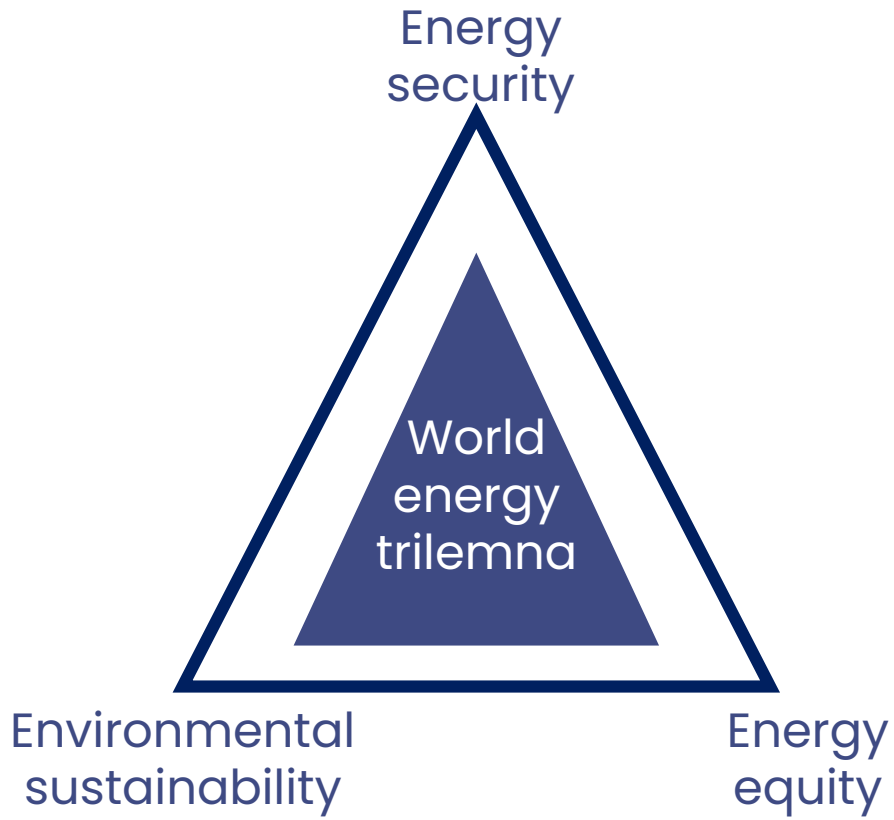
FISA EURADWASTE 2025

SNETP Forum

What holds the future for nuclear science ?

