

The role of the European Nuclear Education Network association in the academic and industrial environment

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Abstract

The temporary network, established through the European 5th Framework Programme project ENEN, was given a permanent character by the foundation in 2003 of the European Nuclear Education Network Association, a non-profit-making association pursuing a pedagogic and scientific aim. Its objective is the preservation and development of higher nuclear education and expertise. It is realized through the co-operation between European universities, involved in education and research in nuclear disciplines, nuclear research centres and nuclear industry. The current membership consists of 35 universities and 6 research centres. The paper elaborates on the objectives and activities of the five ENEN committees. Supported by the 5th and 6th Framework Programme of the European Community, the ENEN Association established the delivery of the European Master of Science in Nuclear Engineering certificate. Education and training courses have been developed and delivered to materialise the core curricula and optional fields of study in a European exchange structure. Pilot course editions and try-outs of training programmes have been organised with support of nuclear industries and international organisations. The ENEN Association contributes to the management of nuclear knowledge within the European Union as well as on a world-wide level. It cooperates with regional Networks in Asia, Canada and the USA and participates to activities of the World Nuclear University.

1. Foundation of the ENEN Association

The ENEN Association has its roots in the Lisbon 2000 European Union summit, which proposed as a major strategic goal for the EU to become the most competitive knowledge-based economy with more and better employment and social cohesion by 2010. With respect to nuclear knowledge specific concerns were expressed in two important studies [1] [2] stating as a conclusion that “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.”

In the 5th Framework EC programme, the “European Nuclear Engineering Network” project was started in January 2002 to establish the basis for conserving nuclear knowledge and expertise by creating a European Higher Education Area for nuclear disciplines and initiating the implementation of the Bologna declaration in the nuclear curricula. As a first priority a harmonized curriculum for nuclear engineering is developed and agreed on by the partners of the ENEN project. In order to preserve the achievements of the project and to formalize the European Higher Education Area in the nuclear disciplines, the European Nuclear Education Network Association is founded on September 22, 2003, as a non-profit-making association according to the French law of 1901, pursuing a pedagogic and scientific aim. The results and deliverables of the ENEN project are available on the web site <http://www.sckcen.be/enen>.

2. The ENEN Association objectives

The general goals of the ENEN Association are defined with respect to the academia as follows:

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

and with respect to the end users, such as nuclear industries, regulatory bodies, nuclear applications, etc...

- To create a secure basis of skills and knowledge of value to the European Union;
- To maintain an adequate supply of qualified human resources for design, construction, operation and maintenance of nuclear infrastructures, industries and power plants;
- To maintain the necessary competence and expertise for the continued safe use of nuclear energy and applications of radiation in industry and medicine.

The objectives and structure of the ENEN Association are formulated in the Statutes, following the conclusions and recommendations of 5th Framework ENEN Project, with the Mission of the ENEN Association being the "Preservation and the Further Development of Higher Nuclear Education and Expertise". A first series of objectives is formulated as follows:

- To deliver a European Master of Science degree in Nuclear Engineering;
- To encourage and support PhD studies;
- To promote exchange of students and teachers participating in the European Nuclear Education 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 nuclear engineering academic education, training and research;
- To create incentives and increase career attractiveness for the enrolment of students and young academics in nuclear disciplines.

3. Scope and Framework of the ENEN Association Activities

In order to achieve the objectives, the ENEN Association facilitates exchanges and cooperation among the academia themselves and strengthen their interactions with research centers, thereby assisting them to attract brilliant students by identifying, developing and disseminating new and challenging subjects for research work. Confronted with a lack of interest from students, universities also need to be convinced to recruit new academic members for teaching and research in nuclear disciplines and for maintaining expertise in key nuclear areas. The ENEN Association is therefore developing, promoting and supporting ENEN exchange courses in nuclear disciplines, further by disseminating and supporting the concept of life long learning in the nuclear field, and by facilitating and coordinating the participation of universities to European research projects. The ENEN Association thereby relies on the European Union to promote international cooperation and to support the mobility of teachers, students and researchers, including as well central and Eastern Europe. The European Union provides the architecture for a nuclear "European Research Area" and sets favorable conditions for the creation of added value through university-industry collaborations.

