
ENEN ASSOCIATION AND ITS ROLE IN STRENGTHENING NUCLEAR EDUCATION AND TRAINING

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Abstract

European Nuclear Education Network (ENEN) Association is a non-profit organization which aims at preservation of education, skills, and expertise in the field of nuclear engineering. In order to suppress the decline of the number of experts working in this field, a harmonized approach, including education and training, is looked for. In the following, the organizational structure of the ENEN Association, its role and particular achievements are described using selected examples. Future perspectives are also outlined.

1. ENEN Association

European Nuclear Education Network (ENEN) Association was established in 2003 as a non-profit-making association pursuing the preservation and the further development of higher nuclear education and expertise. There are effective and associated members. The effective members are academic institutions and research centres providing high-level scientific education in nuclear field. The associated members have a firmly established tradition of relation with members in the field of nuclear education, research, and training. They commit themselves to support the ENEN Association.

The main objectives of ENEN Association comprise the following activities:

- 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.

The ENEN Association was established as a result of the fifth European Framework Programme (5FP) project entitled European Nuclear Education Network. It 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. 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 to fulfil obligations resulting from commitments made by the ENEN Association. The following committees work within the ENEN Association.

The Teaching and Academic Affairs Committee (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.

The Advanced Courses and Research Committee (AC&RC) 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 and PhD theses. AC&RC also encourages and supports student mobility. It defines designs and organizes advanced courses for students, PhD candidates and young professionals.

The Training and Industrial Projects Committee (T&IPC) 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 Quality Assurance Committee (QAC) develops and implements quality assurance 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.

The Knowledge Management Committee (KMC) 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 aims at publishing textbooks, and producing multimedia presentations of interest to ENEN members as well as to general public. 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.

Currently, the ENEN Association has 41 members from 18 countries, consisting of 35 universities and 6 research centres, of which 26 are Effective Members and 15 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, the training programmes and courses are well attended by young professionals from nuclear industries.

2. Achievements in Education & Training

The educational networking activities which have started within the 5FP were further deepened and also extended towards training of professionals in the scope of the 6FP project NEPTUNO (Nuclear European Platform for Training and University Organisations). This project has brought together all aspects of European education and training in nuclear engineering, nuclear safety, and other nuclear disciplines. Its main objectives were to ensure that the courses in nuclear education offered by European universities are high quality and compatible with the Bologna declaration and to harmonise professional training and accreditation schemes in the sector. Along with educational courses, several training courses were also introduced. The Training Course on Nuclear Safety and/or Nuclear Safety for Subcontractors can be cited as examples of training courses with international participation. The project has delivered an operational network of institutions for academic education in nuclear studies at the master, doctoral, and post-doctoral level that is complemented with research organisations, regulatory bodies, and industrial partners supporting research and development, bench-training and continuing professional learning schemes.

To demonstrate the feasibility of European nuclear engineering educational schemes, several educational courses were established. In order to offer master students, PhD students and professionals the possibility to take advantage of the nuclear engineering expertise present in Europe, the ENEN Association fosters international exchange courses, where the different ENEN members offer courses in their field of expertise while making use of the unique experimental and training nuclear infrastructure throughout Europe. These courses can be used to fulfil the EMSNE requirements. The courses on Nuclear Thermal Hydraulics and Nuclear Reactor Theory, organised within the Belgian post-graduate programme on nuclear engineering, are organized in a highly modular way and taught in English to facilitate and enhance participation of European students. The Eugene Wigner Course for Reactor Physics Experiments is another example of international networking. It is a three-week course with a high involvement of practical exercises organized by four European universities for master and postgraduate students from European as well as non-European countries.

Based upon a mutual recognition as well as an intensive exchange of views between the ENEN partners, consisting of a representative cross-section of nuclear academic institutions and research laboratories of the EU-27, a coherent and practicable concept for a European Master of Science in Nuclear Engineering (EMSNE) has emerged. This concept is compatible with the Bologna philosophy of higher education for academic engineers in Europe. The students register in one ENEN-accredited institution and acquire the required credits in ENEN-institutions of their choice. After obtaining the formal degree of Master of Science in Nuclear Engineering from their home institution, the ENEN, on behalf of its members, grants the quality label European Master of Science in Nuclear Engineering. The first series of EMSNE certificates has been awarded to three students (two from France, one from Romania) in a ceremony on December 12, 2005.

2.1 Eugene Wigner Course for Reactor Physics Experiments

As an example of an effective collaboration in education and training, we describe one particular course – “Eugene Wigner Training Course on Reactor Physics Experiments”. Initiated by the ENEN project and as a demonstration of international cooperation in the field of nuclear education, four ENEN Association institutions including Budapest University of Technology and Economics (Hungary), Czech Technical University in Prague (Czech Republic), Atominstitut der Österreichischen Universitäten in Vienna (Austria), and Slovak University of Technology in Bratislava (Slovakia) decided in early 2003 to carry out a common demonstration course on reactor physics and kinetics at three different research- and training reactors in three different locations (Vienna, Prague, Budapest). The experimental

work was preceded by theoretical lectures held in Bratislava, Slovakia aiming to prepare the students for the experiments. In addition, a technical tour to an operating nuclear power plant was also organized. Since then, the course was organized already four times (in 2003, 2004, 2005, and 2006). So far 58 individuals from 13 countries have participated at the course.