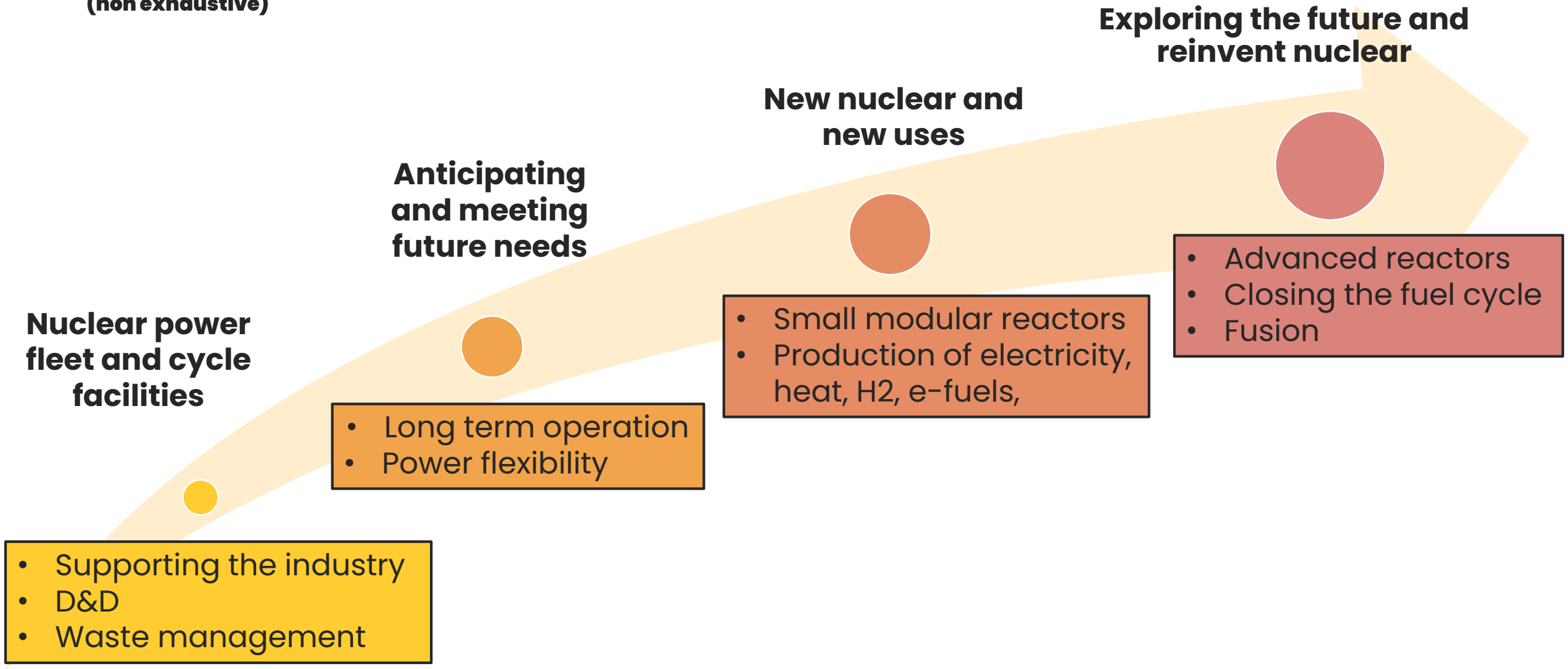
Heloise Goutte, Energy Scientific Director, CEA

May 12, 2025



Our R&D roadmap for Nuclear

(non exhaustive)