To the benefit of the End-Users, the ENEN Association conserves nuclear knowledge and improves access to expertise by developing and establishing databases, web sites and distance learning tools. In this multinational framework it is mandatory to define the goals and set up the criteria for mutual professional recognition and recruitment throughout the EU. The ENEN Association further provides resources and lecturers for advanced training courses, for professional upgrades and continual training programmes. It has a role as an interface between academia and industries to identify, disseminate and support interesting projects and research topics for internships, master theses and PhDs. With respect to training, the role of the European Union is to provide a framework for quality assurance of advanced courses and professional training programmes through accreditation and ranking. It is expected to construct a nuclear "European Education and Training Area" under competitive conditions of quality and cost and to develop a framework for mutual recognition of professional training, licensing and professional recruitment throughout the European Union.

4. Structure and Membership of the ENEN Association

The ENEN Association has two kinds of members. The Effective Members, essentially academia, have a legal status in an EU member or candidate country, provide high level scientific education in the nuclear field in combination with research work, and use selective admission criteria; the Associated Members have a legal status in an EU member or candidate country, have a long term tradition of relations with effective members in the field of research, training or education and commit themselves to support the ENEN Association.

The ENEN association is managed by a Board of Governors, elected by the General Assembly and the work is organised through a Management Committee. The Management committee is constituted

by the Secretary General, appointed by the Board of Governors, and the Chairpersons of the five working committees, which are dedicated to specific tasks, as shown in Table 1. Currently the ENEN Association has 41 members, consisting of 35 universities and 6 research centres, of which 28 are Effective Members and 13 are Associated Members. Without members from the industry and with an overwhelming membership of universities, the ENEN Association seems currently mainly oriented to academic activities. Still, as shown below, the training programmes and courses are well attended by young professionals from nuclear industries.

Advisory Committee	General Assembly Board of Governors			Honorary Members Committee
Management Committee				
		Secretary General		
Chairperson Committee 1	Chairperson Committee 2	Chairperson Committee 3	Chairperson Committee 4	Chairperson Committee 5
Teaching & Academic Affairs Committee	Advanced Courses & Research Committee	Training and Industrial Projects Committee	Quality Assurance Committee	Knowledge Management Committee
4*+2**	3*+2**	2*+3**	3*+2**	3*+2**

* Effective Member ** Associated Member

Table 1. Structure of the ENEN Association

5. The ENEN Committees

The work within ENEN is performed by the ENEN Committees. The core of the committees is formed by five to six Effective and Associated members nominated by the Board of Governors. The core calls on any other ENEN member for carrying out specific tasks and producing specific deliverables in the framework of EC supported projects or to fulfil obligations resulting from commitments made by the ENEN Association. The following paragraphs describe the composition, the tasks and some recent achievements of the ENEN Committees.

5.1 Teaching and Academic Affairs Committee (TAAC)

TAAC has established and continues to monitor the equivalence and to promote the harmonisation of nuclear engineering education curricula at the ENEN member universities. A reference curriculum consisting of a core package of courses and optional substitute courses in nuclear disciplines has been designed and mutually recognised by the ENEN members. TAAC has designed an information leaflet to attract applications for the ENEN certificate of European Master of Science in Nuclear Engineering (EMSNE). It has developed and implements the bylaws and procedures for receiving and selecting applications and for awarding the EMSNE certificate. TAAC also has the task to promote student and faculty exchanges by encouraging and supporting the organization of international exchange courses and high-quality nuclear engineering courses by the ENEN members. In this framework TAAC produced an information package on 10 established ENEN exchange courses, 23 proposed exchange courses and 5 master thesis projects at ENEN member institutions. In cooperation with the ENEN Quality Assurance Committee, TAAC awards an International ENEN Course Quality label. All information is posted on the ENEN Web site <http://www.enen-assoc.org>. Other products of TAAC are available on the web site of the 6th Framework project NEPTUNO <http://www.sckcen.be/neptuno> and include guidelines, best practices and do-it-yourself kits for the organization of international ENEN exchange courses with examples of flyers and application forms.

5.2 Advanced Courses and Research Committee (AC&RC)

The Advanced Courses and Research Committee ensures the link between ENEN members and research laboratories in the European Community. It establishes exchanges with other networks and, through maintaining tight relations with research centres, universities and industry, it identifies and disseminates topics for internships, master theses and PhDs. AC&RC also encourages and supports student mobility. It defines, designs and organizes advanced courses for students, PhD candidates and young professionals. On the basis of a questionnaire, interests for advanced courses have been identified as listed in Table 2.

