

EDUCATION, TRAINING AND MOBILITY, KNOWLEDGE MANAGEMENT: TOWARDS A COMMON EFFORT TO ENSURE A FUTURE WORKFORCE IN EUROPE AND ABROAD

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10th European Commission Conference on EURATOM Research and Training in Safety of Reactor Systems
30 May - 3 June 2022 | Lyon, France

Introduction

- Nuclear power is a (very!) long-term commitment. Each unit may be with us for 100 years or more.
- Long-term sustainability of nuclear power calls for the long-term use of the **best available people, science, knowledge, technologies** and **operational experience**.
- It became quite challenging to **attract, develop and retain** young talents in the nuclear field.
- Common European approach and continuous activities:
 - Develop and implement **attractive modern teaching methods** and **hands-on experience**
 - Providing **mobility** to students and other young nuclear talents
 - Develop **knowledge management actions** for benefit of future nuclear generation



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European Activities on E&T and KM

Overview:

- **ENEN+**: Attract, Retain and Develop New Nuclear Talents Beyond Academic Curricula. Duration: 2018-2021
- **A-CHINCH**: Augmented Cooperation in Education and Training in Nuclear and Radiochemistry. Duration: 2019-2022
- **GRE@T-PIONEER**: Graduate Education Alliance for Teaching the Physics and Safety of Nuclear Reactors. Duration: 2020-2023
- **ENEEP**: European Nuclear Experimental Educational Platform. Duration: 2019-2022
- **PIKNUS**: Pilot action on knowledge management in the area of nuclear Safety. Duration: 2020-2023

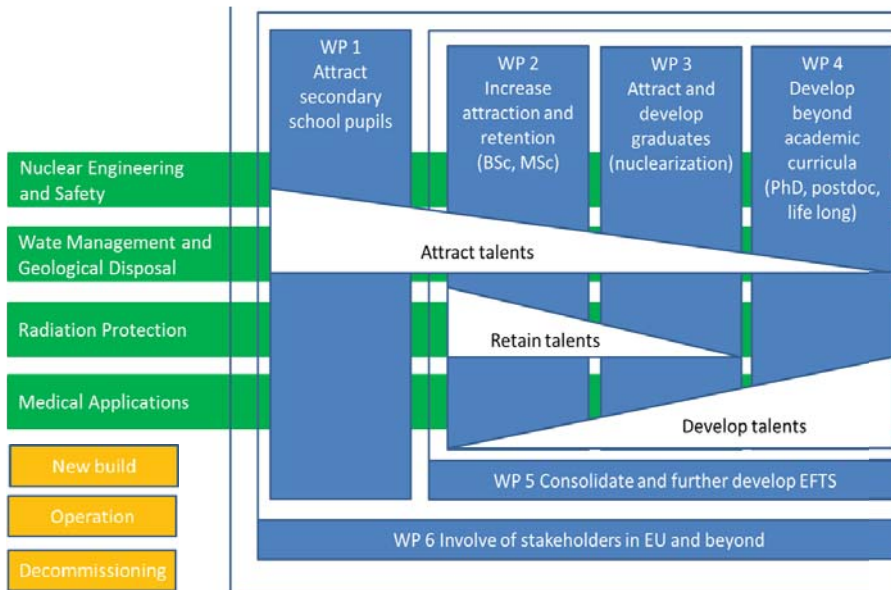


enen+ Objectives

- **Attract new talents** to careers in nuclear.
- **Develop** the attracted talents beyond academic curricula.
- Increase the **retention** of attracted talents in nuclear careers.
- **Involve** the nuclear stakeholders within EU and beyond.
- **Sustain** the revived interest for nuclear careers.



