Research Reactor Safety

Editions

2003
2004
2005
2006
2008

Organising institutions

Budapest University of Technology and Economics (BME) Hungary	
Slovak University of Technology in Bratislava (STUB) Slovak Republic	
Vienna University of Technology, Atominstut (AI) Austria	
Czech Technical University in Prague (CTU) Czech Republic	

http://www.reak.bme.hu/Wigner_Course/



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21 days' course

Starting in September,

Equivalent to : 6 ECTS

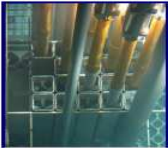
Content of the course

LECTURES (Slovak University of Technology, Bratislava)

The theoretical lectures will be held in the lecture halls of Slovak University of Technology, Bratislava /STUB/ (Slovak Republic). The detailed program and the timetable will be published later on the webpage of the Wigner Course (see on the bottom of this leaflet). The programs of the previous years can be consulted to have a hint what kinds of lectures are to be expected.

TECHNICAL VISIT to Jaslovské Bohunice NPP, and radwaste treatment center

EXPERIMENTS (Czech Technical University in Prague)




View into the TR-1 reactor in Prague

EXPERIMENTS (Vienna University of Technology, Atominstitut)

- Fission chambers (FC), compensated ionisation chambers (CIC), self-powered (SP) detectors
- Reactor power calibration and temperature coefficient of reactivity
- Critical experiment
- Demonstration of a prompt critical power excursion

EXPERIMENTS (Budapest Univ. of Technology and Economics)


- Determination of the distribution and of the absolute value of the thermal neutron flux by activation method
- Measurement of delayed neutron parameters and determination of uranium concentration
- Measurement of void coefficient and the reactivity worth of neutron absorbers



Cerenkov radiation in the reactor core in Budapest

http://www.reak.bme.hu/Wigner_Course

http://www.reak.bme.hu/Wigner_Course

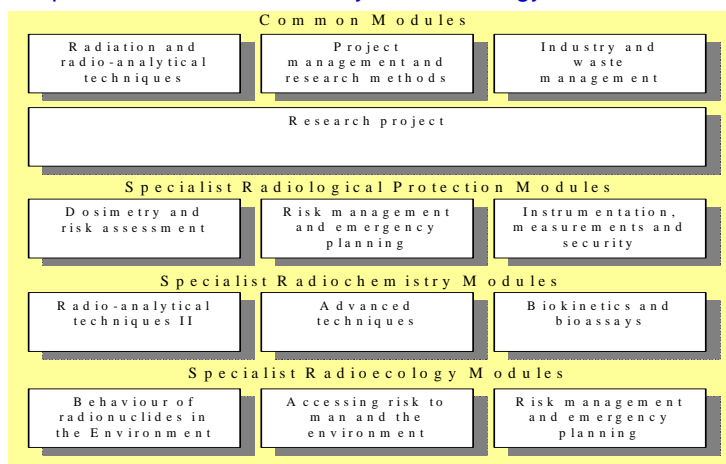


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ENEN II WP 2: Development, Harmonisation and Consolidation of Academic Curricula - Set up curricula for academic education in

➤ Radioprotection, Radiochemistry, Radioecology



PhD level – Advanced courses

- 17 Universities participates to IP EUROTRANS under the ENEN umbrella
- ENEN
 - Represents them at the EUROTRANS Coordination Committee
 - Provides links between research scientists and doctoral students
 - Organises / Facilitates lectures, specialise internal training courses (10)



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PhD level – Advanced courses

EUROTRANS Internal Training Courses

- ITC8 "Impact of new results on the design of the spallation target and the subcritical blanket » Italy 3 – 6th, February 2009
- ITC7 « Impact of new nuclear data on the design of transmutation experiments » France 15 – 18th, December 2008
- ITC6 "Core design and reactor safety analysis" in Madrid, Spain, 2-5 April 2008
- ITC5 "Fuel and Structural Reactor Materials" in Pisa, Italy, 26-29 November 2007
- ITC4 "Particle Accelerator Technology" in Mol, Belgium, 10-11 May 2007
- ITC3 "ADS thermal-hydraulics: system codes and CFD codes, models and experimental validation" in Louvain-la-Neuve, Belgium, 21-23 March 2007
- ITC2 "Nuclear data for transmutation: status, needs and methods" in Santiago de Compostela, Spain, 7-10 June 2006
- ITC1 "ADS: objectives, context, concepts, challenges" in Stockholm, Sweden, 5-9 October 2005



