



Grant Agreement Number: 661910

H2020 – NFRP-2014-2015

ANNETTE PROJECT

Advanced Networking for Nuclear Education and Training and Transfer of Expertise

DELIVERABLE D 1.6

European certifications for E&T and VET in relevant nuclear domains

Nature of the deliverable		
R	Report	X
P	Prototype	
D	Demonstration	
O	Other	

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Date of issue: 30/09/2019

3rd Reporting Period

Start date of project: **01/02/2016**

Duration: **48 Months**

Project co-funded by the European Commission under the Euratom Research and Training Programme on Nuclear Energy within the H2020 Programme, Call NFRP 2014-2015		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the partners of the ANNETTE project	
CO	Confidential, only for partners of the ANNETTE project	

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DELIVERABLE D1.6

1/48

Dissemination level: PU

Date of issue of this report: **15/11/2019**

DISTRIBUTION LIST

Name	Number of copies	Comments
European Commission	Electronic copy via email	
All Partners	Electronic copy via website	

Scope	ANNETTE / WP1	Version:	1
Type/No.	Deliverable Report 1.6	Total pages	48
Title:	European certifications for E&T and VET in relevant nuclear domains	Chapters:	6
Access:	Public	Annexes	2
Filename:	D1.6 European certifications for E&T and VET.pdf	Suppl. pages:	0
Internet	http://www.enen.eu/en/projects/annette.html		

RESPONSIBLE BENEFICIARY: ENEN Association

DOCUMENT TRACKING

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ABSTRACT

This report summarises the activities made in the frame of Task 1.4 of the ANNETTE Project, devoted to analyse the impact of certifications in the nuclear fields to be released by ENEN. During the process of the work, the main effort was assigned to analysing the effectiveness of the EMSNE certification, with CIRTEN releasing a full report on the subject. The planned contacts with Stakeholders were mainly focused on the certifications to be released for the “master” courses, since a parallel work on future certifications on Nuclear Disciplines is being made in the frame of the ENEN+ project. CIRTEN (University of Pisa) and SCK•CEN accepted to write this report initially assigned to the Universitat Politècnica de Catalunya (UPC), because of problems causing the unavailability of the latter to perform the job.

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Dissemination level: PU

Date of issue of this report: **30/09/2019**

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LIST OF ABBREVIATIONS

ANNETTE	Advanced Networking for Nuclear Education and Training and Transfer of Expertise
CPD	Continuous Professional Development
EFTS	European Fission Training Scheme
EMP	European Master Programme
EMSND	European Master in Nuclear Disciplines
EMSNE	European Master of Science in Nuclear Engineering
ENEN	European Nuclear Education Network Association
ECVET	European Credit System for Vocational Education and Training
E&T	Education and Training
VET	Vocational Education and Training
WP	Work Package

1 INTRODUCTION

The European Master of Science in Nuclear Engineering (EMSNE) certification (<http://www.enen.eu/en/emsne/information.html>), developed in the frame of a European project led by ENEN, represents today the paradigm of a certification released by a supranational entity (ENEN) attempting to create **harmonisation** by **mutual recognition**.

An interesting account of the process that led to issuing the certification is proposed by Prof. William D'haeseleer in the collective paper written to celebrate the 10th Anniversary of the ENEN Association [1]. In that account, the difficulties encountered in proposing a specific path for getting a “European” Nuclear Engineering Degree, i.e., to be recognised in the different Universities throughout Europe, is described; this led to a compromise solution that, almost 15 years later, can be qualified as a very successful paradigm.

Also considering the mentioned account, elaborating on the present value of the EMSNE certification the following reflections are proposed.

- In a European Union made of sovereign Member States in search for a better economic and cultural closeness, it is presently still impossible to propose a unique curriculum for any kind of study legally binding at University level.
- The process of European harmonisation of practices in higher education can be traced back to the birth of the European Higher Education Area (EHEA) with the “Sorbonne declaration” in 1998 [2], one year later (1999) approved at a wider level (29 European Countries) by the “Bologna declaration” [3]. This process led to the present implementation of the three levels of higher education (BSc, MSc and PhD), in which mutual recognition is based on the European Credit Transfer System (ECTS).
- In this situation, University curricula aiming at setting a standard throughout Europe in any discipline needs to be proposed at a supranational level, at least in a first instance, to get consensus and stimulate harmonisation by mutual recognition.
- In other words, the standard should be proposed by a sufficiently qualified supranational organisation (as ENEN is nowadays) and should be based on **consensus** and **trust** from relevant stakeholders in the field.
- In this respect, the EMSNE certification satisfies the criterion to be proposed by a supranational entity and to spring out of consensus among the Universities who are members of the Association. Attempts to present this concept elaborated in an academic environment to other Stakeholders were made long time ago. However, these attempts collided with different perspectives, which appear a bit short-sighted, mostly related to a view of nuclear engineering education relying on whatever kind of specialised engineer to be nuclearized simply by an on-the-job training.
- The latter view, seemingly springing from economical convenience, is not considered adequate for a long term educational offer that has to assure a good “nuclear safety culture”, needing a specific process of education starting from University desks. The period of University studies, in fact, is one when young people are specifically devoted to study and absorb knowledge, skills and attitudes that will lead their actions during their working life on the long term.
- The meaning and the advantage of issuing “European” certifications as proposed with the EMSNE one is that, once established, **they represent “pilot” cases, proposed by qualified**

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operators in the field under the aegis of a supranational entity. As such, they can be proposed in the future for setting standards at European level, whenever agreements at Government level will be feasible.

- In summary, **these certifications, mainly based on consensus, aim to pave the way for possible future implementations at the level of European directives** to be received and enforced in the Member States of the Union, **while, in the meantime, they drive the efforts in the field towards agreed objectives.**

This introduction was necessary to clarify, beyond any possible misunderstanding, why a certification set up by ENEN, at University level and beyond, is “per se” of great value. Harmonisation by mutual recognition of the University studies and also of Training practices is a key step in view of setting recognised standards at European level.

Concerning the scope of the present report, the subjects that are dealt with concern ENEN certifications and PhD events, being the target of the actions in Task 1.4. In particular, the EMSNE certification will be firstly considered and the possible extension of the concept to other disciplines (an old idea within ENEN) will be considered, also in view of a parallel work made in the frame of the presently running ENEN+ project. Then, a discussion of Stakeholders’ views in relation to certification will be presented mostly in relation to the master certification proposed in the frame of WP2; these views, which favour the release of certifications by ENEN as a supranational entity, represent a strong incentive for the Association to progress in this line. By the way, the role of a supranational entity, needed also for the establishment of a structure of training coherent with the ECVET principles, was already observed several times in past events related to the application of ECVET principles in nuclear training and is one of the interesting conclusions reached in the progress of WP4 in ANNETTE.

2 THE EMSNE CERTIFICATION: STATUS AND PERSPECTIVES FOR AN EMSND

Within the ANNETTE Task 1.4, the non-uniformity observed in the geographical distribution of applicants of the European Master of Science in Nuclear Engineering (EMSNE) certification as well as the promotion of the certificate were analysed and reported in Milestone 1.6.1.

The milestone documentation by CIRTEN is fully reported in ANNEX I of this report; its full reading is recommended to understand the potential of the EMSNE certification and the challenges that need to be coped with in maintaining the good results obtained in the past years. Questionnaires were sent to ENEN members to understand the reasons of non-uniformities in the distribution of the certifications and the indications received were commented.

The main conclusions of this report are shortly summarized below.

- Though there is a considerably uneven distribution of certifications among Member States, with Italy, Spain, and France (in decreasing order) being the forerunners among the Home Institutions, it is noted a much wider distribution of Host Institutions. These include also non-academic Members of ENEN (e.g., research centres) that, having the potential of offering very attractive researches for MSc thesis, strongly contributed to grant the students stages suitable for the 20 ECTS “abroad” needed for the certification. So, the impression of uneven distribution coming from the records of the EMSNE Laureates is somehow balanced by this good receiving attitude of Members being often Host Institution.
- Some limitation in the spreading of the certification is inherent in the fact that the paradigm of EMSNE is specified in terms of good coverage of nuclear matters, proposing a standard that is not always matching with the local availability of taught subjects. Though the requirements are always defined in very bland terms, looking more to the substance than to the form, it cannot be denied that the role of EMSNE is also stimulating the single Universities to modify their curricula to adhere to the standard in order to let the students have the recognition.
- However, if the EMSNE cannot be granted to specific local curricula not very much oriented towards Nuclear Engineering, an extension of this certification also towards other nuclear domains is possible. Some of the questionnaires pointed out that the education of students is at some University still oriented to the nuclear field, but possibly not exactly to the classical education in nuclear engineering. The preparation of new certifications oriented to a **“European Master of Science in Nuclear Disciplines” (EMSND)**, in which the main envisaged nuclear domains are ‘nuclear engineering’ (current certificate), ‘waste management’, ‘radiation protection’ and ‘medical physics’, is one of the subjects dealt with in the ENEN+ project.

As a concrete outcome of the analysis made on the EMSNE certification, the report on EMSNE reported in ANNEX I has been suggested to the ENEN President and Secretariat for distribution with the yearly call for application to the EMSNE certification, in order to revive interest for the certification and trigger further discussions about its present challenges.