Outline of enen+



3 years: Oct 2017-Sept 2020
(extended due to COVID19)

Total costs: 3.2 €

EC Contribution: 2.9 M€



Key Contributions of enen+

- Attractive e-materials on nuclear profession
- EU wide competition for high school students
- Support for learners in all career phases:
 - Career guidance
 - Support for mobility (funding & access)
- Voluntary accreditation (ECTS, ECVET≈SAT)
- Sustainable mobility fund
- Improved communication with industry and decision makers
- EU strategy for Nuclear Education, Training and Knowledge Management



enen+ : Actions for secondary school pupils



First European Nuclear Competition and Summer Camp
25 participants from 10 countries



Attractive e-information in multiple languages

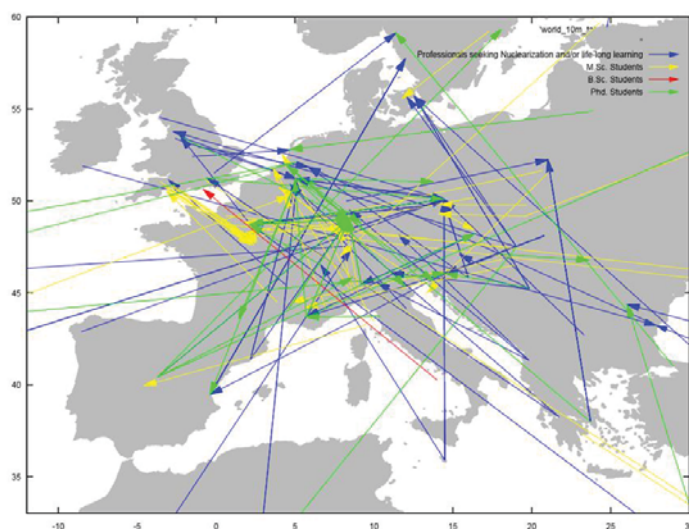


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enen+ : Mobility Actions

- Mobility is a very valuable measure to support E&T
- Data:
 - 553 people (B.Sc., M.Sc., PhD, young professionals)
 - 17,375 days of training
- **Direct benefit for European citizens!**
- Top Hosts:
 - JRC Petten, Geel, Karlsruhe



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A-CINCH: Teaching Nuclear

Cooperation in education development in the A-CINCH Consortium



A-CINCH

General data

- Project number: H2020 - 945301
- Consortium of **17** institutions from **13** countries
- www.cinch-project.eu
- Budget:
 - Total 3,220,856.00 EUR
 - Maximum EC contribution: 2,490,000.00 EUR
- Duration: **36** months
 - Signature date May 27, 2020
 - October 2020 – September 2023
- Representatives:
 - EC Project Officer: Ms Katerina Ptáčková
 - Coordinator: Czech Technical University in Prague – Assoc. Prof Mojmír Němec







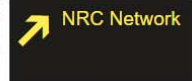

A-CINCH



CINCH HUB

CINCH web Menu item 1 Menu item 2 Menu item 3

This CINCH Hub platform was developed to wrap up outcomes of the series of "CINCH projects" into a user-friendly and easy-to-navigate single page interface and to facilitate access to all the developed education and training tools. It also implements the highly innovative Virtual Laboratory developed in the most recent A-CINCH project.

COURSES Overview to CINCH courses.	CINCH VIDEOS Topical videos issued by CINCH	CINCH VR LAB Online virtual radiochemistry laboratory 	MOOCs Massive Open Online Courses	CINCH TEACHING AIDS RoboLabs, ISE, OER, HSP	VET E-SHOP Select your course directly in VET e-shop!
NUCWIK Nuclear WIKI	EUROMASTER Fundamental NRC education requirements.		   		
					



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A-CINCH

Objectives, tools and teaching techniques



- **CINCH HUB** incorporates (1)
 - **VR-LAB**, 3D virtual reality NRC laboratory
 - **MOOCs**, Massive Open Online Courses
<https://www.pok.polimi.it/>
 - **CINCH MOODLE**, e-learning platform for Nuclear Chemistry
<https://moodle.cinch-project.eu>
 - **RoboLabs** - remote operated robotic experiments
<https://nucwik.com/exercises/robolab>
 - **ISE**, Interactive Screen Experiments
 - **NucWik** database of teaching materials
<https://nucwik.com>
- **CINCH HUB** incorporates (2)
 - **Flipped Classroom** concept, providing improved interaction between teachers and students
 - **HoT** - Hands-on-training courses in "real" radiochemistry laboratories across Europe
 - **CINCH VET e-shop**, CINCH Vocational Education and Training e-shop offering, presenting and organising all types of NRC courses
<https://eshop.cinch-project.eu>
 - **High School Teaching Package**, **Summer Schools** for high school students, **Teach the Teacher** package, **Lab on Tour** toolkit for expanding nuclear awareness.



