SNETP REPORT

SNETP FORUM 2026 - Proceedings

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This SNETP FORUM 2026 – Proceedings report was prepared by the SNETP Association.

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Executive Summary

The SNETP FORUM 2026 took place from March 25th to March 27th, 2026, in Madrid, Spain, bringing together Europe's nuclear community for three days of high-level exchanges, collaboration, and innovation.

The Forum gathered a wide range of stakeholders from industry, research organisations, academia, and public institutions, reflecting the growing importance of nuclear energy in addressing climate change, strengthening energy security, and supporting a clean and resilient European energy system.

The 2026 edition focused on recent technological and scientific progress in advanced nuclear technologies, including Small Modular Reactors (SMRs) and Advanced Modular Reactors (AMRs), as well as key topics such as safety, non-electric applications, long-term operation (LTO), and improved nuclear power plant performance. The discussions highlighted how these innovations can reinforce the contribution of nuclear energy to climate change mitigation and adaptation.

Building on the outcomes of recent collaborative projects, the Forum aimed to identify shared priorities for the European nuclear community, contributing to the definition of future research, development, and innovation (R&D&I) agendas, while fostering knowledge transfer and harmonisation of best practices across Europe and beyond.

The programme combined strategic plenary sessions with technical parallel sessions, ensuring a comprehensive coverage of key topics, including digitalisation, hybrid energy systems, and fuel cycle back-end issues. Particular attention was given to the involvement of the young generation and to strengthening collaboration with international networks.

Acknowledgements

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The collective efforts of all contributors played a key role in making the SNETP Forum 2026 a successful event for the European nuclear community.

1. Introduction and Opening Session

The **SNETP FORUM 2026** took place from **March 25th to March 27th, 2026**, in **Madrid, Spain**, bringing together Europe's nuclear research, innovation, and industrial community for three days of in-depth exchanges, collaboration, and strategic reflection.

Organised under the theme "**Advanced Nuclear Technologies and Innovation for a Clean, Affordable and Sovereign European Energy Future**", the Forum reaffirmed the central role of nuclear energy in addressing Europe's dual challenge of decarbonisation and energy security. In a context marked by increasing geopolitical uncertainties and the urgent need to accelerate the transition towards low-carbon energy systems, nuclear energy is increasingly recognised as a key component of a resilient and diversified energy mix.

The 2026 edition gathered a broad range of stakeholders from across the nuclear ecosystem, including representatives from industry, research and technology organisations, academia, public authorities, and European institutions. The Forum provided a unique platform to foster dialogue across disciplines and sectors, enabling participants to share knowledge, showcase recent achievements, and explore future cooperation opportunities at both European and international levels.

Particular emphasis was placed on recent technological and scientific progress in advanced nuclear systems, notably Small Modular Reactors (SMRs) and Advanced Modular Reactors (AMRs), as well as on the continued safe and efficient operation of the existing fleet. Discussions addressed key topics such as safety, long-term operation (LTO), improved nuclear power plant performance, and the development of non-electric applications, highlighting the growing versatility of nuclear technologies in supporting decarbonised energy systems.

The Forum also explored cross-cutting challenges and opportunities shaping the future of the sector, including digitalisation, artificial intelligence, hybrid energy systems, and the integration of nuclear energy into broader energy systems. These discussions underlined the importance of innovation not only in reactor technologies, but also in operational practices, fuel cycle management, and system integration.

A strong focus was placed on collaboration as a key driver for innovation. The Forum highlighted the importance of strengthening synergies between European initiatives, such as the European Industrial Alliance on SMRs, and fostering partnerships across countries and disciplines. In this context, SNETP continues to play a pivotal role in structuring research, development, and innovation (R&D&I) efforts, contributing to the definition of strategic priorities and supporting the alignment of stakeholders across Europe.

The programme featured a combination of high-level plenary sessions and parallel technical sessions, enabling both strategic discussions and detailed technical exchanges. It also provided a platform for emerging talents and young professionals, whose active participation reflects the sector's commitment to skills development and knowledge transfer.

Overall, the SNETP FORUM 2026 confirmed its role as a flagship event for the European nuclear community, contributing to shaping a shared vision for the future of nuclear energy in Europe, one that is safe, innovative, and fully aligned with climate and energy policy objectives. The event confirmed its attractiveness, bringing together **300 participants** from more than **100 organisations**, representing over **22 countries**.

In line with SNETP's continued commitment to supporting the next generation, more than 30 students were invited to take part in the Forum. Their active involvement in the discussions contributed to the

dynamism of the event and highlighted the importance of knowledge transfer, skills development, and long-term capacity building for the future of the sector.

Beyond participation metrics, communication efforts were central to the event's visibility and broader outreach. The KPIs below reflect the reach and impact of our communication strategy.

- A total of **8 posts** were published across SNETP's platforms (LinkedIn, X, and Bluesky) maintaining consistent and cross-platform presence throughout the event.
- A gain of **70+ new followers** within one week, representing a ~2% growth in our audience. In a specialised field such as nuclear, any sustained audience growth remains a meaningful indicator of rising interest.
- With nearly **29,000 impressions**, approximately 8 times our follower count, the event content extended well beyond our immediate community, highlighting solid organic amplification and clear messaging.
- The average **engagement rate stood at 35.5%**, a remarkable figure when compared to typical social media benchmarks of 1-5%. This underlines how strongly the content connected with our audience.
- A total of **710 reactions** (likes, shares, reposts) were recorded, reflecting positive sentiment and active sharing behaviour. Although reposts remained limited, this nonetheless contributed meaningfully to expanding organic reach.

The Forum officially opened on 25 March with a "**Welcome and Opening Session**", setting the scene for the discussions to follow. The Opening Session was introduced by **Bernard Salha, President of SNETP**, who outlined the strategic vision of the Platform and emphasised the importance of innovation, collaboration, and long-term commitment to ensure the continued contribution of nuclear energy to Europe's energy and climate objectives.

His opening remarks were complemented by contributions from high-level representatives of Spanish institutions and the nuclear community, highlighting both the national context and the broader European perspective. Together, these interventions framed the key challenges and opportunities that would be explored throughout the Forum.

D. Serrano (Director of IMDEA Energy) highlighted the strategic repositioning of the Community of Madrid (CM) towards nuclear R&D, a shift driven by deep structural energy imbalances. Currently, the Madrid region accounts for 20% of Spain's GDP and 14.6% of its population, consuming 11.6% of the national electricity while generating only 7.2% locally. This gap is rapidly compounding due to the proliferation of data centers, with Madrid hosting 55% of Spain's total installed capacity as of 2025. To address this vulnerability, the regional government launched a targeted nuclear innovation strategy, coordinated by IMDEA Energy through a newly established Nuclear Technology Unit. The cornerstone of this initiative is a collaborative Action Plan (2026–2030) involving major national actors (CIEMAT, UPM, Westinghouse, Empresarios Agrupados) focused heavily on the economic feasibility and risk analysis of Small Modular Reactors (SMRs). This regional mobilization directly feeds into the broader European industrial strategy, aiming to develop local experimental capacities that can integrate into EU-wide SMR supply chains and support the decarbonization of intensive technological infrastructures.

Y. Benito Moreno (Directora General of CIEMAT) highlighted the pivotal role of the national research center as the primary bridge between Spanish domestic capabilities and European nuclear innovation frameworks, particularly the Euratom Research and Training Programme. Operating at a macro-

institutional level, CIEMAT embodies Spain's strategic position in the EU's long-term energy transition through major investments in both advanced fission and fusion technologies. A flagship example of this EU-Spain synergy is the IFMIF-DONES project in Granada, a critical European infrastructure for testing fusion materials that represents a massive joint EU-national investment. In the fission domain, CIEMAT actively supports the European harmonization of safety standards, the backend of the fuel cycle, and the technological validation of advanced reactor designs. By aligning its national R&D roadmaps with the EU Strategic Energy Technology (SET) Plan, CIEMAT ensures that Spain remains a highly integrated technological provider in Europe's objective to secure a climate-neutral and sovereign energy mix.

