

Nuclear Education and Training in Response to Industry and Regulatory Needs through the European Nuclear Education Network Association

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ABSTRACT

The temporary network, established through the European 5th Framework Programme project ENEN, was given a more permanent character by the foundation of the European Nuclear Education Network Association, a non-profit-making association according to the French law of 1901, pursuing a pedagogic and scientific aim. Its main objective is the preservation and the further development of higher nuclear education and expertise. This objective is realized through the co-operation between European universities, involved in education and research in nuclear disciplines, nuclear research centres and nuclear industry. The paper briefly describes the history and structure of the ENEN Association and elaborates on the objectives and activities of its five committees during the first four years of operation. 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 cooperation with the industry, regulatory bodies and national nuclear waste agencies in the ENEN-II project, higher education curricula are being developed and harmonised at the European level for radiation protection, radiochemistry, radioecology and underground nuclear waste disposal. 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 good interest and attendance of students, nuclear industries, regulatory bodies and international organisations. The involvement of ENEN in the 6th EC Framework project EUROTRANS, developing an accelerator driven neutron source for isotope transmutation, further expanded the ENEN activities to specialised courses for PhDs and post-doctoral researchers. The ENEN Association contributes to the management of nuclear knowledge within the European Union as well as on a world-wide level, through contacts with the ANENT Network in Asia, and by its participation to activities of the World Nuclear University.

1. INTRODUCTION

The temporary network, established through the European 5th Framework Programme project ENEN, was given a more permanent character by the foundation of the European Nuclear Education Network Association, a non-profit-making association according to the French law of 1901, pursuing a pedagogic and scientific aim. Its main objective is the preservation and the further development of higher nuclear education and expertise. This objective is realized through the co-operation between European universities, involved in education and research in nuclear disciplines, nuclear research centres and the nuclear industry. The paper briefly describes the history and structure of the ENEN Association and elaborates on the objectives and activities of its five committees during its first four years of operation. Supported by the 5th and 6th Framework Programme of the European Community, the ENEN Association developed the European Master of Science in Nuclear Engineering certificate, awarded to selected students. In particular, education and training courses have been developed and offered to materialise the core curricula and optional fields of study for nuclear degrees in a European exchange structure. Pilot editions of those courses and try-outs of training programmes have been successfully organised with the support of nuclear industries and

international organisations and satisfying interest, attendance and performance by the students.

2. ENEN 's STRUCTURE, MISSION and OBJECTIVES

The ENEN association is managed by a Board of Governors, elected by the General Assembly and the work is organised through the 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 ENEN Association has two kinds of members. All members should have a legal status in a European Union member state or candidate country. The Effective Members, essentially academia, provide high level scientific education in the nuclear field in combination with research work, and use selective admission criteria; the Associated Members, such as universities involved in nuclear research, nuclear research centers, industries, regulatory bodies, etc. 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.

- 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. ENEN's ACHIEVEMENTS from 2003 till 2007

ENEN has established and continues to monitor the equivalence of nuclear engineering education curricula at the ENEN member universities through its Teaching and Academic Affairs Committee (TAAC). 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. To promote this realisation, ENEN has established the certificate of European Master of Science in Nuclear Engineering (EMSNE). ENEN has designed an information leaflet to attract applications for this certificate and developed the bylaws and procedures for handling and selecting the candidates and for awarding the EMSNE certificate. The first series of EMSNE certificates have been awarded at the ENC2005 conference in Versailles, France, December 2005. A second series of certificates have been awarded at the International Youth Conference on Energy in Budapest, Hungary, June 2007.

ENEN 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 ENEN produced an information packages on established ENEN exchange courses, proposed exchange courses and master thesis projects at ENEN member institutions. All information on those courses is posted on the ENEN Web site <http://www.enen-assoc.org>. In cooperation with the ENEN Quality Assurance Committee (QAC), the TAAC awards an International ENEN Course Quality label. Other products of ENEN related to the exchange courses are available on the web site of the 6th Framework project NEPTUNO at <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.

A typical example is the Eugene Wigner course, a three weeks course on nuclear reactor physics including theory lectures and practical exercises at three different reactors, which has been organised four times since 2003 by a group of universities and research centres in central Europe, addressing nuclear engineers and young professionals.

