Education & Training

Ensuring the skilled workforce

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Gabriel Lazaro Pavel, ENEN, 02/07/2025

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The Beginning

It addresses the importance of adequate knowledge transfer within the domains covered by the TANDEM project

Approach used

Main steps:

- Identifying the current and expected future needs of E&T related to the SMR safety, including the implications of their coupling in hybrid energy systems,
- Designing, planning and delivering specific E&T actions that fit the findings from bullet point above,
- Developing a strategy to implement future E&T requirements in these fields, in order to deliver recommendations to adequately shape the supply of courses, materials and programs so that the needs for professionals to be trained in these topics can be addressed.

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E&T gap analysis in the domain of safety of SMRs and hybrid energy systems(FORATOM, M8)

Identifying the current and expected future needs of E&T

E&T gap analysis on safety of SMRs and hybrid energy systems.

Participants: ENEN, FORATOM (now, nuclearеurope)

The **knowledge, skills and competences** required by the domains addressed in the TANDEM [...].

An **analysis on what courses are available** that may address them [...].

[...] to identify the main challenges and recommendations. [...].

Jessica J.

key findings (selective summary)

Although some of these technologies are known or already implemented in large-scale reactors, a series of particularities makes dedicated education for such types of NPPs a must.

Education in this case is needed either **to adapt the career path** of an existing employee working in a different field **or for the brand-new workforce**. These two options make it clear that a **full educational programme in Energy Engineering and, more specifically, in nuclear engineering is required**.

At EU level, SMR specific nuclear topics are mostly covered **by Specialization Master** courses which have been issued in recent years, **or by General Master Programmes** which have adopted the **specific topics** required in the field of SMRs and Advanced Modular Reactors (AMRs).

Currently there is no Master programme strictly dedicated to SMRs or AMRs that covers all the needs of the industry.

“a broad range of “soft skills” are required by the industry. ”These skills required by industry can only be met at the necessary level **by cooperating with other Educational and Training institutions, other than those which focus solely on nuclear.**

TANDEM SMR E&T relatedactivities

Design of E&T actions [...]

The aim of this task is **to design the syllabus** and format of the E&T actions to be conducted as part of the project. Based on the results of Task 6.1, and the expected project-specific results (linked to WP1, 2, 3 and 4), the **allocation of specific knowledge, skills and competences** to courses will be designed, resulting in formats such as: one International School, technical workshops (at least 2), webinars (at least 5), videos. The learning objectives of each module will be derived and in-line with the Systematic Approach to Training (SAT), shall be derived in a form which allows the degree of accomplishment by the students to be evaluated.

These E&T actions will be based on two pillars: the needs associated to Safety of SMRs and Hybrid Energy Systems identified in Task 6.1 as well as specific training on advances and results derived by the Technical WPs of the Project

TANDEM E&T activities implementation

Contributors: CIRTEN-POLIMI, CIRTEN-UNIPI, ENEN, TRACTEBEL, FORATOM, CEA, GRS, VTT

Target: the delivery of the E&T actions in accordance with the structure and syllabus previously designed. Aspects such as: **lecturers, delivery dates, venues -where applicable- or Conferences were planned**.The main **impact metrics** resulting from the implementation of the designed E&T actions **were collected and will be analysed**. In addition, to ensure the long-term availability of the training materials and resources developed, **an online hosting platform/repository was used to host the majority of the learning materials**.

Practical results

1. Summer school (1)
2. Workshops (2)
3. Webinars (5)

TANDEM summer school

TANDEM Summer School

June 24th – 28th, 2024

Politecnico di Milano, Lecco campus @Como lake, Italy

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TANDEM Summer School

- The Summer School is specifically conceived for MSc and PhD students, PostDocs, young and experienced researchers and engineers that are interested in deepening their knowledge on the potential role that nuclear hybrid energy systems

- Topics
  i. extensive overview of the advantages and challenges of concepts of nuclear reactors producing commodities beyond power supply,
  ii. training in the use of tools and methodologies essential for designing and simulating the operation of nuclear hybrid energy systems
  iii. the quantitative skills necessary for assessing the impact of these systems within different contexts, ranging from a local scale to the global decarbonisation of the energy system.