J. Dies (Commissioner of the Spanish Nuclear Safety Council (CSN) and chairman of the Spanish Nuclear Energy Technological Platform R&D (CEIDEN) presented the overall Spanish nuclear R&D ecosystem, which successfully federates over 100 national member entities across 11 subsectors, alongside more than 20 international collaborators. CEIDEN acts as the national counterpart to European Technology and Innovation Platforms (like SNETP), aligning Spanish academic and industrial priorities with EU strategic goals through dedicated working groups on SMRs, Advanced Technological Fuels (ATF), and Simulation. A critical macro-challenge addressed in the presentation was the imminent human resources bottleneck, which poses a strategic risk to both the Spanish and European nuclear sectors. Through its KEEP+ education group, CEIDEN is coordinating a massive capability-building effort to supply the industry with hundreds of new higher education graduates over the next five years. Specifically, the initiative targets the enrolment of 100 students per year across Spain's three leading nuclear engineering master's programs (at UPM, UPV, and UPC), ensuring that Spain cultivates the highly qualified workforce necessary to support Europe's nuclear continuity and long-term operational safety.

2. The role of nuclear fission in Europe's energy systems

The first Plenary Session of the Forum was dedicated to the **role of nuclear fission in Europe's energy systems**. This roundtable was **moderated by Bernard Salha, President of SNETP**.

B. Salha outlined the strategic landscape for European nuclear fission, noting that 60% of the EU's fleet is currently targeting Long-Term Operation (40-60+ years). While highlighting the momentum of the EU SMR Alliance in accelerating advanced designs for industrial heat and grid flexibility, he identified major macroeconomic hurdles: fragmented national regulatory frameworks, nascent supply chains, and complex financing. To overcome these barriers, he positioned SNETP as the essential R&I catalyst bridging national ecosystems with major European funding vehicles – including Horizon Europe, Innovation Fund, EUCF, etc., ensuring nuclear R&D directly supports the EU's competitive and climate-neutral objectives.

A. des Cloizeaux (IAEA) provided a global macroeconomic forecast for nuclear capacity, projecting a massive expansion to address the energy trilemma by 2050. The IAEA's high-case scenario anticipates global capacity reaching 992 GWe (a 160% increase), driven by 676 GWe of new builds, of which 162 GWe will be Small Modular Reactors (SMRs). Framing this international momentum alongside the 38 countries now backing the pledge to triple nuclear energy – including many newcomers, she highlighted emerging R&I frontiers highly relevant to European industrial competitiveness, particularly the regulatory and technological development of civil nuclear maritime propulsion and floating nuclear power plants (FNPPs) to decarbonize heavy transport.

N. Espinosa (EPRI) presented a high-level US perspective on accelerating nuclear deployment through trans-Atlantic collaboration and standardized technology platforms. Emphasizing that foundational designs currently underpin over 83% of the world's commercial reactors (comprising more than 360 units globally), she outlined a three-pronged macro-strategy critical to both the US and EU markets: maximizing the operational lifespan and output of existing assets, accelerating the commercialization of advanced Gen III+ and Gen IV technologies, and integrating flexible nuclear power into evolving, decarbonized grids

S. Kopecky (JRC) introduced the integration of nuclear power into the Clean Energy Technology Observatory (CETO), reflecting a major EU policy shift driven by the Net Zero Industry Act. He quantified the current European baseline: roughly 98 GW of operating nuclear capacity contributing €250 billion annually and supporting 500,000 jobs across the bloc. Looking forward, CETO estimates that SMRs could add between 17 and 53 GWe of new capacity within the EU by 2050. However, he warned that achieving this requires aggressive R&I intervention to close critical capital, supply-chain, and skills gaps, making pan-European technological alignment vital for deployment.

S. Milà (Westinghouse) emphasized the deep industrial roots and 50-year cooperation of Westinghouse within the Spanish nuclear sector, having localized technologies to build six of the country's reactors. He highlighted nuclear energy's critical macroeconomic role in providing grid stability and mitigating extreme weather events while reducing European reliance on volatile gas markets. Looking toward the EU's decarbonization and R&I goals, Westinghouse continues to anchor advanced capabilities in Spain, exemplified by the 2025 launch of the AP1000 simulator. He stressed that developing flexible, innovative solutions like the SMR AP300 and the eVinci microreactor will be essential to support both continuous grid baseloads and off-grid remote applications across Europe.

A. Goicea (nucleareurope) highlighted the substantial socioeconomic footprint of the European nuclear sector, which currently operates 98 reactors, produces 24% of the EU's electricity, sustains 900,000 jobs, and injects €100 billion annually into the economy. Emphasizing the Nuclear Alliance's target of reaching 150 GW of installed EU capacity by 2050, he noted a positive shift in the political narrative but warned of a critical missing piece: a concrete EU "Nuclear Action Plan." He advocated for targeted R&I policies and standardized financing frameworks that can transform national-level ambitions into a cohesive, EU-wide industrial deployment reality.

S. Sarrade (CEA) detailed France's aggressive nuclear revival strategy under the new Multiannual Energy Programme (PPE3), which aims to reduce national fossil fuel consumption to 30% by 2035. The macro-level plan relies on extending existing reactor lifespans to 60 years, constructing 6 new EPR2 reactors to reach a 420 TWh generation target, and heavily investing in R&D for advanced reactors and the closed fuel cycle. Within the broader EU context, this massive capability-building and standardization effort is designed to reinforce Europe's industrial base, support cross-border decarbonized electricity markets, and ensure sovereign uranium supply chains independently of volatile global markets.

3. Small Modular Reactors advancement in the EU

The second Plenary Session focused on **Small Modular Reactors advancement in the EU** and was **moderated by Peter Baeten, SCK CEN & Vice-President of SNETP**.

M. Frignani (Ansaldo Nucleare) showcased the EAGLES-300, a 300 MWe Lead-cooled Fast Reactor (LFR) selected as a leading Gen-IV project by the EU SMR Alliance. Designed with 72+ hours of passive safety and a 520°C outlet temperature to supply both steam and electricity, it operates on a 100% sustainable closed MOX cycle. Backed by over €250M in national funding, the project follows a phased roadmap: a technology demonstrator (LEANDREA) by 2034, a pre-commercial demonstrator (ALFRED) by 2037, and full deployment by 2039.

N. Zweibaum (HEXANA) presented the company's fast reactor technology aimed at decarbonizing industrial heat, highlighting a massive market gap: heat constitutes 75% of global industrial energy needs, of which 90% is currently fossil-based. Driven by a highly customer-centric approach, Hexana has already secured 7 industrial contracts and 2 MoUs with industrial off-takers. Their strategy relies on sovereign European supply chains and partnerships with established leaders (CEA, EDF, Orano) to utilize reprocessed spent fuel (MOX).

K. Lauwers (Thorizon) outlined the roadmap for the Thorizon One, a modular molten salt reactor delivering 100 MW of electricity (targeted at an affordable 60 €/MWh) or 550°C industrial heat (25 €/MWh). Supported by Tier-1 industrial partners (including Orano and Tractebel), Thorizon is scaling rapidly. Their aggressive timeline targets the construction of the Thorizon Pioneer nuclear demonstrator in 2028, paving the way for the first full-scale, grid-connected Thorizon One commercial plant by 2032.

P. Charles (EDF) detailed EDF's dual macro-strategy for the French nuclear ecosystem, which currently operates 57 reactors (63 GW capacity). The strategy balances the Long-Term Operation (LTO+) of the existing fleet beyond 60 years via the "Grand Carénage" refurbishment program, with a massive new build pipeline. This includes the construction of 6 new EPR2 reactors (with 8 more as options by 2050) and the Nuward SMR, with a heavy emphasis on design simplification, standardization, modular prefabrication, and digitalization.