Moreover, as a further outcome of this analysis, suggestions are proposed in the next chapter as a feedback to the terms of reference for an EMSND Certification (ENEN + D2.10 [4]) proposing an approach similar to the one taken for EMSNE also for other nuclear disciplines.

3 EUROPEAN CERTIFICATIONS FOR E&T IN RELEVANT NUCLEAR DOMAINS

As described in the related by-laws, the EMSNE (European Master of Science in Nuclear Engineering) certificate is delivered by the ENEN Association, after a scrutiny of the applications by the Teaching and Academic Affair Committee (TAAC), with the endorsement of all its members through the General Assembly. As clarified in the previous chapter and in the report in ANNEX I, the EMSNE certification is an example of the certifications that ENEN may release, having the value of a 'quality label' to be provided upon satisfaction of the requirements established in its specific by-laws which are available at the site: <http://www.enen.eu/en/emsne/information.html#DD>.

In both the ANNETTE and ENEN + projects the extension of the EMSNE certification towards other nuclear domains (such as radiation protection, geological disposal and medical physics) is proposed. In particular, within ANNETTE an inquiry with Stakeholders about the possibility and usefulness of certifications by ENEN was planned. However, since a similar inquiry was made for the new certification proposed for the Master programme for Continuous Professional Development (CPD), this step was not repeated, to avoid decreasing the willingness of Stakeholders to answer repeated questions. The involvement of some of the Stakeholders and their willingness to be involved in inquiries, in fact, was found in some cases excellent, though in other cases it was perceived that repeated calls to answer were intruding with the schedule of people who are busy with many daily engagements.

In the ENEN+ deliverable D2.10 (confidential report, released by UPB in March 2018) [4] the terms of reference for a **European Master of Sciences in Nuclear Disciplines (EMSND)** are described. The document defines the objectives and the scope of the EMSND, outlines the responsibilities of the ENEN Association Board and provides a description of the resources and the mandatory conditions to be fulfilled. Within the ENEN+ project the main EMSND objective is to converge (in the following deliverable D2.12 'Proposals of by-laws for EMSND') towards a definition of the common core rules (by-laws) applicable for the different domains.

In deliverable D2.10 **different courses/topics for the core curriculum** of the domains 'nuclear engineering' and 'waste management' are suggested. In the framework of ANNETTE, this ENEN+ deliverable is further completed by suggesting topics for the course curriculum in the domains of 'radiation protection' and 'medical physics'. Therefore, ANNETTE project partners and stakeholders in these domains were requested to provide input (suggestions for topics) in their domain. As a result of the input of EFOMP (European Federation of Organisations for Medical Physics), SCK•CEN and INSTN the table with course topics of the ENEN + deliverable D2.10 could be completed.

Table 1. Suggested topics for the curriculum of the different nuclear domains (adapted from [4])

Nuclear Engineering Track	Waste Management Track
<ul style="list-style-type: none"> • Nuclear power plant technology & 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 	<ul style="list-style-type: none"> • Waste management • Radiochemistry • Environmental impact • Decommissioning • Nuclear fuel cycle • Radioecology and radiological protection • Geological disposal of radioactive waste etc. • Safety, security and safeguards • Radiation dosimetry and radiation biophysics
Radiation protection	Medical Physics
<ul style="list-style-type: none"> • Nuclear and radiation physics • Nuclear measurement techniques • Dosimetry • Radiochemistry • Radiobiology • Fundamental principles of radiation protection • Practical aspects of radiation protection • Legislation • Optimization, intervention and safety • Ethical aspect of the radiological risk 	<ul style="list-style-type: none"> • Interaction of ionizing radiation with matter • Diagnostic and interventional radiology • Radiation therapy • Nuclear medicine • Medical imaging with ionizing radiation (for all the three above sections) • Medical imaging with non-ionizing radiation • Radiation protection and safety in medical uses of ionizing radiation • Radiation dosimetry • Radiation biology for physicists • Statistics in medicine • Image processing – informatics • HIS, RIS, PACS, telemedicine and dose tracking • Monte Carlo simulation and modelling

An extensive promotion of the EMSND certificate within the ENEN Association and within the different nuclear domains seems necessary. Added values such as better opportunities of job placement (abroad) and cross border mobility must be highlighted.

Considering the report on the side of the ANNETTE project, it seems that the proposed Terms of Reference (TOR) satisfies the requirements for a sound writing of the related by-laws. The only possible suggestion coming from the views that stimulated the ANNETTE project is that the EMSND label should not substitute completely the EMSNE one, being a renowned brand name. The suggestion could be to propose labels like EMSNE (for engineering), EMSWM (for waste management), EMSRP (for radiation protection) and EMSMP (for medical physics), all to be mentioned under the common appellative of “variants” of the EMSND.

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Dissemination level: PU

Date of issue of this report: **15/11/2019**

4 EUROPEAN CERTIFICATION FOR THE MASTER FOR CPD

It must emphasized that the effort made within WP2 of ANNETTE was mainly focused on the proposal of courses which can be offered to professionals, researchers and PhD students **having already a MSc**. These professionals can allocate just a fraction of their time each year to acquire, refresh or deepen their competences in the nuclear fields covered by the offer starting with the ANNETTE Project.

Within WP2, it is proposed that **ENEN will release certifications for partial and full completion** of the European Master Programme (EMP) in support to continuous professional development. By-laws are proposed that define the rules and requirements upon the ENEN certification and they were recently included in the Deliverable D2.4 [5].

While the details of the motivations of this proposal are presented in various deliverables of WP2, it is here clarified why the proposal of having ENEN releasing the certification was selected among the different possible ones, upon suggestion by Stakeholders. A first suggestion that certifications for the master could be released by ENEN were initially found in the first inquiry in relation to the pilot course programme reported in Deliverable D2.1 [6]. In that case, a free comment suggested to avoid a real full master, focusing on a certification; since the only body capable to release that certification could be ENEN, this seemed to suggest that route in preference to others.

Nevertheless, after the Stakeholders' meeting held in teleconference on June 13 2017, which had only partial success due to a reduced participation of the invitees, a questionnaire in the form of a PowerPoint file was sent to the Stakeholders, inquiring on a number of aspects to be taken into account in setting up the master for CPD. One of these questions was related to the accreditation of the master by a circle of Universities and/or by ENEN:

Response from BelV



Response from Ansaldo Nucleare



Response from EHRO-N



Response from IAEA



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Response from JRC-G10

2. On ANNETTE vision

- **ANNETTE vision is realistic with one amendment**
 - * to achieve the conversion process of TP-disciplines oriented to TP-based on exit outcomes

3. On accreditation by universities and/or ENEN

- **Identification of the authority for courses & qualifications recognition**
 - * the identification of a respected body in charge of the strategic matter of official recognition of qualifications, units of learning outcomes (impacts the WoW) and modules/courses/TP (impacts the WoL) is necessary for E&T and nuclear labour market modernization
 - * JRC-G10 proposal: ENEN could be defined as the independent body, trusted by the nuclear stakeholders, for recognition of both:
 - a) qualifications, units of LOs or LO
 - b) training programmes/courses based on exit-outcomes (ECVET approach)



Response from Westinghouse

3. On Accreditation by Universities and/or ENEN: We would advocate for the issuance of certifications by ENEN. We would further advocate for discipline-specific certifications instead of (or at least in addition to) general, broad-based ENEN common certificates for professionals.

As it can be noted, all the six organisations that responded to the questionnaire (in different forms) declared to be in favour to the choice of ENEN as the accrediting body. The answer of JRC G-10, deeply involved in the implementation of the ECVET system in the nuclear fields, is particularly interesting, since the argument in support of the choice is exactly the already mentioned role of ENEN as the independent body, trusted by Stakeholders, for accreditation of LOs and training programmes as well.

It can be inferred that this small but representative set of the Stakeholders suggests ENEN as the supranational body that can propose and accredit certifications for CPD. If this holds for CPD, a fortiori, also owing to the experience with EMSNE, this will hold for the EMSND certifications which, being at a University level, fall in classical domain of the academic institutions, which was the first focus of the Association long ago.

5 JOINT PHD EVENTS

Proposals for a unified PhD event for the different nuclear sectors are described in Milestone 1.6.4, reported in ANNEX II and have been communicated to the ENEN+ project for due consideration for the future phase of possible implementation.

As it can be noted by reading the report in ANNEX II, the existing formats of the known PhD Events relevant for the nuclear fields differ for organisation, level of funding and scope. For instance, the PETRUS PhD Event is structured as a School of several days in which students may also learn from specialised presentations applicable to the sector; its cost is also relatively higher than that of the ENEN PhD event, structured more as a competition and prize a later one of a major conference.

A possible unified event is presently conceived as a compromise between the different schemes. Some aspects should be remarked:

- having a plurality of events (ENEN, PETRUS, NUGENIA, FuseNet), even understanding the specific needs of the different sectors, gives the impression of poor coordination, something against the purpose of advanced networking of the ANNETTE project;
- the funding of a possibly unified event could come from the same sources active now for the single events, favouring the interconnection between the different fields and, in particular, a useful cross-pollination of young researchers;
- whenever the format of the PETRUS PhD event would be considered the most appropriate (e.g., in a long term planning of Summer or Winter Schools including PhD events) a reduction of the costs for covering the travelling expenses of the lecturers could be considered by using e-learning techniques;
- a proposal could be made to NUGENIA as well as to other organisations addressing students (e.g., the European Nuclear Society and FORATOM) for concentrating financing over a single event;
- it can be finally envisaged also that the event(s) can be included as a permanent feature of some annual European Conference, concentrating financing, the presence of side events and sessions and the involvement into a major scientific event: all these aspects are believed to result very beneficial for inspiring PhD students in this early phase of their scientific career.

