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*Research and Innovation Action (RIA)*

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# TANDEM E&T courses structure and syllabus

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**Summary**

plan and implement the delivery of the E&T actions in accordance with the structure. Aspects such as: lecturers, delivery dates, venues -where applicable- or Conferences will be planned. Feedback Forms shall be designed in advance to obtain insights from the students. E.g., GRS can give an online course on ?Simulation of cogeneration with system codes? based on the results of the simulations performed in Task 2.4 and 4.2

Approval

| Date | By |
|---|---|
| 2023-12-11 13:52:39 | Dr. Gabriel Lazaro PAVEL (ENEN) |
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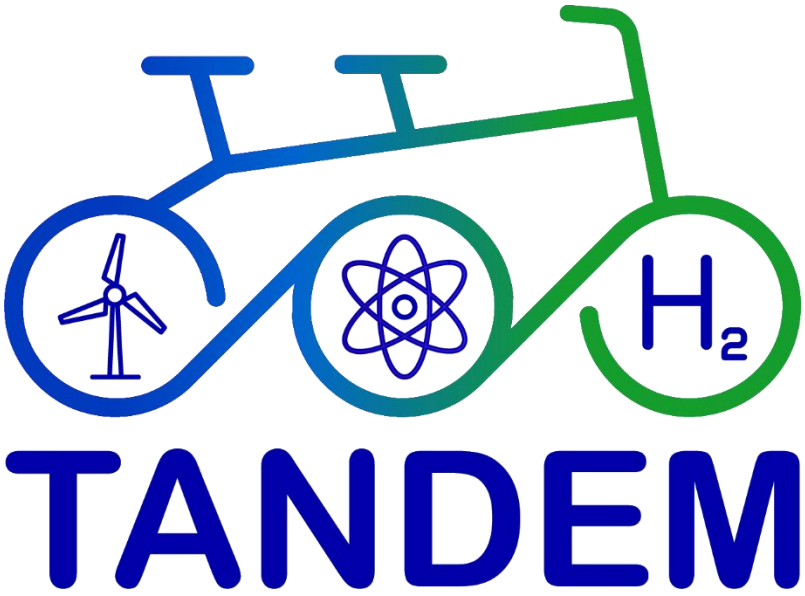


# D6.2 - Design of E&T actions on safety of SMRs and hybrid system applications

## WP6 - Task 6.2

11-12-2023

**Andrea Pucciarelli (CIRTEN-UNIPI), Walter Ambrosini (CIRTEN-UNIPI), Alessandro De Angelis (CIRTEN-UNIPI), Claire Vaglio-Gaudard (CEA), Stefano Lorenzi (CIRTEN-POLIMI), Marco Enrico Ricotti (CIRTEN-POLIMI), Gabriel Pavel (ENEN)**

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# Abbreviations and Acronyms

| Acronym | Description |
|---|---|
| ADDIE | Analyse, Design, Develop, Implement and Evaluate |
| BSc | Bachelor of Science |
| CEA | Commissariat à l'Energie Atomique et aux Energies Alternatives |
| CIRTEN | La Ricerca Tecnologica Nucleare nelle Università Italiane |
| ECTS | European Credit Transfer and Accumulation System |
| EDF | Electricité de France |
| E&T | Education and Training |
| EU | European Union |
| IAEA | International Atomic Energy Agency |
| MSc | Master of Science |
| NHES | Nuclear Hybrid Energy Systems |
| PhD | Doctor of Philosophy |
| SAT | Systematic Approach to Training |
| SMR | Small Modular Reactor |
| VTT | Technical Research Centre of Finland |

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## Executive Summary

The aim of this deliverable is to design the activities to be later implemented in Task 6.3 in the frame of the Education and Training Work Package.

Starting from the information collected during Task 6.1, suggestions about the preliminary structure, venue and topics of the foreseen activities are proposed. An International Summer School, Workshops (at least two) and a cycle of Webinars (at least 5) are expected to be delivered. The activities are designed following the Systematic Approach to Training (SAT): they will thus be prepared on the basis of selected expected learning outcomes, skills and competences together with feedback both from the audience and the organizers. The obtained information will be considered for further improvement to be implemented in the following events. The activities will be devoted to enhance the understanding about SMR applications and the integration of SMRs in hybrid energy systems by students, engineers and researchers working in the wider energy sector and in the nuclear field. Lecturers could be both people belonging to the TANDEM consortium or external experts in cogeneration, hydrogen production and nuclear/industrial safety.