Key Takeaways:

- **Industrial Heat is the New Frontier**: Advanced Modular Reactors (AMRs) like Hexana and Thorizon are explicitly targeting the high-temperature industrial heat market, moving beyond pure electricity generation.
- **Closed Fuel Cycles**: There is a strong, unified push toward sustainability using Gen-IV fast reactors (EAGLES, Hexana) that leverage closed MOX cycles to minimize waste.

- **Accelerated Timelines**: Startups and scale-ups are driving aggressive deployment roadmaps, aiming for operational demonstrators by the late 2020s and early 2030s.

Conclusion: The presentations demonstrate a clear paradigm shift in the European nuclear sector from conceptual R&D to rapid commercial industrialization. Driven by the urgent need to decarbonize heavy industry and secure sovereign energy supplies, both historical incumbents and agile deep-tech scale-ups are heavily focused on standardization, strategic partnerships, and aggressive deployment schedules for the next generation of reactors.

4. Current status of Nuclear energy in the Spanish energy mix

The third Plenary Session presented the **current status of Nuclear energy in the Spanish energy mix** and was moderated by **Enrique Gonzalez from CIEMAT and member of the SNETP Governing Board**.

Alberto Martin Garcia, (PwC) outlined the macroeconomic footprint of Spain's 7 operational reactors (7.1 GW), which currently face a phased closure between 2027 and 2035. The analysis underscored a severely increasing tax burden on nuclear generation, particularly the ENRESA and general taxes, which heavily inflate operating costs and restrict market competitiveness despite the fleet's high reliability.

Paulo Jorge Domingues dos Santos (SNE) critically assessed Spain's 2030 National Energy and Climate Plan, which targets 81% renewable electricity but faces a required demand growth of 34% (17.6 TWh/year). Highlighting recent grid vulnerabilities, including a nationwide blackout in April 2025 and 55% asynchronous generation, the presentation stressed that nuclear's synchronous baseline is technically indispensable for voltage control, price stability, and overall grid resilience.

M-T Dominguez Bautista (Empresarios Agrupados) emphasized the robust domestic value of the Spanish nuclear supply chain, noting that Spain remains virtually self-sufficient across the entire NPP lifecycle. Despite a domestic construction pause, Spanish engineering and manufacturing retain top-tier international recognition, remaining fully prepared to support the global nuclear renaissance and train a new generation of professionals.

P. T. Leon (CEIDEN) quantified Spain's readiness for new nuclear builds, revealing that the domestic industry can already supply 77% of the economic activity required for a new project. With targeted capacity building over five years, this sovereign share could rise to 82%, highlighting a resilient supply chain capable of driving advanced R&D (including SMRs and Long-Term Operation) and creating highly qualified technical jobs.

R. T. Fernández (ENSA) emphasized ENSA's transformation over 50 years from a state firm crafting components for Spain's NPPs into a worldwide nuclear leader. Pioneering SMRs by heading a European

manufacturing readiness alliance, partnering with U.S. developers, startups, and Spanish collaborators on studies, prototypes, and designs, ENSA counters workforce gaps via its ENSA Academy, nurturing young experts in nuclear skills, safety, and culture.

M. T. Domínguez Bautista (Empresarios Agrupados - EAG) highlighted Spain's nuclear programme success, built on decades of investment since the 1960s that created a self-sufficient industrial ecosystem covering nearly the full nuclear lifecycle. This robust supply chain, spanning engineering, manufacturing, and services drives innovation, trains new professionals, and contributes to advanced R&D like molten salt reactors and fusion, where Spain ranks second in Europe, offering a model of national coherence for newcomers.

Key Takeaways:

- **Supply Chain Readiness**: Despite the planned phase-out, the Spanish nuclear industry retains exceptional sovereign capabilities, able to localize up to 82% of any new build project.
- **Grid Stability Imperative**: As renewable penetration surges, the dispatchable, synchronous power of nuclear is critically needed to prevent blackouts and stabilize the grid.
- **Economic & Fiscal Pressures**: The current fleet faces heavy, disproportionate tax burdens that threaten economic viability during their final years of planned operation.

Conclusion: The presentations reveal a stark paradox in the Spanish context: while national policy dictates a phased nuclear shut down by 2035, the domestic supply chain remains world-class and highly capable of executing new builds. Simultaneously, aggressive renewable targets are exposing severe grid vulnerabilities, making the technical and economic case for retaining nuclear assets increasingly vital for long-term energy security.

5. Collaboration as a driver for innovation

The fourth Plenary Session focused on **collaboration as a driver for innovation** and was moderated by **Lou Martinez from Westinghouse and member of the SNETP Governing Board**.

This panel aimed to explore how cross-sector partnerships, digital transformation, and international cooperation are reshaping the nuclear energy landscape. Representatives from the European Space Agency (ESA), the Nuclear Energy Agency (NEA), the International Atomic Energy Agency (IAEA), the European Commission's Directorate-General for Research and Innovation (Euratom), and the French Alternative Energies and Atomic Energy Commission (CEA) led the discussions. They underscored a shared recognition that the future of nuclear innovation depends on breaking down silos and fostering integrated, mission-driven ecosystems.

The session began with agreement that nuclear innovation in Europe is slowed by the fragmentation of broader research and innovation initiatives. To address this, speakers emphasized the need to transition to mission-driven ecosystems where industrial players, research institutions, startups, and regulatory bodies collaborate from the very beginning of projects. Euratom's presentation highlighted EU role in facilitating this shift. This includes launching innovation hubs, enabling regulatory sandboxes, and connecting nuclear research to the EU's broader data, infrastructure, and funding frameworks. This approach aims to align nuclear innovation with the EU's strategic priorities, such as energy security, industrial competitiveness and climate neutrality.

International cooperation has emerged as a critical enabler of this transition. NEA demonstrated how its platform fosters collaboration on over 30 joint projects spanning nuclear safety, fuel research and advanced technologies. The NEA's involvement in organizations such as the Generation IV International Forum (GIF), the Multinational Design Evaluation Programme (MDEP), and the International Framework for Nuclear Energy Cooperation (IFNEC) highlights the need for global consensus on standards, knowledge exchange, and regulatory alignment. The International Network for Nuclear Power Plant Operational Experience (ISOP) of the International Atomic Energy Agency (IAEA) and its Innovation in Action Webinar Series act as catalysts for cross-disciplinary discussions.

Digitalization and AI were identified as transformative forces in the nuclear sector, with the potential to enhance safety, efficiency and competitiveness. The IAEA's symposium on AI and nuclear energy led to significant results that were discussed throughout the panel. First, the integration of AI and nuclear technologies is already underway, with uses ranging from predictive maintenance to plant optimization. Expansion of these technologies is limited by systemic factors, such as regulatory frameworks, data availability, workforce expertise, and trust. Moreover, deploying AI responsibly in the nuclear industry requires transparency, auditing capabilities, and human oversight, specifically in high-risk situations where safety is paramount.

The NEA's AIxpertise collaboration demonstrates these principles in practice. It aims to create trustworthy AI systems tailored to nuclear applications by curating AI-ready datasets that include scientific, reactor, and cross-cutting data. This project also offers benchmarking exercises, training programs and workshops to enhance AI skills among nuclear professionals. Meanwhile, Euratom's focus on integrating AI and digitalization into nuclear innovation highlights the importance of cybersecurity as a core pillar. This will ensure that digital transformation does not compromise the sector's rigorous safety standards.

The crucial role of tapping into open innovation ecosystems for nuclear advancement is another key point. Euratom emphasized the need to integrate nuclear research with current EU initiatives, such as Horizon Europe, and adopt collaborative investment strategies that blend public and private sectors. Standardization was also highlighted as a key enabler of innovation, providing a common framework for safety, interoperability and regulatory compliance across member states. NEA's joint projects, such as the Framework for Irradiation Experiments (FIDES), demonstrate how shared infrastructures and pooled resources can sustain critical research in fuel safety, materials science and advanced reactor designs.