6 CONCLUSIONS

This report addressed the issues of the release of certifications at various levels by the ENEN Association and of the possible merging of existing PhD events.

It was shown that ENEN, also owing to the prior successful experience of the EMSNE certification, can safely believe to be qualified for releasing its own “informal” certifications as quality labels that may pave the way for future official European titles, whenever this will be possible via inter-Governmental agreements or European directives.

The extension of the EMSNE certification to other nuclear sectors is presently addressed also in the frame of the ENEN+ project, in whose frame Terms Of Reference (TOR) have been already produced, in view of proposing by-laws that will rule the release of a certification in Nuclear Disciplines.

It was also mentioned the endorsement received by ENEN in the frame of the ANNETTE project by some Stakeholders, who support the idea of ENEN as a supranational entity releasing European certifications with the meaning and limitations applicable to the one of the EMSNE. It is again remarked that the presence of such a supranational entity is of overwhelming importance for the establishment of an ECVET based system in the nuclear fields in Europe.

Finally, the perspectives for a unified PhD event, collecting the experience of the different presently proposed ones, were discussed, proposing suggestions for a similar action being carried on in the frame of the ENEN+ project.

REFERENCES

- [1] Walter Ambrosini and Founding Members of ENEN, Lessons learnt from 10 years of ENEN collaboration: from a knowledge to an end-user driven approach, Paper Presented at the FISA 2013 Conference, Post-FISA Workshop #2, 17 October 2013 - Vilnius, Lithuania (<http://www.enen.eu/en/about/the-10th-birthday-enen.html>)
- [2] Sorbonne Declaration
<http://www.ehea.info/cid100203/sorbonne-declaration-1998.html>
- [3] Bologna Declaration
<http://www.ehea.info/cid100210/ministerial-conference-bologna-1999.html>
- [4] Terms of reference for EMSND, ENEN+ D2.10, P. Ghitescu, March 2018
- [5] Walter Ambrosini, Rosa Lo Frano, Jarmo Ala-Heikkilä, Christian Schoenfelder and ANNETTE Course Providers, ANNETTE Project Deliverable 2.4, Implementation of the pilot courses, August 2019.
- [6] W. Ambrosini and P. Dieguez Porras, ANNETTE Project Deliverable 2.1, Specific needs for an advanced European Programme for CPD in the nuclear areas, June 2017
- [7] Walter Ambrosini, Rosa Lo Frano and Jarmo Ala-Heikkilä, ANNETTE Project Deliverable 2.2, Course Plan for the Advanced European Programme for CPD and the Summer School, November 2017.

ANNEX I - CIRTEN REPORT ON THE EMSNE CERTIFICATION

ANNETTE

DELIVERABLE D 1.6

15/48

Dissemination level: PU

Date of issue of this report: **15/11/2019**



CIRTEN

Consorzio Interuniversitario per la Ricerca TEcnologica Nucleare

**Analysis of the EMSNE Certification Records:
a short report in support to future actions**

Walter Ambrosini

Pisa, August 21st, 2018

CIRTEN Report No. MR/ANH2020/012018

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ANNETTE

DELIVERABLE D 1.6

16/48

Dissemination level: PU

Date of issue of this report: **15/11/2019**

ABSTRACT

This report summarises the available information coming from the records of the European Master of Science in Nuclear Engineering (EMSNE) laureates and from a limited number of answers received from ENEN Members in relation to its features and attractiveness.

The received indications, including the answers received from ENEN Members during the specific inquiry, point out different causes for the observed uneven distribution of the EMSNE Alumni throughout ENEN Members. It is anyway noted that, though a limited number of Institutions frequently send students abroad, a larger number of ENEN Members are involved in hosting them.

A proposal of actions in order to improve the success of the certification is advanced to be implemented in the frame of the ANNETTE and of the ENEN+ Project.

This document can be considered as an additional deliverable of ANNETTE issued to satisfy Milestone MS 1.6.1 and MS 1.6.3.

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1. INTRODUCTION

The present short report analyses and proposes lines of intervention for the observed problem of the uneven distribution of the population of the European Master of Science in Nuclear Engineering (EMSNE) Laureates across Europe. This study is performed as part of a task to be completed for the ANNETTE Project in the frame of its WP1 and is aimed at reviving interest in the certification among the ENEN Members and the Stakeholders.

The European Master of Science in Nuclear Engineering (EMSNE) certification is the result of efforts spent during the **EU NEPTUNO FP5 Project** (January 2004 -December 2005) to achieve mutual recognition of curricula in Nuclear Engineering throughout Europe, by proposing a paradigm for harmonising the different traditions existing in different Member States in the nuclear engineering field. As such, the EMSNE certification intends to encourage the different Universities being members of ENEN to have closer relations, making possible the cross-border mobility of students for attending courses or performing MSc thesis works. The EMSNE is an example of the certifications that ENEN may release, having the value of a “quality label” to be provided upon satisfaction of the requirements established in its specific by-laws, which in this case are available at the site: <http://www.enen.eu/en/emsne/information.html#DD> .

The characteristics of the certification and of its requirements as per the by-laws are firstly considered hereafter. Then, the records of the EMSNE alumni are considered and commented, focusing on the distribution of the certifications throughout Europe.

An inquiry was recently made on this issue by distributing by e-mail a questionnaire to ENEN Members (see ANNEX I) on March 14, 2018. This questionnaire was also circulated at the General Assembly held in Brussels in March 2 2018, an action that was not completely successful for conflicting priorities. The inquiry provided only a few responses with respect to the total number of Universities and Members contacted. However, thanks to the useful indications provided by these responses and to the fact that the lack of answer may also indicate lack of knowledge and/or interest for the subject, it was finally decided to draw first conclusions and provide a response in terms of proposed promotional actions.

So, after presenting data related to the EMSNE certification and to the results of the inquiry, proposals for better promoting this quality label among ENEN Members are set out at the end of this report.

2. THE EMSNE CERTIFICATION AND ITS CHARACTERISTICS

The questionnaire distributed in the occasion of the inquiry conducted to reach the results presented in this work summarises the characteristics of the EMSNE Certification as follows:

“Every year a number of Engineers from ENEN Member Universities apply and most often receive the European Master of Science in Nuclear Engineering certification (EMSNE). The conditions to be fulfilled to get the certification, in short summary, are the following:

- *at least 5 years university education (3+2, 4+1, or 5);*
- *at least 60 ECTS must be in “purely nuclear” matter;*
- *at least 20 ECTS must be obtained from a “foreign” (different Country) Institution, member of the ENEN Association.*

The purely nuclear matters whose reasonable coverage must be satisfied to get the recognition are: 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.

Though the number of Engineers awarded since 2005 is greater than 200 and continuously increasing, the distribution of the certifications across Europe is very non-uniform, with Spain, Italy and France being the Countries whose Engineers received most of the certifications. As a specific action of the ANNETTE project, we wish to investigate more on this phenomenon trying to favour a future better distribution of this certification. ”

This description must be supplemented by the detailed reading of the by-laws [1], which is necessary to discriminate in detail the requirements, the conditions of applicability and the procedure of application for receiving the EMSNE certifications. In particular, it is interesting to report integrally Art. 6 to 8, describing the requirements for obtaining the certification:

Art. 6 The main requirement for awarding the EMSNE-EC is that the applicant has obtained a Master Degree in Nuclear Engineering, or equivalent, delivered by or in co-operation with an academic institution which is a member of the ENEN-A, or at an academic institution that is a member of a cluster of academic institutions which is a member of the ENEN-A, as described in Article 3.1 of the Statutes of the ENEN-A. This academic institution is hereafter called the home institution.^B

In case the applicant has obtained a double, a multiple or a joint Master Degree in Nuclear Engineering, or equivalent, issued by more than one academic institution, the applicant must designate one of these academic institutions as the home institution, provided that this institution meets the requirements of the first paragraph of this article.^C

Art. 7 The additional requirements for awarding the EMSNE-EC are:

- a. the total load of the study programme of the applicant leading to the degree of Master in Nuclear Engineering, or equivalent, is at least 300 ECTS credits at university level (besides the exception mentioned in Art. 8);^D
- b. of which at least 60 ECTS credits (which may include the master thesis project) are in nuclear sciences and technology, preferably engineering, at master level;
- c. of which at least 20 ECTS credits (which may include the master thesis project) are taken at one or more academic institutions or clusters of such academic institutions, that are effective members of the ENEN-A, other than the home institution and in a different country than the home institution;^E
- d. the applicant has successfully defended a nuclear engineering master thesis project;^F

- e. the courses referred to in Art. 7.b cover at least the following fields of study:^G
 - Nuclear Power Plant Technology & 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.
 - f. laboratory work on some of the above fields of study.^H
- Art. 8 Exceptions to the minimum total academic course load of 300 ECTS credits as described in Art. 7a can be made only if the TAAC is of the motivated opinion that the academic programme followed by the candidate is equivalent to a 300 ECTS credits university programme representative for the academic ENEN-A members.^I

As it can be noted, the requirements represent rather bland constraints, not too difficult to be satisfied, at the price to adhere to a paradigm of the studies in nuclear engineering that is clearly pointed out as a reference one. This helps both mutual recognition and harmonisation throughout Europe. In other words, without being too compelling (e.g., specifying the number of ECTS for each one of the “nuclear” matters), the EMSNE paradigm anyway helps in making converging different conceptions of the curricula available throughout Europe, without flattening the richness of the traditions of teaching and research at the different Universities Member of ENEN.

