newcleo
Futurable Energy

ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA | DIPARTIMENTO DI INGEGNERIA INDUSTRIALE

Energy Talk - Careers in nuclear
newcleo company presentation

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A *new*, innovative player in nuclear energy

REACTOR DESIGN:

Small Modular (SMR) + Lead-cooled Fast Reactors (LFR) = AMR

*new*cleo is working to design, build, and operate Gen-IV Advanced Modular Reactors (AMRs) cooled by liquid lead

FUEL MANUFACTURING:

Mixed Uranium Plutonium Oxide (MOX)

MOX and Fast Reactors allow the multi-recycling of nuclear waste into new fuel with no new mining for generations

INTRINSICALLY SAFE	**COMPETITIVE**	**CIRCULAR**
power production	energy cost	nuclear waste recycling

Presence across **EUROPE**

Launched in **SEPTEMBER 2021**

- **€537 million** of private funds **~€50 million** turnover in 2024
- French **first licensing stage completed** for the first reactor and the fuel production facility
- Selected by **France 2030** and the **European Industrial Alliance on SMRs**

1,100+	**30+**	**22**
EMPLOYEES GLOBALLY	**YEARS OF R&D**	**PATENTS**

Highly specialised EPCM capabilities

FUCINA ITALIA – A *newcleo* company
S.R.S. – A *newcleo* company
RÜTSCHI – A *newcleo* company

ISO9001 and ISO19443 certification

A long-term vision centred on safety, costs and sustainability

Reactor technology:
AMR: SMR + Gen-IV LFR

LEAD-COOLED

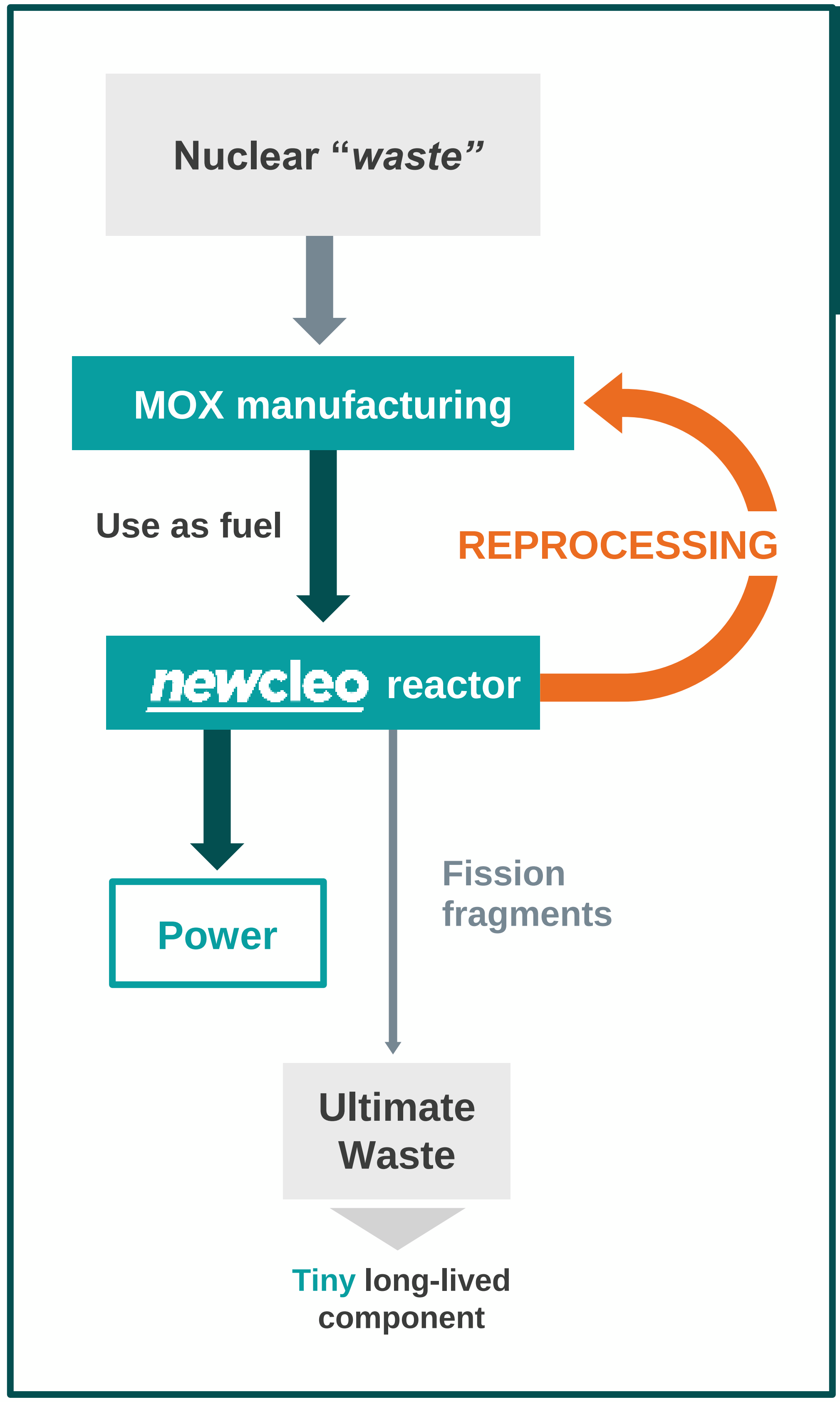
High temperature	Compact and simple	Intrinsic safety

FAST NEUTRON SPECTRUM

Low production of nuclear waste	Able to recycle reprocessed spent fuel

SMALL MODULAR REACTOR

Faster construction	Site flexibility and industrial heat production	Further economies from series and modularisation



Fuel: MOX

- MOX is made of reprocessed spent fuel. A clean solution to the issue of costly and **long-lasting nuclear waste disposal,** but also a protection against future high, oscillating Uranium costs and availability
- The **long-term strategy** will eliminate the need to mine new uranium, enable **energy independence**, and reduce the volume headed to geological repository
- Spent fuel will be **reprocessed** multiple times. The unavoidable waste is less than **1t of fission fragments** (radioactive for 250y) from one year's generation by a 1GWe of *new*cleo LFRs vs. **200t** of nuclear waste from conventional reactors (radioactive for 250,000y)