- Results participation: 24 people (in presence)

TANDEM Summer School Agenda

	Monday	Tuesday	Wednesday	Thursday	Friday
09:00 – 10:30	Registration & Opening remarks Current and future energy landscape, role of nuclear in the energy transition	SMR & AMR Projects	Licensing and regulatory challenges of NHES	Industrial interest on SMR & NHES technology	Laboratory tour
10:30 – 11:00	Coffee break				
11:30 – 13:00	SMR Overview Introduction to Nuclear Renewable Hybrid Energy Systems	SMR & AMR Projects	Nuclear cogeneration: H2 & district heating	The European nuclear community and its strategy on SMRs and NHES	Laboratory tour
13:00 – 14:00	Lunch				
14:00 – 15:30	Modelling of NHES	Hands-on session on modelling	Public Engagement	Hands-on session on modelling	Closing
15:30 – 16:00	Coffee break				
16:00 – 17:30	Project work	Project work	Project on SMR/NHES deplyment and public engagement	Presentation of WG projects	

TANDEM Workshops

TANDEM technical workshop at Cadarache

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

September 18-19, 2024

CEA premises, Saint Paul les Durance, France

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TANDEM workshop at Cadarache

- The workshop is specifically conceived for MSc and PhD students, PostDocs, young and experienced researchers and engineers that are interested in deepening their knowledge on the potential role that nuclear hybrid energy systems

- Free and open: 24 attendees

- No financial support for students' travel and accommodation, contrary to the Summer School

Agenda of the workshop

Day		Activity	Speakers
Day 1	Morning	Welcome	Workshop organizers
		Brief presentation of the TANDEM project: objectives, activities, expected outcomes, status	C. Vaglio (CEA)
		Overall description of hybrid energy systems and their components	C. Schneidesch (Tractebel)
		Nuclear polygeneration	M. Fütterer (EC-JRC)
	Afternoon	Design of multipurpose reactors (SMRs, AMRs)	F. Morin (CEA)
		NUWARD™ project	NUWARD project
		Hydrogen production from nuclear energy	G. Rodriguez (CEA)
		Flexibility of energy production	C. Bono (EDF), G. Simonini (EDF)

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Agenda of the workshop

Day		Activity	Speakers
Day 2	Morning	Power conversion system and electrical grid (including impact of new sources on grid)	Tractebel and M.A. Evans (EDF)
		Desalination	M. Kanniche (EDF), M. Fütterer (EC-JRC,)
		Heat network and needs for district heating	K. Värri (Fortum), A. Rantakaulio (Fortum)
		Carbon capture and synthetic fuel production	Ph. Amphoux (CEA)
		Thermal and electrical storage	S. Sholomitsky (Energorisk), Tractebel
	Afternoon	Technical visits (TBC)	Organized by C. Vaglio (CEA)

Technical Workshop in Pisa

- **Organised in Pisa on 20-21 February 2025 at the “Le Benedettine” Congress Centre, Piazza S. Paolo a Ripa D'Arno, 16 - Pisa**
- **Deadline for registration elapsed on January 15, 2025**
- **71 registrations received, 24 persons were present on site; 37/day were present online**

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TECHNICAL WORKSHOP

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

SAVE THE DATE

February 20 – 21, 2025

“Le Benedettine” Congress Centre, Pisa

Piazza S. Paolo a Ripa D'Arno, 16 - Pisa

UNIVERSITÀ DI PISA

The TANDEM project is organizing a second free, open technical workshop. TANDEM is a European research project funded by the European Commission focusing on the study of an integrated vision of the energy system based on the hybridization of nuclear and renewable sources with thermal and power storage and downstream applications to provide electricity, heat and hydrogen.

The workshop will be held in Pisa, Italy, at the “Le Benedettine” Congress Centre of the University of Pisa on February 20-21, 2025. The technical workshop is specifically conceived for MSc and PhD students, PostDocs, young and experienced researchers and engineers that are interested in deepening their knowledge on the potential role that hybrid energy systems including Small Modular Reactors (SMRs) play in the ongoing energy transition.