The “dilemma” between harmonisation and mutual recognition is very well described in a paper published in 2013 in the occasion of the 10th Birthday of the European Nuclear Education Network. The paper [2] collects contributions by the illustrious professors involved in the conception of the certification; the abstract of the publication on *Nuclear Engineering and Design* (see below the front page in Figure 1) of the main features of the EMSNE Certification concept is also reported in the paper and is included hereafter:

“The need to preserve, enhance or strengthen nuclear knowledge is worldwide recognised since a couple of years. Among others, “networking to maintain nuclear competence through education and training”, was recommended in 2001 by an expert panel to the European Commission [EUR, 19150 EN, Strategic issues related to a 6th Euratom Framework Programme (2002–2006). Scientific and Technical Committee Euratom, pp. 14].

It appears that within the European University education and training framework, nuclear engineering is presently still sufficiently covered, although somewhat fragmented. However, it has been observed that several areas are at risk in the very near future including safety relevant fields such as reactor physics and nuclear thermal–hydraulics. Furthermore, in some countries deficiencies have been identified in areas such as the back-end of the nuclear fuel cycle, waste management and decommissioning.

To overcome these risks and deficiencies, it is of very high importance that European countries work more closely together. Harmonisation and improvement of the nuclear education and training have to take place at an international level in order to maintain the knowledge properly and to transfer it throughout Europe for the safe and economic design, operation and dismantling of present and future nuclear systems. To take up the challenges of offering top quality, new, attractive and relevant curricula, higher education institutions should cooperate with industry, regulatory bodies and research centres, and more appropriate funding from public

and private sources. In addition, European nuclear education and training should benefit from links with international organisations like IAEA, OECD-NEA and others, and should include worldwide cooperation with academic institutions and research centres.

The first and central issue is to establish a **European Master of Science in Nuclear Engineering**. The concept envisaged is compatible with the projected harmonised European architecture for higher education defining bachelors and masters degrees. The basic goal is to guarantee a high quality nuclear education in Europe by means of stimulating student and instructor exchange, through mutual checks of the quality of the programs offered, by close collaboration with renowned nuclear-research groups at universities and laboratories. The concept for a nuclear master program consists of a solid basket of recommended basic nuclear science and engineering courses, but also contains advanced courses as well as practical training. Some of the advanced courses also serve as part of the curricula for doctoral programs.

A second important issue identified is Continued Professional Development. The design of corresponding training courses has to respond to the needs of industry and regulatory bodies, and a specific organisation has to be set up to manage the quality assessment and accreditation of the Continued Professional Development programs.

In order to achieve the important objectives and practical goals described above, the ENEN Association, a non-profit association under French law, was formed. This international association can be considered as a step towards the creation of a virtual European Nuclear University symbolising the active collaboration between various national institutions pursuing nuclear education.

Based on the concepts and strategy explained above, and with the full cooperation of the participating institutions, it may be stated that the intellectual erosion in the nuclear field can be reversed, and that high quality European education in nuclear sciences and technology can be guaranteed."

Frans Moons, Joseph Safieh, Michel Giot, Borut Mavko, Bal Raj Sehgal, Anselm Schaefer, Georges Van Goethem, William D'haeseleer



Available online at www.sciencedirect.com



Nuclear Engineering and Design 235 (2005) 165–172



www.elsevier.com/locate/nucengdes

European Master of Science in Nuclear Engineering

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Received 7 April 2004; received in revised form 19 August 2004; accepted 31 August 2004

Figure 1. Front page of the paper published on Nuclear Engineering and Design on EMSNE

A further contribution reported in the mentioned paper [2], concerned what was happening “behind the scenes” of the elaboration of the EMSNE certification and came from Prof. William D’haeseleer, one of those professors who mostly contributed to lay-down the structure of the EMSNE certification:

“The abstract reported in the previous section [from Nuclear Engineering and Design, editor’s note] explains the objectives of the EMSNE certification in formal language. But, it is clear that much work and mental shaping was needed to arrive at that positive outcome.

Imagine the situation. Knowledgeable experts in nuclear engineering, i.e., mostly professors, representing something like 20+ academic organizations (basically universities), decide to cooperate and to keep high standards for European nuclear education. The word most participants were originally thinking of was “harmonization”, to some extent also a dream of the EU officials. After some careful reflections, and posing ample “what if” questions, we relatively quickly agreed that that was not the route to be taken. Just consider the state of affairs: all universities have their own program, each of those universities has always enjoyed considerable freedom in setting up their own program, as the local nuclear experts saw it.

In addition, each of these personalities and universities has his/its own pride and are convinced that their program is the best. Furthermore, each of those universities has different governmental authorities with different desires and rules! The challenge was to avoid a construction like the British saying that “a camel is a horse designed by a committee”; nor did we want to come up with a zebra: a blind mixture with a well-balanced measure of each color. And, what we certainly wanted to avoid were a downward-level harmonization and/or lengthy administrative procedural processes for overall recognition of a common degree.

Hence, the pragmatic, but wise, decision to set something up with a completely different philosophy. The fundamental goal was to support each other, to stimulate European mobility and to guarantee a high-level nuclear education. By means of well-designed open courses and/or labs taught in English, or by stimulating Master-level research and thesis work abroad, in some specialized topics, by some ENEN-member universities or labs (not everything the same at every place) we managed to kill two birds with one stone: facilitating European mobility and allowing some institutions to specialize in particular topics, while others could with good conscience downgrade or stop activities in those particular areas. The EMSNE-“degree” idea would then formally be dropped, but replaced by an at least as valuable certification by the ENEN Association.

In other words, students can still obtain their formal MS degree in Nuclear Engineering in their own home institution, but after the contents of the individual program is carefully checked by an ENEN evaluation committee, the international mobility of at least 20 ECTS is considered as an extra asset that gives a quality label to the original NE degree. If the nuclear community takes itself seriously, it should highly value that extra quality EMSNE certification!

The concept of the EMSNE certification was by and large designed by the above mentioned authors. Two extra mentions are in order though. Professor Fernand Vanmassenhove, known for his desire to keep the standards in nuclear Engineering high, and known in Belgium as “Mr Nuclear at the University of Ghent”, was a warm supporter of our quality-label concept. He did not see the first EMSNE awards though as he suddenly passed away in December 2004. And finally, although most of the conceptual ideas of the EMSNE certification originate from the above list of authors, we gladly acknowledge that the practical translation of the concept into bylaws and assessment guidelines, was done by Geert Van den Branden.

William D’haeseleer, KU Leuven, Belgium”

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The above idea of “certification by ENEN” still inspires the present work of the Association which, in different EU projects, is following the old idea of promoting and issuing certifications in different nuclear disciplines. Moreover, the by-laws of EMSNE have been the basis on which the present certifications for the “Master” for continuous professional development (CPD) being set up in ANNETTE are being developed: the idea of a “quality label” is just the same, the target is different, since it addresses CPD, lifelong learning and nuclearisation.

The certification is generally awarded to the Alumni during major international occasions, in which they are invited to participate in a guided tour of the location and, finally, are delivered the certification by the President of ENEN. The Ceremonies, which in the years 2013 to 2018 have been held in the wonderful frame of IAEA Headquarters, at Vienna International Centre, aside of the IAEA annual General Conference, are conceived to let the Alumni meet each other and be inspired for their future professional life, hearing speeches of by the Organisers (recently the President and the Vice-President of ENEN, the Under DG and the responsible of the Nuclear Knowledge Management section of IAEA). One of the students is also invited to have a speech in order to transmit to the audience his/her feelings and aspirations in relation to the future career.



Figure 2. President Joseph Safieh awarding one of the EMSNE Alumni at IAEA in 2012



Figure 3. Group photo from the EMSNE award ceremony at IAEA in 2014



Figure 4. Group photo from the EMSNE award ceremony at IAEA in 2017



Figure 5. Student speeches at EMSNE Award ceremonies

3. DATA ON THE EMSNE ALUMNI

The Table and the Figures reported below summarise the distribution of the EMSNE Alumni as achieved from the most updated record, up to the evaluation made in the first months of 2018 and already presented at the General Assembly of ENEN in 2018.

