European approaches and initiatives for Nuclear Education & Training and Knowledge Management

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1. What is ENEN
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1. What is ENEN
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”.

1. European Commission – EURATOM
5th Framework programme **ENEN project**

2. European Commission – EURATOM 6th
Framework programme **NEPTUNO project**
in January 2004 – December 2005
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 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 Structure

- General Assembly
- Board of Governors
- Secretary General
- Action 1
- Action 2
- Action 3
- Action 4
- Quality Assurance
- Teaching and Academic Affairs Area
- Advanced Courses and Research Area
- Training and Industrial Projects Area
- Knowledge Management
- WG1
- WG2
- WG3
- WG4

Day to day work
ENEN Members in May 2010

- 52 Universities
- 7 Research Centres
- 1 Multinational Company located in 18 European Countries
- MoU concluded with
  - European Nuclear Society
  - North West University, Potchefstroom, South Africa
  - Moscow Engineering Physics Institute, Russian Federation
  - Centre Institute for Continuing Education and Training, Russian Federation
  - Tokyo Institute of Technology, Japan
  - Japan Atomic Energy Agency, Japan
  - IAEA for the cooperation with the Asian Network (ANENT)
  - Kharkiv “Karazin” National University, Ukraine
- Memberships/cooperation under discussion with
  - European Commission Joint Research Centre
  - University Network of Excellence in Nuclear Engineering, Canada etc.
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.

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.
2. Achievements since 2003
2-1. Master level

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

Scholarship available for non-European students.
2-1. Master level
International Exchange Courses

Editions
2003
2004
2005
2006
2008

„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) Hungary |
| Slovak University of Technology in Bratislava (STUB) Slovak Republic |
| Vienna University of Technology, Atominstitut (AI) Austria |
| Czech Technical University in Prague (CTU) Czech Republic |
2-1. Master level
International Exchange Courses

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 (STU), (Slovak Republic).

**TECHNICAL VISIT** to Jaslovske Bohunice NPP, and radwaste treatment center

**EXPERIMENTS** (Czech Technical University 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, Atom Institut)

- 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

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

Group of students at the reactor in Vienna

21 days
6 ECTS
2-1. Master level

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
EMSNE Certificates Ceremony 2007

Student receiving the ENEN EMSNE certificate during ENS conference on E&T NESTet Budapest May 4-8, 2008
2-1. Master level
Possible expansion of EMSNE in 2010
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 (support to IAEA, EC JRC Ispra, ESARDA) etc.
2-2. PhD level Advanced Course

- 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
2-2. PhD level

**FP6 EUROTRANS project**

- **Integrated Project EUROTRANS (FP6)** in 2005-2010
- 17 Universities participated under the ENEN umbrella
- ENEN organises / facilitates lectures, scientific visits, joint experiments, and specialised 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** in 2010
2-2. PhD level

Annual ENEN PhD Event

- 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 in collaboration with the EC JRC
  - 3rd at International Youth Conference on Energetics 2009 in Budapest, Hungary, 4-7 June 2009
  - 4th at European Nuclear Conference in Barcelona, Spain, 2 June 2010
2-3. For young professionals
Training Courses

INTERNATIONAL SEMINAR ON
NUCLEAR FUEL CYCLE
2008

FRANCE
June 23rd – July 4th 2008

INTERNATIONAL SEMINAR
ON NUCLEAR FUEL CYCLE
FRANCE
November 20th – December 1st, 2008

UNITED KINGDOM
19th – 30th November 2007

Nuclear Department, HMS SULTAN
DGMF, Defence Academy
2-3. For young professionals
EFTS projects starting in 2009

- Projects on Euratom Fission Training Schemes will start in 2009
- The objective is to establish a common certificate for professionals at the European level
  - ENEN III on Nuclear Engineering
  - ENETRAP II on Radiation Protection
  - PETRUS II on Waste Management and Disposal
  - TRASNUSAFE on Nuclear Safety Culture

*European MSc for Education; What for Training??*
2-4. Knowledge Management
ENEN Website and Database

