



# Advanced Networking for Nuclear Education and Training and Transfer of Expertise (ANNETTE)

Horizon 2020  
Call: NFRP-2014-2015  
Topic: NFRP-10-2014  
Type of action: CSA  
Proposal number: 661910  
Proposal acronym: ANNETTE

## 1. Introduction

The present situation of nuclear energy in Europe asks for a continuing effort in the field of Education and Training aimed to assure a qualified workforce in the next decades.

In this scenario, the present proposal is aimed at enhancing and networking the Europe-wide efforts initiated in the past decades by different organisations belonging to academia, research centres and industry to maintain and develop Education and Training in the nuclear fields.

This will allow consolidating, developing and better exploiting the achievements already reached in the past and to tackle the present challenges in preparing the European workforce in the nuclear fields.

The main objectives of the proposal are:

1. SURVEY AND COORDINATION OF NETWORKING IN E&T AND VET IN THE NUCLEAR AREAS
2. DESIGN AND IMPLEMENTATION OF COORDINATED E&T AND VET EFFORTS (Master and Summer Courses for continuous professional development)
3. GENERATIONAL TRANSFER OF EXPERTISE (Sustainable production of educational material)
4. CROSS BORDER TRANSFER OF EXPERTISE (Implementation of ECVET based exchanges among industrial bodies)
5. REINFORCING ETI ACTIONS FOR SHARING AND ENHANCING NUCLEAR SAFETY CULTURE COMPETENCE
6. FACILITATING THE NUCLEAR TRANSITION IN FUSION: COORDINATING THE E&T ACTIONS

The European Nuclear Education Network (ENEN), as coordinator of the proposed action, together with the other Participants, is committed to pursue the above objectives, being fully coherent with the ones suggested in the call (NFRP10) and proposed by the SET Plan Roadmap for Education and Training for the nuclear sector, tightening at the same time the links among the different nuclear areas and better coordinating their contributions in the E&T fields.

Strict links with the SNETP; IGD-TP and MELODI platforms and other relevant associations and bodies (EHRO-N, NUGENIA, EUTERP, IAEA, HERCA, etc.) will be implemented to assure coherence of this effort with similar other efforts going on in Europe.

## 2. Objectives

The present situation of nuclear energy in Europe asks for a continuing effort in the field of education and training aimed to assure qualified workforce in the next decades. Among the motivations for this effort, even considering the adverse policies established in some member countries, the following can be mentioned.

- “An extrapolation to 2050 of the ‘20 % nuclear’ scenario indicates that 100-120 units should be built in Europe.” (María Teresa DOMÍNGUEZ, 2012 Interdisciplinary Study, benefits and limitations of nuclear fission for a low-carbon economy, Topic 2: SET Plan)
- “Even countries that have phase-out policies still have active nuclear programmes associated with generation and ultimately decommissioning.” (Gustaf LÖWENHJELM, *ibid.*, Topic 3: Research and Development).
- “The nuclear science and engineering community in the EU is beset with numerous challenges that threaten nuclear power’s role as a clean and abundant source of reliable energy. These range from growing disinterest in higher education among young and upcoming scientists and engineers to a nuclear workforce that is rapidly ageing and not

being replaced. The result is likely to be a lack of future generations to operate, promote and expand the nuclear power sector, as well as the loss of trained experts with the necessary knowledge and technical competencies to build, operate, and decommission current and future nuclear facilities safely.” (François WEISS, *ibid.*, Topic 4: Education and Training).

In this scenario, the present proposal is aiming at enhancing the Europe-wide efforts initiated in the past decades by different organisations belonging to academia, research centres and industry to maintain and develop education and training in the different nuclear areas. The main aim of this action is to consolidate and better exploit the achievements already reached in the past and to tackle the present challenges in preparing the European workforce in the different nuclear areas, with special attention to continuous professional development, life-long learning and cross border mobility.

In particular, the European Nuclear Education Network (ENEN), as coordinator of the proposal, together with the other participants, is committed to perform coordination and support actions coherent with the ones suggested in the Horizon 2020 call under NFRP10 and in the SET Plan Roadmap for education and training for the nuclear sector, tightening the links between the areas of nuclear safety/engineering, radiation protection, waste management and geological disposal at the same time, by better coordinating their contributions in the E&T fields. The transition from science to technology occurring in the fusion research environment justifies an additional effort to tighten the links with FuseNet, thus integrating the E&T effort on the fission side with common actions related to fusion. Links with the SNE-TP, IGD-TP and MELODI platforms, with EHRO-N, NUGENIA and other bodies interested in maintaining or developing the nuclear (fission / fusion) workforce throughout Europe (ENSREG, HERCA, WENRA, ENEF, FORATOM, EuroFusion, FIIF, etc.) will be necessary, in order to assure coherence of this effort with similar other efforts going on in Europe.

The objectives proposed hereafter encompass different issues on which consensus is reached in relation to the need of urgent actions. The corresponding proposed actions have well defined and tangible outcomes that will produce a considerable and durable impact on the effectiveness of E&T in the nuclear areas in Europe.