The workshop will focus on the description of SMR modelling and optimization tools to assess hybrid energy systems integrating nuclear reactors, together with the SMR coupling with other energy sources and energy storage systems in hybrid energy systems.

The workshop preliminary programme is provided below.

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Workshop Program

Day		Activity	Speakers
Day 1	Morning	9:30 Welcome Addresses	M. Ricotti (CIRTEN and POLIMI) W. Ambrosini (UNIPI)
		9:45 – 10:00 Self Introduction of participants	All
		10:00 – 10:30: Brief presentation of the TANDEM project: objectives, activities, expected outcomes, status	Claire Vaglio-Gaudard, Coordinator (CEA)
		10:30 – 11:00: Coffee Break	
		11:00 – 11:30: Energy system scenarios in TANDEM	Christophe SCHNEIDESCH (TRACTEBEL - BELGIUM), WP1 Leader
		11:30 – 13:00: Panel on the future energy system scenarios according to Industrial and Utility Representatives: • Ansaldo Nucleare • ENEL • Edison	Michele Frignani (Ansaldo) Luca Mastrantonio (ENEL) Alberto Pasanisi (Edison)
		13:00 – 14:00: Lunch Break	
	Afternoon	14:00 - 15:00: Status of design and technology development of advanced reactors, including SMRs, and their applications	Mr. Frederik Reitsma, IAEA (TBC)
		15:00 – 16:00: Components of Hybrid Energy Systems with Advanced Nuclear Power Reactors, including SMRs	Mr. Frederik Reitsma, IAEA (TBC)
		16:00 – 16: 30: Coffee Break	
		16:30 – 17:30: Non-Electric Applications of Nuclear Energy	Ms. Molly-Kate Gavello, IAEA (TBC)
		17:30 – 18:30 Tools for energy system design, optimization and analysis	Paul Talbot, INL

Day		Activity	Speakers
Day 2	Morning	9:00- 10:00: Nuclear Desalination	G. Caruso (Università di Roma Sapienza)
		10:00 – 11:00: Modelling Tools for NHES: Introduction to Modelica and BoP models	S. Lorenzi (POLIMI)
		11:00 – 11:30: Coffee Break	
		11:30 – 12:00: Coupling strategy between CATHARE and Modelica	A.De Angelis (UNIPI)
		12:00 – 13:00: Simulation of a load rejection and a loss of offsite power scenario in a cogeneration SMR	P. Olita (CEA)
		13:00 – 14:00: Lunch Break	
	Afternoon	14:00 - 15:00: Demonstration Exercise, Session with Modelica	S. Lorenzi (POLIMI), A. De Angelis (UNIPI), P. Olita (CEA)
		15:00 – 16:00: Coupled SMR Simulation with ATHLET and Modelica	Sebastian Buchholz (GRS)
		16:00 – 16: 30: Coffee Break	
		16:30 – 17:30: Lesson Learned and Modelling tools to assess the safety of NPPs	Sebastian Buchholz (GRS), S. Lorenzi (POLIMI), A. De Angelis (UNIPI), P. Olita (CEA)
		17:30 -18:00: Concluding remarks	All

Harmonised contributions by Companies and Research Centres

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TANDEM Webinars

Webinars in the frame of the cooperation between ENEN++ and TANDEM

http://nucleare.ing.unipi.it/it/

(google “younuclear” and you will find it…)

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What comes next

- We need to address the skilled workforce need in due time since E&T takes time
- We need to collaborate among ourselves (E&T institutions that can address both hard and soft skills)
- We need to collaborate with industry
- We need to have a local, regional and European strategy to cope with the challenges(*)

- (*) Challenges do not arise necessarily from the SMR deployment but also from classic NPPs

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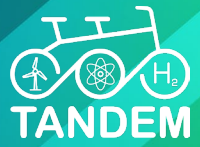
Acknowledgement for contribution



Get in touch for more information:

Gabriel Lazaro Pavel

gabriel.pavel@enen.eu

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