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A-CINCH



"We consider gamification of education and smart simulation of nuclear and radiochemistry procedures to be appropriate supportive instruments to reach our objectives."



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GRE@T-PIONEER

- **GRE@T-PIONEER**: Graduate Education Alliance for Teaching the Physics and safety of Nuclear Reactors
- Project running between November 1st, 2020 and October 31st, 2023
- **10 European partners**



www.great-pioneer.eu



[@GREATPIONEER_EU](https://twitter.com/GREATPIONEER_EU)



[@GREAT-PIONEER](https://www.linkedin.com/company/great-pioneer)

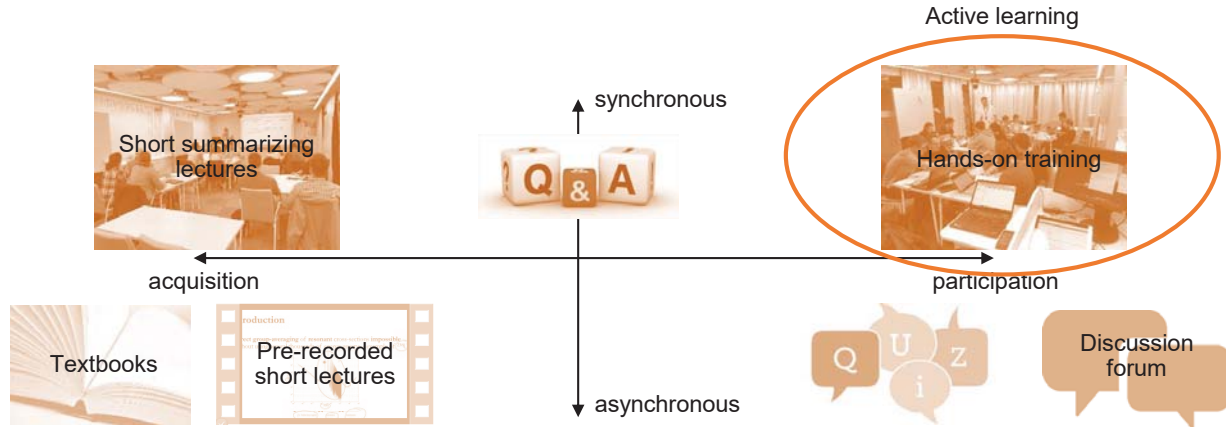


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GRE@T-PIONEer

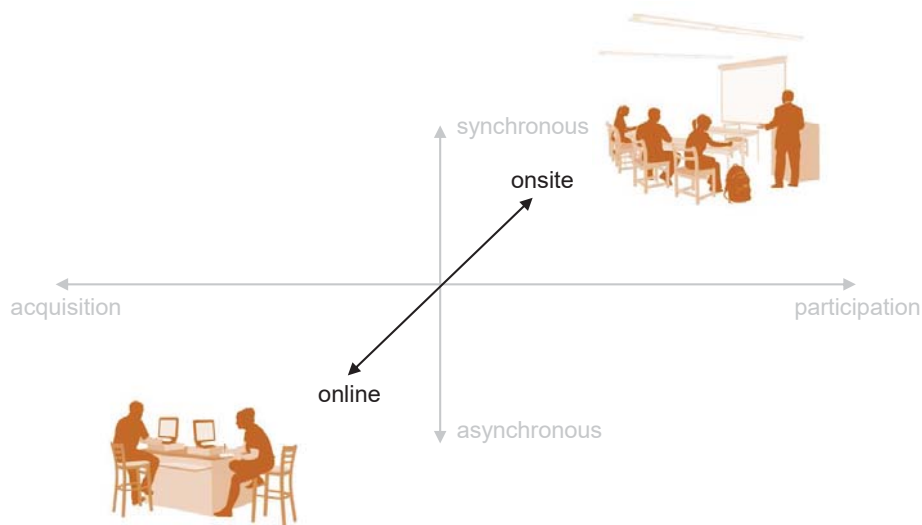
- Learning is an incremental process
- Several dimensions:



Hrastinski, S. (2008). Asynchronous and synchronous e-learning. *Educause Quarterly*, 31(4), 51-55.