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PhD level – Advanced courses

Course 1 Reactor Core Physics: Deterministic and Monte Carlo Methods
from August 31 to September 4

Course 2 Materials for Reactor Fuels and Structures
from September 7 to September 11

Course 3 LWR and FR Thermal-Hydraulics, Fuel Design and Safety
from September 14 to September 18

Course 4 Experimental Validation and Calibration of Numerical Simulation
from September 21 to September 25

Course 5 Reactor Multiphysics and Fuel Management
from September 28 to October 2

Course 6 Bifurcation, Stability and Chaos in Nuclear Systems
from October 5 to October 9

Course 7 Nuclear Fuels for LWRs and FRs
from October 12 to October 16

Course 8 Fuel Cycle Back-End and Reprocessing
from October 19 to October 23

Course 9 Reactor Dismantling and Waste Management
from October 26 to October 30

Course 10 Experimental Nuclear Techniques
from November 2 to November 6

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ENEN II WP 3: Facilitating and Supporting Research

- Organise an annual ENEN event for the presentation of research work by PhD students
 - One-day event during an international conference
 - 12-14 presentations by PhD students
 - ENEN Prize
 - Past events
 - 1st ENEN PhD Event - International Youth Conference on Energetics 2007 in Budapest, Hungary, 1 June 2007
 - 2nd ENEN PhD Event - International Youth Nuclear Congress (IYNC) in Interlaken, Switzerland, 23 September 2008 in collaboration with the EC JRC
 - 3rd ENEN PhD Event 2009 – International Youth Conference on Energetics, Budapest June 4th, 2009



ENEN II WP 3: Facilitating and Supporting Research

✓ PhD Event

Budapest 2007
Budapest 2009

Interlaken 2008

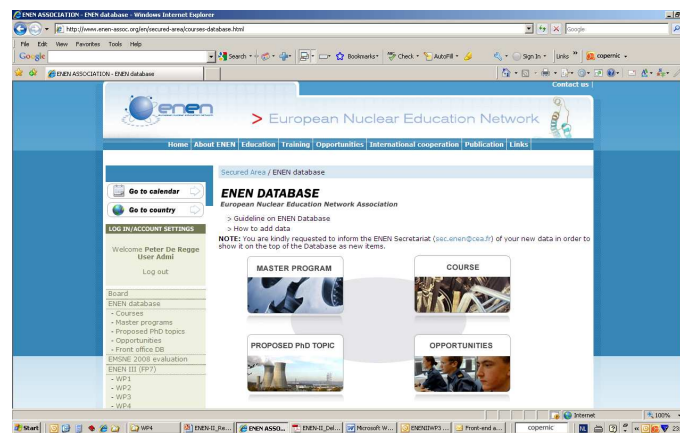


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ENEN II WP 3: Facilitating and Supporting Research


✓ Set up an information system between academia, research centres and End Users to feed relevant and applied research topics into internships, PhDs and postdoctoral work




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Main achievements – Training courses




Training Course on Nuclear Safety



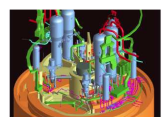
Munich, Germany
March 12th - 23rd, 2007

www.isar.tum.de/safetycourse


© ISaR, 2006



Training Course on Nuclear Safety








Saclay, France
April 4th - 22nd, 2005



Course on Nuclear Safety of WWER
Bratislava, Slovakia, May 2 – 6, 2005

Organised by the Slovak University of Technology and CENS (Center for Nuclear Safety) under the auspices of the ENEN Association



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INTERNATIONAL SEMINAR ON NUCLEAR FUEL CYCLE 2008



FRANCE
June 23rd - July 4th 2008



INTERNATIONAL SEMINAR ON NUCLEAR FUEL CYCLE



UNITED KINGDOM
19th - 30th November 2007






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ENEN Training Courses

ENEN II WP 4: Professional Training Programmes

INTERNATIONAL SEMINAR ON
NEUTRONICS FOR LIGHT
WATER REACTORS

FRANCE
March 16th -27th 2009

ENEN
INSTN
TU Delft

INTERNATIONAL COURSE ON
RADIOACTIVE WASTE MANAGEMENT

6 - 10 November 2006

Organised at:

UNIVERSITY "POLITEHNICA" OF BUCHAREST
FACULTY OF POWER ENGINEERING
DEPARTMENT OF NUCLEAR ENGINEERING

Under EURATOM FP-6 projects:

ESORED - ENGINEERING STUDIES AND DEMONSTRATION OF
REPOSITORY DESIGNS

and

ENEN - EUROPEAN NUCLEAR EDUCATION NETWORK

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ENEN II WP 5: Knowledge Management

- ✓ Integrate different current web sites into one single portal

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ENEN II WP 5: Knowledge Management

- ✓ Develop and disseminate textbooks on nuclear topics, multimedia presentations for students

The collage features several educational resources:

- NEUTRON PHYSICS** by Paul Reuss, published by INSTN and EDP Sciences.
- A diagram of a nuclear reactor core with components labeled: Barra absorbente, Conducto de salida del refrigerante, Barra de combustible, Reja soporte, Tubos guía de las barras de control.
- A graph showing neutron flux over time.
- A table of nuclear data.
- A diagram of a nuclear reactor core with various components labeled.

ENEN II WP 5: Knowledge Management

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3. PERSPECTIVES

ENEN II WP 5: Knowledge Management

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For young professionals : Three EFTS projects starting in 2009

- Three projects on Euratom Fission Training Schemes will start in 2009
- The objective is to establish a Training Scheme which covers the structuring, organisation, coordination and implementation of training in cooperation with local, national and international training organisations, to provide training courses and sessions at the required level to professionals in nuclear organisations or their contractors and subcontractors.

**To establish a common certificate for
professionals at European level**



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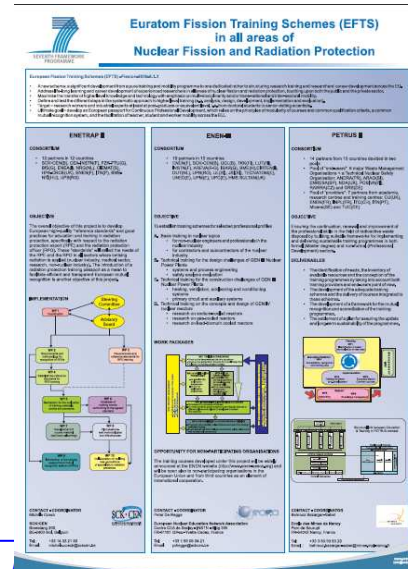
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For young professionals Three EFTS projects starting in 2009

ENETRAP II project
on radiation protection
(12 partners from 12 countries)

ENEN III project on
nuclear engineering
(19 from 12 countries)

on radioactive
PETRUS II project
waste disposal
(14 from 10 countries)



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For professionals : ENEN-III Project

ENEN-III project on Nuclear Engineering

- Three-year project: 2009 - 2011
- Four training schemes
 - Basic Nuclear Topics for Non-Nuclear Engineers
 - Design Challenges for Generation III NPP
 - Construction Challenges for Generation III NPP
 - Design Challenges for Generation IV Reactors
- Coordinated by the ENEN Association
- 19 Partners in 12 countries
 - ENEN, SCKCEN, UCL, TKK, LUT, INSTN, AREVA, ISaR, BME, CIRTEN, DUT, UPB, UL, JSI, TECNATOM, UPM, UPC, HMS SULTAN



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ENEN Perspectives -1

Education & Training

- In the framework of ENEN Association major education and some training institutions across Europe are working together
- ENEN is acting through education and training for the renewal of competencies
- ENEN provides education and training courses across the nuclear energy life cycle (design and build → operate → decommission and dispose)
- ENEN works with the end-users to attract more brilliant students to the nuclear field