The present report provides the general guidelines for the implementation of the expected activities, more specific information (lecturers, venue, dates) will be defined in the frame of Task 6.3.

## Keywords

Skills, knowledge, competences, education, training, E&T, SAT.

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# 1 Introduction

The current Deliverable 6.2 describes the design of the Education and training actions on safety of SMRs and hybrid energy systems. These actions will focus on two major inputs. On the one hand, we will use the findings and results in Working Packages 1 to 4 and on the other hand we are going to take into consideration the findings from Deliverable D6.1 [1].

In Deliverable 6.1 there were identified the gaps in the education and training related to the integration of SMRs into hybrid energy systems. One important finding related to the SMR integration in such systems is that today there is no higher education program that addresses the specificities of this integration and, more than this, the topics concerning the integration of nuclear power plants into energy grids are addressed by people who are not specialized in nuclear energy.

This background allows us to set the stage for addressing this issue in a coordinated and coherent manner that will familiarize the recipient with the advantages of such coupling of SMRs to hybrid energy systems but will also present the latest advancements in the field.

The TANDEM project plans to organize a summer school that will provide an in-depth analysis of the topic. The summer school will have a comprehensive curriculum as described below. It will be complemented by a series of open webinars which are going to be made available for the general public (participation is open) and we are looking into making the recording of the webinars available even after the webinars took place.

Two workshops on SMR general characteristics and key findings from Work Packages 1, 2, 3 and 4 will be organised. The workshops are planned to be held in two different EU countries in order to obtain an optimal geographical coverage.

All education and training actions in TANDEM are going to use the Systematic Approach to Training (SAT) methodology for an optimal approach and for better outputs. SAT is a methodology for managing the E&T programs of end-users. It is an orderly, logical approach to determine what people must know and do for a particular job, ensuring that they are prepared for their work by having the necessary knowledge, skills, and attitudes. Unlike the ECTS based education, SAT uses constant evaluation of the training program to ensure that it meets the needs of the students and of the beneficiary institutions against existing standards and regulation.

SAT begins with identifying people's work-related needs. It ensures that training is delivered properly, that the student learns what is important, and the student is competent to be assigned

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to work. The SAT is always a combined effort between trainers and experts from operating line organizations as the managers, supervisors, and experienced workers from organization play an important role in its implementation.

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# 2 Implementation of the Systematic Approach to Training

The Education and Training activities to be designed in the frame of the present deliverable must be prepared in accordance with the Systematic Approach to Training (SAT) while keeping a strong focus on the main topics of SMRs safety and Hybrid Energy Systems also identified in Task 6.1 [1]. The information regarding the SAT approach reported in the present document is mainly derived from the IAEA Nuclear Energy Series document "Systematic Approach to Training for Nuclear Facility Personnel: Processes, Methodology and Practices" [2] to which the reader is addressed for a deeper description of the methodology.

The Systematic Approach to Training is a method aiming to improve the performances of both the audience and the trainer itself by adopting an iterative procedure based on mutual feedbacks of all the participants to the training operations. The approach should allow monitoring the quality of the delivered training, programmed activities content and learning materials as well as assessing if the designed learning outcomes were received by the audience and what its general perception of the training activities is. All the collected information during the active phase of the training will be later revised by organizers or a committee to evaluate the global results of the performed activities as well as to propose possible changes/improvements for the following ones. The Systematic Approach to Training it uses a procedure that can be schematized adopting the so-called ADDIE cycle: Analyse, Design, Develop, Implement and Evaluate.

*Analysis Phase* - In the analysis phase the expected or needed learning outcomes are identified as well as the kind of audience to which the training/lectures are to be delivered. For first of a kind events the analysis phase consists in the very first step of the procedure; for more mature programs (see, e.g., the proposed Webinar Series in section 3.3) it could be included in or benefit from the revision process since valuable information were already collected in previous editions of the event.

*Design Phase* – In this phase the actual objectives of the training are defined and organized into a training programme in accordance with requirements and goals identified during the previous analysis phase. Expected evaluation test questions could also be developed in this phase.

*Development Phase* – In this phase the training is prepared in a more detailed manner. Training material is, e.g., developed and revised and different lecturing styles may be discussed in order to decide what could be a suitable proportion between frontal lessons or hands-on/exercise sessions.

*Implementation Phase* – It is the actual and active phase of training. Lectures and exercise sessions are delivered on the basis of the programmes and material developed during the

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previous phases. The assessment of the achievement of the desired learning outcomes and the collection of further feedbacks on the event both from the audience and organizers sides is also performed during this phase.