The AC&RC is also in charge of the organization of 10 advanced training courses for PhD students in the framework of the participation of the ENEN Association to the EU 6th Framework Integrated Project EUROTRANS. This project aims at the design and feasibility assessment of an industrial prototype Accelerator Driven System dedicated to the transmutation of long-lived radioisotopes, mainly actinides, after their partitioning from high level waste streams. Seventeen universities from eight countries are represented by the ENEN Association in this project. The training courses will cover the large variety of research topics addressed by the project. In cooperation with TAAC, AC&RC produced recommendations for the organization of advanced courses, for mentoring PhD students and for continued academic education on an international basis. They are available from <http://www.sckcen.be/neptuno>.

Title	Organization	ECTS	Period
Scaling and Uncertainty in System Thermal Hydraulics	CIRTEN Univ. Pisa	6-8	2006
Coupled 3D Neutron Kinetics and Thermal Hydraulics; application to Nuclear Reactor Theory	CIRTEN Univ. Pisa	6-8	2006
System Thermal Hydraulic Code Assessment and Code User Training and Qualification	CIRTEN Univ. Pisa	6-8	2006
Natural Circulation in Existing Reactors and Innovative Reactor Concepts	CIRTEN Univ. Pisa	6-8	2006
Radiological Protection	Univ. Manchester	6-8	2 weeks 4/2006
Safety Aspects of WWER Operation	Univ. Bratislava	15-20	
Eugene Wigner extension: Experimental Training in Reactor Physics on LW critical Assembly	Ustav Jaderného Výzkumu Řež	?	?
MSc. Nuclear Reactor Design Study (Project)	HMS Sultan	30	4-10 2006
Reactor Physics for Accelerator Driven Systems	Univ. Pol. Madrid	4	3/2006
Nuclear Fusion Technology	Univ. Pol. Madrid	4	2/2006
International Course on Advanced Thermal Hydraulics	Univ. Pol. Madrid	?	2006
Advanced Course on Pressure Vessel Aging	Univ. Pol. Madrid	?	2006

Table 2. Advanced Courses Proposed by ENEN Members

5.3 Training and Industrial Projects Committee (T&IPC)

The Training and Industrial Projects Committee identifies the industrial needs for continued professional development and organizes continuous training sessions and courses on different subjects of common interest for ENEN Associated members, regulator bodies and nuclear industries. T&IPC maintains and disseminates a database on third cycle advanced courses and continued professional development sessions. It facilitates and supports professional training, the mobility of professionals and lecturers, assists in accessing large nuclear infrastructures and integrates European industrial and national projects.

The training courses organised in the framework of the NEPTUNO project are listed in Table 3. Open to students as well as to professionals, they were mainly attended by young professionals from a variety of nuclear industries and regulatory bodies inside and outside the European Union.

Title	Participants	Countries	Renewal
ENEN International Seminar on The Nuclear Fuel Cycle France, 29/11-10/12, 2004	20 (2 students)	B, CPR, CZ, E, F, IND, ISR, ROK, RO, RUS, SLO, SAF IAEA	11-12/2005 France 2006 Un.Kingdom
ENEN Training Course on Nuclear Safety INSTN Saclay, April 4-22, 2005	12 (1 student)	AUL, CZ, D, IND, ISR, SLK, SAF, SE	2006 Germany
ENEN – EUR Training Course on Leveling the Playing ground for New Nuclear Power Plants in Europe Helsinki, June 6-10, 2005	35 (5 students)	B, BUL, CZ, D UK, FIN, I , LIT LUX, NL, RUS, SLK,SE, CH,UKR	To be decided
ENEN-SUTB-CENS Course on Nuclear Safety of WWER Bratislava, May 2-6, 2005	10 (1 student)	B, BUL, HUN, SLK, SLO, SE	To be decided

Table 3. Topical Training Courses for Professionals and Students [3]

5.4 Quality Assurance Committee (QAC)

The Quality Assurance Committee develops and implements QA processes to be applied in the design and delivery of education and training courses by the ENEN members. It collects information about rules and practices such as selection, training and certification of teachers and proposes a scheme for their harmonisation. The QAC evaluates and monitors the quality of current and newly proposed members of the ENEN Association according to set of agreed criteria. Following the recommendations issued by the QAC, the Board of Governors proposes new membership applications to the General Assembly. The QAC further evaluates courses and awards the International ENEN Course label, in collaboration with the ENEN TAAC.

