

European Challenges in Nuclear Education and Training for the Industry and Regulatory Needs

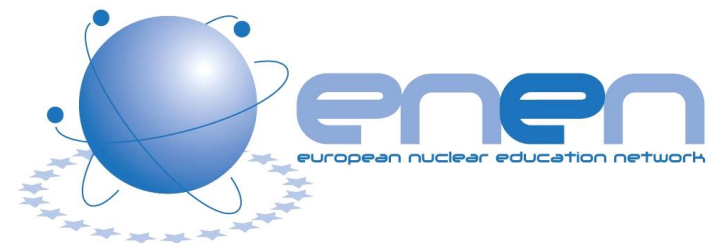
**European Nuclear Education Network (ENEN) Association
ATOMEXPO, Russian Federation, Moscow, 4th of June 2012**



What is ENEN

The European Nuclear Education Network
Association

- A non-profit organization established in September 2003 under the French law of 1901
- For the continuity of achievements obtained through the past Euratom-EC projects on nuclear E&T
- Headquarters is located near Paris, CEA Centre in Saclay, France



ENEN Objectives

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

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 centre, universities etc.)

ENEN Members in June 2012

- have a legal status in an EU country or a candidate EU member country
- Universities, research organisations, regulatory bodies, nuclear industry, or any other organisations involved in the application of nuclear science and ionising radiation
- Providing or supporting academic or professional education and training in the application of nuclear science and ionising radiation
- Committed itself to support the ENEN Association
- Having a firmly established tradition of relations with some of the members in the fields of education, research and training (Recommendation by at least one ENEN Member)