*Evaluation Phase* – The design of training programmes, delivery and their contribution to the improvement of the understanding of the audience are assessed during this phase. The analysis thus investigates both the competencies obtained by the students and the effectiveness of the lectures, exercises and training programmes. The aim of this session is to suggest possible corrective actions to be implemented in future training activities in order to keep or improve the standards of the delivered training sessions.

The application of the SAT approach to the Education and Training activities foreseen for the TANDEM project will require the use of different strategies.

A detailed analysis phase will be for sure required for activities which do not directly benefit from the experience gained in the frame of past editions such as the planned Workshops. The foreseen International School and the Webinars, which will respectively benefit of the 2022 ELSMOR Summer School [3] experience and of the UniPi Webinar platform could instead start from a critical revision of the past experiences. As suggested in the introduction of this document, the selected audience should be students, engineers and researchers working in the energy or nuclear sector aiming for a better understanding of SMR capabilities and potential safety issues especially when included in a hybrid energy system with a sufficiently large penetration of renewable energy sources.

The design phase will involve a more precise definition of the desired learning outcomes, thus proposing potential specific topics to be discussed in the frame of the planned events, e.g. SMRs operating in cogeneration or updates regarding the status and outcomes of the TANDEM project.

The development phase will involve the preparation, if needed, of the learning material as well as the definition of the lecture style and potential lectures.

During the implementation phase, feedback from the audience and organizers will be collected. The questionnaire used for the evaluation phase is presented in Annex 1, as an example.

The analysis of feedbacks will be the main topic of the evaluation phase. The gathered information will be especially useful for those activities for which a certain level of repetition (Workshops and Webinars) is foreseen in the frame of the present project. Possible corrective actions will be thus foreseen in order to improve the quality standards of the following training events.

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# 3 Expected activities

According to the TANDEM description of work, a International Summer School, two Workshops and at least 5 Webinars are to be delivered in the frame of the project. In this section the planned activities will be described providing a Syllabus for the Summer School, as well with the topic, proposed venue and platforms to be considered for the Workshops and Webinars.

## TANDEM Summer School

The proposed International Summer School, organized within the framework of the TANDEM project, aims at providing a comprehensive understanding of the potential role that nuclear hybrid energy systems play in the ongoing energy transition. In this context, particular attention will be devoted to SMRs and exploring the various advantages, as well as the techno-economic and safety challenges, associated with the integration of nuclear power plants with applications beyond conventional electricity generation. This wants to provide a contribution in the E&T gaps identified in the deliverable D6.1 of the TANDEM project.

According to the SAT method, some learning outcomes have been identified for the International Summer School:

- LO1: to provide participants with an extensive overview of the advantages and challenges of concepts of nuclear reactors producing commodities beyond power supply;
- LO2: to train students in the use of tools and methodologies essential for designing and simulating the operation of nuclear hybrid energy systems;
- LO3: to equip attendees with the quantitative skills necessary for assessing the impact of these systems within different contexts, ranging from a local scale to the global decarbonization of the energy system.

The target audience comprises last year BSc, MSc, and PhD students, as well as researchers, young professionals and experienced engineers who aim to improve their knowledge about SMRs, their application and challenges and opportunities offered by integrating them into hybrid energy systems. Given the specificity of the TANDEM Summer School, students are required to have a general background in nuclear systems and SMR technology.

Given the outcomes of the SAT analysis phase, the design phase has been carried out to define a set of minimal information required for the effective development and implementation of the TANDEM Summer School:

- Target audience: The participation in the summer school is expected to range between 30 and 50 attendees. In order to guarantee an adequate and inclusive representation of

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viewpoints and experiences among the participants, the selection process will place a high priority on both gender balance and international diversity;

- Location: Politecnico di Milano, Lecco campus, Lecco, Italy. Attendance in presence is strongly encouraged, but it could be possible to attend the summer school online, e.g., through the Webex platform, and record the presentations with the permission of each lecturer;
- Period: one week in June or July 2024.

In compliance with the expected learning outcomes, a draft of the summer school program is proposed. The program's development rationale aims for a balance between lectures that provide a robust understanding of advanced nuclear technologies and their integration opportunities into NHES and interactive sessions where participants can directly apply the knowledge they acquire during the summer school to different group projects. These sessions will involve practical case studies and the outcomes of each working group's efforts will be shared with the other participants. Hands-on activities may include the direct application of tools and methodologies developed within the TANDEM project, including but not limited to dynamic simulations of multiple NHES architectures in the Modelica language and their techno-economic optimization concerning both operational aspects and system design.