The Advanced Courses and Research Committee (AC&RC) ensures the link between the ENEN academic members and research centres in the European Community. It establishes exchanges with other networks and, through developing 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 in this respect. AC&RC also designs and organizes advanced courses for students, PhD candidates and young professionals. In this context, ENEN is, among others, in charge of the organization of 10 advanced training courses for PhD students in the framework of the Integrated Project EUROTRANS. EUROTRANS is a major project in the 6th EU Framework Programme which develops a concept of transmutation of long-lived higher actinides in nuclear waste into short-lived products by accelerator irradiation. Five courses have been organized on respectively the general aspects of transmutation concepts, nuclear data of relevance to transmutation, accelerator thermal hydraulics, accelerator and beam line design, and advanced nuclear fuels.

4. EXTENSION to OTHER NUCLEAR DISCIPLINES

After founding of the European Nuclear Education Network Association as an outcome of the FP 5 ENEN project and the development of ENEN products (EMSNE certificate, exchange courses, databases, E-learning concepts, communication systems, visibility, etc.) under the FP 6 NEPTUNO project, it was found appropriate to expand the ENEN scope from the nuclear engineering field into other nuclear disciplines, such as radioprotection, radiochemistry and waste management. The ENEN Association also wishes to expand its activities from the academic and research environment into the industrial and regulatory fields and strengthen the membership of industrial partners and regulatory bodies. Moving out from basic and advanced academic education, the ENEN Association intends to define and harmonize 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. A follow-up project with the title "Consolidation of European Nuclear Education, Training and Knowledge Management" under the name of ENEN-II was designed and submitted to the last call of the EC 6th framework programme, and accepted. This Coordination Action involves 25 ENEN members and 16 European partners in the fields of radioprotection, radiochemistry, radioecology and waste management and disposal. The project will consolidate, expand and extend the achievements of the ENEN and the NEPTUNO projects.

5. CONSOLIDATION of EUROPEAN NUCLEAR EDUCATION, TRAINING and KNOWLEDGE MANAGEMENT – THE ENEN-II PROJECT

The European Nuclear Education Network Association (ENEN) is currently coordinating a project named ENEN-II, funded by the European Union, with the purpose to consolidate the results and

achievements obtained by the ENEN Association and its partners during the former “ENEN” (2002-2003) and the “NEPTUNO” (2004-2005) projects. Those former projects focused on the harmonization of academic curricula of nuclear engineering and fostered mutual recognition of curricula and courses by academic institutions across national boundaries. In addition those projects explored and developed schemes and modalities for student and teacher mobility. The ENEN-II project expands the ENEN Association’s activities into other disciplines such as radiation protection, radiochemistry, radioecology and geological disposal of radioactive waste, attracting thereby universities and faculties active in those fields. The ENEN-II project also extends the scope of activities from academic education towards professional training. It further strengthens the cooperation with industries and regulatory bodies, with other networks for nuclear education and training, such as the Asian Network for Education in Nuclear Technology, and with the World Nuclear University.

The ENEN-II project is structured around five main Work Packages (Fig. 2) to be carried out by consortium composed by three groups of partners. The first group consists of 14 universities and 3 research institutes, members of the ENEN Association, of which the majority did contribute to the past FP-5 “ENEN” and FP-6 “NEPTUNO” projects. The second group is composed of 6 universities and 2 research organizations with an international reputation in radiation protection, analytical radiochemistry and radioecology. The third group is composed of 9 universities with a main interest in education and research on management, underground storage and geological disposal of radioactive waste and 6 organizations involved in research and management of radioactive waste.

The major objectives of the project are the development of Master curricula in different nuclear disciplines, their mutual recognition throughout the European Higher Education Area, and the testing of education and training modules in pilot sessions. Continuing on the developments of the NEPTUNO project, teacher and student mobility schemes will be further implemented and optimized.

Three keywords “Consolidate, Extend, Expand” represent the activities of the ENEN-II project.

“Consolidate” by implementing the education and training modules proposed and developed in the past few years and tested during the pilot sessions. “Consolidate” by applying the course evaluation criteria to the actual course and training performance, taking into account feedback from the participants and their companies, the end users and other stakeholders. “Consolidate” by combining and organizing scattered web sites, data bases and course information in a well-designed and accessible communication and knowledge management system including the NEPTUNO communication system www.neptuno-cs.de. “Consolidate” by testing in practice, and in collaboration with accreditation authorities, the developed mutual recognition schemes for academic education in nuclear disciplines.