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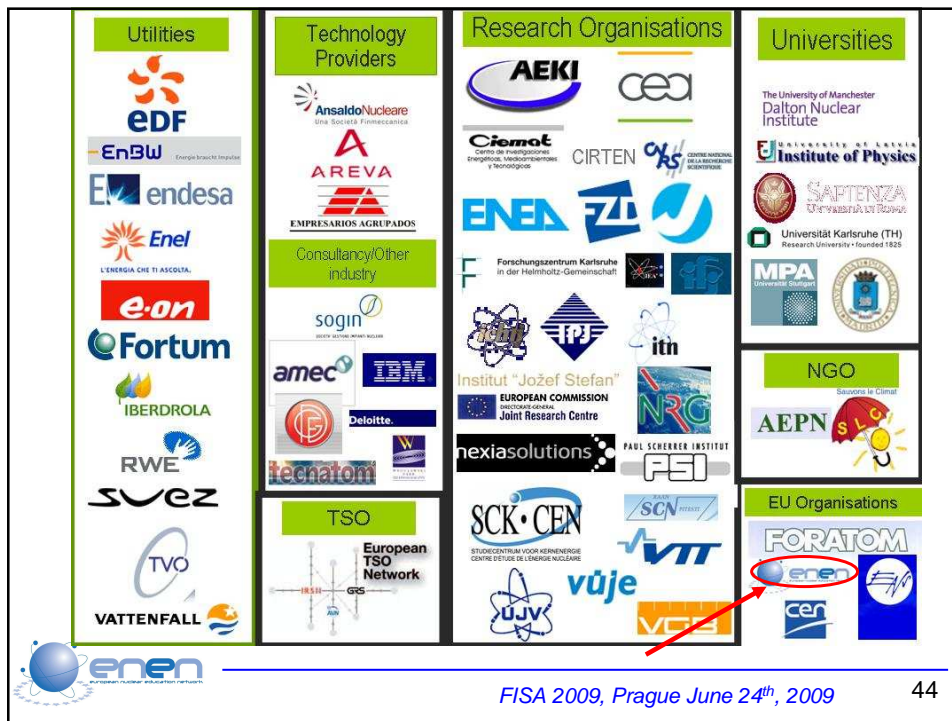
ENEN Perspectives -2

- Expand the scope from nuclear engineering to all nuclear disciplines, including radiation protection, radiochemistry, radioecology, waste management and geological disposal
- Consolidate its activities in the training area required by the industry and regulatory organisations
- Promote international mutual recognition of professional training for some key functions in nuclear industries, regulatory bodies and nuclear applications
- Expand the membership from universities and research centres to the industry and regulatory organisations
- Expand its activities beyond Europe



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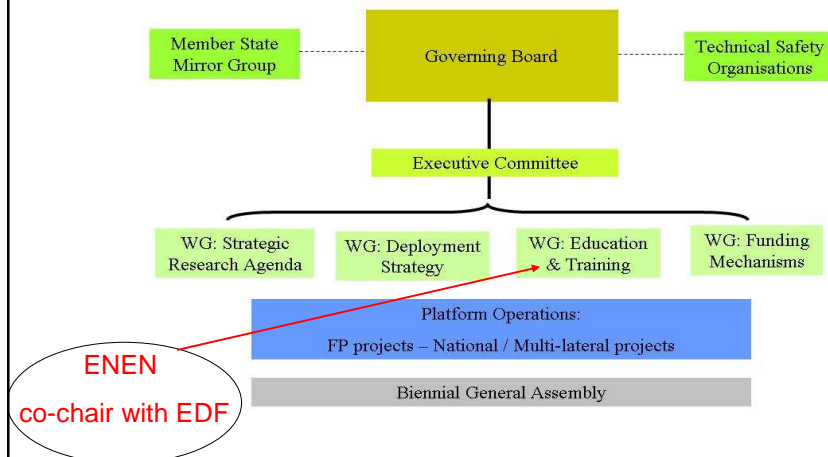
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The Sustainable Nuclear Energy Technology Platform



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EU Council, 1-2 December 2008



Adopted the conclusions which refers explicitly to the ENEN and to other FP6/FP7 initiatives originated by the ENEN

- The Council **welcomes** the existence within the European Union of coordinated teaching and training leading to qualifications in the nuclear field, **provided notably by the ENEN.**
- The Council hopes that, with the help of the EU, ENEN and its members will **continue to develop the coordination** of nuclear education and training in Europe.
- The Council insists that **the appropriate conditions** must be created for mutual recognition of nuclear professional qualifications throughout the European Union.
- The Council encourages the Member States and the Commission to establish a "review of professional qualifications and skills" in the nuclear field for the European Union, which would give **an overall picture** of the current situation and enable appropriate solutions to be identified and implemented.



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European Council of December 2008 -1

It also emphasizes the need of additional efforts for

- **reinforcing** the teaching of basic scientific prerequisites in preparation for energy-related occupations
- **developing** generally the provision of programmes in different languages specifically geared to energy-related and especially nuclear-related occupations
- **assessing** ways of attracting more European and non-European students to those programmes by improving the competitiveness of scientific and technical careers
- **equipping** European universities and institutions involved in nuclear-related teaching programmes



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European Council of December 2008 - 2

- **extending** the network of institutions and universities offering this type of teaching and ensuring mutual recognition
- **improving** the visibility of European nuclear training which constitutes a world level reference
- **making available** common European technical documentation and teaching materials



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THANK YOU FOR YOUR ATTENTION

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