**Table 1. Preliminary programme of the TANDEM Summer School.**

| Day | | Activity | Possible Speakers |
|---|---|---|---|
| Day 1 (Mon) | Morning | / | / |
| | Afternoon | Registration, opening remarks, and welcoming event | Summer school organizers |
| Day 2 (Tue) | Morning | Current and future energy landscape, role of nuclear in the energy transition | IAEA or other experts involved in the development of scenarios |
| | | Introduction to nuclear cogeneration: current situation, advantages and challenges, future trends | |
| | | Introduction to nuclear-renewable hybrid energy systems | |
| | Afternoon | International research initiatives (TANDEM, Gemini+, NPHyCo, US-DOE IES, GIF NEANH…) | Projects representatives |

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| | | | |
|---|---|---|---|
| | | Introduction to the modelling of NHES and on the tools for the hands-on sessions | |
| | | Introduction to the hands-on sessions and working groups formation | Summer school organizers |
| Day 3 (Wed) | Morning | Overview of non-electric applications to be integrated into NHES | |
| | | Advanced nuclear technologies: SMRs | SMR vendor |
| | | Advanced nuclear technologies: AMRs | AMR vendor |
| | Afternoon | Hands-on sessions | Summer school organizers |
| Day 4 (Thu) | Morning | Licensing and regulatory challenges of NHES, focus on safety implications | Safety authorities |
| | | Advances in the policy making process: the European case | EU/Euratom representative |
| | | Industrial users' interests in nuclear cogeneration (EU experiences) | European industrial representative (e.g., Finland, France etc.) |
| | Afternoon | Industrial users' interests in nuclear cogeneration (global experiences) | International industrial representative |
| | | Working group presentations | Summer school organizers |
| Day 5 (Fri) | Morning | Technical visit | Summer school organizers |
| | Afternoon | Technical visit | Summer school organizers |
| | | Concluding remarks, certificate distribution, school closure | Summer school organizers |

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## Workshops

At least two Workshops are going to be organized in the framework of the TANDEM project. Following the recommendations of Deliverable 6.1, it is envisaged that the topics of the workshops could cover thematic areas which are not sufficiently discussed in the frame of BSc and MSc courses across Europe. In particular, the deliverable suggested that SMR applications, especially when adopted for cogeneration purposes, and the potential questions raised by the integration of SMRs in hybrid energy systems still represent a weak spot in the educational proposal. As a consequence, it is considered appropriate to select the topics of the workshops in accordance with those recommendations, thus trying to provide an insight into SMR applications. The target audience will consist in experienced engineers and researchers who aim to improve their knowledge about SMRs, their applications and hybrid energy systems, engineers and researchers of younger generation to develop new competences, as well as MSc and PhD students.

Particularly, the following two topics have been identified for the workshops:

1) Non-electric applications of SMRs, hybrid energy systems and their components

2) Modelling and optimization tools to assess hybrid energy systems integrating nuclear reactors

The workshop about topic n°1 is planned to be hosted at CEA Cadarache in France, during the first semester of 2024. The workshop will focus on SMR applications such as district heating and cooling, hydrogen production, sea water desalination and synthetic fuel production, and the SMR coupling with other energy sources and storage systems in hybrid energy systems. The workshop preliminary programme is given in Table 2.

The workshop about topic n°2 is planned to be hosted by UniPi in Italy, during the second semester of 2024. It is envisaged to present the tools developed and/or implemented in the TANDEM project, as well as to invite other organizations who also develop tools to assess and optimize hybrid energy systems (IAEA, US Idaho National Laboratory). The workshop preliminary programme is given in Table 3.

The workshops will be organized for one or two days. Between 15 participants and 20 participants are expected. Some lecturers could give their lectures remotely, if they cannot travel, or if the project cannot cover their travel costs.

The learning outcomes could be either connected with theoretical information or numerical capabilities to be trained during a designed hands-on session, especially for the second proposed

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topic. Technical sections of the Workshops focusing on the outcomes and status of the TANDEM project could be included as well.

Lecturers could be either Consortium Partner members or invited external experts from institutions in the nuclear and in the wider energy fields as well as representatives of the stakeholder industries. In this sense, IAEA will be contacted in order to assess its availability in delivering some of the designed lectures. In addition, the Consortium members will be kindly asked to contribute to the success of the events by providing possible dates for their availability and possible specific topics to be discussed during their lessons.