### **Objective 1: SURVEY AND COORDINATION OF NETWORKING IN E&T AND VET IN NUCLEAR AREAS**

The actions related to this objective will have as a tangible outcome the identification and implementation of efficient networking mechanisms aiming at favouring coordination, synergies and “cross-pollination” of E&T and VET initiatives among the nuclear safety/engineering, the radiation protection and the waste management and geological disposal communities, and E&T domains beyond these fields.

This first phase of the project will also provide the necessary background to the other actions, even if it will partly run in parallel to them, promoting the involvement of the various nuclear areas through the pilot cooperation actions described below. Education and training certifications, as the already existing European Master of Science in Nuclear Engineering (EMSNE), will be better promoted and their added value will be demonstrated in relation to the needs of the end-users. Gaps in nuclear E&T will be identified. Harmonising

Fusion Industry Innovation Forum and/or linking existing course databases and revitalising national and international E&T networks and other initiatives will be additional goals in this regard. Connections with the relevant regulatory bodies and the European E&T qualification systems (EQF, ECVET, ECTS) will be made.

The support of and interaction with SNETP, IGD-TP and MELODI, as well as with EHRO-N

and other relevant bodies interested in enhancing education and training in the nuclear (fission/fusion) fields in Europe (such as IAEA, ENSREG, HERCA, FORATOM, EuroFusion, etc.), will be necessary ingredients in this action in order to ensure the incorporation of the most recent research results in the developed E&T initiatives and to tailor them to the needs of the research and technology market.

## **Objective 2: DESIGN AND IMPLEMENTATION OF COORDINATED E&T AND VET EFFORTS.**

This objective is in line with the recommendations for actions presented in the Annex I of the SET Plan Roadmap for E&T and also with the Horizon 2020 call for NFRP10, in which, in particular, “A special effort” is asked to be spent in the “to the development of European Masters and summer schools for the continuous professional development of researchers and other private/public actors.”

The contribution to the design, implementation and evaluation of courses for a European Master Programme for Continuous Professional Development in Nuclear Science and Technology (60 ECTS after MSc graduation) and of a European Summer School in Nuclear Disciplines, providing lifelong education and training opportunities to professionals and PhD students, will constitute tangible outcomes and the best workbench for proving the effectiveness of the identified coordination mechanisms in promoting synergies among the different nuclear areas, in strict cooperation with stakeholders, as the end-users of the E&T products.

This action will be carried out in cooperation the GENTLE project (<http://gentleproject.eu/>) and other relevant E&T projects, in the common aim to set up and proceed towards accreditation of an Executive Master for continuous professional development. Experienced teachers from academia, research centres and industry were invited to join this effort, bringing their knowledge, skills and competencies/attitudes.

The actions to achieve Objective 2 will be partly complemented by the actions to be described in Objective 4 mentioned below and will make use of ECTS and ECVET accreditation methodologies, where appropriate. Further contributions will be obtained from the actions envisaged for Objective 5 and 6, providing input for common E&T actions in the field of nuclear safety culture and for the “nuclear transition” occurring in the fusion area. An interface with the actions at Objective 3, coordinating the development of educational material, is clearly present.

## **Objective 3: GENERATIONAL TRANSFER OF EXPERTISE: PROMOTING KNOWLEDGE PRESERVATION IN FRONT OF PERSONNEL TURNOVER BY PRODUCING TEACHING MATERIAL**

In view of the generational turnover, which is already taking place, and of the need to keep key expertise in the different nuclear areas, actions will be made for launching a systematic and sustainable programme for the production of E&T material, thus favouring the generational transfer of knowledge, skills and competencies / attitudes.

This material, including books, lecture notes, multimedia courses, e-learning material and means for its storage will be produced by pilot actions at academic and industrial partner institutions, working in strict cooperation. As mentioned above, these actions will also be linked to the European Master Programme and the Summer School to be established by the actions under objective 2, since the pilot produced material, once completed, may be useful for future editions of these initiatives.

## **Objective 4: FACILITATING CROSS BORDER TRANSFER OF EXPERTISE BY APPLICATION OF ECVET AND ITS TECHNICAL COMPONENTS**

A specific task group constituted by interested industrial bodies and training providers, also supported by academia and in strict cooperation with the relevant Technological Platforms as well as other stakeholders in the nuclear field, will examine the opportunities and the problems raised by the application of the ECVET system in a nuclear industrial environment. The work to be done consists of analysing the present situation in the nuclear field, and preparing, implementing and evaluating pilot cross-border exchanges of personnel working in nuclear industry, thereby providing an important basis for a widespread application of ECVET in the nuclear field.

#### **Objective 5: REINFORCING ETI ACTIONS FOR SHARING AND ENHANCING NUCLEAR SAFETY CULTURE COMPETENCE**

The NUSHARE Project ( [www.nushare.eu](http://www.nushare.eu) ), presently running under the coordination of the single beneficiary ENEN, is an action stimulated by the cabinets of two EC commissioners after the Fukushima accident, in order to enhance nuclear safety culture (NSC) in Europe.