This approach to open innovation emphasizes the importance of knowledge management and education. NEA's Nuclear Education, Skills and Technology Framework (NEST) and IAEA's Innovation Award Programme and webinar series aim to cultivate a new generation of experts equipped to navigate the

intersection of nuclear technology and digital transformation. These initiatives not only address the workforce gap, but they also foster a culture of collaboration and continuous learning.

The importance of regulatory adaptability in response to technological breakthroughs was emphasized. Proposed regulatory sandboxes would allow for the testing of innovative technologies, such as small modular reactors (SMRs) and advanced fuels, without compromising safety or stifling progress. The European Commission's Industrial Alliance on SMRs offers an example of how public and private stakeholders can collaborate on significant projects.

Financial mechanisms were also a point of discussion, with speakers advocating for a greater emphasis on public-private partnerships (PPPs) and mission-driven funding models. The aim is to ensure that nuclear innovation is not only technologically advanced but also economically viable and aligned with societal requirements.

The discussion focused on two exciting cross-industry applications of nuclear technology: space exploration and integrated energy systems. ESA presented a vision for nuclear power as an enabler of deep-space missions, where traditional solar power is insufficient. Nuclear fission and radioisotope power systems (RPS) are being developed to support surface infrastructure on the Moon and Mars, interplanetary travel, and propulsion systems. The ENDURE program, led by the European Space Agency (ESA), showcases the importance of cross-sector collaboration in tackling complex issues like launch safety, waste management, and self-sufficiency from non-European technologies.

While CEA's presentation on integrated energy systems highlighted the pivotal role of nuclear energy, it also emphasized the need for a diverse and low-carbon energy portfolio. By combining nuclear with renewable resources (such as solar and hydrogen) and interconnected systems (like SMRs for hydrogen production), CEA envisions a future where nuclear energy not only drives electricity generation but also facilitates industrial heat, hydrogen production, and carbon cycle closure. This comprehensive method necessitates cooperation between various energy fields and disciplines, from the study of materials to the application of artificial intelligence (AI) in optimization.

6. Technical session – New Nuclear projects (financing, planning, construction)

This technical session was moderated by **P. Nevitt (UKNNL) & I. Darby (UKNNL)**.

The speakers were:

- **Lou Martinez** (Westinghouse)
- **Steve Chengelis** (EPRI), Advanced Manufacturing and supply chain
- **Zbigniew Krysiak** (SGH Warsaw School of Economics)
- **Mathieu Scherer** (NUWARD), NUWARD SMR's strategy regarding constructability, including prefabrication and modularization
- **Pieter Dehairs** (Tractebel), Code selection for European SMRs considering ASME and RCC-M differences, supply-chain standardization and the European regulatory framework
- **Isabel Parrado** (Westinghouse), A training simulator for the eVinci microreactor and beyond
- **Salim El Bouzidi** (Metroscope), The role of AI-based expert systems in enhancing collaboration and knowledge management in nuclear power plants
- **Federica Pancotti & Valerio Piscini** (Sogin), Advanced Technologies for Large Scale Steam Generator Dismantling: The Latina Boilers Project

This session featured a high-level panel led by Lou Martinez (Westinghouse CTO), Steve Chengelis (EPRI, Vice President for Nuclear Development), Prof. Zbigniew Krysiak (SGH Warsaw School of Economics), and Mathieu Scherer (NUWARD).

The session opened with a presentation by Lou Martinez on Advancing Europe's Nuclear Innovation. Key observations and challenges included the growing importance of digitalisation and data, the use of artificial intelligence in nuclear construction, and the establishment of specialised digital R&D groups (notably in Spain). Advanced manufacturing was also highlighted, with a focus on specialised manufacturing techniques and the development of new materials. In addition, the need for specialised testing capabilities in Europe to support the nuclear operations and innovation ecosystem was emphasised. Examples included Westinghouse's advanced lead-based experimental test rigs, operating at temperatures of up to 800°C, which support the development of next-generation nuclear technologies.

The discussion then shifted to European supply chain challenges, led by Steve Chengelis, who shared insights drawn from EPRI's role as a global collaborator supporting independent, objective research. Steve highlighted constraints across the supply chain, including shortages in heavy forgings, engineered components, and large power transformers, all of which pose significant cost and delivery challenges. In addressing these issues, he described examples of innovation that, if implemented, could offer a

compelling value proposition—potentially delivering up to a 40% cost reduction for Small Modular Reactors (SMRs).

The innovation theme continued with a presentation from Mathieu Scherer, who outlined approaches to simplification, modularisation, and the use of prefabrication to enable fast, reliable, and predictable project delivery for light water reactor projects. He further developed the benefits of rapid construction for European projects, targeting a 48-month build time for nth-of-a-kind units. This ambition could be achieved in part by transferring the majority of direct on-site labour to factories and mobile workshops. Meeting these accelerated construction targets requires a strong industrial partnership model that integrates strategic technology partners with local European suppliers, thereby securing a long-term, resilient European supply chain.

Recognising that technical innovation alone does not guarantee project success, Prof. Zbigniew Krysiak expanded on the importance of a sophisticated understanding of capital markets and their potential role in supporting the nuclear industry, particularly in relation to the economic effectiveness of SMRs. His analysis of market behaviour and investor risk profiles demonstrated that nuclear energy is increasingly attracting capital, which is being reinvested into new projects—driven by advances in SMR technology and rising global demand for decarbonised energy.

Throughout the session, the importance of innovation across all aspects of new nuclear projects was consistently highlighted. Equally evident was the value of sharing experiences, challenges, and successes, encapsulated by the theme #ShareOurScars. This reflected both a sense of pride in the progress already achieved and recognition of the immense potential that lies ahead.

7. Technical session – Long-Term Operation

This technical session was moderated by **P. Ferroni (Westinghouse) & J.C Huchard (EDF)**.

The speakers were:

- **Faiza Sefta** (OECD-NEA), NEA Nuclear Reactor Safety Research in support of LTO
- **Federico Rocchi** (ENEA), The need for robust and anticipated safety assessments in European LTE/LTO projects: ETSON's perspective
- **Pieter Hellings** (Tractebel), Long-Term Operation (LTO) of Doel 4 and Tihange 3 Nuclear Power Plant: Design Upgrades and Test & Inspection Strategy
- **Marie Bertholot** (EDF/MAI), The Materials Ageing Institute: An international consortium driving excellence in nuclear long-term operation
- **Alec McLennan** (Amentum), A Decade of Euratom-Horizon 2020 Environmentally Assisted Fatigue Research
- **Hannu Malmberg** (Fortum), Loviisa NPP LTO in I&C technologies: current state and plans for remaining life time
- **Yves Derriennic** (Westinghouse Belgium), LMD & Cold Spray to repair critical components
- **Mohamed Ben Chouikha** (GeePs - Sorbonne Université), AI-augmented Sensor Interface for NPPs safety assessment and Long Term


This session addressed the central role of Long Term Operation (LTO) in meeting rising global demands for carbon free, secure, and affordable electricity. Nuclear power plants are among the most reliable and robust assets in today's energy system, and their continued operation—well beyond the original design lifetime—offers a pragmatic means of stabilizing and securing electricity supply while facilitating transition to low carbon energy systems. Achieving this, however, requires a coordinated approach between R&D activities, e.g., understanding and predicting material ageing, enhancing inspection capabilities, etc., and ensuring that safety and reliability standards reflect current knowledge.

The session was structured to first provide a global and European overview of LTO frameworks, and then present concrete technical advances underpinning safe and reliable long term operation.
A first key theme highlighted during the session is the material ageing knowledge. Extensive research—ranging from environmentally assisted fatigue to irradiation effects on metals, polymers, and concrete—has helped to develop better understanding of these phenomena. Collaborative efforts on material ageing, international fatigue programmes, and material harvesting initiatives from plants undergoing decommissioning provide the scientific basis for predicting long term behaviour of critical components. All these programmes have significantly reduced conservatism in component lifetime predictions.
A second theme is the need for coordinated, forward looking safety assessments. European regulators and TSOs converge on the importance of harmonized methodologies, proactive identification of knowledge gaps, and realistic evaluation of safety margins. As units age, challenges such as RPV embrittlement, ageing of cast stainless steel piping, concrete degradation, and cable condition monitoring require sustained experimental data, validated models, and robust inspection capabilities. Across the session, speakers emphasised that LTO must be prepared years in advance, with clear planning for R&D, investments, and regulatory dialogue.