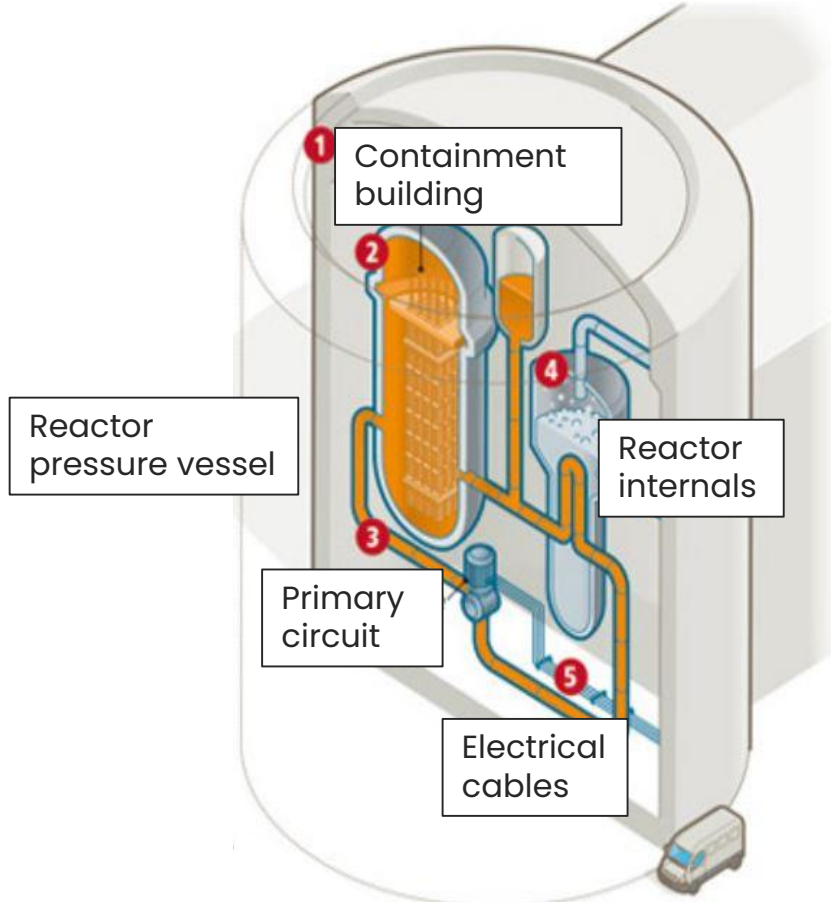


Power reactors

Challenges

- Contributing to **extending reactor long-term operation** to over 60 years, while all safety conditions are met

- Increasing the **power flexibility** of reactors as part of new energy mixes



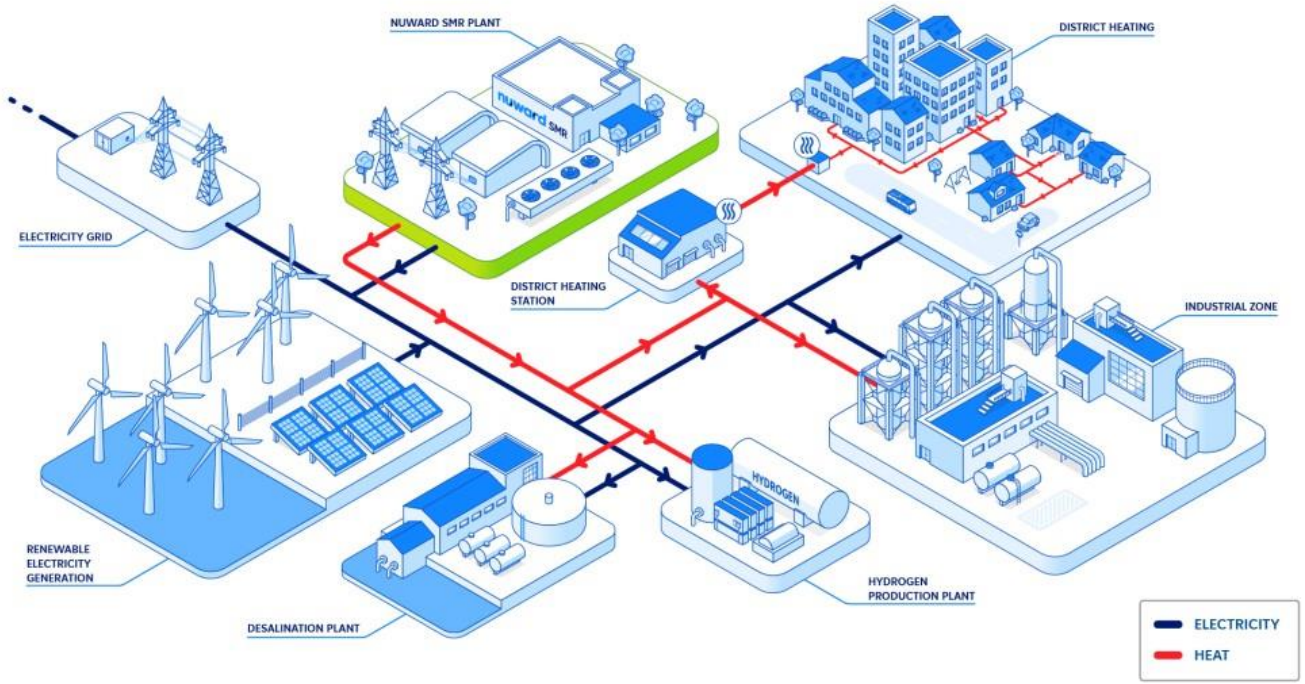
New nuclear

Unit power :
EPR : **1650 MWe**
SMR = **1/10** EPR
MMR = **1/100** EPR

Challenges

- Develop small modular reactors and Advanced modular reactors

- Utilize nuclear energy not just for electricity production, but **also for decarbonizing the transport, industry and heat networks**