YEAR	Belgium	Czech R.	Finland	France	Germany	Italy	Romania	Slovakia	Slovenia	Spain	Sweden	UK	TOTAL
2005	0	0	0	2	0	0	1	0	0	0	0	0	3
2006	1	0	0	2	0	0	1	0	0	3	0	0	7
2007	3	0	0	2	0	3	0	0	0	2	0	1	11
2008	1	0	0	5	0	3	0	0	0	2	0	1	12
2009	0	0	0	2	0	7	0	0	0	3	0	1	11
2010	1	0	0	2	0	5	0	0	0	14	0	0	22
2011	2	0	0	4	0	5	3	1	0	9	0	0	15
2012	0	0	0	2	0	6	0	0	0	9	0	0	17
2013	0	0	0	2	0	4	0	0	0	7	0	0	13
2014	0	0	0	0	0	7	0	0	0	8	1	0	16
2015	0	1	0	1	1	10	1	0	0	13	0	0	27
2016	1	0	0	0	0	15	0	5	1	6	2	0	30
2017	0	1	1	1	1	8	0	1	0	3	3	0	19
2018	0	0	0	1	0	9	0	0	0	1	1	1	13
TOTAL	9	2	1	24	2	82	6	7	1	71	7	4	216

Table 1. Records of EMSNE Alumni since 2005 distributed per year and per Country of the Home Institution

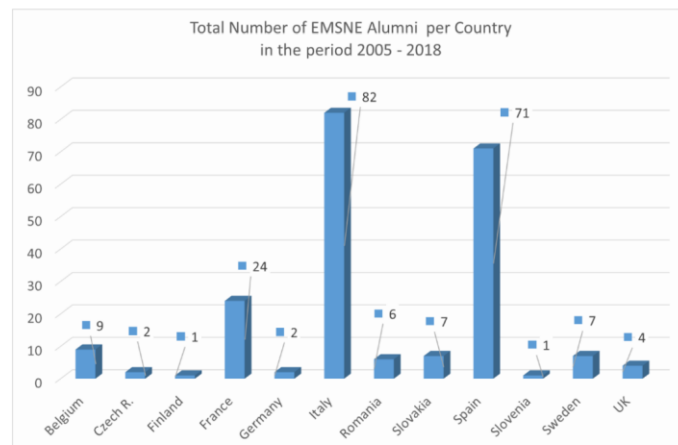


Figure 6. Distribution of the of total number of EMSNE Alumni per Country of the Home Institution

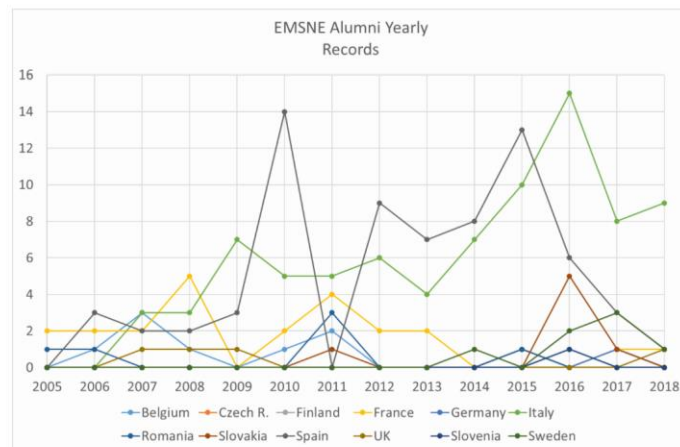


Figure 7. Yearly distribution of the EMSNE Alumni per Country of the Home Institution

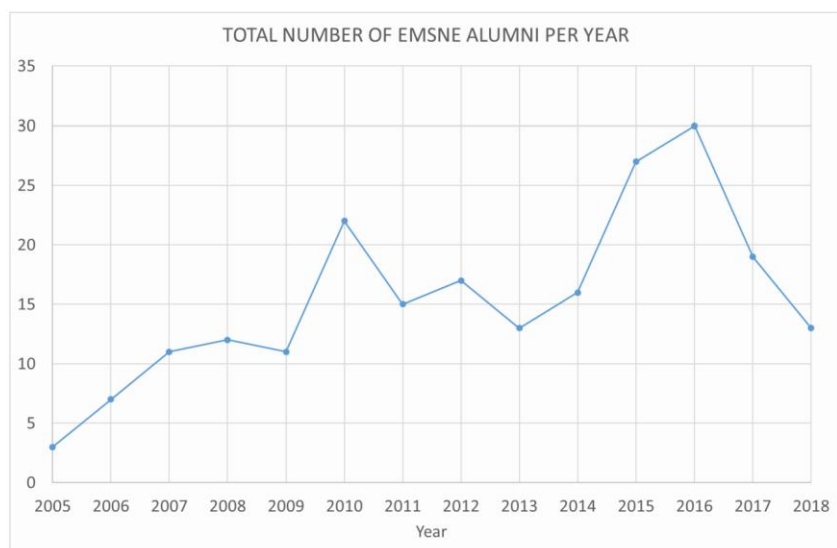


Figure 8. Yearly trend of the total number of EMSNE Alumni

The table as well as the figures show the uneven distribution of the certification in the different Member States. Figure 8 also shows increasing and decreasing trends of the total number of EMSNE Alumni, possibly reflecting periods of greater or lower attractiveness, also due to the historical context and or of the effort spent in advertising this opportunity.

Taken into consideration this uneven distribution, it must be anyway noted that the previous figures **would be misleading** to draw conclusions about the engagement that ENEN Members put in the EMSNE certifications, if not complemented with information on the **Host Institutions**. Though a complete record is not available at the time of writing, examples are provided in the tables reported below.

HOME INSTITUTION	HOST INSTITUTION
UPC	GRENOBLE INP
CIRTEN	CEA-INSTN
UPC	GRENOBLE INP
CIRTEN	CEA-INSTN
UPC	PSI-ETHZ
UPC	GRENOBLE INP
CIRTEN	SCKCEN
UPM	AALTO U
CEA-INSTN	CEA-INSTN
UPC	STUBA
USTUTT	ATI AUSTRIA
UPC	CEA-INSTN
UPC	GRENOBLE INP
CIRTEN	CV REZ
CIRTEN	AREVA
CTU	TOKYO TECH
CIRTEN	AREVA
UPC	PSI-ETHZ
UPC	GRENOBLE INP
UPC	PSI-ETHZ
CIRTEN	UC LOUVAIN
CIRTEN	CEA-INSTN
CIRTEN	CEA-INSTN
UPB	TOKYO TECH
UPC	GRENOBLE INP
CIRTEN	UC LOUVAIN
UPC	GRENOBLE INP

a) 2015

Home institution	Host institution
U Ljubljana	Kyoto Univ.
KTH	ECP
CIRTEN	CEA
CIRTEN	KTH
CIRTEN	CEA
CIRTEN	CEA
CIRTEN	SCKCEN
CIRTEN	SCKCEN
CIRTEN	SCKCEN
KTH	CEA
CIRTEN	SCKCEN
CIRTEN	SCKCEN
UPC	KTH
CIRTEN	SCKCEN
STUBA	TOKYO TECH
STUBA	TOKYO TECH
STUBA	TOKYO TECH
CIRTEN	CEA
STUBA	JAEA
UPM	TUM
CIRTEN	BNEN
STUBA	TOKYO TECH
UPC	ETHZ
CIRTEN	KTH
UPC	TUM
CIRTEN	SCKCEN
UPC	CIRTEN
UPC	U GENT
CIRTEN	U LIEGE
BNEN	UPM

b) 2016

Home institution	Host institution
KTH	EPFL
Univ. Of Pisa	SCK-CEN
ETSEIB-UPC	BNEN
POLIMI	KTH, CEA-INSTN
POLITO	BNEN, SCK-CEN
KTH	INSTN
Univ. Of Rome	CEA-Cadarache
POLITO	BNEN, SCK-CEN
ETSEIB-UPC	JAEA
AALTO Univ.	Manchester Univ.
Univ. Of Pisa	JRC, Petten
ETSEIB-UPC	KTH
Slovak Univ. Techn.	TokyoTech
KTH	INP Grenoble
INSTN, AREVA	KTH
CTU	KTH
Univ. Of Pisa	Univ. Of Birmingham
POLITO	EPFL
RWTH	Fukui

c) 2017

Home institution	Host institution
Imperial College London	TECNATOM
CIRTEN - UniPi	CEA
CIRTEN - PoliTo	SCK • CEN
CEA - INSTN	ETSEIB-UPC
CIRTEN - PoliTo	SCK • CEN
CIRTEN - UniPi	SCK • CEN
UPM	IST Lisboa
CIRTEN - UniPi	Joint Research Centre, Petten
CIRTEN - UniPi	Delft University of Technology
KTH	Grenoble INP
CIRTEN - Rome La Sapienza	CEA Cadarache
CIRTEN - PoliTo	Belgian Nuclear Education Network
CIRTEN - PoliTo	CEA/INSTN

d) 2018

Table 2. Home and Host Institutions for the EMSNE Alumni who received the award in recent years

As it can be noted, while some ENEN Members are **“frequent Home Institutions”**, others are **“frequent Host Institutions”**, showing a rather **choral involvement of ENEN Members in EMSNE exchanges**. The role of the exchange projects with Countries having an MoU with ENEN can be also considered.

4. INFORMATION FROM THE QUESTIONNAIRES

As anticipated in the Introduction, though the questionnaires were distributed at large to all the ENEN Members, only eight of them came back fully completed. It is chosen hereafter to report anonymously the observations collected to the proposed questions. Though the names of persons and or institutions were scratched from the questionnaires, in some cases the indication of the countries has been left.

4.1 Answers to the questionnaires and specific comments

Questionnaire #1

1. Has your Institution a complete study programme in Nuclear Engineering? ☒ Yes ☐ No
2. Is the EMSNE certification systematically advertised each year at your Institution? ☐ Yes ☒ No
3. Are your students attracted by European mobility for courses or thesis work? ☐ Yes ☒ No
4. Are your students attracted by the EMSNE certification? ☐ Yes ☒ No

5. Please, comment the reasons for attractiveness or unattractiveness of the EMSNE certification among students:
We do not know how to access facilities to enable students to be mobile for courses or thesis work. ENEN certification does not translate easily to the UK system.