The session also highlighted significant modernization and refurbishment programmes underway in multiple countries to support LTO. These programmes integrate design upgrades, targeted component replacements, enhanced safety systems, extended testing campaigns, and ambitious renewal of safety critical I&C architectures. They demonstrate that LTO is not merely an extension of time, but a structured technical programme ensuring continued compliance with modern safety expectations. Despite the scale of these efforts, experience shows that systematic prioritisation, clear safety bases, and strong project management enable efficient and safe implementation.
Finally, the session illustrated the growing role of advanced technologies in supporting LTO. Additive and surface repair methods such as Laser Metal Deposition and Cold Spray provide alternatives to replacing large or complex components, reducing outage duration and dose exposure for plant workers. At the same time, AI augmented sensing and edge computing monitoring systems open new possibilities for real time ageing diagnostics—especially for polymers and other materials historically difficult and expensive to

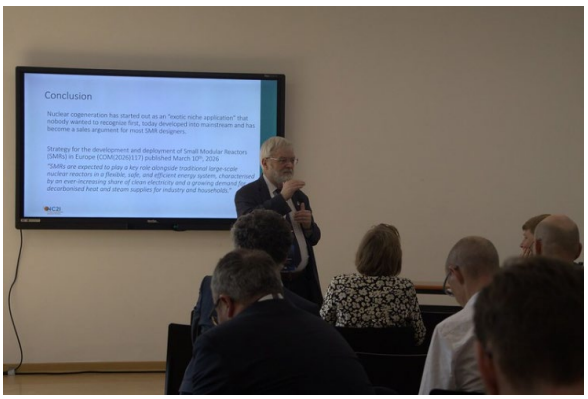
inspect. These innovations pave the way for more predictive maintenance, more refined ageing models, and reduced operational uncertainty.
Conclusion: This session demonstrated a unified vision: Long Term Operation is both technically achievable and strategically essential to ensure secure, low carbon electricity supply over the coming decades. Across countries, operators, TSOs, research organizations and industry suppliers, a consistent message emerged: safety driven ageing management, robust research, and targeted modernization programmes together make LTO a credible path toward extending the lifetime of existing nuclear fleets beyond 60 years.

8. Technical session – Non-electric Applications

This technical session was moderated by **M. Fütterer (JRC) & C. Boudet (CEA)**.

The speakers were:

- **Józef Sobolewski** (NCBJ), The role of the Nuclear Cogeneration Industrial Initiative
- **Michael Fütterer** (JRC), Highlights from the GIF Working Group on Non-Electric and Cogeneration Applications
- **Alina Constantin** (IAEA), IAEA activities on HTGR Technology Development and their Non-Electric Applications
- **Allan Simpson** (Equilibrion), Update to the 2011 EUROPAIRS Report on European Industrial Heat Demand
- **Fabio Nouchy** (Tractebel), Perspectives for SMR in industry and in future integrated Nuclear Hybrid Energy Systems
- **Gianni Bruna** (Calogena), Bridging the District Heating Gap: The Competitiveness of Calogena's Low-Temperature SMR



This session brought together a range of perspectives on the development of nuclear non-electric applications, highlighting their growing importance for industrial decarbonisation in Europe and beyond. Contributions from international organisations, industry representatives, and European initiatives provided a comprehensive overview of both technological progress and market opportunities.

The Nuclear Cogeneration Industrial Initiative (NC2I) outlined its role in advancing integrated energy solutions combining heat, electricity, and hydrogen production. The initiative reflects a broader shift in the nuclear sector, where cogeneration is increasingly recognised as a key pathway to address non-electric energy demand, which represents a major share of greenhouse gas emissions. NC2I emphasised the importance of industrial applications such as process heat, hydrogen production, and district heating, and its ongoing work to structure collaboration across European stakeholders.

Complementing this perspective, the NECA Working Group of the Generation IV International Forum presented recent work on system analysis for hydrogen production using HTGR–HTSE coupling. The results demonstrate convergence across international modelling approaches, while also identifying key challenges related to system integration, regulatory readiness, and economic uncertainty. These findings confirm that while individual technologies are progressing, their large-scale deployment depends on coordinated developments across the full value chain .

An updated European market analysis for non-electric energy products highlighted a decline in industrial process heat demand mainly due to delocalization of industrial capacity to non-European sites. Nevertheless, demand remains strong for low- and medium-temperature heat, particularly below 550°C, which represents a key entry point for nuclear applications in industry and energy systems. The full report will be available soon.

Industrial and technological perspectives on SMRs further illustrated how nuclear systems could be integrated into future hybrid energy systems. Key enabling concepts include heat storage, high-temperature steam networks, and flexible infrastructure to connect nuclear supply with industrial demand. Priority application sectors identified include refineries, petrochemical clusters, district heating networks, and hydrogen production, with deployment expected to follow a phased approach from near-term integration to long-term industrial transformation.

Finally, international developments on High Temperature Gas-cooled Reactors (HTGRs), presented by the IAEA, demonstrated strong global momentum, with multiple projects under development or already in operation. These technologies are particularly suited for high-temperature industrial processes and hydrogen production, and are supported by growing international collaboration on R&D, safety, and deployment frameworks.

Across all presentations, several common challenges and priorities emerged. Regulatory alignment—particularly between nuclear and non-nuclear sectors—was identified as a critical issue for cogeneration projects. The need for demonstration projects was widely emphasised to validate technologies, reduce uncertainties, and support investment decisions. In addition, economic competitiveness and market conditions remain key drivers for deployment, alongside the importance of engaging industrial end-users early in project development.

Overall, this session confirmed that nuclear non-electric applications and cogeneration are transitioning from emerging concepts to concrete industrial opportunities. While significant progress has been achieved, further efforts in system integration, regulatory frameworks, demonstration and economic life cycle analysis will be essential to enable large-scale deployment in Europe.

9. Technical session – Hybrid Energy Systems

This technical session was moderated by **C. Vaglio-Gaudard (CEA) & A. Cagnac (EDF)**.

The speakers were:

- **Marco Ricotti** (POLIMI), Modelling approach for Hybrid Energy Systems analysis
- **Cecilia Herrero-Moriana** (Westinghouse), Advancing Hybrid Energy Systems: Technical, Economic, and Operational Insights from Nuclear–Hydrogen Integration
- **Nicolas Moulin** (NEEXT), Hybrid & Flexible Energy from SMRs: The Key Role of the Conventional Cycle and Its Multiphysics Modelling
- **Sylvain Takenouti** (EDF), EDF experience and perspectives on nuclear cogeneration

- **Iain Darby** (UKNNL), FlexMix Insights – The power of industry collaborations on Integrated Energy Systems analyses
- **Martin Scheepers** (TNO), Small modular reactors in the Dutch energy system: combined heat and power production in industry

This session addressed the growing importance of Hybrid Energy Systems (HES) as a key enabler for the transition to low carbon, resilient and cost effective energy systems. With increasing penetration of variable renewable energies, stronger electrification of end uses, and rising demand for low carbon heat and hydrogen, nuclear power is facing both new challenges and new opportunities. Hybridisation—through the coupling of nuclear reactors with heat networks, industrial processes, hydrogen production, storage and other energy vectors—emerged throughout the session as a strategic pathway to preserve the value of nuclear assets while supporting broader system decarbonisation.

The session brought together complementary perspectives from research organisations, system modellers, operators and industry, covering the full spectrum from system level modelling and policy insights to concrete engineering, operational and economic considerations. Despite the diversity of approaches, a strong convergence emerged around the idea that nuclear hybrid systems must be assessed, designed and operated at the level of the overall energy system rather than as isolated generation assets.