**Table 2. Preliminary programme of the TANDEM workshop about "Non-electric applications of SMRs, hybrid energy systems and their components".**

| Day | | Activity | Possible Speakers |
|---|---|---|---|
| Day 1 | Morning | Welcome | Workshop organizers |
| | | Brief presentation of the TANDEM project: objectives, activities, expected outcomes, status | TANDEM coordinator (CEA) |
| | | Overall description of hybrid energy systems and their components | WP1 leader (TRACTEBEL) and/or WP2 leader (CEA) |
| | | Nuclear polygeneration | SNETP/NC2I, GIF/NEANH |
| | Afternoon | Design of multipurpose reactors (SMRs, AMRs) | CEA/IRESNE |
| | | Hydrogen production from nuclear energy | IEA/Task Force 44, CEA/LITEN |
| | | Photovoltaics production | CEA/INES |
| | | Power conversion system and electrical grid | TRACTEBEL or EDF |
| Day 2 | Morning | Desalination | EAI |
| | | Heat network and needs for district heating | VTT / Fortum |
| | | Carbon capture and synthetic fuel production | CEA/IRESNE |
| | | Thermal and electrical storage | ENERGORISK or TRACTEBEL |
| | Afternoon | Technical visits (CEA facilities or ITER building site) | TANDEM coordination (CEA) |

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**Table 3. Preliminary programme of the TANDEM workshop about "Modelling and optimization tools to assess hybrid energy systems integrating nuclear reactors".**

| Day | | Activity | Possible Speakers |
|---|---|---|---|
| Day 1 | Morning | Welcome | Organizers (CIRTEN UniPI) |
| | | Brief presentation of the TANDEM project: objectives, activities, expected outcomes, status | Project Coordinator and/or EU Representative |
| | | Energy systems scenarios and NHES | WP1 Leader, Industry Representatives |
| | | SMR designs and applications | IAEA, INL |
| | Afternoon | Cogeneration applications of NPPs | IAEA, INL |
| | | Components of a NHES | IAEA, INL |
| | | Non-electric applications of SMRs, hybrid energy systems and their components | Sapienza Università di Roma |
| | | Modelling tools for NHES – Introduction to Modelica | CIRTEN PoliMI and UniPi |
| Day 2 | Morning | Demonstration/Exercise session with Modelica | CIRTEN PoliMI and UniPi |
| | Afternoon | Impact of NHES on SMRs safety | IRSN, GRS, CIRTEN UniPi, ENEA |
| | | Lessons learned and modelling tools to assess safety of NPPs in NHES | IRSN, GRS, CIRTEN UniPi, ENEA |
| | | Concluding remarks/Closure of the Workshop | Organizers (CIRTEN UniPI) |

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## Webinars and Videos

According to the TANDEM description of work, at least 5 Webinars are expected to be delivered in the frame of the TANDEM project. To fulfil this task, it is proposed to take advantage of existing platforms working in the nuclear field, especially if coordinated by Consortium members. With this view, it is proposed to consider the platform "Past-student and Expert Webinars in Nuclear Energy" managed by the MSc in Nuclear Engineering of the University of Pisa. The platform has been offered in the frame of the ENEN2plus project (https://enen.eu/index.php/portfolio/enen2plus-project/ ) and it is open also to host dissemination, education and training activities designed by other EU projects. The webinars are expected to have a duration of 1-1,5hours and to tackle various SMR related subjects.

While seminars and webinars addressing nuclear engineering topics have been delivered at the University of Pisa since 2013, the frequency of Webinars rapidly increased as a consequence of the 2019 COVID pandemic. The Webinar series, initially started as a pilot project, seems now sufficiently mature to provide a valuable environment for dissemination, education and training activities in the nuclear engineering field. This is also confirmed by different categories of attendants reported in Figure 1 based on a sample of 156 answers. Initially devoted to enrich curricular lectures for MSc and PhD students and to provide BSc students with an idea of possible nuclear scientific careers, the Webinar series proved to be very attractive to PhD students and general public as well. This is for sure connected with the high level of invited lecturers representing institutions in the nuclear and in the general energy fields.

For a complete list of the past invited lectures the reader is referred to the following links:

2020-2021 Webinar Series: http://nucleare.ing.unipi.it/it/webinars/webinars-2021

2021-2022 Webinar Series: http://nucleare.ing.unipi.it/it/webinars/webinars-2021-2022

2022-2023 Webinar Series: http://nucleare.ing.unipi.it/it/webinars/webinars-2022-2023

2023-2024 Webinar Series: http://nucleare.ing.unipi.it/it/webinars/webinars-2023-2024

On top of that, it must be mentioned that the platform confirmed to be a solid basis also for the organisation of external "spot" events like the one celebrating the 80$^{th}$ anniversary of the Fermi pile criticality, (see the webpage at following link: http://nucleare.ing.unipi.it/it/webinars/80th-anniversary-of-the-fermi-pile-criticality).