6. How could ENEN help you in providing better advertising and/or enhancing attractiveness for EMSNE?
[... continuation from the previous question, editor's note...] *(Typically a 3+1 year or a 4 year MEng is) and international teaching is not facilitated at our University.*

Comment to Questionnaire #1

The situation depicted here is typical of UK and was also previously considered by ENEN in internal discussions. The differences in the education systems present in UK and in continental Europe make exchanges somehow difficult. In particular, the 300 ECTS constraint is one of the most difficult to be respected for UK students to be candidate for the EMSNE certification, though by the way they have an excellent education in Nuclear Engineering, normally with a lower number of credits.

In this case, we may say that intention of EMSNE to become a clear paradigm is somehow linked to the Bologna Convention system. At the moment, this difficulty seems not easily eliminable.

Questionnaire #2

- | | |
|--|--|
| 1. Has your Institution a complete study programme in Nuclear Engineering? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 2. Is the EMSNE certification systematically advertised each year at your Institution? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 3. Are your students attracted by European mobility for courses or thesis work? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 4. Are your students attracted by the EMSNE certification? | <input type="checkbox"/> Yes <input type="checkbox"/> No |

5. Please, comment the reasons for attractiveness or unattractiveness of the EMSNE certification among students:
Attractiveness: Our graduates continue their career either in IT or as PhD students, mostly in European research centres in Physics, mostly in Nuclear Physics or related spheres. Unattractiveness: Rules of certification are extra stringent. They make it impossible for our students to take part in the certification since our curriculum does not contain a number of necessary issues: e.g. we do not provide "nuclear thermal hydraulics"; poverty of our students does not allow them to study abroad and obtain at least 20 ECTS from foreign institution. On the other hand, the diploma projects of many of our students directly concern Nuclear Physics and Nuclear Power, in particular, radiation material science.

6. How could ENEN help you in providing better advertising and/or enhancing attractiveness for EMSNE?
Let accept those students whose MSc thesis relate to the Nuclear Physics and/or Nuclear Power without stringent following the demand "at least 20 ECTS must be obtained from a "foreign" (different Country) Institution, member of the ENEN Association". Either let provide support for such studying e.g. in framework of Erasmus Mundus or other programs.

Comment to Questionnaire #2

The questionnaire comes from a MoU linked Institution out of Europe. Again, it is suggested that the rules for achieving the EMSNE Certification are not easily fulfilled by the students of this Institution. In this case, the lack of some matters and the difference of the curricula from the paradigm developed by ENEN seem to put the most relevant difficulties. The lack of support, which is actually often granted by the Host Institutions within ENEN, is suggested to be another problem for completing the curriculum. It must be noted that projects were run in the past by ENEN with Japan, China and Russia in order to facilitate the exchanges; very evidently these actions, which had generally very good results, did not solve the problems for many areas of the world interested to possible exchanges with Europe.

In the questionnaire, it is further suggested to eliminate some of the constraints in terms of credits to be earned abroad and also in terms specific curriculum (not only for Nuclear Engineering). Evidently, this request collides with some of the principles at the basis of the EMSNE.

Questionnaire #3

1. Has your Institution a complete study programme in Nuclear Engineering? ☒ Yes ☐ No
2. Is the EMSNE certification systematically advertised each year at your Institution? ☐ Yes ☒ No
3. Are your students attracted by European mobility for courses or thesis work? ☒ Yes ☐ No
4. Are your students attracted by the EMSNE certification? ☐ Yes ☒ No
5. Please, comment the reasons for attractiveness or unattractiveness of the EMSNE certification among students:
 The yes-no questions above lack nuances. Some students are interested to go abroad, but the stay abroad itself makes more sense that any type of certification associated with it. The added value of the certification, compared to the added value of a stay abroad in the cv, is rather limited. Does the nuclear industry make a distinction between a good engineer with skills in nuclear engineering with the EMSNE certification and the same good engineer with skills in nuclear engineering and a stay abroad in an institution that could be a non-member of the club? So it's fine for the student to get this certification, but to which extent will it change his/her life later on...?
6. How could ENEN help you in providing better advertising and/or enhancing attractiveness for EMSNE?
 No clear idea

Comment to Questionnaire #3

In this questionnaire, the issue of the "added value" of the ENEN certification is pointed out. This is not the first time that the issue is considered in the frame of ENEN. As it is said, mobility of students

has a worth per se, independently of the EMSNE certification. Moreover, discussions with industry not always brought to a clear conclusion.

A feedback in relation to these questions should possibly include:

- a clearer presentation of the step forth made in the NEPTUNO project by proposing the EMSNE certification: this step achieved the level of a good attempt to harmonise in Europe the curricula by promoting mutual recognition and encouraging mobility; this was anyway a difficult task to achieve, as we could hear from the very words of those who were involved in this effort;
- a campaign to clarify with Stakeholders the meaning of this achievement in order to get further feedback and reach a common view of the education needed for a Nuclear Engineer to operate in research and industry during his career.

Questionnaire #4

1. Has your Institution a complete study programme in Nuclear Engineering? ☐ Yes ☐ No
2. Is the EMSNE certification systematically advertised each year at your Institution? ☐ Yes ☒ No
3. Are your students attracted by European mobility for courses or thesis work? ☐ Yes ☒ No
4. Are your students attracted by the EMSNE certification? ☐ Yes ☐ No
5. Please, comment the reasons for attractiveness or unattractiveness of the EMSNE certification among students:
____Remark Q1: What is a complete programme? We do not offer courses in all fields of : *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* , but we do provide many other courses in the field of medical imaging, radiotherapy, fundamental sciences with neutron and positron beams, etc
____Remark Q3: Our students are attracted to follow an internship at a company abroad, but no thesis project or individual courses as this would be difficult to get permission for by the examination committees of our master programmes.
6. How could ENEN help you in providing better advertising and/or enhancing attractiveness for EMSNE?
Focus less on purely nuclear fission energy, and more on the use of nuclear techniques in the areas of Health and Fundamental sciences. Our impression is this is much more attractive to students nowadays.

Comment to Questionnaire #4

In this case, the Institution is not having a full programme in Nuclear Engineering and, seemingly, no need is felt to have one. The very concept of a specific education for Nuclear Engineers seems to be in question. There are also bureaucratic difficulties in adhering to the concept of internships abroad. The ENEN Association is suggested to focus less on fission power applications and more on that variety of nuclear subjects that is considered more attractive for students, especially in this historical period. In this regard, it must be noted that the EMSNE was certainly born to preserve knowledge in the field of Nuclear Engineering for power applications.

Questionnaire #5

1. Has your Institution a complete study programme in Nuclear Engineering? ☐ Yes ☒ No
2. Is the EMSNE certification systematically advertised each year at your Institution? ☐ Yes ☒ No
3. Are your students attracted by European mobility for courses or thesis work? ☒ Yes ☐ No
4. Are your students attracted by the EMSNE certification? ☐ Yes ☐ No
5. Please, comment the reasons for attractiveness or unattractiveness of the EMSNE certification among students:
The ... has no academic role, so it is the questions are not fully relevant to us. I think that the main attractiveness of the EMSNE is its international and cross-national character. I believe that if it is not attractive as it could/should be comes from the fact that it might be little advertised or simply known how it can have an impact on finding a job in a competitive environment.
6. How could ENEN help you in providing better advertising and/or enhancing attractiveness for EMSNE?
The ... has no academic role, so it is the questions are not fully relevant to us. I think better advertising and attractiveness should come from a joint approach in our case hosting institution (e.g. ...) and ENEN. Information material could be provided to be put at hosting facilities and exchanges stays/trainings (from e.g. mobility programmes) in participating organisations be eligible for ECTS to acquire the EMSNE even if not performed in this scheme (kind of bonus point that you get, which could be an incentive to pursue the programme).

Comment to Questionnaire #5

This non-academic Member of ENEN seems suggesting that one of the problems of EMSNE is its scarce advertising. The question raised in relation to the ECTS seems [to this writer] actually not applicable, since period of stages abroad at Research Centres can be granted a number of ECTS by the Home Institution, whether or not the Host Institution can do it. So, this problem is largely overcome at present time.

Questionnaire #6

1. Has your Institution a complete study programme in Nuclear Engineering? ☐ Yes ☒ No
2. Is the EMSNE certification systematically advertised each year at your Institution? ☐ Yes ☒ No
3. Are your students attracted by European mobility for courses or thesis work? ☒ Yes ☐ No
4. Are your students attracted by the EMSNE certification? ☐ Yes ☒ No
5. Please, comment the reasons for attractiveness or unattractiveness of the EMSNE certification among students:
... University has a nuclear engineering program at a national level of "Högskoleingenjör", which is equivalent to a B.Eng. degree, and several non-nuclear engineering programs at the Master level. The nuclear engineering program is primarily aimed at providing graduates that can take on positions within operation and maintenance in the Swedish nuclear energy sector. Because graduating engineering students within all subjects are in very high demand within Swedish industry, the motivation for students on the Bachelor level to continue with education on the Master level has been, and still is, low. Uncertainties concerning the future of the nuclear sector, in Sweden and elsewhere, also severely limits student motivation to embark on higher education within nuclear engineering.
6. How could ENEN help you in providing better advertising and/or enhancing attractiveness for EMSNE?
In order to motivate students towards higher education in nuclear engineering there is a need for role models in the form of nuclear engineering graduates that have embarked on careers within the nuclear sector and have gained some professional experience. These role models should preferably appear in social media, e.g., in videos that could consist of interviews, either with individuals or with small groups of young engineers that discuss education, careers,

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future opportunities and other subjects related to their career within the nuclear sector under the guidance of an experienced TV host, i.e., a “nuclear talk show”. Another possibility could be videos about “a day/week/... in the life of a nuclear engineer” in order to provide prospective students with an idea about what a career in nuclear could involve. Another option could be to make the role models “accessible” to students in the form of mentors (mentorship programs?) where they share their knowledge and experience, and also puts an international aspect on nuclear careers.