A first key theme highlighted during the session is the system level value of hybrid nuclear energy systems. Several contributions stressed that nuclear power plants are increasingly exposed to market volatility, with a growing number of hours where electricity prices fall below nuclear LCOEs. In this context, hybridisation offers a way to convert market constraints into productive value by reallocating energy towards non electrical uses such as industrial heat, district heating, hydrogen production or synthetic fuels. System models consistently show that integrating nuclear into a diversified energy hub can help stabilise nuclear operation, maintain high capacity factors and reduce overall system costs, especially in energy systems dominated by renewables.

Closely linked to this, a second theme concerns the central role of industrial and district heat decarbonisation. Heat accounts for around half of final energy consumption and a large share of CO_2 emissions, yet remains one of the most difficult sectors to decarbonise. The session clearly demonstrated that nuclear cogeneration is not a theoretical concept but a mature and credible solution, already implemented in a significant fraction of reactors worldwide. Experience from France, Switzerland, China and other countries shows that low and medium temperature heat supplied from nuclear plants can serve industrial processes, urban heating networks and large energy consumers. Looking forward, Small Modular Reactors and Advanced Modular Reactors, especially when cogeneration options are embedded from the design phase, offer new opportunities to address industrial heat demand, including higher temperature applications.

A third major theme is the importance of techno economic modelling and multi physics simulation for hybrid energy systems. Speakers emphasised that hybrid systems introduce complex interactions across thermal, electrical, fluid and economic domains, over multiple time scales. Traditional plant level optimisation or static cost metrics such as LCOE or LCOH are insufficient to capture these dynamics. Instead, advanced modelling approaches—combining system wide energy models, dynamic simulators and detailed techno economic assessment tools—are needed to evaluate architecture choices, operational strategies, flexibility options and investment decisions. Several contributions highlighted the value of hourly or sub hourly modelling, integration of storage and market participation strategies, and explicit consideration of CAPEX, OPEX and revenues across the full value chain.

The session also underlined that the conventional island and balance of plant play a crucial role in enabling hybridisation. While nuclear islands benefit from standardisation to support licensing, cost reduction and operational simplicity, flexibility and integration with end users can be largely achieved through the design of the conventional island and downstream systems. Advanced Multiphysics modelling platforms and digital twins were presented as key enablers to optimise system architecture, operating envelopes and design trade-offs from concept to operation. This reinforces the need to consider hybridisation early in the design phase rather than as a late retrofit option.

From an economic and business perspective, several speakers stressed that operational strategy becomes a financial lever. The viability of hybrid nuclear systems depends strongly on utilisation rates, dispatch strategies, delivery constraints and contractual arrangements rather than on technology performance alone. Long term heat or hydrogen offtake contracts between nuclear operators and industrial customers were identified as powerful tools to reduce investment risk, hedge price uncertainty and unlock decarbonisation decisions. At the same time, system level studies show that, in high renewable energy systems, SMRs may be economically optimised primarily for heat supply, with electricity production playing a secondary role limited to specific periods.

Finally, the session highlighted broader system integration and policy considerations. Hybrid nuclear systems contribute to flexibility not only through electrical dispatchability, but also via thermal storage, sector coupling and complementary use with hydrogen and heat networks. Whole system analyses indicate that a balanced mix of renewables, nuclear (large reactors and SMRs), storage and flexibility options can significantly reduce the need for expensive infrastructure reinforcements and backup capacities. However, realising this potential requires enabling market frameworks, regulatory clarity, appropriate valuation of flexibility services, and close coordination between energy system actors.

Conclusion:

This session demonstrated a shared and consistent vision: Hybrid Energy Systems represent a credible, technically feasible and strategically important evolution of nuclear energy in future low carbon energy systems. By coupling electricity, heat, hydrogen and storage, nuclear power can move beyond the traditional baseload paradigm and become a key contributor to system flexibility, industrial decarbonisation and energy security. Achieving this will require early integration of hybridisation in reactor and balance of plant design, advanced system level modelling, robust techno economic assessment, and business models that align incentives between nuclear operators, end users and policymakers. Across the presentations, a clear message emerged: hybrid nuclear energy is not a niche option, but a system level solution that can significantly strengthen the long term role of nuclear power in deeply decarbonised energy systems

10. Technical session – Digitalization & Artificial Intelligence

This technical session was moderated by **C. Schneidesch (ENGIE) & S. Szabolcs (AEMI)**.

The speakers were:

- **Aurélien Schwartz** (Metroscope), Harnessing AI to improve the performance and reliability of nuclear power plants
- **Agnieszka Czeszumska** (EPRI), AI in Action: Applied Research Projects for the Nuclear Sector at EPRI
- **Nicolas Bousquet** (EDF), AI R&D at EDF: methodologies and tools serving the nuclear industry
- **Sergio Canil** (NFQ), Generative AI for Nuclear Documentation. Achieving Automated Precision for Technical and Regulatory Alignment
- **Mateo Ramos** (Westinghouse), Nuclear Specific AI in Practice
- **Manuel Sainz** (EAG), Digital Twin of Almaraz NPP in Spain
- **Louis Bal-Dit-Sollier** (EDF), LLMs4EU Project

This session confirmed that digitalization and AI are moving from exploratory pilots toward concrete industrial uses in the nuclear sector. In line with the official session scope—predictive maintenance, anomaly detection, digital twins and AI-driven risk tools—the presentations showed that the most mature applications are those with clearly defined operational or engineering value and seamless integration into existing workflows. Across the session, AI was presented not as a generic promise, but as domain-specific tooling to improve reliability, efficiency, traceability and decision support in highly regulated environments.

A first key theme was the convergence of physics-based modelling, plant data and AI. Several contributions demonstrated that the highest-value applications combine first-principles understanding with machine learning rather than treating AI as a black box. This was visible in online monitoring and diagnostics for early fault detection, in digital-twin approaches combining BIM, simulation and real-time plant data, and in hybrid surrogate models that drastically accelerate fracture-mechanics calculations while preserving engineering interpretability. The session highlighted a clear direction: hybrid architectures can provide faster analysis, earlier warning of degradation and better operational insight while remaining anchored in physical models and plant configuration knowledge.

A second major theme was the rise of generative AI and knowledge-centric tools for engineering, documentation and regulatory work. The session illustrated how large language models and retrieval-based methods are already being applied to troubleshooting, knowledge retention, decommissioning experience capture, document comparison, engineering assistance and requirements engineering. These use cases address a common challenge in the nuclear sector: critical knowledge is fragmented across large volumes of legacy documents, reports, drawings, procedures and national regulatory texts. AI can help

retrieve, structure, compare and formalize this information much faster than manual work alone, but speakers consistently underlined that such tools must remain grounded in cited sources, structured data and expert review.

A third theme was the importance of trust, qualification and secure deployment. The session repeatedly stressed that successful AI in nuclear requires more than technical performance: it requires clear use-case definition, appropriate technology choice, benchmarking, human validation, cybersecurity, protection of plant data and intellectual property, and compliance with applicable regulatory and legal frameworks. This was reflected in several approaches, including keeping inspection data local, building secure or federated AI platforms, embedding traceability into outputs, and advancing European initiatives that address multilingually, sovereignty and regulatory conformity.

The session also reinforced a common organizational message: AI augments experts rather than replacing them. Whether in ultrasonic inspection, troubleshooting, engineering document review or configuration and licensing work, the role of AI is to reduce fatigue, shorten search and analysis time, and direct human attention toward the most safety-significant issues. Experts remain indispensable for judgement, validation and final decision-making. The most convincing solutions presented were therefore those that acted as expert multipliers, improving consistency and productivity while preserving accountability and human oversight.