5.5 Knowledge Management Committee (KMC)

The Knowledge Management Committee identifies and monitors deficiencies in scientific knowledge relevant to nuclear technology and safety. It prepares, maintains and implements an action plan by academia in order to preserve valuable scientific knowledge. The KMC ensures efficient use of ICT for the dissemination of knowledge, for supporting teaching and learning, and for accessing and maintaining databases. It provides access to simulators and specialized software. It further publishes books, and produces CDs and DVDs of interest to ENEN members. The KMC has the task to integrate the current different web sites and to operate them as a single ENEN web site and communication system.

An important achievement made within the 6th Framework NEPTUNO project is the NEPTUNO communication system currently operated by the University of Stuttgart under <http://www.neptuno-cs.de>. It is in full operation since August 2004 and provides the platform for a common knowledge base for nuclear fission. It merges classical database driven information systems with role-based research and education functionalities to a common knowledge system. The system is constructed on a framework that uses a LEGO like approach to build web-based knowledge and communication systems for research and training using basic system components. The basic system components are currently customized to the NEPTUNO needs. Each component can be programmed to have access to other components, for example an on-line course can be supported by a simulation package. The system should also provide basic support for communication in the nuclear community like addresses, data bases, technologies, E-learning platforms, etc.

One of the components is a well-documented database on nuclear courses and training sessions. In total more than 700 courses collected from various sources and datasheets are arranged in 4 groups - education, training, education and training, others – and in 14 categories covering different nuclear disciplines. In a restricted area of the system, the courses are submitted for confirmation to the organizing institutions, after which they will be released to the public pages of the system as approved courses. Until now about 200 courses have been approved in this way. The access to the communication system is designed to allow for different users a role- dependent view on a common data base. Views on the database are optimized to respond to the needs of the role, which can be a teacher, a student, a scientist, etc. In this way the knowledge can be more easily managed, preserved and updated. The information is kept in one place with different access methods depending on the goal to be achieved and presented to different users in their different roles in a consistent way.

The communication system intends to support different aspects of Knowledge Management and in particular:

Production of Knowledge

- Provide forms for information input e.g. related to nuclear courses, experimental facilities, knowledge centers, etc.
- Provide tools to store, update, select and visualize documents, reports, tables, presentations, videos, media, etc.
- Accept existing databases for reformatting and reuse of data

Dissemination of Knowledge

- Provide basic tools to support net-based seminars and master theses
- Provide commented hyperlinks to pages in nuclear education and training
- Provide role-based views and access to the content of the system
- Provide reports on selected nuclear applications and fields (e.g. nuclear safety)

Exploitation of Knowledge

- Provide optimized role-based view on the content of the system
- Provide methods to analyze the stored information
- Provide access to consistent and updated information
- Put information into context of specific roles and applications
- Allows to combine information from different sources

6. Perspectives for the ENEN Association

Barely two years after being founded, the ENEN Association has completed a variety of tasks and delivered appreciated products to the European Higher Education and the European Research Areas, as described in the previous paragraphs. The financial support from the EC provided through the NEPTUNO project has been a substantial contribution to reach those achievements. Although the present working field of the ENEN Association started with, and was limited to academic nuclear engineering education, the Association intends to expand and integrate its activities into nuclear disciplines outside nuclear engineering, such as radioprotection, radiochemistry and waste management. The Association also wishes to expand its activities from the academic and research environment into the industrial and regulatory fields and attract the membership of industrial partners and regulatory bodies. Moving out from basic and advanced academic education, the Association intends to define and harmonize for professional training programmes directed to key functions in nuclear industries, regulatory bodies and nuclear applications, and promote their international mutual recognition. The ENEN association further intends to continue its participation to EC framework projects, in particular in the European Higher Education and European Research Areas. Finally, the ENEN Association will strengthen its cooperation with the World Nuclear University and the regional nuclear education networks in Asia, North America and elsewhere, and continue to promote and support their activities. It will be up to the ENEN Association, its structural bodies, committees and their members to take up this challenging programme, which will significantly contribute to the management of nuclear knowledge within the European Union as well as on a world-wide level.

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References

- [1] "How to Maintain Nuclear Competence in Europe", A Reflection Paper prepared in 2000 by the CCE-FISSION Working Group on Nuclear Education, Training and Competence, EUR-19787, Brussels 2001.
- [2] "Nuclear Education and Training: Cause for Concern?" OECD / Nuclear Energy Agency, ISBN 92-64-18521-6, OECD Publishing
- [3] Abbreviations for non-European Countries taken from IAEA member state list at http://www-tc.iaea.org/tcweb/abouttc/terminology/Country_codes.pdf

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