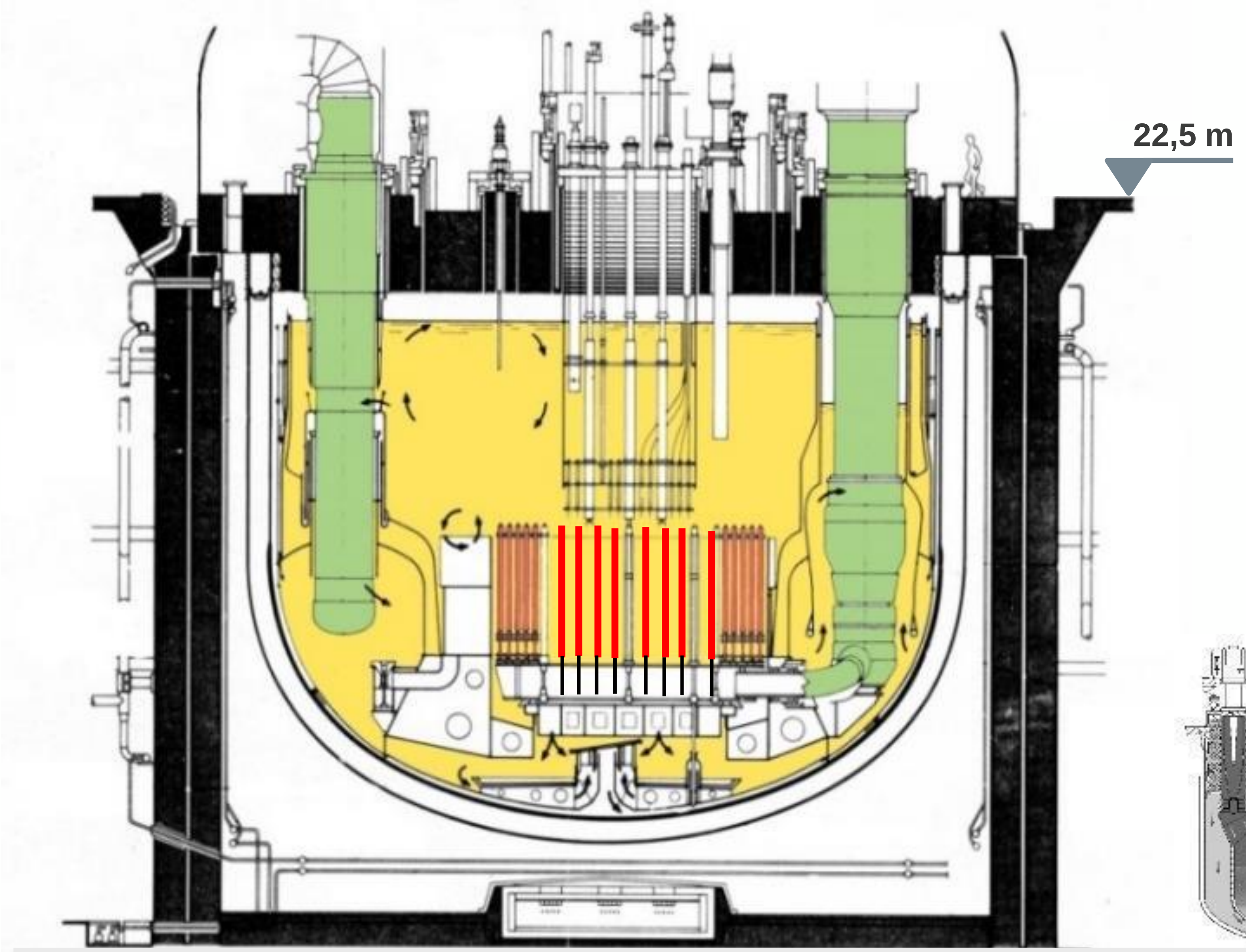
Evolution of Fast Reactors

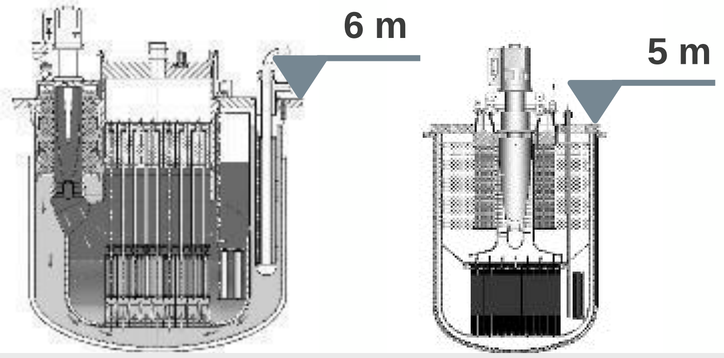
From old-generation SFRs to a new generation of small, modular LFRs

The development of Sodium Fast Reactors (SFRs) particularly amongst other Fast Reactors has been an area of huge investment in recent years, but there has been limited deployment. Sodium is chemically reactive with both water and air; safety issues required complications to design which made SFRs **expensive.**

Learning from the past

Fortunately, the **experience** acquired with SFRs can be almost entirely used for the development of LFRs. They use a similar fuel, behave in a similar way functionally, present similar thermal-hydraulic and mechanical aspects**. LFRs are much more promising in terms of cost and safety.**