Overall, Session B2 conveyed a coherent conclusion: AI and digitalization are becoming credible, high-value enablers for the nuclear sector when they are nuclear-specific, physics-informed where relevant, secure by design, and deployed with rigorous human-in-the-loop governance. The most immediate benefits are already visible in predictive maintenance, engineering knowledge management, document and requirement processing, digital twins, and accelerated structural integrity analyses. Across operators, vendors, research organisations and European initiatives, a consistent message emerged: the sector is not looking for generic AI, but for trusted tools anchored in plant knowledge, validated workflows and nuclear expertise.

11. Technical session – Advanced Fuels & Materials

This technical session was moderated by **M. Bertolus (CEA) & J. Van den Bosch (SCK CEN)**.

The speakers were:

- **Lorenzo Malerba** (CIEMAT), Accelerating innovation in nuclear materials: the CONNECT-NM partnership
- **Murthy Kolluri** (NRG Pallas), Irradiation Testing and Qualification of Fuels and Materials at HFR for Advanced Reactor Systems and proposal ideas for the current EURATOM call
- **Didier Bardel** (Framatome), Framatome involvement in Advanced and Additive Manufacturing: a focus on LPBF developments for fuel assembly applications
- **Alberto Saez Maduero** (CIEMAT), Highly Corrosion-Resistant Cladding Alloys: Results from the ECC-SMART Project and Future Applications (PRECISE Project)
- **Tommaso Barani** (CEA), Advancing MOX nuclear fuel knowledge in Europe: from recent Euratom achievements to a future proposal for integrated fuel cycle strategies
- **Jorge Sanchez Torrijos** (NFQ), Simulation of several ATF fuel rod concepts performance under LOCA conditions using TRANSURANUS and TRACE

- **Antoine Claisse** (Westinghouse), Westinghouse orientations for near-and long-term fuel material developments

The session on Advanced Fuels & Materials was made up of 7 presentations and 1 poster communication.

Lorenzo Malerba (CIEMAT) first presented the CONNECT-NM partnership, which promotes a transition from traditional “observe and qualify” approaches to a “design and control” one combining modelling, simulation, targeted experiments and *in situ* characterizations. This paradigm, applied to the various types of materials of fission reactors of all generations, relies on advanced digital technologies to shorten development times. Already more than twenty projects have started in the five research lines of the partnership, which range from data management to qualification through modelling and on-destructive examinations, forming a fully integrated ecosystem.

Murthy Kolluri (NRG Pallas) then emphasized the importance of experimental infrastructure. Irradiation testing, in particular in the HFR reactor, remains essential to validate fuels and materials under realistic conditions. Proposed EURATOM projects aim to extend ongoing work on nickel alloys, graphite, MOX and nitride fuels, materials for molten salt reactors, while introducing innovations such as in-pile cladding creep measurements. This reflects the need to couple modelling advances with robust experimental validation.

Manufacturing innovation was another major focus of the session. Didier Bardel (Framatome) showed how additive manufacturing, particularly Laser Powder Bed Fusion is moving from experimentation to industrial deployment. Applications to fuel assembly components demonstrate that even with unconventional microstructures, materials like 316L stainless steel can meet performance requirements, including in reactor conditions. This opens pathways for improved component design, reduced costs and greater supply chain flexibility.

On materials performance, Alberto Saez Maduero (CIEMAT) addressed corrosion challenges in supercritical-water reactors. Results from the ECC-SMART project underline the complex interplay between oxidation, water chemistry and irradiation effects on cladding alloys. The follow-up PRECISE project introduces AI-based models to predict cracking, combining experimental datasets with mechanistic understanding, an example of hybrid modelling approaches gaining traction.

Fuel development strategies were also discussed. Tommaso Barani (CEA) reviewed progress in MOX fuel research across several Euratom projects, covering behaviour under irradiation, fuel cycle integration and plutonium management. These efforts provide the basis for a future integrated programme addressing

the full fuel value chain, from resource management to reprocessing, including licensing harmonization, which is crucial for fast reactor deployment.

Advanced fuel concepts were further examined through the simulation work presented by Jorge Sanchez Torrijos (NFQ). The combination of the TRANSURANUS and TRACE codes demonstrated that fuel rod performance can be significantly improved under LOCA conditions, particularly when both fuel and cladding are optimized.

Antoine Claisse (Westinghouse) presented industrial perspectives on near- and long-term fuel development. Efforts focus on enhancing current LWR performance through cladding coatings for enhanced accident tolerance, higher burnup fuels and improved absorbers, while exploring advanced materials like SiC and UN for future systems.

Finally, the poster contribution by Giovanni Zulllo (Polimi) aimed at demonstrating how multiscale multiphysics modelling frameworks combined with machine learning can support more accurate and efficient fuel performance predictions. While more technical, this communication reinforced the broader trend seen in the session toward the coupling of detailed mechanistic understanding with computational efficiency and real-time adaptability.

Conclusion:

The session underscored a transition toward the acceleration of the development and qualification of nuclear fuels and materials thanks to integrated, digital and accelerated approaches. Progress in modelling, manufacturing and experimental validation are applied to support both improved operation of current reactors and the development of future systems. Strong emphasis is put on qualification efficiency, safety margins and fuel cycle sustainability.

12. Technical session – LWR Small Modular Reactors

This technical session was moderated by **N. Sobecki (EDF), M. Vázquez Cabezudo (EAG) & I. Horvatovic (SCK CEN)**.

The speakers were:

- **Antti Tarkiainen** (Steady Energy), Key Challenges involved in integrating passive safety systems into the LDR50 design to support its licensing
- **Oscar Campos** (Westinghouse), Advanced passive safety of the AP300
- **Céline Poret** (ASNR), Main Human & Organisational Issues regarding Passive Safety Systems in LW-SMRs
- **Elena Bernardo Quejido** (CIEMAT), Developing a qualification pathway for additive manufacturing
- **Arturo Suarez Reales** (Tractebel), Standardisation challenges for BWRX-300 Design Codes in the European context
- **Karel Deknopper** (NUWARD), NUWARD Joint Early Review: pragmatic multi-regulatory engagement for multi-country deployment

This session focused on the role of LWR-SMRs as a key complement to future nuclear energy systems, combining proven technology with innovative design, manufacturing, and licensing approaches to improve safety, flexibility, and deployment efficiency.

The session was structured around three main themes: passive safety and severe accident mitigation, innovations in factory fabrication and modular assembly, and the standardization of design and licensing frameworks to enable multi-country deployment.

A first key theme addressed passive safety and severe accident mitigation in LWR-SMR designs. Passive systems based on natural circulation and gravity underpin the safety case, while posing some licensing challenges. The LDR approach presented solutions combining a dedicated 1:1 test facility, extensive thermal-hydraulic testing, empirical data generation and code validation to support licensing. AP300 further illustrated how mature passive safety concepts reduce reliance on active systems while maintaining robust defence in depth, with human and organisational factors integrated into operational concepts.

The second theme addressed innovations in factory fabrication and modular assembly, focusing on additive manufacturing within the EASI-SMR project. A qualification methodology for PBF-LB/M and DED-LB/M processes applied to steam generator components was presented to demonstrate reproducible performance and full traceability. Despite remaining challenges, notably dimensional accuracy for DED-LB/M, the approach enables manufacturing of specific features on pre-fabricated parts and supports future regulatory acceptance.

The third theme focused on standardization of design codes and licensing frameworks for multi-country deployment. Challenges linked to supply chain quality and consistency across national regulatory environments were highlighted, alongside the need for harmonized requirements and qualified suppliers. The Joint Early Review, based on the NUWARD SMR project, was presented as a pragmatic bottom-up approach to early engagement with multiple European regulators, supporting dialogue on safety concepts, early identification of regulatory divergences and increased convergence, while preserving national regulatory independence.

Conclusion:

This session demonstrated that LWR-SMRs are progressing through a balanced combination of technological innovation, safety-driven design, and regulatory adaptation. Passive safety systems, advanced manufacturing methods, and coordinated licensing strategies are mutually reinforcing elements of a credible SMR deployment pathway.

13. Technical session – Innovation in the Nuclear sector

This technical session was moderated by **B. Pothet (Framatome) & E. Guillaut (Orano)**.