As of June 2012, 60 members in 18 EU countries

ENEN MoU partners

- Special case in Europe
- Beyond Europe
- International cooperation

*+ Project partners
beyond
ENEN membership*

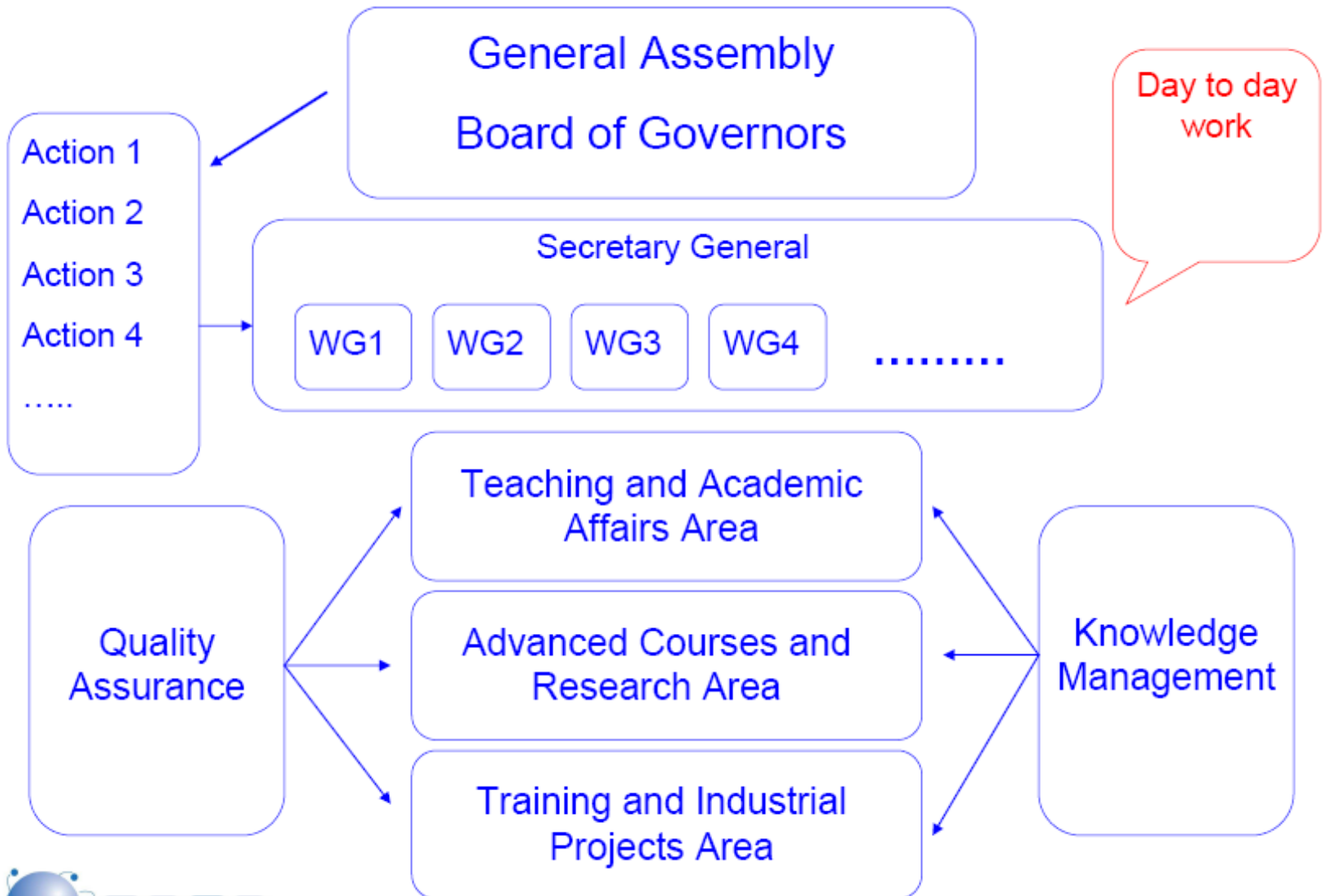
As of June 2012, MoU concluded with

- European Commission Joint Research Centre
- European Nuclear Society
- North West University, Potchefstroom, South Africa
- Moscow Engineering Physics Institute, Russian Federation
- Centre Institute for Continuing Education and Training, Russian Federation, Russian Federation
- Tokyo Institute of Technology, Japan
- Japan Atomic Energy Agency, Japan
- Kharkiv “Karazin” National University, Ukraine
- IAEA for the cooperation with the Asian Network (ANENT)