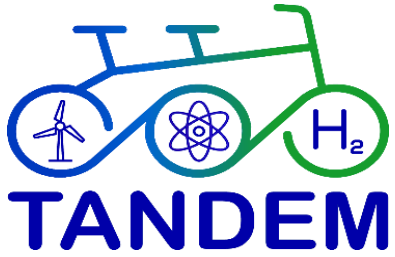
@ Nuward

European projects on SMR (elements)

- **European Industrial Alliance on SMR**

Launched by the European commission February 6, 2024

- **Euratom project** TANDEM (2022-2024)



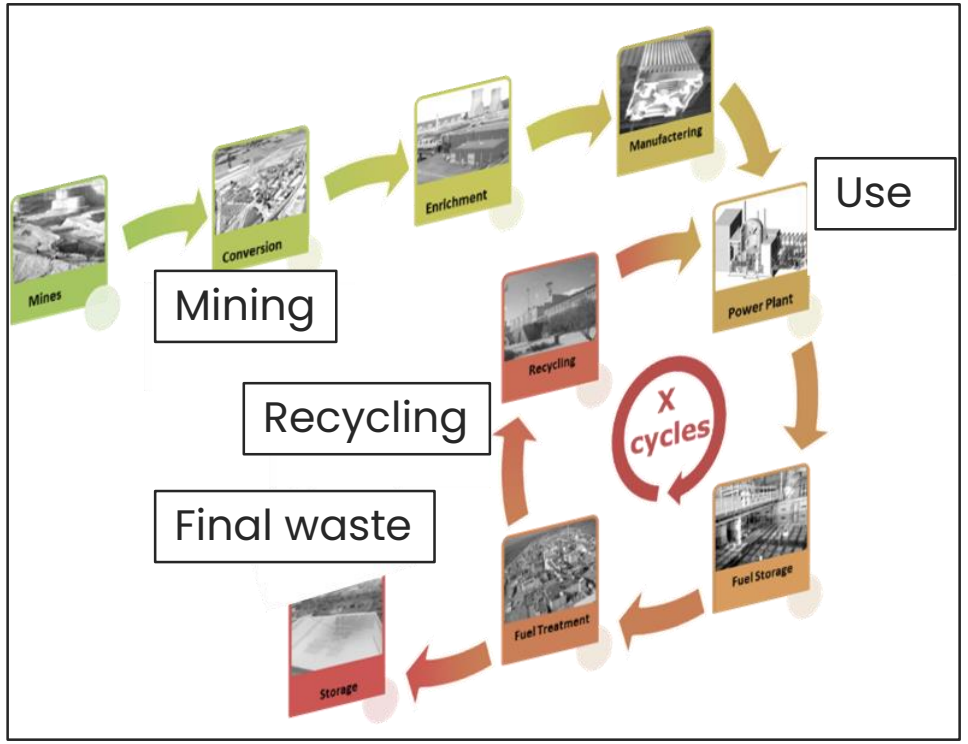
Belgium: nucleareurope TRACTEBEL ENGIE enen
Czech Republic: UJV
Finland: VTT fortum
France: cea EDF IRSN
Germany: GRS
Italy: POLITECNICO MILANO 1863 UNIVERSITÀ DI PISA ENEA ansaldo nucleare
Spain: EMPRESARIOS AGRUPADOS
Ukraine: ENERGORISK