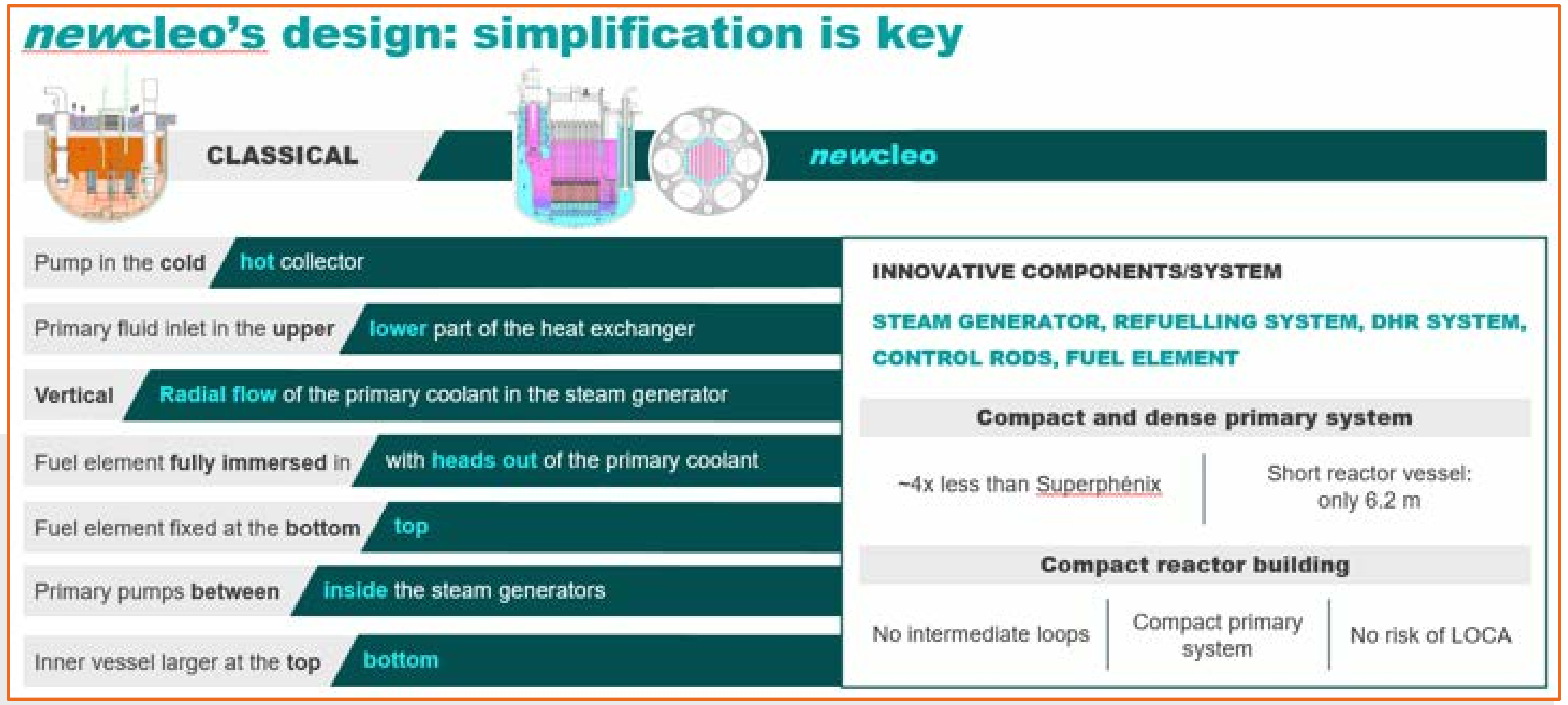




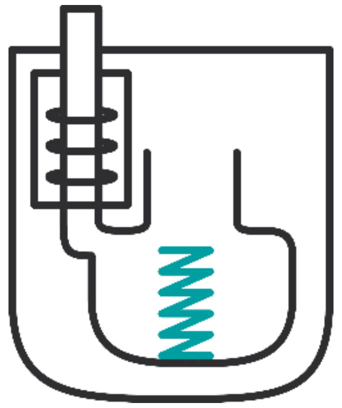
200 MWe | 30 MWe

Superphénix (1974, 1240 MWe)

***new*cleo LFRs**



*new*cleo's plan-to-market: an ambitious timeline



R&D and Precursor

2026

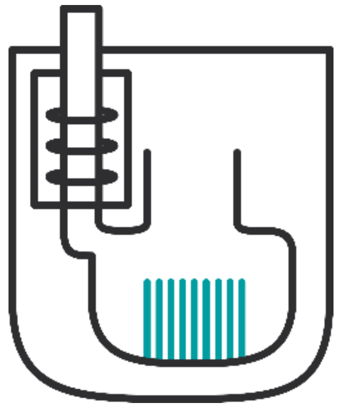
Several R&D and qualification facilities, and a **10 MW non-nuclear reactor** with turbo-generator (Precursor) built in ENEA-Brasimone

Design, manufacturing and operation in progress

MOX production

2030

FR-MOX production facility, starting from available (separated) material in France

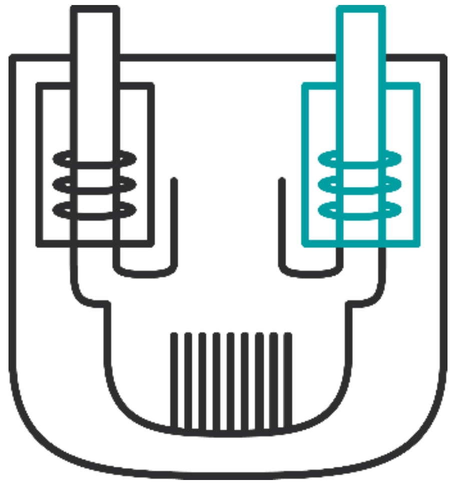


LFR-AS-30

2031

30 MWe nuclear irradiation reactor with core outlet at 440°C and later 530°C in France

Basic Design in progress
Licensing in progress for both facilities



LFR-AS-200

2033

200 MWe FOAK, also for non-electrical uses (e.g. cogeneration and chemicals production)

Basic Design in progress
UK Licensing started in 2024

R&D is at the core of *new*cleo's DNA

In parallel to engineering activities, *new*cleo's R&D programme is progressing fast: findings are key in the completion of the reactors' design and licensing processes.

UNDERSTANDING

CHARACTERISATION

QUALIFICATION

VALIDATION

ASSESSMENT

OPERATION AND SAFETY

DEMONSTRATION

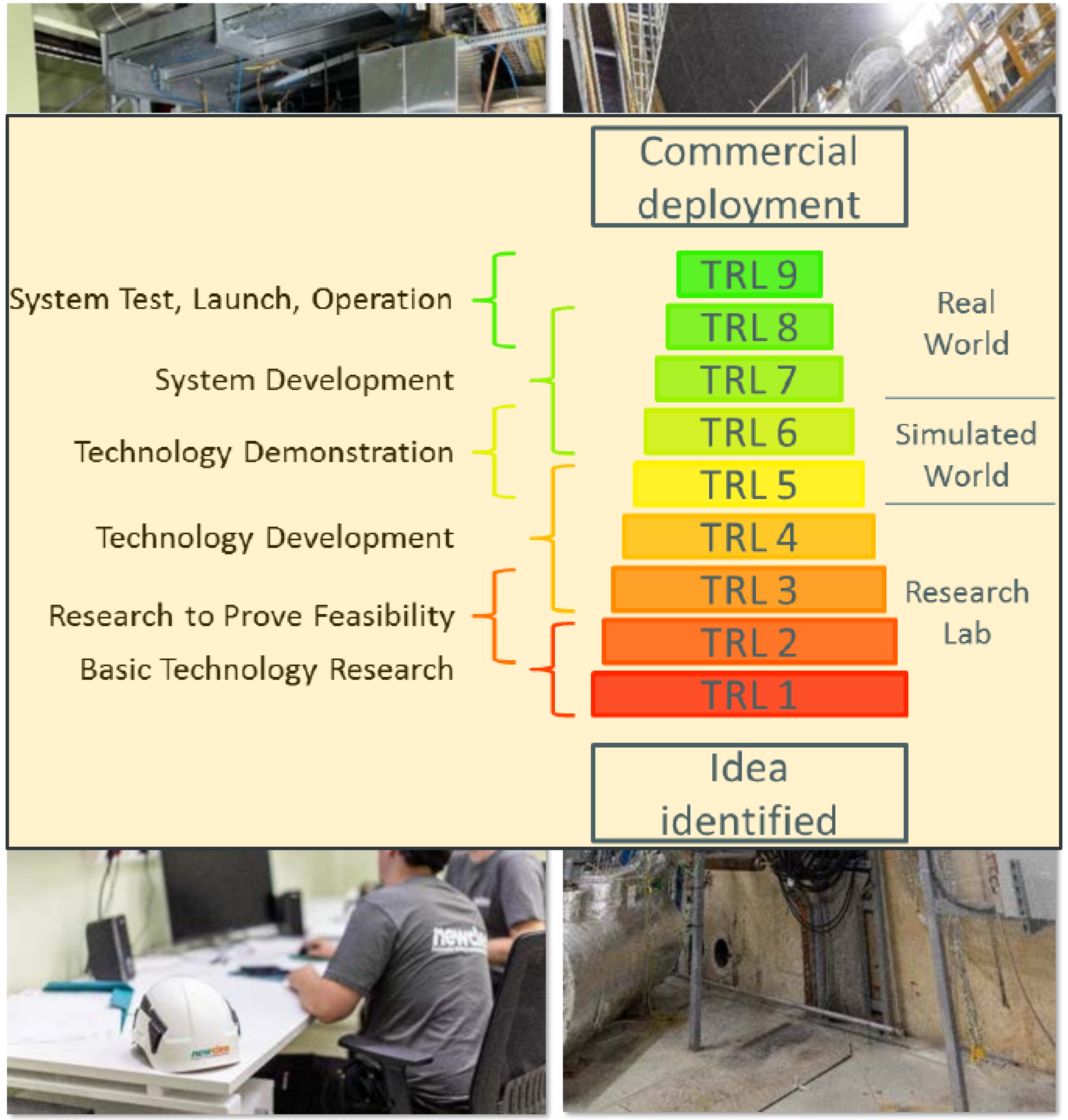
- Structural materials and coatings
- Fuel and fuel integrity
- Primary coolant behaviour and chemistry
- Core integrity
- Primary system integrity
- Instrumentation and Control (I&C)
- Reactor physics / neutronics
- Components handling systems
- In-Service Inspection and Repair (ISI&R)
- Balance of plant
- Plant operation and accident response