- **ENEN Website**
  
  http://www.enen-assoc.org

- **NEPTUNO Database** (Aug 2004-)
  
  http://www.neptuno-cs.de/

  E&T courses by ENEN Members

- **A new ENEN Database** (to be opened soon)
  
  - E&T courses
  - Master program
  - PhD topics
  - Opportunities (scholarship, fellowship, internship, job opportunities)

  provided by ENEN Members and Partners
2-4. Knowledge Management

ENEN publication

- First text book published under ENEN as a deliverable of ENEN II project
  - 18 chapters, 670 pages including exercises and solutions
  - mainly for students, young professionals and researchers
- CD-ROM including multimedia presentations for the general public
2-5. ENEN Event

Dialogue btw ENEN and the End-Users


2. Post-FISA 2009 Workshop “Integration of nuclear education and training: common needs, EU vision and implementation instruments” in Prague, 25 June 2009 (Areva, EDF, Posiva, SCKCEN, CEA, EPFL, Russia, China, USA etc.)

3. 2nd Special Event “Needs and strategies on Education & Training for increasing Nuclear Power Production” in Ljubljana, Slovenia, 4 March 2010 (ENEL, EC JRC, IAEA, Safety Authority)
2-5. ENEN Event

Annual pan-European Recruitment Event

- In Brussels
- 4-5 December 2009
- to be held on 3-4 December 2010

- Supported by the EC and the ENEN

- Expected to participate in
  - European major industries
  - 200 students over EU and Russian Federation

- Contents
  1. Workshop/panel discussion
  2. Interviews for job opportunities, internship and fellowships

Expected to participate in

- European major industries
- 200 students over EU and Russian Federation

Contents

1. Workshop/panel discussion
2. Interviews for job opportunities, internship and fellowships
3. European projects
Ongoing European projects

- Euratom Fission Training Schemes (EFTS)
  - ENEN III on Nuclear Engineering
  - ENETRAP II on Radiation Protection
  - PETRUS II on Waste Management and Disposal
  - TRASNUSAPE on Nuclear Safety Culture
- Bilateral
  - EUJEP with Japan
  - ETNET with China
  - ENEN-RU with Russian Federation
3-1. EFTS project (since 2009)
ENEN-III Project on Nuclear Engineering

- Three-year project: 2009 - 2012
- 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, AALTO, LUT, INSTN, AREVA, ISAR, BME, CIRTEN, DUT, UPB, UL, JSI, TECNATOM, UPM, UPC, (HMS SULTAN)
3-1. EFTS project (since 2009)
ENEN-III Project on Nuclear Engineering

- WP1 TRAINING FRAMEWORK
  - To set up the framework and the training scheme
  - To set up the accreditation structure for mutual recognition
  - To launch the training passport concept

- WP2 QUALIFICATION PROGRAMME
  - To establish the qualification programmes
  - To run the qualification programme

- WP3 SKILLS DEVELOPMENT
  - To establish the training programme for developing the required skills
  - To run the training sessions for developing the required skills

- WP4 INTERNSHIPS & INCREASING AUTONOMY
  - To increase the autonomy of trainees
  - To create schemes and procedures confronting the trainees to different policies and cultures of employers in various EU countries

- WP5 RESPONSIBILITY & AUTONOMOUS ACTIVITIES
  - To acquire responsibility, self-confidence and autonomy through on-the-job training
  - To get acquainted with employer environment, policy, culture and with professional counterparts

- WP6 PROJECT MANAGEMENT
  - Coordination and management of the project
  - Quality Assurance
  - Knowledge Management

- WP7 COLLABORATION WITH OTHER TRAINING NETWORKS
  - Mapping of E&T activities across ENEN-III, SNETP, ENEIF and HLG
  - Arrange common Workshop on E&T with SNETP, ENEIF and HLG
3-2. Bilateral – EU and Japan
EUJEP Project (since 2009)

- Objective: Foster, organise and implement exchanges of European and Japanese Master level students with mutual recognition of credits.