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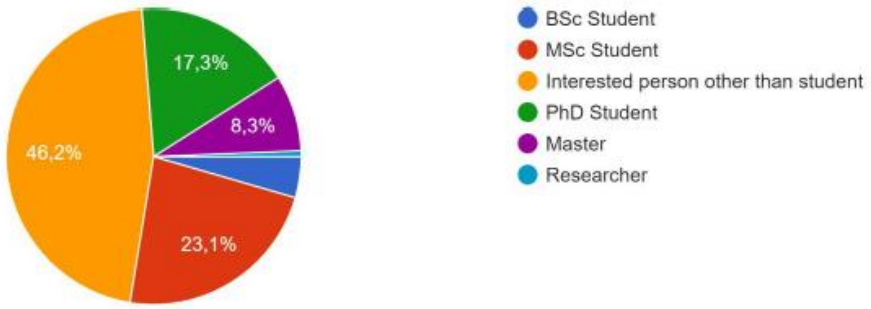


**Figure 1 Distribution of reserving attendants among different categories during one of the series of webinars held in last years**

Speaking about the SAT approach, the fundamental aspects of the methodology like collecting feedback of the audience to better calibrate the proposed webinar delivery and lectures are already implemented in the "Past-student and Expert Webinars in Nuclear Energy" series. Figure 2 reports suggestions received from the audience for future subjects and topics at the end of one of the webinar series: it is highlighted that SMRs applications were mentioned twice in this list as desired future topics of the webinars. The perceived quality level and satisfaction of the audience was measured as well and is reported as an example in Figure 3. Eventually, information about the best media for the communication and webinar organization was also collected as reported in Figure 4.

- Nuclear accidents, Nuclear analysis methods for environmental samples
- Near miss events in Operating NPPs,, Regulatory Requirments, Gen IV reactors, Accelerators
- Radioisotopes production by nuclear applications
- Lead fast reactors and Liquid Metal thermal-hydraulics
- Developments on fusion research. Impact of nuclear energy on the environment.
- Radiation protection related topics, climate change related topics
- I would like to sé more lectures about next generation reactors
- Maybe OECD/NEA global overview of reseach
- nuclear medicine, radiation protection
- Nuclear reactor development from companies like GE, Rosatom, Tepco, or EDF
- SMR and Advanced Reactors with capacity of >= 1000MW
- For generating interest in the real work with real problems i suggest to hav eexpalnation in real working problems in integrating engineering and installation / commissioning.
- Nuclear Decommissioning, Medical applications
- Practical lectures or simulation program for operation nuclear reactor
- The lecturers that were in series, were very interesting, I would like to hear the research continuation of researchers (if, of course, they have). But your other guests, I am sure, will be no less interesting!
- SMRs, Nuclear Project Management topics, Life extension, Decommissioning
- Molten Salt Reactor and Thermal Hydraulics

**Figure 2 Suggested future subjects and/or lecturers in the Webinar Series**

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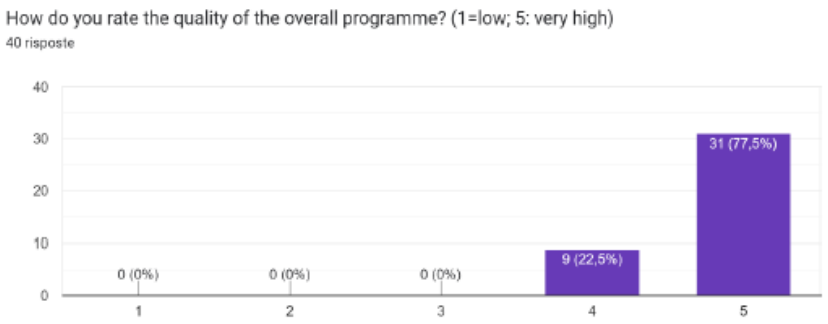