SIMULATION AND EXPERIMENTAL CAMPAIGNS

Close technological partnership with **ENEA** and notable contributions from **SRS** and **FUCINA**

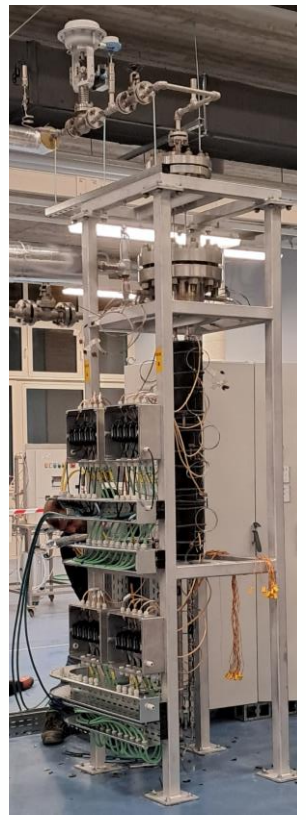
Collaborations with labs and universities

Ongoing conversations with specialised companies



Large investments: EUR90+ millions allocated

*new*cleo: the world's largest R&D network for lead-cooling technology development



DCI
operational in Mar 2025 at PoliTO

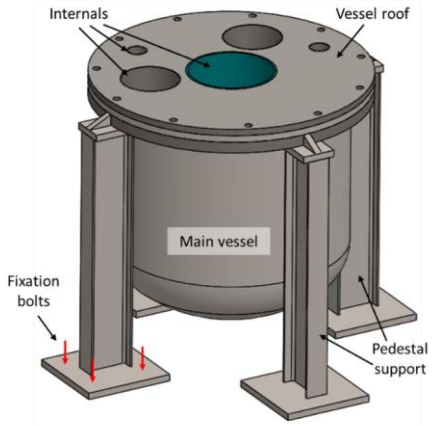
Dip Cooler Instability test facility with two Decay Heat Removal systems, in- and ex- vessel, designed to ensure safe reactor temperatures