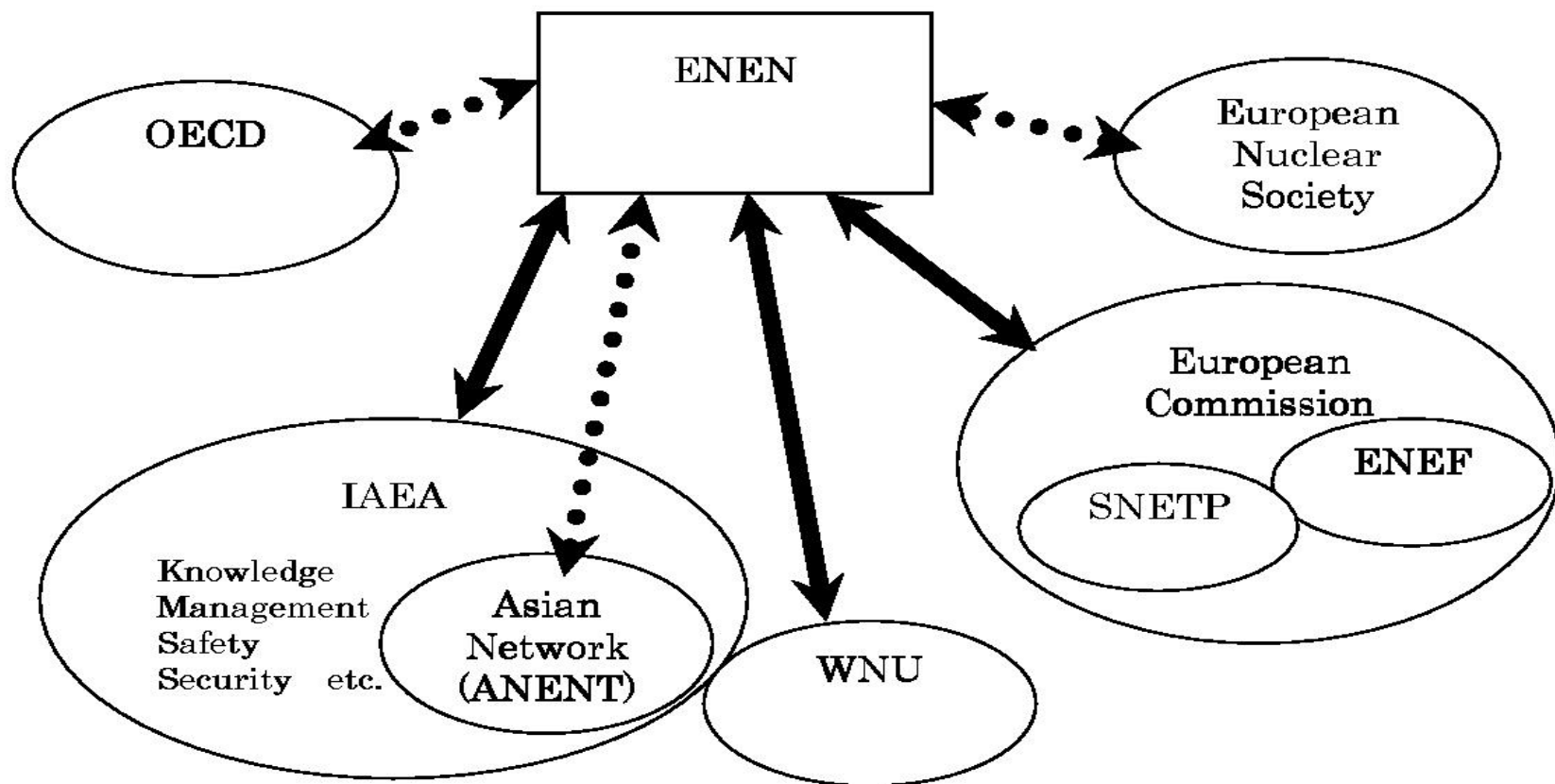
Memberships/cooperation under discussion with

- University Network of Excellence in Nuclear Engineering, Canada etc.

ENEN Structure



European and International Cooperation



Achievements

New Master in Switzerland (in English)

SWITZERLAND

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

Starting September
2008



New Master in France (in English)

FRANCE

- 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

Starting September 2008

UNIVERSITÉ PARIS-SUD 11 **Master** **instn**

Nuclear Engineering

Objectives :

- Education of Engineers and Researchers :
 - pluridisciplinary skills
 - thorough knowledges in nuclear research field

Careers Opportunities :

- Engineer in nuclear industry
- Researcher : universities, research centers

Main Educational Topics :

- Nuclear Physics
- Neutronics, Particle Propagation
- Thermal hydraulics
- Nuclear Materials
- Modelisation and calculation codes
- Nuclear Reactor Design and Operation - Reactor lines
- Nuclear Fuel Cycle
- Safety - Criticality
- Protection / Radiation shielding
- 5 months training in industrial company or in research laboratory

Teaching in English language

Admission Prerequisites:

- This master M2 applies to students of :
 - Master 1 or equivalent
 - Engineering schools
- Opened to international candidatures
- Selective entry based on students' academic file

« Subject to accreditation »

Informations - Candidature - Contact : <http://www.master-nuclear-engineering.eu>
IPN, Bât 100, Campus universitaire - 91405 Orsay, FRANCE ☎ +33 1 69 15 74 26
INSTN, CEA/Saclay - 91191 Gif-sur-Yvette, FRANCE ☎ +33 1 69 08 93 11

Faculté des Sciences d'Orsay

CEA

Scholarship available for non-European students.