**Figure 3 Satisfaction of the attendance of the Webinar Series**

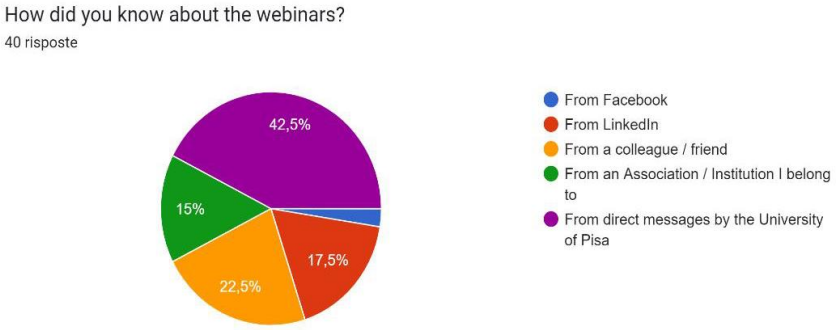


**Figure 4 Distribution of media from which the audience learned about the existence of the Webinar**

The "Past-student and Expert Webinars in Nuclear Energy" could thus be as a suitable frame for the delivery of webinars to be included in the TANDEM framework. Lecturers as WP leaders updating the audience about the progress of the project or experts in cogeneration could thus be invited fulfilling the aims of the Education and Training WP6. The draft version of the invitation letter is reported in Annex II

The second part of the task is instead devoted to sharing videos in a suitable repository available on the web. Since the 2022-2023 series, the webinars of the "Past-student and Expert Webinars in Nuclear Energy" are recorded and stored in in a UniPi repository which is available for the public via a link on the MSc website. A similar approach could be considered for the videos regarding the TANDEM project which could be records of the delivered webinars. Additional repositories, e.g., provided by ENEN, whose link is provided on the TANDEM project website could be considered in order to fulfil the task.

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# 4 Conclusion

The present deliverable is intended to pave the way for the delivery of the education and training activities foreseen for the TANDEM project.

Starting from the recommendations coming from Deliverable 6.1 to fill the gaps in the education and training related to the integration of SMRs into hybrid energy system, the present deliverable builds the basis for the delivery of the planned activities. The SAT approach has been discussed and its bases will be applied for the final design and implementation of the E&T activities.

In particular, the Syllabus for the Summer School has been prepared also suggesting a potential venue and period (Lecco, Italy – June 2024). Two workshops with different main topics are also envisaged during the first and second semester of 2024.

Eventually, a cycle of Webinars on relevant topics for the TANDEM project is proposed to be hosted in the frame of the "Past-student and Expert Webinars in Nuclear Energy" platform available at CIRTEN-University of Pisa for the years 2023-2024 and 2024-2025.

The implementation of the presently designed activities will be the subject of the upcoming Task 6.3.

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Annex 1

# ANNEX – 1 - COURSE EVALUATION BY TRAINEE

# "NAME OF THE WORKSHOP HERE"

## GENERAL FEATURES

**1.1 Content of Module :**

**Nothing new** ☐ **Too general** ☐ **Well-balanced** ☐ **Too detailed** ☐ **Too advanced** ☐

| | | Excellent | Good | Average | Low |
|---|---|---|---|---|---|
| **Your evaluation of Module content** | | ☐ | ☐ | ☐ | ☐ |
| **1.2** | **Practical information, logistic** | ☐ | ☐ | ☐ | ☐ |
| **1.3** | **Time management** | ☐ | ☐ | ☐ | ☐ |
| **1.4** | **Number of trainees** | ☐ | ☐ | ☐ | ☐ |
| **1.5** | **Interactive elements** | ☐ | ☐ | ☐ | ☐ |
| **1.6** | **General quality of teaching, lectures** | ☐ | ☐ | ☐ | ☐ |
| **1.7** | **Interest of virtual lab visits** | ☐ | ☐ | ☐ | ☐ |
| **1.8** | **Interest of workshops** | ☐ | ☐ | ☐ | ☐ |
| **1.9** | **Your Teaching tools** | ☐ | ☐ | ☐ | ☐ |
| **1.10** | **Quality of handouts** | ☐ | ☐ | ☐ | ☐ |
| **1.11** | **Interest on the practical exercises** | ☐ | ☐ | ☐ | ☐ |

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## DETAILED EVALUATION OF LECTURE

**Course 1 name**

**2.1.1** **Your interest in the topics presented**

**High** ☐ **Average** ☐ **Low** ☐

**2.1.2** **Importance of know-how and knowledge transfer**

**Excellent** ☐ **Good** ☐ **Average** ☐ **Low** ☐

**Course 2 name**

**2.2.1** **Your interest in the topics presented**

**High** ☐ **Average** ☐ **Low** ☐

**2.2.2** **Importance of know-how and knowledge transfer**

**Excellent** ☐ **Good** ☐ **Average** ☐ **Low** ☐

**Course 3 name**

**2.3.1** **Your interest in the topics presented**

**High** ☐ **Average** ☐ **Low** ☐

**2.3.2** **Importance of know-how and knowledge transfer**

**Excellent** ☐ **Good** ☐ **Average** ☐ **Low** ☐

.
.
.