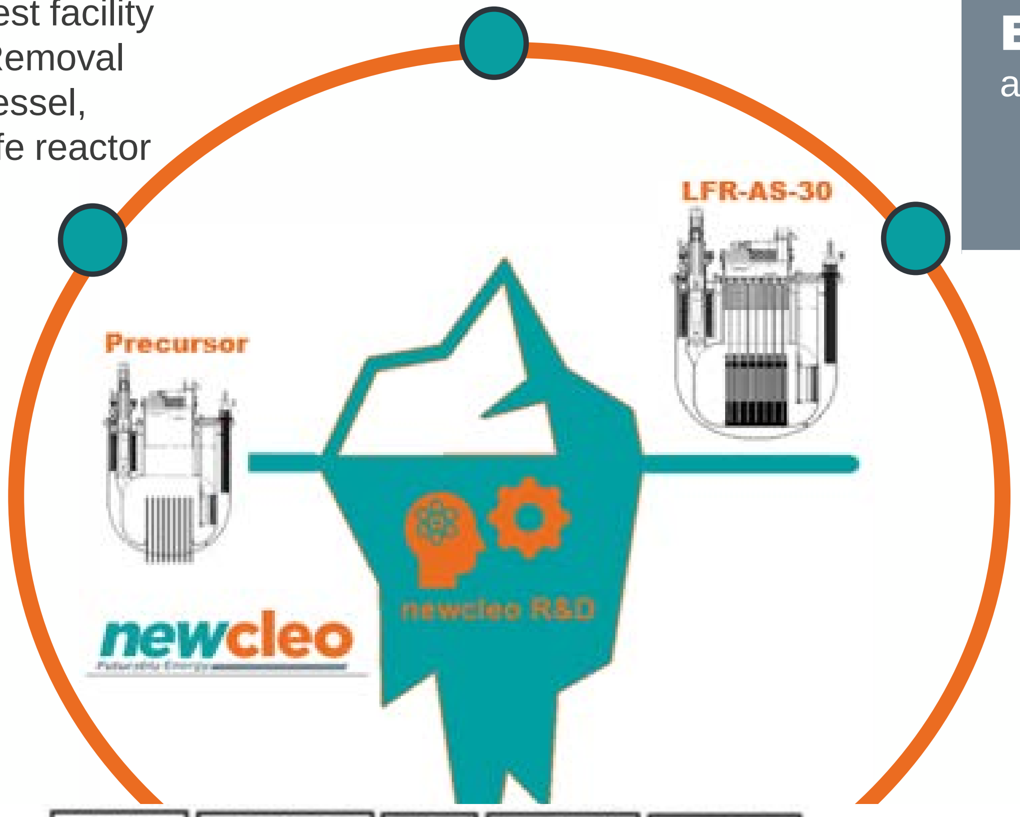
MATERIALS LAB

Mechanical testing and characterisation

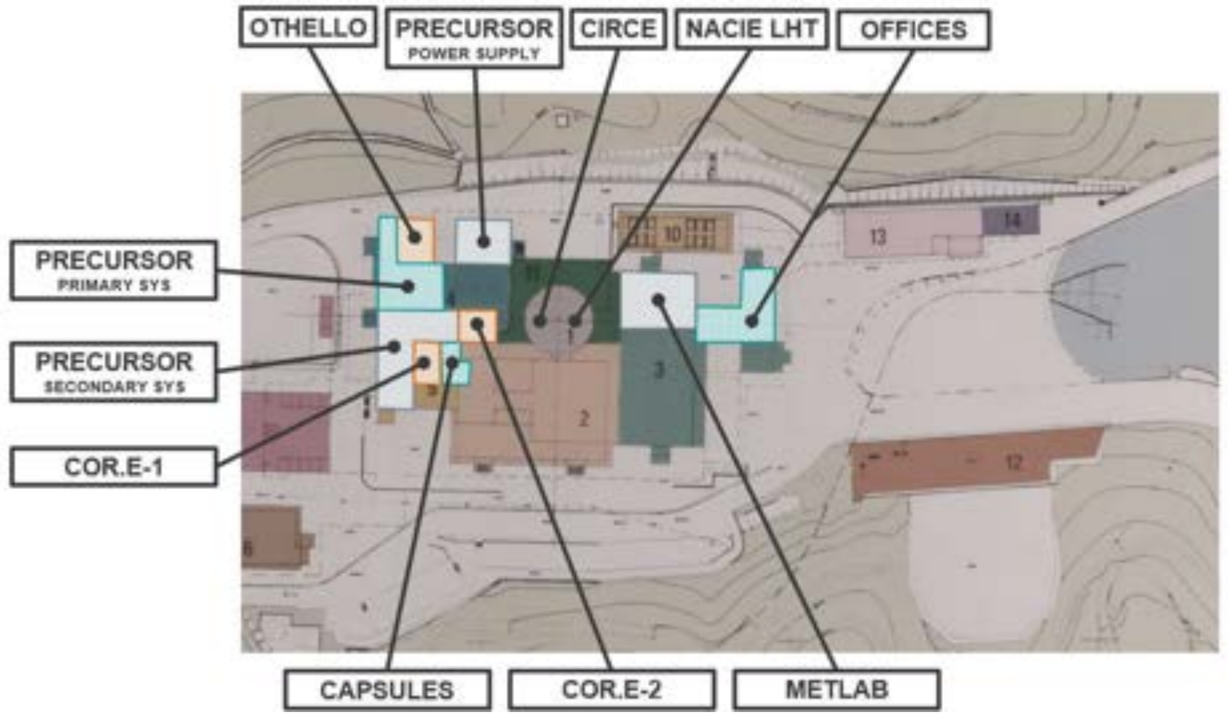
EFESTO
at ENEA-Casaccia

Earthquake and Sloshing Test Observation. Pool-type test facility filled with liquid lead that reproduces LFR-AS-30 behavior under seismic events





H: main hall, E: electricity buildings
C: chemistry lab, O: offices



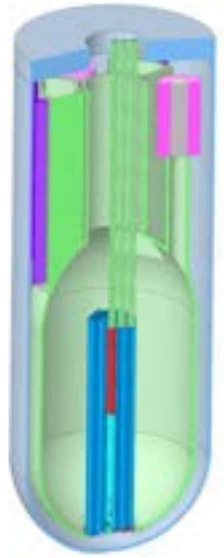
*new*cleo: the world's largest R&D network for lead-cooling technology development

CORE
200 kW
CORE-1 operational in Apr 2024
CORE-2 installation in progress

Loop-type test facility for corrosion and erosion testing of structural materials in flowing lead

CAPSULE
operational Dec 2023

Several tanks filled with Lead and Argon with immersed specimens for corrosion tests in stagnant lead. Advanced temperature and oxygen control



PRECURSOR
10 MW
operational in 2026

New pool-type large-scale test facility representative of the LFR-AS design for broad-scope investigations on LFR system transient behaviour, component testing/qualification, etc.

MANUT
dry and in-lead

Infrastructure to validate mechanical aspects of fuel assemblies including fuel/component handling and control rods. Two facilities: one in air and one in lead

CIRCE-NEXTRA
Phase I – Pumps
Phase II - SGTR

To sit within existing CIRCE pool-type facility. Phase I: Primary pumps to study hydraulic performances, vibration dynamics, long-term endurance and mechanical loads

Phase II: Steam Generator Tube Rupture (SGTR) scenarios in LFR design

CHEMISTRY LAB
MATERIAL LAB

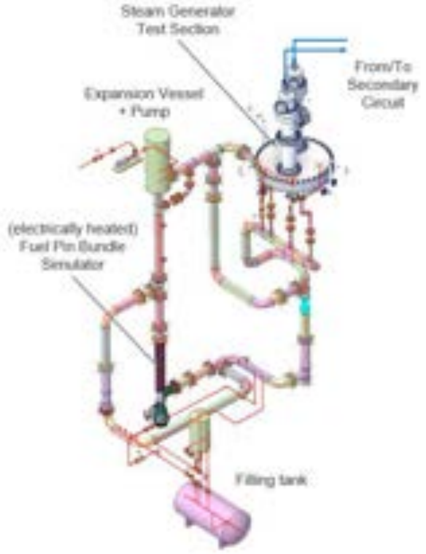
Chemical laboratory to evaluate mechanical properties in lead i.e., creep, long-term creep, slow strain rate tests, creep fatigue

HUSTLE
operational May 2025

Hot Ultra Sonic Testing Lead Experiment, two phases – one in hot air and the second in liquid lead

OTHELLO
2 MW
commissioning in 2025

Multipurpose thermal-hydraulics loop test facility for post-test analysis of components and thermal-hydraulic code validation



NACIE-LHT
operational Jun 2024

*new*cleo's upgrade at existing ENEA NACIE loop facility. Aims to provide lead-side transverse heat transfer coefficient data

SOLEAD
operational 2023

Lead coolant chemistry facility

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Workforce and Economic Impact of National Nuclear Programs