- Partners:
  EU: ENEN (F), INSTN (F), EMN (F), UPB (RO), SUTB (SK)
  JAPAN: TokyoTech, Kyoto U, JAEA

- Planned Mobility of students:
  EU  30 students for a total of 154 months
  Japan 30 students for a total of 180 months

- Planned mobility of faculty staff:
  EU   10 faculty staff for a total of 19 weeks
  Japan 8 faculty staff for a total of 8 weeks
3-2. Bilateral – EU and China
ECNET Project (under preparation)

- Objective: to define a common basis to allow effective cooperation between the European and Chinese networks for nuclear E&T

- Partners:
  EU: ENEN (F), SCKCEN(B), INSTN (F), INPL (F), KIT (G), CIRTEN (I), UPM (E), ICL (UK)
  China: Tsinghua U, North China Electric Power U, South-West U of Science and Technology, Harbin Engineering U, Shanghai Jiao Tong U, China National Nuclear Corp/Graduate School and Xi’an Jiao Tong U

- Work packages
  Needs and strategies of long-term cooperation
  - WP1: In Nuclear Engineering
  - WP2: In Radiation Protection
  - WP3: In Waste Management and Disposal
  - WP4: Recognition of credit systems
  - WP5: E&T facilities, laboratories and equipments
  - WP6: Project management
3-2. Bilateral – EU and Russian Fed. ENEN-RU Project (to be launched)

- Objective: to define a common basis to allow effective cooperation between the European and Russian networks for nuclear E&T
- 500 000 EURO for 2-year on the EU side

Partners on the Russian side
- ROSATOM
- National Research Nuclear University
  - MEPhI
  - Obninsk Technical University
  - etc.
- Research Institute for Nuclear Reactor, Dimitrovgrad
- Centre Institute for Continuing Education and Training, Obninsk etc.
ENEN-RU Project
Project partners for the EU side

- ENEN (Project Coordinator)
- SCKCEN, Belgium
- Czech Technical University in Prague, Czech
- Nuclear Research Institute Rez plc., Czech
- Stuttgart University, Germany
- University Politehnica Bucharest, Romania
- Slovak University of Technology in Bratislava, Slovakia
- TECNATOM, Spain

All ENEN Members will have an opportunity to contribute under the ENEN umbrella
ENEN-RU Project

Working structure - 1/2

- **WP1**: Bologna process and ECTS in Russia (to analyse the implementation and the compatibility of the Bologna process and ECTS in Russia as a basis to enhance future exchanges of lectures and students, to promote the implementation of the Bologna process within a new National Research Nuclear University in Russia)

- **WP2**: Needs of cooperation in the long term (to define the needs and modality of cooperation between EU and Russia in the long term, to define the pilot items for E&T to be implemented by WP3 and WP4)

- **WP3**: Pilot items for Education (to conduct pilot educational courses and PhD projects, to define further actions to be taken for the long term cooperation in the nuclear Education)

- **WP4**: Pilot items for Training (to conduct pilot training courses, to cooperate with the European Training Scheme projects, to define further actions to be taken for the long term cooperation in the nuclear Training)
ENEN-RU project

Working structure -2/2

- **WP5**: E&T facilities, laboratories and equipments (to map the E&T facilities, laboratories and equipments for exchange purposes in EU and in Russia, to clarify the access rules and procedures, ideally to be used with WP3 and WP4)

- **WP6**: Knowledge dissemination (to secure experience and disseminate the project results, to ensure proper knowledge dissemination of the project results, such as website and database)

- **WP7**: Project management (to coordinate and manage the project according to the time schedule and budget, to produce and support the dissemination of the project results)
ENEN-RU Project

Expected working schedule

- Beginning of 2010 – Negotiation on the EU side (between the European Commission (EURATOM) and the ENEN)

- Coordination Agreement has to be agreed among ALL European + Russian project partners

- Before summer – A contract signed on the EU side (between the European Commission (EURATOM) and all European project partners)

- Launch the project early summer of 2010 for the period of 2-years
THANK YOU FOR YOUR ATTENTION

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