**Course n name**

**2.n.1** **Your interest in the topics presented**

**High** ☐ **Average** ☐ **Low** ☐

**2.n.2** **Importance of know-how and knowledge transfer**

**Excellent** ☐ **Good** ☐ **Average** ☐ **Low** ☐

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**2.23 Your suggestion for lecturers (for example, "show more examples"...)**

2.24 What additional topics should be included in the Lectures?

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## EVALUATION OF THE LAB VISITS /PRACTICAL EXERCISES

**3.1.1** **Your interest in the topics presented in the lab visit**

**High** ☐ **Average** ☐ **Low** ☐

**3.1.2** **Your evaluation of the usefulness of the lab visit**

**Nothing new** ☐ **Too general** ☐ **Well-balanced** ☐ **Too detailed** ☐ **Too advanced** ☐

**3.1.3** **Your overall evaluation of the lab visit (content and organization)**

**Excellent** ☐ **Good** ☐ **Average** ☐ **Low** ☐

3.2 Your suggestion for organization of lab visit

.....

.....

.....

3.3 What additional topics/experiments should be included in the lab visit?

.....

.....

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## EVALUATION OF QUIZED/EXERCISES

**4.1.1** **Quizzes reflect the information received during lectures**

**3** ☐ **High** ☐ **Average** ☐ **Low**

**4.1.2** **Your evaluation of the usefulness of the Quizzes**

**Nothing new** ☐ **Too general** ☐ **Well-balanced** ☐ **Too detailed** ☐ **Too advanced** ☐

**4.1.3** **Your overall evaluation of the Quizzes (content and organization)**

**Excellent** ☐ **Good** ☐ **Average** ☐ **Low** ☐

4.2 Your suggestion for Quizzes

.....

.....

.....

4.3 What additional topics should be included in the Quizzes?

.....

.....

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## FUTURE SESSIONS

**5.1 Your suggestions for the improvement of the Workshop**

.....

.....

**5.2 Would you be interested in a Webinar in one of the topics presented on this Workshop?**

☐ **Yes** ☐ **No**

*If so, which one?* .....

.....

**5.3 Would you be interested in another course?**

☐ **Yes** ☐ **No**

*If so, which one?*

.....

Name .....

Organization .....

Country .....

E-mail .....

Phone number .....

In ..... Date .....

Signature

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Annex 2

## ANNEX – 2 Webinar Invitation letter

Dear (name),

In the frame of WP6 of the TANDEM Project, we are inviting lecturers for the planned webinars, to be delivered in the frame of the initiatives of the ENEN2Plus project as a form of cooperation between European projects.

At the site Webinars 2022-2023 (unipi.it) you may find an account of the webinars held last year and at the site http://nucleare.ing.unipi.it/it/webinars/webinars-2023-2024 you can consider the planning for this academic year.

TANDEM Webinars are intended to cover subjects related to SMRs included in hybrid energy systems, with particular interest for district heating, hydrogen production and energy storage. Light water SMRs are particularly targeted, but it is also interesting to report experience in conceiving hybrid systems based on other nuclear reactor technologies. Presentations about the working principles of the technologies to which the nuclear reactors will be coupled in the hybrid systems are also highly valued to get better knowledge of the needs in interfacing the nuclear island with the external users of the generated power.

The idea is that **TANDEM WP Leaders and external experts** propose **a roughly one hour talk** (more or less at ease) aiming to disseminate knowledge about the mentioned subjects of relevance for our project. With your experience and/or your role in the project, we believe you may have many possibilities to propose a talk. The public will be students of any level, but we are also targeting a general audience of persons interested in these technical aspects that you may also contribute to enlarge by inviting to attend people you know.

If you kindly accept, following this link you will find a form that will allow you to select one of the still available dates via a linked Excel file.

Thanks in advance for considering this invitation and keep in touch.

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[1] J. Johnson, G. Pavel, 2023, D6.1 - E&T gap analysis on safety of SMRs & hybrid energy systems, Deliverable for the EU TANDEM project.

[2] IAEA nuclear energy series, 2021, "Systematic approach to training for nuclear facility personnel: processes, methodology and practices", ISSN 1995–7807 ; no. NG-T-2.8.

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