Fuel cycle and advanced reactors

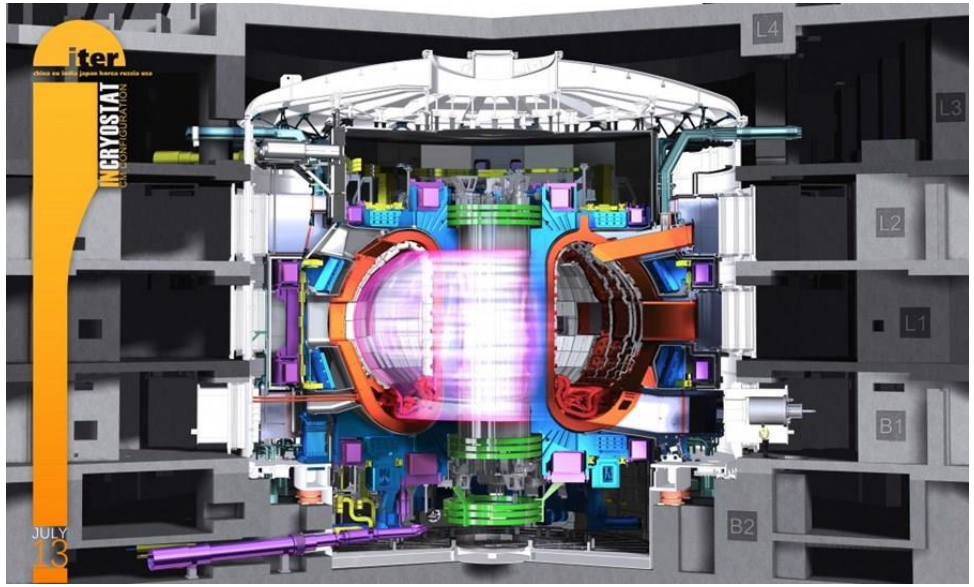
Challenges

- Even better use of fissile materials: stabilizing inventories through multi-recycling in Pressurized Power Reactor and **closing the cycle** through multi-recycling in fast Neutron Reactor.

- Advanced reactor concepts **(GenIV).**



Nuclear fusion



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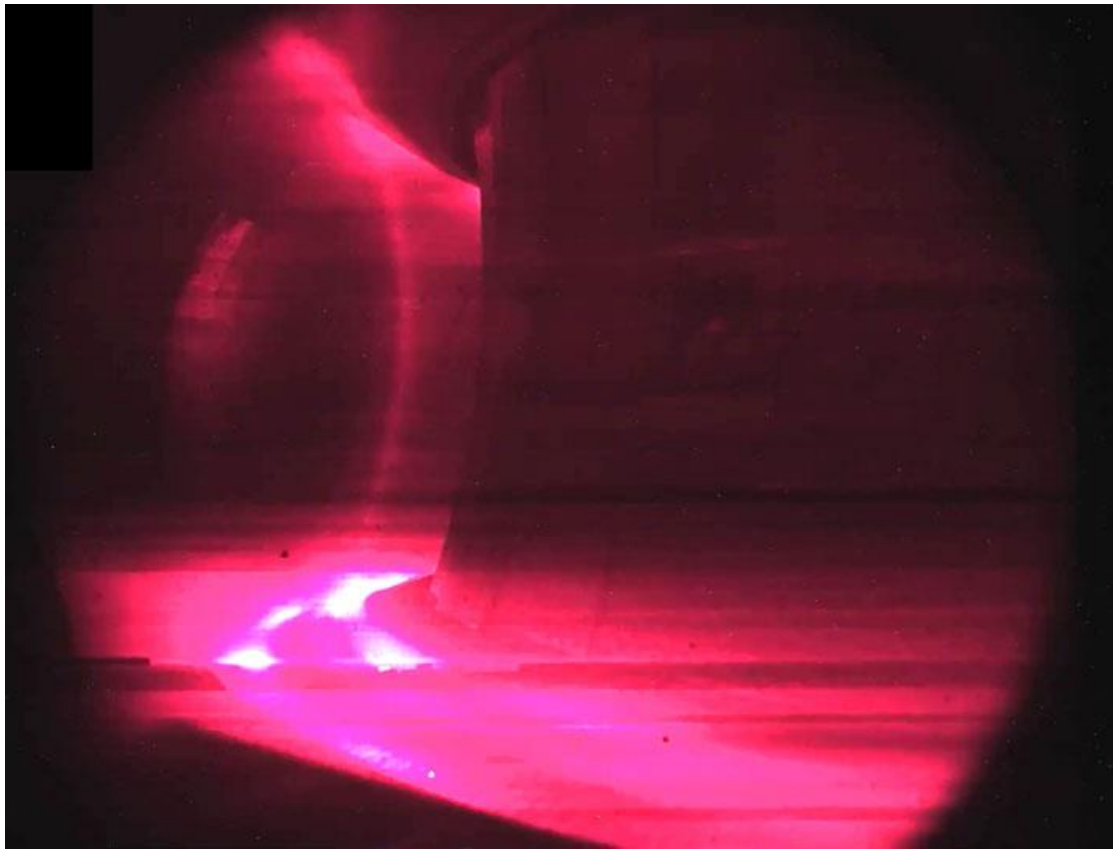