Skilled Workforce Needs for Nuclear Programs

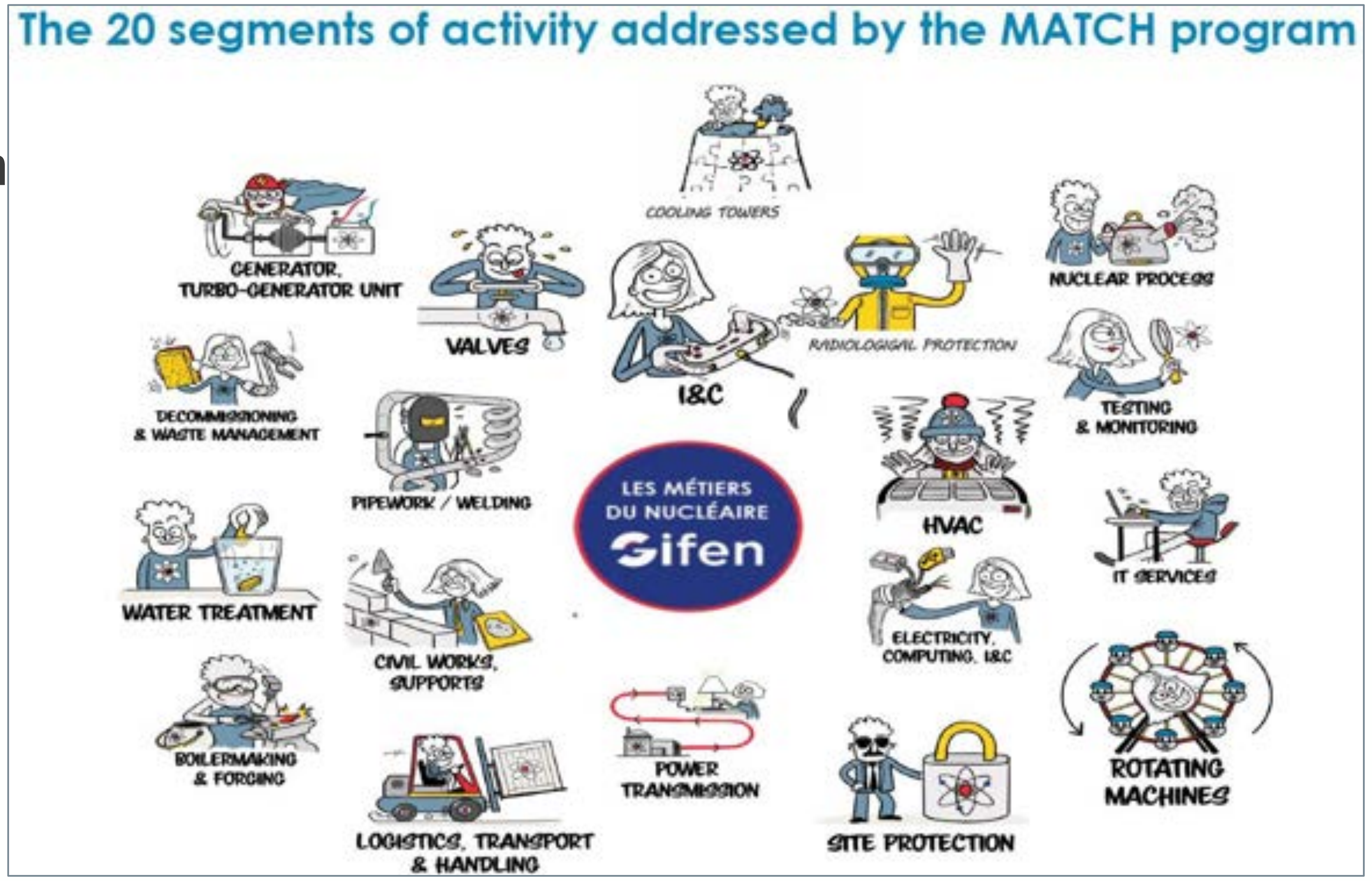
Based on insights from the GIFEN MATCH report, the International Atomic Energy Agency (IAEA), and the International Energy Agency (IEA), the following key points outline the current and projected needs for skilled workers in nuclear programs:

- **Aging Workforce**: A significant portion of the current nuclear workforce is approaching retirement age, risking a major loss of expertise.
- **Training and Development**: Building nuclear-specific skills requires long training pipelines and significant investment.

PROGRAMME MATCH

Critical Professional Profiles in Demand

- ✓ **Nuclear Engineers**: Specializing in reactor design, safety, and systems integration
- ✓ **Radiation Protection Experts**: Ensuring safety compliance and monitoring.
- ✓ **Skilled Tradespeople**: Welders, electricians, and technicians for construction and maintenance.
- ✓ **Project Managers**: To manage large-scale, long-term infrastructure projects.
- ✓ **Regulatory and Safety Personnel**: For licensing, inspection, and compliance.



Workforce and Economic Impact of National Nuclear Programs

Job Creation Potential of a Nuclear Power Plant (Per ~1GW Unit)

Construction Phase (5–10 years):

- Total Jobs Created: ~10,000–12,000
- Onsite Construction Workforce: ~3,000–4,000 at peak
- Key roles: ~1,000–1,200 engineers, ~2,000+ tradespeople, ~200–300 project managers, ~150–200 safety personnel

Operational Phase (60+ years):

- Direct Permanent Jobs: ~500–800 full-time staff per reactor
- Roles include operators, maintenance, engineers, safety officers, and support staff

Indirect & Induced Jobs:

- For every direct job, ~2.5–3.5 additional jobs are created in the broader economy.
- Typical Net Output: 1,000–1,600 MWe
- Average used in workforce estimates: ~1GWe
- Reference Plant Types: EPR (~1,600 MWe), AP1000 (~1,100–1,200 MWe), VVER-1200 (~1,200 MWe)

Summary of Workforce Impact (Per Reactor Unit)

Lifecycle Stage	Direct Jobs	Indirect/Induced Jobs
Construction	~10,000–12,000	~20,000–30,000
Operation (60 yrs)	~500–800	~1,250–2,800

Industrial Competitiveness Benefits

- **Technological Advancement:** Drives innovation and engineering capabilities.
- **Supply Chain Development**: Strengthens domestic industries.
- **Energy Security**: Reduces reliance on imported energy.
- **International Collaboration**