International Exchange Courses



Editions

2003

2004

2005

2006

2008

2011

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

Organising institutions

Budapest University of Technology and Economics (BME) <i>Hungary</i>	
Slovak University of Technology in Bratislava (STUB) <i>Slovak Republic</i>	
Vienna University of Technology, Atominstitut (AI) <i>Austria</i>	
Czech Technical University in Prague (CTU) <i>Czech Republic</i>	

International Exchange Courses



21 days

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 VR-1 reactor in Prague

- Measurements of reactivity by various methods
- Study of nuclear reactor dynamics
- Digital control and safety systems of the research reactors and reactor operation

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



Group of students at the reactor in Vienna

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

European MSc in Nuclear Engineering

- “ENEN Certificate” recognised among ENEN Members
- Common reference curricula established under the European Commission – EURATOM 5th FP *ENEN project* and 6th FP *NEPTUNO project*
- ECTS (European Credit Transfer and Accumulation System) introduced since 1989
- Master program at home university + Experiences in other country
- To promote and facilitate the mobility of students and teachers
- Implemented since 2005



European Master of
Science in Nuclear
Engineering
ENEN Certification

Nuclear Education by
the European Nuclear Education Network



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

EMSNE Certificates Ceremony 2007



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

Possible expansion of EMSNE in 2012

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

- 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, INSEN, EC JRC Ispra, ESARDA) etc.

PhD level Advanced Course -1



- **Course 1** Reactor Core Physics: Deterministic and Monte Carlo Methods
from September 1st to September 5
- **Course 2** Materials for Reactor Fuels and Structures
from September 8 to September 12
- **Course 3** LWR and FR Thermal-Hydraulics, Fuel Design, Safety and Risk Assessment
from September 15 to September 19
- **Course 4** LWR Core Physics and Fuel Management
from September 22 to September 26
- **Course 5** Experimental Validation and Calibration of Numerical Simulation Models
from September 29 to October 3
- **Course 6** Reactor Kinetics and Dynamics
from October 6 to October 10
- **Course 7** Neutronics Experiments and Simulations
from October 13 to October 17
- **Course 8** Reactor Dismantling and Waste Management
from October 20 to October 24
- **Course 9** Fuel Cycle Back-End and Reprocessing
From October 27 to October 30

The image shows two overlapping posters for the International School in Nuclear Engineering. The top poster is for the 2007 edition, with the title in green. The bottom poster is for the 2008 edition, with the title in orange. Both posters feature a central diagram of a nuclear reactor core with various components like fuel rods, control rods, and piping. The 2008 poster includes the text 'SAGLAY, France' and '9 Doctoral-level Courses in Advanced Nuclear Science From September 1st to October 30, 2008'. Logos for 'ceci' and 'instn enen' are visible at the bottom of the 2008 poster.

2007
INTERNATIONAL SCHOOL
IN NUCLEAR ENGINEERING

2008
INTERNATIONAL SCHOOL
IN NUCLEAR ENGINEERING

SAGLAY, France

9 Doctoral-level Courses
in Advanced Nuclear Science
From September 1st to October 30, 2008

ceci

instn
enen

PhD level Advanced Course -2



Integrated Project EUROTRANS (FP6) in 2005-2010

- 17 Universities participated under the ENEN umbrella
- ENEN provides links between research scientists and doctoral students (50 - 60 PhD's in the project)
- ENEN organizes / facilitates lectures, scientific visits, joint experiments, and specialized training in 10 advanced courses (Internal Training Courses)
 - ITC6 “Core design and reactor safety analysis” in Madrid, Spain, 2-5 April 2008 14 PhD students
 - ITC9 “Accelerator-driven Transmutation System for European and Asian Young Scientists and Engineers” in Tokai Mura, Japan, 1-4 December 2009 47 Asian and 10 EU PhD students
- Juan Antonio Rubio - Paul Govaerts ENEN – EUROTRANS Prize for the Best Doctoral Dissertation within the Project