“Extend” by moving outside the academic education area into professional and even vocational training, thereby strengthening the interactions and collaboration of universities, research centers, training organizations and industries to make training offers respond to industry needs and enhance mutual recognition of professional qualifications across European countries. “Extend” to make a better use of and facilitate the access to EU tools to increase mobility of students and professors in nuclear disciplines.

“Extend” by strengthening the links with nuclear education and training networks outside Europe, the World Nuclear University, and by developing a viable Erasmus scheme for Master of Science in Nuclear Engineering within the ENEN Association.

“Expand” by moving beyond the disciplines related to nuclear engineering for power plant design, construction and operation, into a broader area including nuclear engineering and other disciplines in support of reactor safety, radiation protection, radioactive waste management, radiochemistry, decommissioning, and industrial applications of nuclear technologies. “Expand” by addressing the needs for education, training and skills development expressed by other groups of End Users. Of particular concern to the industry and to regulatory authorities, and to the EU Commission, are the deficits at masters and doctorate levels within nuclear radiological protection, radioecology and radiochemistry. It is contended that skills in these areas are of strategic, as well as immediate, importance for the maintenance of European nuclear operations and options within the EU economy.

The 56 project deliverables produced by the seven Work Packages can be grouped into four groups as shown in the table below. About half of the deliverables are topical and progress reports on coordination activities. One fourth of the deliverables consists of pilot and demonstration sessions of new courses and training packages, one fifth are new developed concepts and five reports are dealing with quality assurance of the products and deliverables of the project. Finally four reports are dealing with the project and resources management.

Due to the nature and scope of the ENEN-II project, the exploitation of its results affects virtually and effectively the whole European “nuclear” community. The project impact is in this respect huge. As for the NEPTUNO project in the past, the European universities, the students in nuclear fields, the nuclear professionals, training centres, nuclear operators, regulators and research institutions in each country, and the related international organisations are the potential customers and beneficiaries of the project achievements.

The practical implementation of the project outcomes will result in the consolidation of a sustainable European Area of Higher Education and Training covering nuclear engineering, nuclear safety, radiation protection, analytical radiochemistry, radioecology, and radioactive waste management and disposal. It will contribute to the preservation of the nuclear knowledge in Europe and make it more accessible. It will facilitate the mobility of individuals, as well students as professionals, and enhance the mutual recognition of their diplomas and qualifications across the European Union. Through the mechanisms implemented within the project, it will be possible to achieve European certifications of an educational type, such as for the European Master of Science and for advanced courses on a variety of nuclear disciplines, and for the professional type, like training programmes or post-graduate courses to be imparted and recognized anywhere in Europe.