Comment on Questionnaire #6

Also in this case, while describing the Swedish situation, the accent is on the need for a better advertising and on the lack of attractiveness for nuclear careers in this period of uncertainties for nuclear programmes in many European Countries. The suggestion of role models and information on the career of EMSNE Alumni stimulates to actions that were actually planned in the past and to which the Association could have devoted more attention. This is one of the reasons in which the monitoring of EMSNE was included as an action in the ANNETTE Project.

Questionnaire #7

1. Has your Institution a complete study programme in Nuclear Engineering? ☐ Yes ☒ No
2. Is the EMSNE certification systematically advertised each year at your Institution? ☐ Yes ☒ No
3. Are your students attracted by European mobility for courses or thesis work? ☒ Yes ☐ No
4. Are your students attracted by the EMSNE certification? ☐ Yes ☐ No
5. Please, comment the reasons for attractiveness or unattractiveness of the EMSNE certification among students:
 _____ Most of the attracted students are master students already (mobility students at _____).

6. How could ENEN help you in providing better advertising and/or enhancing attractiveness for EMSNE?
 _____ EMSNE to be advertised together with some mobility financial help.

Comment to Questionnaire #7

Again, the accent is on advertising and providing financial help, for this Member of ENEN which actually is not releasing any title specifically in nuclear engineering, though is actively involved in teaching to nuclear-oriented students.

Questionnaire #8

1. Has your Institution a complete study programme in Nuclear Engineering? ☒ Yes ☐ No
2. Is the EMSNE certification systematically advertised each year at your Institution? ☒ Yes ☐ No
3. Are your students attracted by European mobility for courses or thesis work? ☒ Yes ☐ No
4. Are your students attracted by the EMSNE certification? ☒ Yes ☐ No
5. Please, comment the reasons for attractiveness or unattractiveness of the EMSNE certification among students:
 + it allows them to enrich their knowledge, culture, views about the nuclear domain
 - lacks practical use _____
6. How could ENEN help you in providing better advertising and/or enhancing attractiveness for EMSNE?
 Involve more partners and activities in projects, activities that specifically foresee lobby for the certificate _____

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Comment to Questionnaire #8

In this questionnaire, the Member recognises the value of the certification but suggests the lack of “practical use” of it. This seems to be again in relation to the Stakeholders’ view; in fact, the suggestion to activate project activities that may show the value of the certification is going exactly in this direction.

An Additional Questionnaire: from the University of Pisa

It was not possible for the Author at this point in the report to avoid bringing also the experience of the University of Pisa. The questionnaire was then written and is reported below, obviously without additional comments.

Name Walter Surname Ambrosini

Institution CIRTEN – University of Pisa

1. Has your Institution a complete study programme in Nuclear Engineering? ☒ Yes ☐ No

2. Is the EMSNE certification systematically advertised each year at your Institution? ☒ Yes ☒ No

3. Are your students attracted by European mobility for courses or thesis work? ☒ Yes ☒ No

4. Are your students attracted by the EMSNE certification? ☒ Yes ☐ No

5. Please, comment the reasons for attractiveness or unattractiveness of the EMSNE certification among students: Italian students in general are very much attracted by periods of stay abroad, since they perceive their high value for future careers. If this is true in general for any Italian student, this is particularly true for Nuclear Engineering students in a Country that abandoned nuclear power for the second time. The students feel the step of a thesis abroad as an important one for their career; they are instead less attracted by courses, both for the good teaching tradition in Pisa and for the greater difficulties to find financing. The classical scheme for students from Pisa is to complete their exams and then to go to have a thesis abroad at Research Centres or Universities Members of ENEN. In a few cases, they chose to have a thesis abroad at Institutions that are not members of ENEN.

6. How could ENEN help you in providing better advertising and/or enhancing attractiveness for EMSNE?
Here I can only rephrase comments made in previous questionnaires, related to the need to advertise and also to promote the certification as a stimulus to harmonisation at academic level and exchanging ideas with industry on the value of such a certification.

I agree that the information I provided in this questionnaire is freely used in the frame of the ANNETTE Project, in the purpose of analysing the reasons for the partly unsatisfactory spread of the EMSNE certification across Europe.

Signature Walter Ambrosini Date, August 21, 2018

4.2 General Comment on the Outcomes from the Questionnaires

Trying to summarise the suggestions and remarks coming from the questionnaires, we can draw, directly or indirectly, the following conclusions.

- **The level of information about the certification should be improved.** This aspect is appearing as underlined directly by some of the received comments and indirectly by the fact that little awareness of some of the objectives of the certification is shown in the received comments (namely “harmonisation” to be achieved by “mutual recognition”). Advertising systematically EMSNE should be a common duty of both the ENEN Association organisms and of its Members. By the way, we can note even from prior information that high numbers of EMSNE alumni where

achieved by a combination of willingness to have mobility on the side of students and systematic advertising at each call of the EMSNE certification.

- **The added value of the EMSNE certification in terms of employability of the Alumni should be better considered.** Besides the important role of the EMSNE certification in harmonising curricula throughout Europe, a tight dialogue with Stakeholders should be (re)started. Actually, there were prior experiences not completely successful in this regard, but an effort should be made in order to clarify what the EMSNE certification may or may not mean.
- **Harmonisation of curricula may encounter serious barriers.** This was seen in the experience of UK and of the Members of ENEN located out of Europe and being Members by a MoU. This is a serious problem whose solution is quite difficult, since the main ground on which the EMSNE certification was developed was the Bologna Convention system. Whenever this system is not applicable, it is quite difficult to achieve the respect of the bylaws of EMSNE.
- **Organising EMSNE Alumni in an active group.** This was somehow suggested by one of the questionnaires, asking for “role models” to be proposed. This action is since a rather long time discussed within ENEN, though no specific action was made in the past in this regard.
- **Extending the scope of ENEN certifications to other areas.** This is something implied in one of the comments. In this regard, it must be noted that an action is planned in the frame of the ENEN+ project (Task T2.3) to consolidate the EMSNE certification and make it evolve into a certification in nuclear disciplines.

5. CONCLUSIONS

The present overview of the status of the EMSNE certification allowed to identify the extent of the uneven distribution of the EMSNE Alumni around Europe observed at the time of project preparation and that stimulated this study.

On the side of the population of EMSNE Alumni, it was seen that the **most active Home Institutions** can be found in Italy, Spain, France and, at a lower level, Belgium. Though complete records of **Host Institutions** could not be achieved at this stage, it was clearly shown on the basis of recent records that **many members of ENEN, also non-academic, have contributed to the success of the EMSNE certification by hosting students.**

So, while historical reasons may intervene in the observed distributions of EMSNE Alumni, together with phenomena that are active also in other industrial sectors (e.g., “brain drain”), the outcomes of the present analysis are somehow reassuring about the involvement of ENEN Members in contributing to the success of EMSNE. This success has different forms in different Countries owing to the mentioned reasons, but is nonetheless clear.

In the previous section 4.2, some possible actions have been envisaged which would be fruitful to put in place in the frame of the ANNETTE and the ENEN+ projects, presently coordinated by ENEN. We explicitly remind the most relevant ones:

- the level of information about the certification should be improved;
- the added value of the EMSNE certification in terms of employability of the Alumni should be better considered;
- organising EMSNE Alumni into an active group;
- extending the scope of ENEN certifications to other areas.

The problems related to the formal barriers due to the limited penetration of the Bologna Convention rules throughout Europe seem instead more difficult to overcome at the present stage and a reflection on them may involve higher decisional levels than available within the ENEN Association.

6. REFERENCES

- [1] ENEN Board of Governors, By-Laws regarding the European Master of Science in Nuclear Engineering, Available at the website <http://www.enen.eu/en/emsne/information.html#DD>
- [2] Walter Ambrosini and Founding Members of ENEN, Lessons learnt from 10 years of ENEN collaboration: from a knowledge to an end-user driven approach, Paper Presented at the FISA 2013 Conference, Post-FISA Workshop #2, 17 October 2013 - Vilnius, Lithuania, Available at <http://www.enen.eu/en/about/the-10th-birthday-enen.html>

ANNEX II - MILESTONE REPORT ON THE PHD EVENTS

ANNETTE

DELIVERABLE D 1.6

38/48

Dissemination level: PU

Date of issue of this report: **15/11/2019**

ANNETTE Milestone 1.6.4

Suggestions for jointly organised PhD event

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October 20, 2019
Version 2

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ABSTRACT

Task 4 of Work Package (WP) 1 in ANNETTE aims to achieve **harmonisation and links between different nuclear sectors** with the objective to provide input to the organisation of the Master programme in WP2. In addition, a format for a PhD event, which could be organised jointly for different nuclear areas, could be designed by taking advantage of the formats of already existing initiatives (in e.g. ENEN, PETRUS).