@ CEA

Tokamak West breaks world record for plasma duration (22 minutes)

February 12, 2025

Some guidance for the future: Towards greater integration between experiments, simulations and data bases

Game changers:
- Artificial Intelligence
- Digital twins

Data bases

- Build **FAIR data** (Findable, Accessible, Interoperable, Reusable) with the associated uncertainties
- Maximize the potential of **AI-enhanced databases**

Experiments

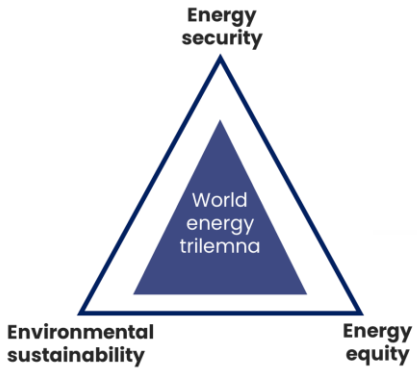
- Perform measurement as close as possible to the **finest scale**
- Keep integral experiments deemed critical

Simulation

- Generalize **predictive** simulation and **flexible** tools (to integrate new knowledge and new use cases)

Take home message

Motivations



Crosscutting concepts

Enablers

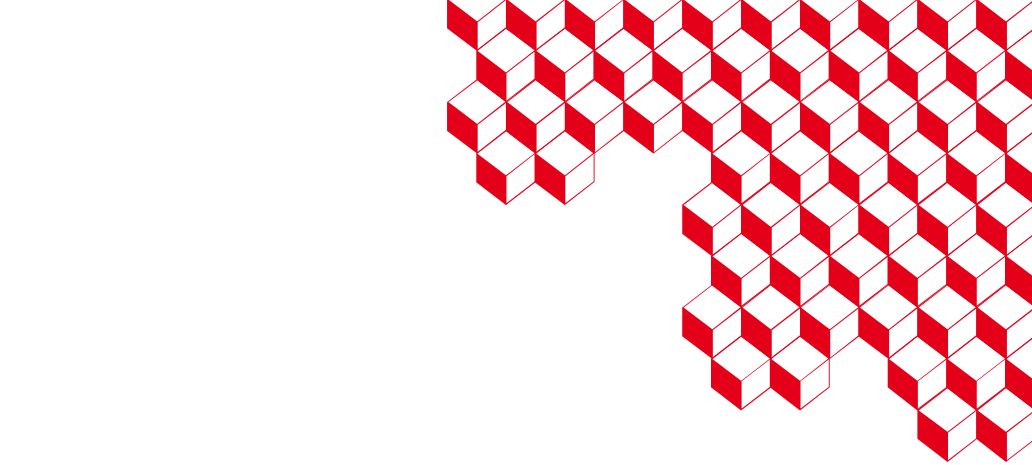
- **New technologies**
- Inclusive **collaborations**

Implementation challenge

- **Workforce**
- State of **readiness** for deployment

Expected outcomes and impact

- **Low-carbon, reliable electricity** generation
- Use nuclear **beyond electricity** production to decarbonize energy
- Build **trust** in communities



Thank you for your attention