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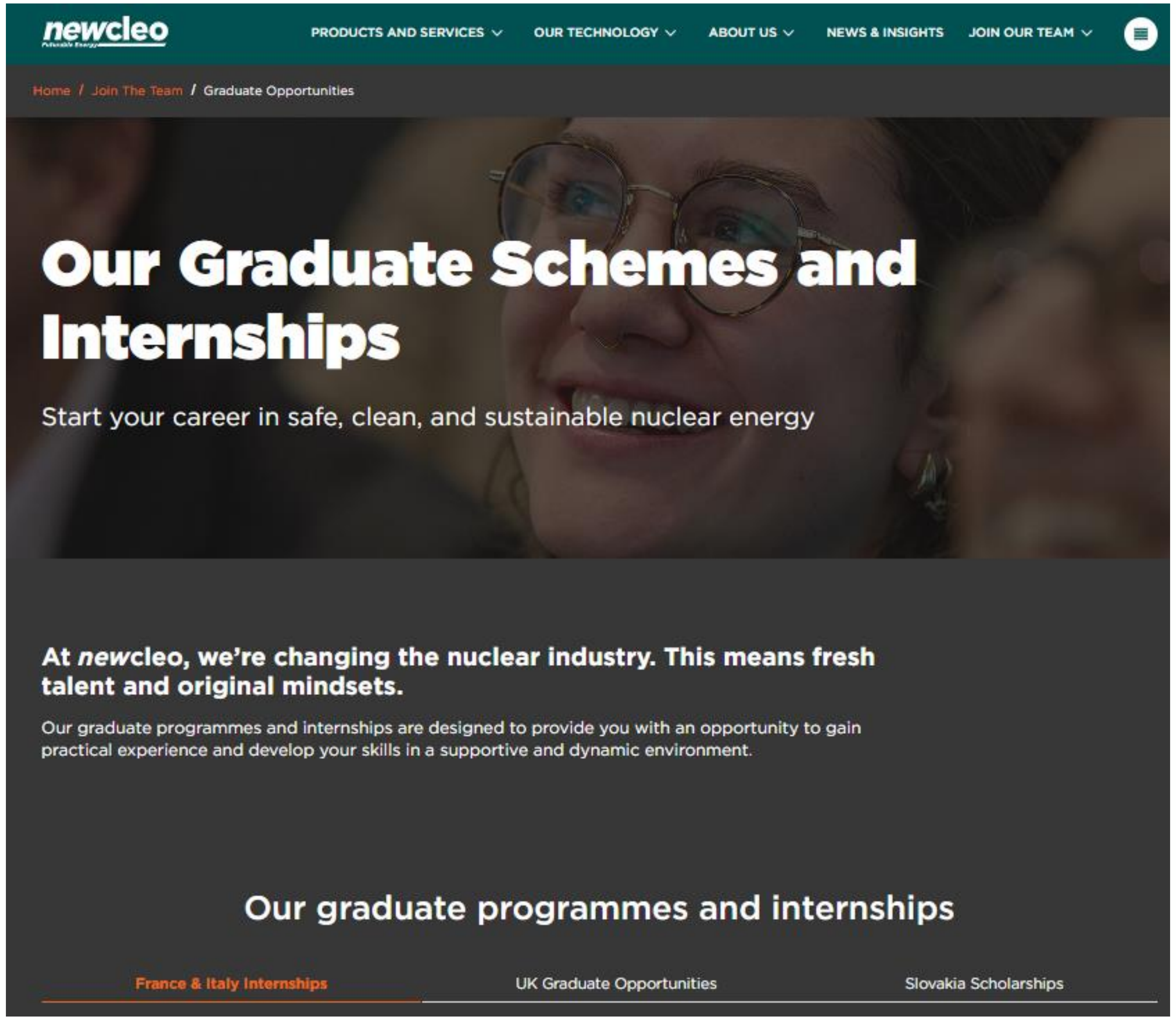
Newcleo Graduate Schemes and Interships

Areas of Skills & Competences

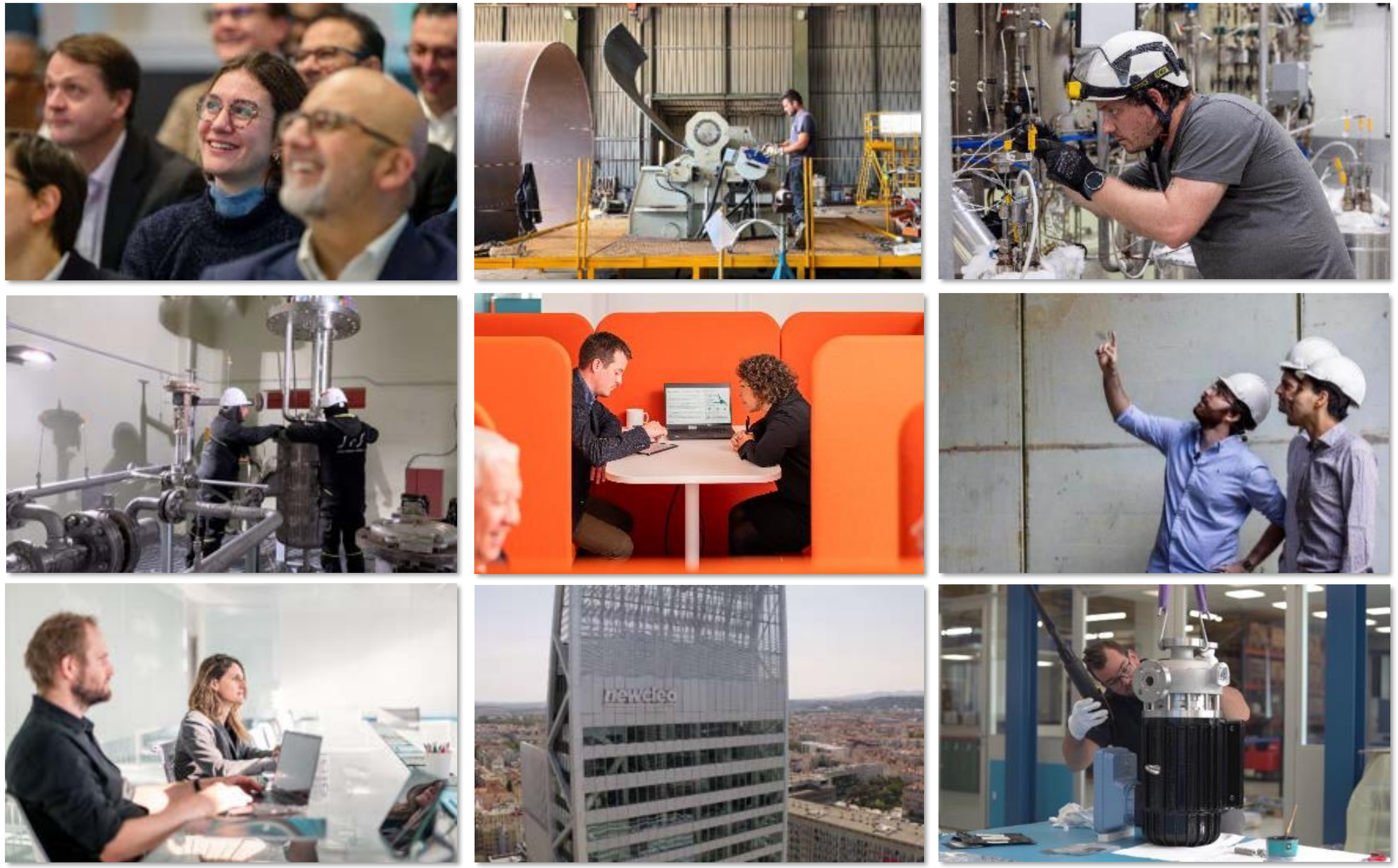
- *Mechatronics and In Service Inspection*
- *Material Science*
- *Radiation Protection & Criticality*
- *Fluid Dynamics/ Numerical Modelling*
- *Code Development*
- *Thermal-Hydraulics*
- *Neutronics*
- *Safety*
- *Reactor Process System Design*
- *MOX fuel*
- *Mechanics*