In this report, a review is provided of the **current existing formats** in which PhD events in the various nuclear sectors (nuclear engineering, radiation protection, medical sector, waste and disposal) are organised. Thereafter, some **suggestions** are made about possible event formats in which PhD students of the different nuclear sectors are similarly represented. Suggested formats will aim for sustainability of the organisation on the long term.

This milestone M1.6.4 could serve as a **starting point of the actions** to be done in Task 3 ('Consolidate and further develop the ENEN PhD event') of WP4 of the **ENEN PLUS project**.

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1. INTRODUCTION

One of the objectives of the ANNETTE task 1.4 is to explore the possible formats of a PhD event that includes all nuclear sectors.

During such a PhD event students can, by interacting with various professionals and other participants (from the same domain and other domains of their work field), **enlarge their vision and knowledge** of the nuclear sectors. The event will stimulate exchange of ideas, suggestions and experiences from different perspectives.

Another added value for the participants during a PhD event is that the PhD students have the opportunity to present their work and **receive feedback**. Via this exchange of knowledge and experience with academics and professionals working in different domains, more insight about **career possibilities** in the various sectors could be gained. A meet and greet with potential future employers is facilitated as well during such an event.

2. DESCRIPTION OF EXISTING PhD EVENTS

2.1 ENEN PhD event

Concept

The ENEN PhD Event & Prize is an action of the European Nuclear Education Network to support the Research and Science in the Nuclear fields promoting the works of the young scientists and researchers who start their professional career finishing their PhD.

Objectives of the event

The objectives of the ENEN PhD Event are:

- to provide a forum for PhD students to present their research work to their fellows and colleagues in a friendly but competitive spirit;
- to promote the research work of PhD students in the nuclear fields, in particular experimental work;
- to set up a bridge between PhD students and professionals in the nuclear field.

Pre-selection of participants

The ENEN PhD Event consists of up to 12 PhD presentations selected by the ENEN PhD Prize Jury from those nominated by the ENEN Members.

The criteria for selection of the participants are:

- quality of the research work;
- enough achievements at least as same as the 3rd year of PhD student;
- no balance among the participating countries is taken into account.

Venue and structure of the event

The event is generally held as a side activity during major nuclear conferences at European level or taking place in Europe, with the aim to involve PhD students in a lively scientific forum. If it is the case, the event is divided into sessions according to the subjects. The participants make a presentation of their research work for 25 minutes followed by 5 minutes of questions and discussion. All presentations are judged by the members of a jury on the basis of the submitted paper as well as on the quality of presentations and on the clarity in the discussion while answering the questions and discussions.

Conference papers submitted to the event are generally included in the conference proceedings. All abstract, papers and presentations provided for the event will be shared among the ENEN Members after the event. All participants are requested to attend the event and the award ceremony of the ENEN prize.

Selection criteria and procedure

The criteria in selecting the best works are the following:

1. Quality of the paper
2. Clarity of the presentation: ability to communicate the message
3. Quality of the answers to the questions following the presentation
4. Ability to communicate the enthusiasm
5. Quality of the iconographic materials
6. Formal compliance with the rules (respect of the allotted time)
7. Active participation in the event

For each item, each member of the jury gives a mark comprised between 0 (poor) and 4 (excellent). At the end of the day, the totals will be summed up for each participant and an arithmetic ranking will be established. The results are discussed until a consensus is found to attribute the three ENEN prizes. Three best presentations are awarded the ENEN prize.

Applicants

Applicants should be either:

- PhD students studying or working at the ENEN Members in any nuclear field, or
- those who completed their PhD studies at an ENEN Member after the application deadline of the previous ENEN PhD event.

Number of participants

Since its start in 2007, a number of 115 applicants from 19 European countries were selected to present their thesis work.

Domains/sectors covered

The majority of the presented thesis work was in the domain of nuclear engineering.

Date/duration

It takes place on an annual basis in the framework of an international congress in the field of nuclear science. Normally, it takes one and a half day for the presentation sessions and an afternoon for the work of the jury. The prizes can be delivered to the winners during a formal event of the conference (e.g., during the luncheon).

Prizes for PhD

For the 12 finalists PhD researchers the ENEN Association support travel expenses with a lump sum of 650 EUR, as well as registration fee of the conference where the event will be hosted. The ENEN PhD prize is awarded to the best three presentations. For the 3 ENEN PhD prizes ENEN Association grants 1000 euro to the winners to cover the expenses to attend to an international conference and present the result of his/her research work.

Financing (costs, funding)

Per PhD event the cost for ENEN of the ceremony is around 10 000 euro. This includes prizes, conference fees, logistics and travel costs of the jury.

2.2 Petrus PhD event

Concept

The PETRUS PhD events brings together PhD students and early-stage researchers, alongside professionals and academics in the topic of radioactive waste management and geological disposal. The event/conference was designed to be simultaneously a research school and a conference giving attendees from across the Europe a chance to network with academics, professionals and students and to create and strengthen professional relationships.

Selection procedure

Participants are selected based on an extended abstract (4-6 pages) sent to a selection committee formed by four professors from universities involved in PETRUS consortium. At this stage, selection criteria of the

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competing PhD students are the quality of the paper and the originality of the research subject. The selected students are invited to give a presentation about their research.

Number of participants

The event is open to all people interested in waste management and geological disposal. In average, around 70 participants in total attend the event, among them 10 to 15 PhD students who present their work.

Domains/sectors covered

The domain of the event is limited to radioactive waste management and geological disposal.

Date/duration

The event takes one week event.

Prizes for PhDs

The best presentation and the best abstract are rewarded with prizes of around 750 euro.

Financing (costs, funding)

For the organization of the event, one person is hired for 6 months. The total cost is around 25 000 euro. Up to 2018 the University of Lorraine has covered part of this cost as in kind contribution.

2.3 Nugenia-ENEN Young Generation Award

Scope

NUGENIA Forum is an occasion to award selected Master's students or PhD, or post-docs candidates planning to pursue a career in the nuclear field. The awards are attributed by the NUGENIA and ENEN Associations with the joint aim to promote interactions between the established nuclear R&D and industrial actors and the young generation of engineers and researchers.

Objectives for applicants

The awards are aimed to help successful candidates to enlarge their network of professional contacts and further develop international collaboration by working on their research and/or innovation topic with European and international sectorial experts and professionals.

Prizes

Three prizes of 5000 euro, 3000 euro and of 2000 euro will be awarded following the evaluation of applications by an independent jury. The awards shall cover in particular travel and accommodation costs related to the personal project.

Selection procedure

The ranking shall be decided by the jury following project presentations during the forum (5 min speech during the forum).

2.4 FuseNet PhD event

Concept

The FuseNet PhD event aims to enhance the bonds within the group of PhD students registered at a European university and working in the field of fusion science and engineering. A program packed with excellent speakers from ITER accompanied with visits to the impressive ITER site and the WEST tokamak made a strong background for networking among the young fusion researchers from all over Europe.

Selection procedure

Participating PhD students should shortly present their work in the challenging PechaKucha format and via posters.

Domains/sectors covered

The domains covered during the event are nuclear engineering and fusion.

Financing

Started within the framework of the FuseNet project, FuseNet has now supported five successful editions of its annual PhD Event. The FuseNet Association coordinates and supports the organisation of this annual PhD event.

Date/ duration

The FuseNet PhD event is an annual event with a duration of 3 days.

3. POSSIBILITY TO MERGE PhD EVENTS

3.1 Representation of each domain in existing ENEN PhD event

In each domain (nuclear engineering, waste and disposal, medical sector, radiation protection) three PhD students could be selected in order to have an even distribution among the participants. A prize could be given per domain (e.g. 1 prize in each domain).

The PhD event will preferably be organised in conjunction to a conference that has a broad scope so that the conference is of interest of the PhD students working in the different domains. An intensive advertisement in the different domains is crucial to attract an equal number of participants from the different domains to the event and conference.

3.2 Concept of Petrus PhD event with ENEN funding

As the duration of the Petrus PhD events is one week, most probably ENEN will not have the means to fund a PhD event with a concept equal to that of the Petrus PhD event. A group request of the ENEN PLUS mobility funding (or other) could be an option.

3.3 Concept of Petrus PhD event with stakeholders funding

In addition to the request of mobility funds of the ENEN PLUS project for the participants, funding /support for the event and prizes can be asked to the various stakeholders (industry/ platforms) in the different domains. The involvement of the stakeholders from in the beginning to the PhD event could make the stakeholders more engaged to interact with possible new employees. The value of the EMSNE certifications could be enlarged via an enhanced involvement of the stakeholders.

4. CONCLUSIONS

In order to make suggestions for a jointly organised PhD event in which all nuclear domains are incorporated, an overview of existing events organised for PhD students were described. Further three formats of a PhD event which includes all nuclear sectors are suggested. These suggestions could be taken into account in WP3 of the ENEN PLUS project in which the event could in addition be organised in the preferred format. The inquiry of the interest of stakeholder involvement as well as broad advertisement in the different nuclear domains are important action points.