The actions of the project are underway and the present proposal, also in view of the specific focus on nuclear safety culture of the Euratom call, intends to contribute in reinforcing the Europe-wide cooperation in this field, by proposing courses and different initiatives on NSC for different target groups.

These courses, together with the five Eurocourses of the TRASNUSAFE project (<http://trasnusaft.eu/>), that ENEN will inherit after the project's closure, will be mostly offered in the frame of the advanced European Master Programme. Selected or summary lectures from these courses will be proposed in the Summer School.

#### **Objective 6: REINFORCING COOPERATION BETWEEN FISSION AND FUSION IN E&T**

The European ambition is to bring fusion electricity to the grid by 2050. To realize this, the fusion development programme is making a triple transition: from lab-work to industrial involvement, from science driven to technology driven and from essentially non-nuclear to nuclear technology. To facilitate the latter, i.e. the nuclear transition, is the objective of the action.

This transition has major consequences for the composition and competences of the workforce. The present proposal aims to link the available nuclear knowledge on this nuclear training in the fission community with the needs in the fusion community. The representative education networks, ENEN for fission and FuseNet for fusion, are the obvious partners for this activity. As a contribution to Objective 2, courses on specific fusion technology issue will be delivered in the frame of the European Programme and of the Summer School.

The actions necessary to achieve the above Objectives 1 to 6 will be coordinated by ENEN in strict cooperation with the technological platforms operating in the nuclear areas and are aimed to generate renewed cooperation among the relevant institutions delivering E&T or VET or those interested in providing support to the maintaining and developing the nuclear workforce in Europe. A strict interaction with EHRON and other relevant bodies will be also necessary in order to monitor the needs of relevant stakeholders in these fields and to adapt the project strategy in accordance.

### 3. Partners

Part. No *	Participant organisation name	Participant organisation short name	Country
1	European Nuclear Education Network	ENEN	France
2	Commissariat à l'Energie Atomique - Institut National des Sciences et Techniques Nucleaires	CEA-INSTN	France
3	Belgian Nuclear Research Centre	SCK-CEN	Belgium
4	Technical University of Catalonia-Barcelona Tech	UPC	Spain
5	TECNATOM	TECNATOM	Spain
6	AREVA	AREVA	Germany
7	Consorzio Interuniversitario per la Ricerca Tecnologica Nucleare	CIRTEN	Italy
8	Jozef Stefan Institute	JSI	Slovenia
9	EUTERP Foundation	EUTERP	Netherlands
10	Aalto University	AALTO	Finland
11	Uppsala University	UU	Sweden
12	Joint Research Centre	JRC	Belgium
13	Aachen University	AACHEN	Germany
14	FuseNet Association	FUSENET	Netherlands
15	Bundesamt für Strahlenschutz	BFS	Germany
16	Czech Technical University	CVUT	Czech Republic
17	'Horia Hulubei' National Institute of Physics and Nuclear Engineering	HH-IFIN	Romania
18	Forschungszentrum Jülich GmbH	JUELICH	Germany
19	Karlsruhe Institute of Technology	KIT	Germany
20	Université catholique de Louvain	UCL	Belgium
21	Université de Lorraine	UL	France
22	University of Manchester	UMAN	United Kingdom
23	Università di Pavia	UNIPV	Italy
24	Universidad Politecnica de Madrid	UPM	Spain
25	University of Centre Lancashire	UCLAN	United Kingdom
26	Universidad Nacional de Educación a Distancia	UNED	Spain
27	National Skills Academy for Nuclear Ltd	NSAN	United Kingdom

### 4. Work plan – Work packages, deliverables and milestones

The structure of the project is illustrated in the following functional sketch, highlighting that the relations with the platforms, IAEA and other Bodies (Work Package 7) and the project management activities (Work Package 8) will constantly supersede at the good development of the tasks envisaged in Work Packages from 1 to 6, exactly corresponding to the Objectives 1 to 6 described in section 1.1. The Gantt chart of the project is reported in the following pages, showing the chronological and logical development of the actions in the project. The related Work Packages and the related work content are described below.



culture is singled out in a specific work package since it deserves the special attention, as suggested by the Euratom call. The related courses will address professionals in different target groups and will be aimed to provide the knowledge, skills and attitudes necessary to value safety as the most important aspect in nuclear activities. Considering the nature of nuclear safety culture, the development of specific attitudes favourable to perceive safety as the overwhelming interest in any nuclear activity will be a priority for the development of the courses. The courses will be then the subject of a specific assessment, contributed to the overall quality assessment of courses to be performed in WP2. A preliminary offer of courses has been already defined at the time of proposal finalisation, including modular activities for different target profiles; an interesting proposal that will be given attention in the development of the work will be the production of MOOCs on nuclear safety culture which will have the objective to disseminate the contents of selected courses, thus reaching a wider public.