PhD level

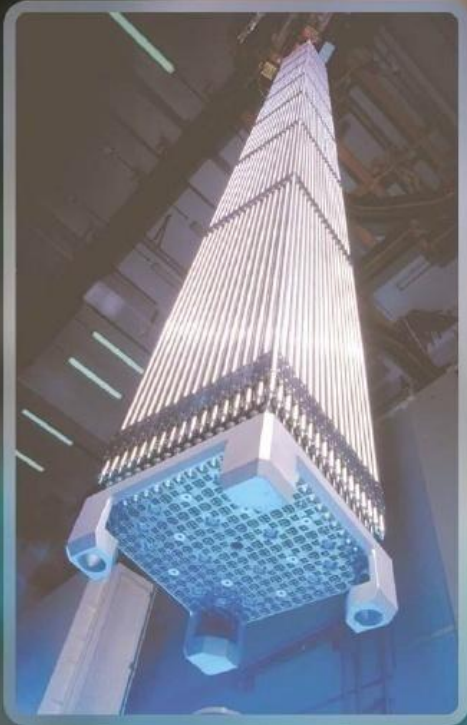
Annual ENEN PhD Event

- ▶ Every year since 2007
- ▶ Half- or one-day event during an international conference
- ▶ 8-14 PhD students
- ▶ ENEN Prize
- ▶ ENEN Alumni
 - 1st at International Youth Conference on Energetics 2007 in Budapest, Hungary, 1 June 2007
 - 2nd at International Youth Nuclear Congress (IYNC) in Interlaken, Switzerland, 23 September 2008
 - 4th at European Nuclear Conference in Barcelona, Spain, 2 June 2010
 - 5th at International Congress on Advances in Nuclear Power Plants (ICAPP) in Nice, France, 4 May 2011
- ▶ 6th to be held at 21st International Conference Nuclear Energy for New Europe in Ljubljana, Slovenia, 5-7 September 2012



For young professionals Training Courses

INTERNATIONAL SEMINAR ON NUCLEAR FUEL CYCLE 2008

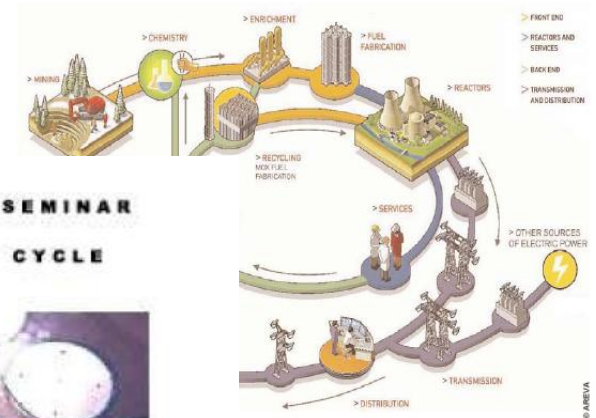


FRANCE

June 23rd – July 4th 2008



INTERNATIONAL SEMINAR ON NUCLEAR FUEL CYCLE



INTERNATIONAL SEMINAR ON NUCLEAR FUEL CYCLE

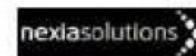


UNITED KINGDOM

19th – 30th November 2007



Nuclear Department, HMS SULTAN
DCMT, Defence Academy



FRANCE
0th - DECEMBER 1st, 2006



For young professionals

EFTS project



- Projects on Euratom Fission Training Schemes (EFTS) starting from 2009/2010
- The objective is to establish a common certificate for professionals at the European level
 - ✓ ENEN III on Nuclear Engineering (2009-)
 - ✓ ENETRAP II on Radiation Protection (2009-)
 - ✓ PETRUS II on Waste Management and Disposal (2009-)
 - ✓ TRASNUSAFE on Nuclear Safety Culture (2011-)

***ECTS and European MSc for Education;
WHAT for Training?***