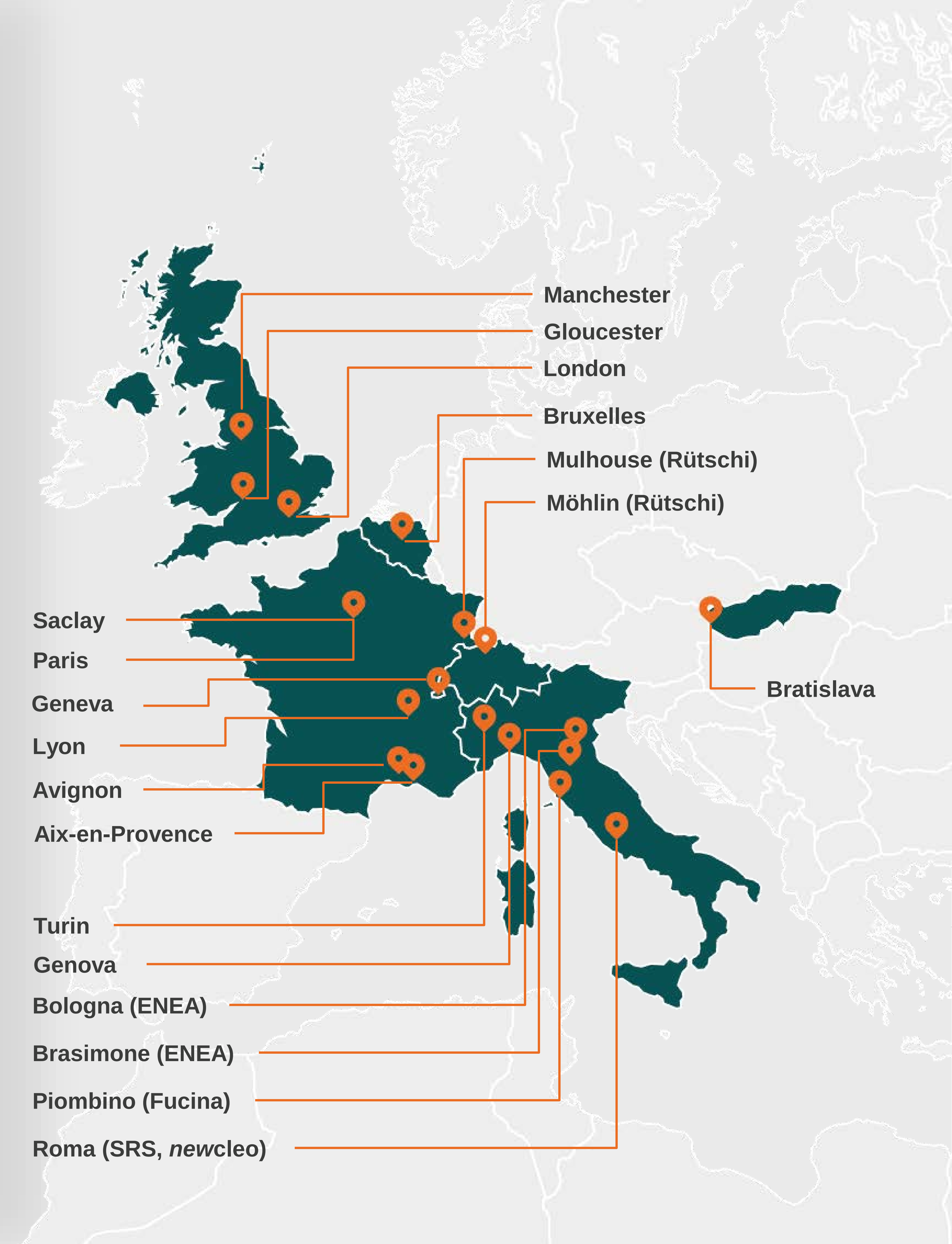


[Our graduate schemes and internships - newcleo | Futurable Energy]

Presence across Europe

19+ locations include 3 factories and 1 qualification/R&D centre





Increasing number of partners and suppliers

Creating a global strategy supporting our delivery

UK

TÜV SÜD, NIA Nuclear Industry Association, wnti, Nuclear Institute, DWD, National Nuclear Laboratory, Dalcour Maclaren, Siemens energy, Achilles, Tecnimont, Frazer-Nash Consultancy, IBM, AtkinsRéalis, amentum, LSE The London School of Economics and Political Science, Nuclear AMRC, mace, Hydrock, Mott MacDonald

FRANCE

EDF, framatome, cea, orano, afcen, ONET, le cnam, SFEN, Mines Saint-Étienne, assystem, SIEPS, GEVOLYS, Gifen, INGEROP, Robatel, ARKADIA Group, naarea, OECD, ALSYMEX, Thorizon, NEA Nuclear Energy Agency, École Centrale Lyon, IMT Mines Alès École Mines-Télécom, ENSTA, INP La Prépa, Mannesmann Stainless Tubes, Nuclear Valley, GICAN, Photonis, egis, ECIA, ECM, Bureau Veritas, ANDRA

ITALY

iit Istituto Italiano di Tecnologia, Politecnico Milano 1863, Politecnico di Torino, Sapienza Università di Roma, Alma Mater Studiorum Università di Bologna, RINA, Thermocoax, SIMIC, Caraglio, ENEA, Fincantieri, SOGIN, AIN, Danieli, enel, ATB Group, Seamthesis, UNIMORE Università degli Studi di Modena e Reggio Emilia, Università degli Studi di Palermo, ansaldo nucleare, MAIRE, tosto, Orion Valves, SAIPEM, NEXTCHEM, pininfarina

SLOVAKIA

javys, vúje, SMA

OTHER PARTNERS IN EUROPE

SOLVAY, TRACTEBEL Engie, nuclear europe, RATEN ICN Pitești, INETEC, ktu, Blykalla

US

NEI Nuclear Energy Institute

JAPAN

JAEA, JNFL, NFI

GLOBAL

World Economic Forum, World Nuclear Association, Vivatome, ENEC, SNETP Sustainable Nuclear Energy Technology Platform, UNECE

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Thank you