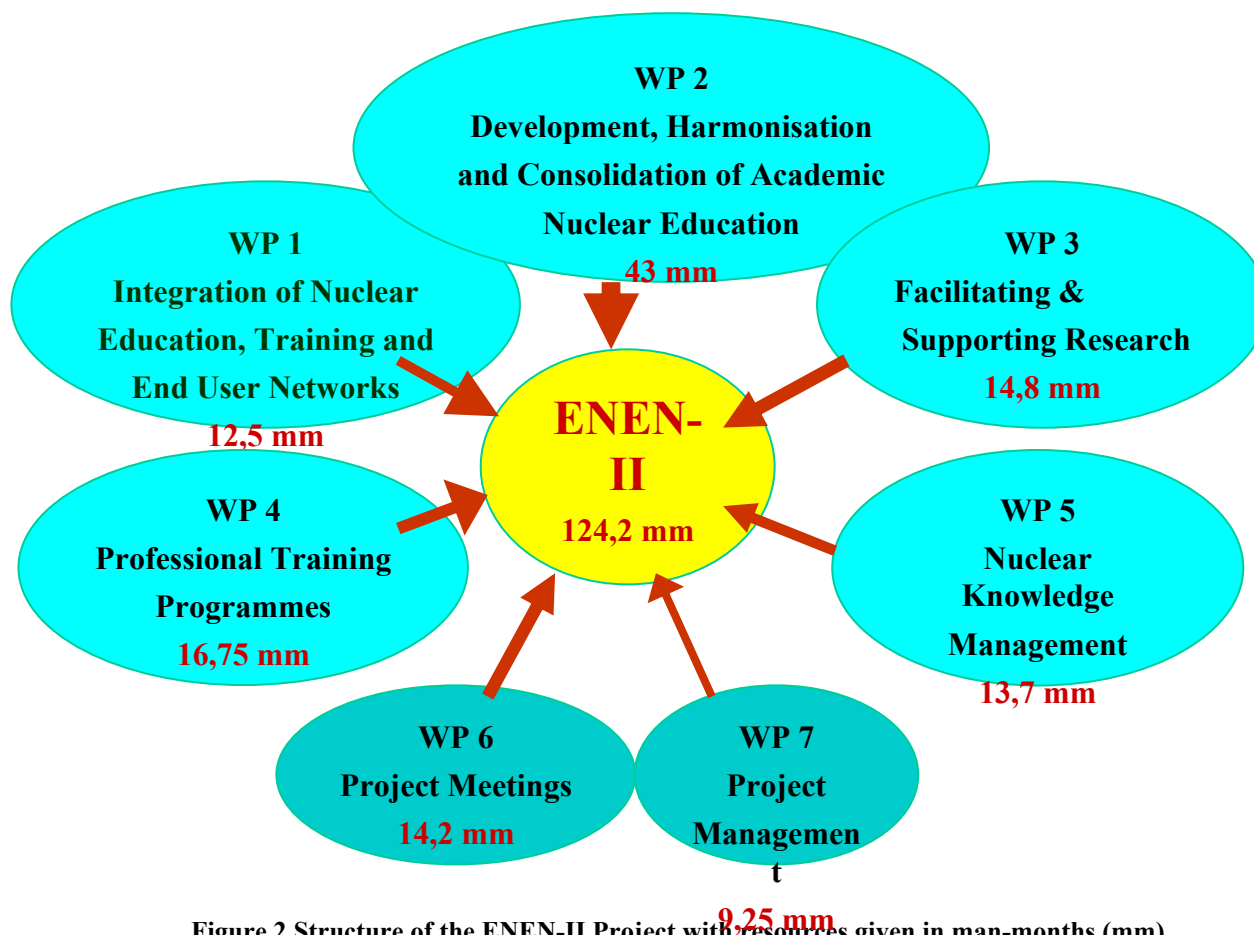


Figure 2 Structure of the ENEN-II Project with resources given in man-months (mm)

Table I ENEN-II Project Deliverables

	Communication and Reports	New Concepts	Pilot & Demo Sessions	Quality Assurance
WP 1 Networking	5	1		
WP 2 Academic Education	9	6	2	2
WP 3 Support Research	1	1	5	1
WP 4 Training Professionals	2		4	1
WP 5 Knowledge Management	1	3	2	1
WP 6 Meetings	5	1		
WP 7 Project Management	4			
Totals	27	11	13	5

6. FUTURE PERSPECTIVES and CONCLUSION

The ENEN Association will develop a higher level of networking with nuclear related organisations and industries at the European level, in particular within the nuclear disciplines of engineering, radiation protection, radioactive waste management and decommissioning. The network will include the academic institutions, the training organisations and the end-user associations. This will enhance the adjustment of curricula and training packages to the end-user needs, thereby improving the employment and career opportunities, and the qualifications of the young professionals.

At the world-wide and intercontinental level, networking will enhance opportunities for European teachers and professionals to disseminate their expertise and produce added value by exporting outside Europe the leading position of the European Union in nuclear power plant construction and other nuclear applications.

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. The ENEN Association, its structural bodies and working committees and their members endeavour to implement this challenging programme, which will significantly contribute to the development of higher nuclear education and expertise within the European Union as well as on a world-wide level.

7. REFERENCES

- [1] SAFIEH J., DE REGGE P., (2006) "NEPTUNO, the Nuclear European Platform of Training and University Organisations", FISA 2006, EU Research and Training in Reactor Systems, Proceedings EUR 21231, 13-16 March 2006, Luxembourg, pp 399-412
- [2] BLOMGREN J., MOONS F., DE REGGE P., SAFIEH J., (2007), "European Nuclear Education Network Association", Atomic Strategy 21 (in Russian), February 2007, pp. 26-27
- [3] DE REGGE P., (2005) 'The role of the European Nuclear Education Network Association in the academic and industrial environment', ETRAP, 3rd International conference on Education and Training in Radiological Protection, 23-25 November 2005, Brussels, Belgium
- [4] MOONS F., (2005) 'BNEN: The Belgian Nuclear Higher Education Network. Your way to the European Master of Nuclear Engineering', ETRAP, 3rd International conference on Education and Training in Radiological Protection, 23-25 November 2005, Brussels, Belgium
- [5] SAFIEH J. (2007) 'Networking in Nuclear Education in EU 25', ANS Conference on Nuclear Education and Training CONTE, February 2007