GRE@T-PIONEer

- Learning is an incremental process
- Several dimensions:



GRE@T-PIONEer

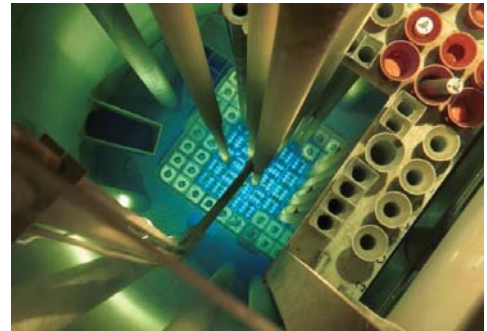
- GRE@T-PIONEer making use of **flipped classrooms** in a **hybrid learning environment** and promoting **active learning**
- **Hands-on** exercises:
 - Relying on the use of 3 **training reactors**:



AKR-2
TUD, Dresden, Germany



CROCUS
EPFL, Lausanne, Switzerland



BME Training Reactor
BME, Budapest, Hungary



GRE@T-PIONEer

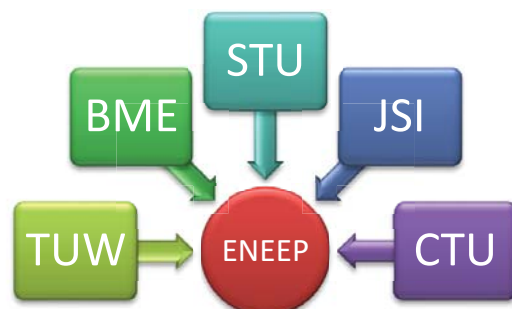
- **Hands-on** exercises:
- Relying on **computer-based modelling and simulations**:
 - Either **using existing tools** (commercial and open-source)
 - Or **implementing algorithms** in computing environments



- **6 course modules** being developed:
 - Nuclear cross-sections for neutron transport
 - Neutron transport at the fuel cell and assembly levels
 - Core modelling for core design
 - Core modelling for transients
 - Reactor transients, nuclear safety and uncertainty and sensitivity analysis
 - Radiation protection in nuclear environment
- Teaching materials **being developed**
- First course modules to be offered in **November 2022**

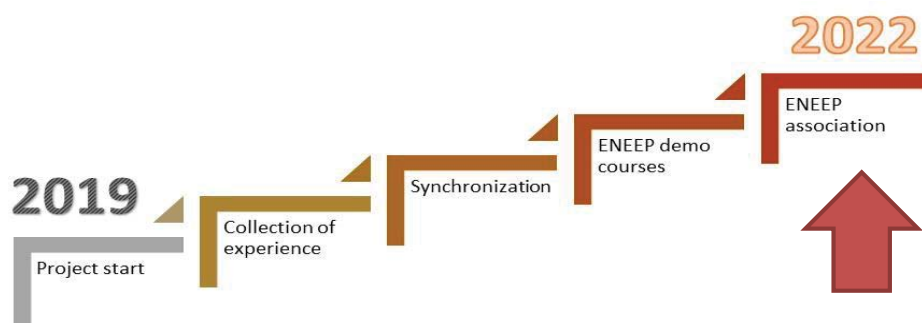
ENEEP – European Nuclear Experimental Educational Platform

- An essential element in the implementation and safe operation of nuclear facilities is a knowledgeable and skilled workforce.
- The desired nuclear specific skills and experience of workforce cannot be built without an experimental hands-on nuclear E&T.
- The personnel to run a nuclear power plant should be categorized as *nuclear personnel*, *nuclearized personnel* and *nuclear-aware personnel*.
- For all above defined categories hands-on experience need to be provided.
- To address these challenges the European Nuclear Experimental Educational Platform is established.
- There are five project partners,
from Central Europe,
each operating a research reactor or
specialized laboratories.