Because four different institutions (universities) are involved in the organization of the Wigner course, an attention is given to the fact that there is no overlapping between the course content at the different locations. As the three involved reactors differ strongly in their technical design and in their special features, the participants receive an excellent technical overview during this educational program. For each reactor station, a training and exercise program was established which was compacted in such a way that the trainees would perform around 4 experiments at each location in 2,5 days and prepare protocols.

It should be emphasized that the E. Wigner Course on Reactor Physics Experiments is unique in a sense that it provides access to experimental nuclear facilities comprising practical exercises on research nuclear reactors as well as an excursion to an operating nuclear power plant in four European countries. As such, it strengthens the European dimension in nuclear education which is actually twofold: (i) The course takes place in four European capitals and it is supervised by experts from these countries and, at the same time (ii) the participants are working in international groups which, as a rule, are not formed from students coming from the same country. So the trainees are experiencing working conditions in an international team in foreign institutions for the whole duration of the course.

For these reasons, the course is very attractive because it enables not only to acquire new knowledge and skills but also to share one's experience with colleagues from other countries. On the other hand, particularities of this course which is jointly organized by four universities from four countries with direct involvement of nuclear experimental facilities makes it very demanding from the financial as well as organizational point of view. Even though the feasibility of such a course was successfully demonstrated, the self-sustained financial model puts some constraints to the participation mainly due to lack of financial sources at some universities. To improve this situation as well as to enable lowering of the participation fee an external support of e.g. running reactor costs would be of a great help. Dedicated grants from EU funds, leading industrial companies, WNU or other sources should be considered. Otherwise this useful activity would be in threat. In this respect, a continuous support of the IAEA is to be mentioned and it is gratefully appreciated.

The participation is opened to students (master course, PhD) as well as to young professionals working in nuclear field, however, basic knowledge of reactor physics theory is requested, and this knowledge has to be attested by a professor of the student's home university. As the number of participants is limited the application is a subject to selection procedure. The quality control and accreditation of ENEN assures that the acquired knowledge of the participants will fulfil the requirements of the European Nuclear Education and fits in the European ECTS system.

3. Future Perspectives

The expertise of the ENEN Association in harmonization of European education and training schemes in the field of nuclear engineering has led to an application for another 6FP project entitled "Consolidation of European Nuclear Education, Training and Knowledge Management" under the acronym ENEN-II. The project was approved and runs under the coordination of the ENEN Association since October 2006. This Coordination Action consolidates and expands the achievements of the ENEN and the NEPTUNO projects attained by the ENEN Association in respectively the 5th and 6th framework programme. The ENEN-II project is aiming at developing ENEN Association in a sustainable way in the areas of nuclear engineering, radioprotection and radwaste management, including underground

disposal. Nuclear education and training networks will be developed at the national level to provide a solid basis for networking at the European dimension.

The ENEN Association has completed a variety of tasks and delivered appreciated products to the European Higher Education and the European Research Areas. The financial support from the EC provided through framework programme projects 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. In doing so, a participation and active contribution from both effective and associated members is inevitable in order to improve the impact of the Association's activities. For example, during organization of exchange (educational and/or training) courses a variety of criteria should be considered. Surely one of the most decisive is the local support. Experience and skills of the (local) organizers directly affects the outcomes of the course. Together with available infrastructure, timing, availability of lecturers and instructors an attractive course program can be proposed.

Nevertheless, practical organization depends also on another important aspect which is financing. Especially for educational courses, the participants of which are mostly from academic environment (universities, research institutes, etc.), the overall expenses should be cautiously calculated. Better situation seems to be for trainings where the majority of participants comes from industry. According to the experience gained over the last four years, close involvement of associated members (mainly from industry) and their financial support might substantially help in practical organization of such educational/training activities. On the other hand, it is understood that the number of courses as well as their contents should be carefully considered to meet the overall needs to the highest possible extent. In this respect, especially trainings are often intentionally targeted to rather narrow and specific needs.

Another practical aspect turned out to be the number of participants. Not only from the point of view of their mobility which demands time coordination. Also from the viewpoint of effective transfer of knowledge and skills, the number of persons in a working group should be optimized. Not always high number of participants ensures an effective performance of the course even though financial conditions are strongly in favour of ample participation. The latter has direct consequences towards preparation of teaching materials (textbooks, handouts, etc.). Even though they can be in principle disseminated via internet (web pages of the Association), question related to free distribution of teaching (and/or training) materials must be decided first. All of these practical issues of organization form a sort of know-how which has led to a preparation of a tool kit for best practises.

Based on the above and taking into consideration practical aspects of education and training, 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.

4. Conclusion

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. In particular, education and training courses have been developed and offered to materialise the core curricula and optional fields of study in a European exchange structure. Pilot editions of those courses and try-outs of training programmes have been successfully organised with a satisfying interest, attendance and performance by the students and the support of nuclear industries and international organisations. The involvement of ENEN in the 6th EC Framework project EUROTRANS will further enlarge its field of activities into a realm of nuclear disciplines. The ENEN Association further contributes to the management of nuclear knowledge within the European Union as well as on a world-wide level, through contacts with its sister Network ANENT in Asia, and by its participation to activities of the World Nuclear University.

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