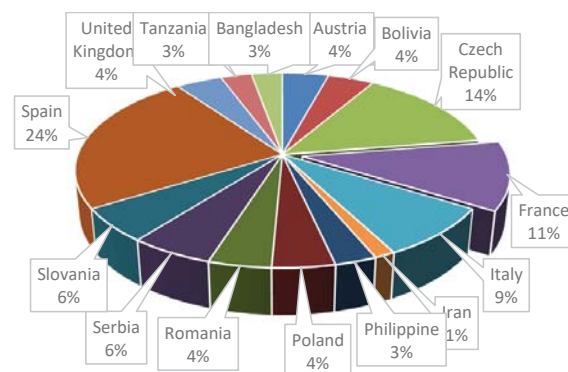
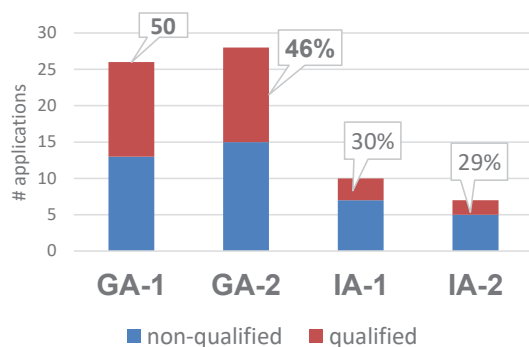
ENEEP – European Nuclear Experimental Educational Platform

- To improve the level of education and to attract new talents to nuclear, research programs, international cooperation and the involvement of industry and R&D organizations is required.
- ENEEP brings nuclear E&T closer to almost everyone.
- ENEEP E&T activities are based on experiments utilizing research reactors and laboratories of nuclear physics, material science and radiation protection.
- there are no specific limitations on the educational background of trainees and students, the level of training can be tailored.



ENEEP – European Nuclear Experimental Educational Platform

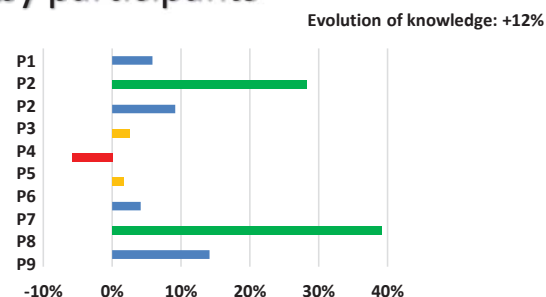
- As one of the most important objectives of the project, the demonstration of educational and training capabilities of the ENEEP was carried out through dedicated educational activities:
 - GA1 - *Safe and Secure Operation of Nuclear Installations*
 - GA2 - *Experimental Reactor physics*
 - IA1 - *Experiments on the Training Reactor*
 - IA2 - *Experimental Study of the TRIGA Fuel Characteristics*



ENEEP – European Nuclear Experimental Educational Platform

• Evaluation of group and individual activities by participants

Items of the evaluation	GA-1	GA-2	IA-1
General content of the course	93.8 %	96.3 %	87.5 %
Meeting the objectives of the course	89.9 %	95.8 %	100.0 %
Applicability of the acquired knowledge	92.9 %	91.7 %	83.3 %
Organization and logistics	92.9 %	93.5 %	80.0 %
Quality of lectures	95.2 %	87.5 %	100.0 %
Overall rating	93.0 %	93.2 %	88.9



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ENEEP – European Nuclear Experimental Educational Platform

- The main goal of the ENEEP project is to establish coordinated and sustainable access to the infrastructure also beyond the project.
- In 2022 ENEEP non-profit association will be established.
- The association will create a management, communication and promotion umbrella above all institutions and activities.
- The association will represent all member institutions under one brand.
- In 2022 also another round of demo courses will be organized:
 - „Train the trainers“ – 10 p – 3 days
 - „Train the lecturers“ – 10 p – 3x3 days
 - „Train the students“ – 10 p – 5 days



www.eneep.org



www.facebook.com/eneep.org



#ENEEP

www.linkedin.com/groups/13834594/



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PIKNUS

PIKNUS – **P**ilot action on **K**nowledge management in the area of **NU**clear **S**afety

Administrative arrangement between DG RTD and JRC to create a **knowledge management platform** in order to:

- Improve synergies between Euratom funded Direct and Indirect actions*
- Improve accessibility to Euratom funded research results
- Offer a collaboration platform for European research community

PIKNUS is a **pilot project**, with **focus on materials' ageing in Generation II-III NPPs (~ Nugenia TA4)**.

- However, the search tool will cover all JRC and CORDIS/EURATOM deliverables.

PIKNUS in **NOT** a data repository

- PIKNUS can offer links / help to find where e.g. experimental data is available, but they are not stored in the system.

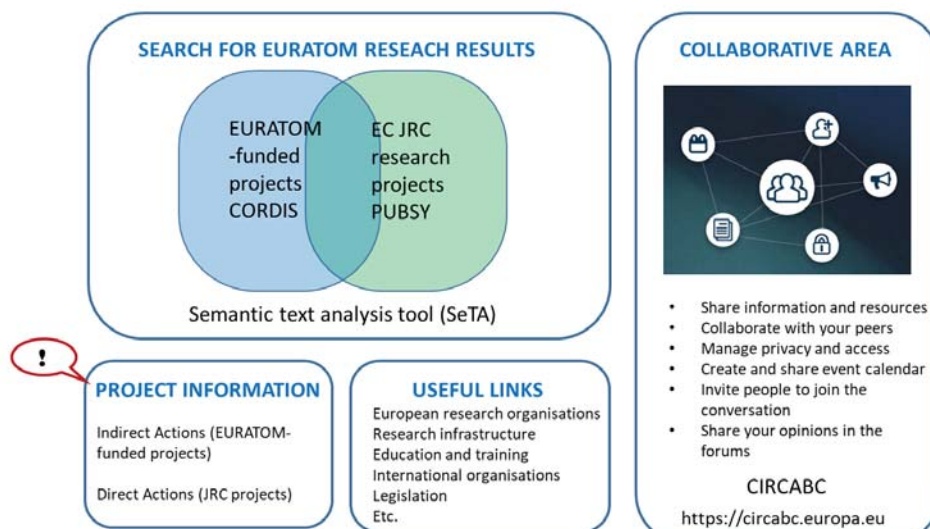
*Indirect actions = Euratom research activities undertaken by multi-partner consortia

Direct actions = Euratom research activities undertaken solely by the JRC



PIKNUS

PIKNUS – **P**ilot action on **K**nowledge management in the area of **NU**clear **S**afety



! Pilot project focuses on materials ageing in Generation II-III reactors (Nugenia TA4)



PIKNUS

Examples of possible use cases of the platform:

- A researcher/student looking for bibliography and references for her or his research uses the platform
 - to retrieve information about the latest results from European funded projects
 - to retrieve related datasets ready to be used (connection to the EU Open Data Portal)
- A researcher developing a new research proposal uses the platform to
 - identify those knowledge gaps where new research would be most beneficial
 - to identify potential research partners and laboratories that could complement and enhance the research initiative
- A group of researchers use the platform to develop their research proposal using the collaborative space



PIKNUS

Website development on-going:

- Back-end: tailoring of JRC-developed semantic text analyser tool (SeTA) to the needs of the platform, to retrieve documents from CORDIS and JRC PUBSY
- Front-end: development of the user interface, visualisation, access tools, interactive workspace

First version of the system expected to be available for testing in autumn 2022

After the pilot phase:

- Extending the platform to cover other areas of NPP safety research? Extending the platform to include activities related to new reactor types (SMR & Gen IV)?
- Waste management? Radiation protection? Security and safeguards?



Summary

- Continuous and future-oriented education and training as well as knowledge management for young talents are required for the safe and reliable operation of nuclear reactors or nuclear facilities in Europe.
- The projects ENEN+, A-CHINCH, GRE@T-PIONEeR, and ENEEP are outstanding examples by providing modern and attractive education and teaching material to students and life-long learners.
- PIKNUS pilot aims at creating a collaborative KM platform for European research community with improved access to Euratom funded research results.
- **Attracting, developing and retaining young nuclear talents is one of our key tasks for this decade to successfully decarbonize our European energy system!**



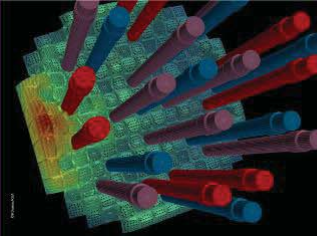
Acknowledgments



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FISA 2022

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Thank you for your attention!
Questions?

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