The speakers were:

- **Roger Garbil** (EC DG RTD), Building Tomorrow, Today: Scaling R&I Desks from Horizon to Euratom
- **Hidde Baars** (Urenco), Nuclear fuel: today and tomorrow
- **Thibault Louvet** (Orano), Fuelling Nuclear Ambition to Sustain Small, Advanced and Large Reactors
- **Annick Elie** (Framatome), Fueling the Future of Advanced Nuclear Technologies
- **Sergii Pugach** (National Science Center Kharkiv Institute of Physics and Technology) & **Kateryna Piliuhina** (ENEN), Nuclear education and industry collaboration in Ukraine: joint e-learning system
- **Vinicius Alves Fernandes** (EDF R&D, METI2S): Methodologies and Tools Innovation and Industrialization for Seismic Risk Assessment

This session aimed to bring together research and industry stakeholders around major innovations in the nuclear sector, covering both upstream and downstream parts of the fuel cycle value chain, reactor technologies, as well as initiatives focused on the training of young professionals.

The session was introduced by Roger Garbil from the European Commission, who provided an overview of European initiatives supporting innovation in the sector, mainly through the Euratom Research and Training Programme.

The first part of the session focused on the nuclear fuel cycle, with presentations from Urenco, Orano, and Framatome. These discussions highlighted the innovations that are currently being brought in the domain; as well as the collective need to deliver on the momentum for nuclear, which can only be achieved through robust, diverse, and sustainable supply chains. This requires strong cooperation between European and OECD nuclear actors. While the industry is ready to deliver innovation, it also requires an appropriate regulatory and financial framework to support the current nuclear revival.

The second part of the session was dedicated to two Euratom-funded projects: METIS and NURECAB. Regarding METIS, seismic Probabilistic Risk Assessment (PRA) for nuclear power plants remains challenging due to significant uncertainties in seismic hazards and the high computational cost of modelling plant systems and components. Building on METIS, the METI2S project aims to develop more integrated and innovative approaches using high-performance computing and surrogate models, while strengthening European cooperation and training of experts to improve seismic risk assessment. On NURECAB, the project aims to integrate nuclear operator training into Ukrainian university curricula through a shared e-learning platform, based on core safety and foundational knowledge modules accessible continuously. It also supports knowledge transfer and dissemination of results in the context of EU–Ukraine integration.

Conclusion:
The session confirmed that innovation across the nuclear value chain depends on both technological progress and strong European cooperation, supported by adequate regulatory and educational frameworks.

14. Technical session – Advanced Modelling & Simulation

This technical session was moderated by **F. Roelofs (NRG Pallas) & L.E. Herranz (CIEMAT)**.

The speakers were:

- **Mohamed Hibti** (EDF R&D), Quantum Computing in Safety Assessment: Present Status and Future Outlook
- **Kevin Zwijsen** (NRG Pallas), DRAKCAR: A Horizon Europe Project Proposal on Flow-induced Vibrations in Prototypical Configurations
- **Aya Barakat** (NEEXT), Chemically Reactive Working Fluids for High-Efficiency Secondary Thermodynamic Cycles in Next-Gen Nuclear Plants
- **Patrick Blaise** (Framatome), AMETIST: Advanced Models Evaluation and Tools for Improved reactor Simulation during Transient
- **Luis Herranz** (CIEMAT), Consolidation of UaSA application in severe accident analysis
- **Sofiane Benhamadouche** (EDF), Experimental and numerical perspectives for predicting the flow in a dead branch

The session focused on ongoing European research efforts aimed at improving the safety, efficiency, and predictive capabilities of nuclear power systems through advanced modelling and innovative simulation methodologies.

Overcoming computational limitations in safety analysis is a challenge worth exploring and a way to do it is through the application of quantum computing, particularly to Probabilistic Safety Assessment (PSA) addressing the computational hard nature of fault tree analysis. Dr. Hibti (EDF) speech showed that while fully quantum solutions remain impractical in the near term, hybrid quantum-classical methods and quantum-inspired techniques, such as tensor networks, have been identified as promising pathways to significantly improve computational efficiency and analytical accuracy. At the end of his presentation, the audience questioned about the size of handable problems and the uncertainty propagation in the quantum framework displayed in the presentation.

The development of high-fidelity simulation tools focused on Multiphysics coupling approaches combining detailed neutronics and thermal-hydraulics (including CFD) was also touched upon on search of more accurate “best-estimate” simulations of transient scenarios in light water reactors. The AMETIST Project proposal, presented by Dr. Blaise (FRAMATOME), proposed a path consisting in 3 phases progressively more complicated: a 3x3 fuel assemblies minicore, a 2-loop (300-400 MWe) PWR and, finally, a 3-loop 900 MWe PWR. The transient scenarios to be addressed are a Steam Line Break (SLB) and a High Boron Dilution (HBD).

Despite the progress made in the projects VIKING and GO-VIKING, there are scenarios in which Fluid-Structure Interaction (FSI) and the Flow-Induced Vibration (FIV) are still issues worth investigating in key components such as core internals and steam generator tubes, integrating experiments, CFD simulations, and data-driven methods to better understand vibration-induced wear and failure mechanisms, particularly in the context of long-term operation and power uprates. Gaining deeper insights to enhance the system reliability and to better understand complex phenomena such as flow asymmetries and heterogeneous core behaviour, while also supporting benchmarking and future AI-driven analyses, are the core of the VALKYRIE project. At the end of the presentation, Ir. Zwijsen (NRG Pallas) referred to the synergies that there might be with other technologies experiencing sort of similar issues.

The thermal hydraulic complexity of “dead branches” (stagnant pipe sections connected to main coolant loops) was introduced by Dr. Benhamadouche (EDF). The scenario entails phenomena like recirculation and thermal stratification, and it has the potential to induce thermal fatigue and structural degradation, which eventually would deteriorate reactor performance. Due to limited experimental data and scaling challenges, the in-kind STRIPES Project aims to combine high-resolution experiments and advanced simulations to build validated models and improve predictive capabilities for these critical phenomena. It was underscored that the first phase of the Project (2026-2028) will be in-kind to get ready to submit a proposal in the 2028-2034 EURATOM call.

Methodological standardization got also a spot in the session. After the success of the MUSA Project, the Severe Accident (SA) community was enabled to adopt the UaSA (Uncertainty and Sensitivity Analysis) for SA simulation. Nonetheless, to make this key progress really relevant in terms of nuclear safety, a consolidated and systematic methodology of UaSA should be set, proved and openly disseminated. After identifying the challenges concerning the extension of the database of uncertain parameters, the issues to deal with in the application of this approach with the aim of enhancing and better support accident management and the demonstration of the methodology in large and small-modular water-cooled reactors, they all will be accommodate in the frame of me MUSAM Project. During the Q&A, Prof. Herranz (CIEMAT) made it clear that it is foreseen that experts in data analysis will be involved in the Project and use of AI/ML will be explored.

Finally, enhancement of the thermal efficiency in thermodynamic cycles through the use of chemically reactive working fluids was presented by Dr. Barakat (NEEXT) as an alternative to conventional water/steam Rankine cycles. By leveraging reversible chemical reactions (i.e., $N_2O_4 \leftrightarrow 2 \cdot NO_2$), these fluids can enhance heat absorption and rejection resulting in a substantial increase of power output (30%). Despite challenges related to toxicity and material compatibility, ongoing research aims to develop safer and more practical reactive fluids, offering a promising route to improving overall plant efficiency without modifying reactor cores. The importance of the chemical compounds stability in the presence of radiation and the need to ensure reaction completeness to avoid secondary contamination of the thermal fluid were discussed at the end of the presentation.

15. Technical session – Advanced Modular Reactors (AMR) & Generation IV

This technical session was moderated by **H. Aït Abderrahim (Myrrha) & A. Goicea (nucleareurope)**.

The speakers were:

- **Nicolas Zweibaum** (HEXANA), HEXANA: building on the EU's SFR legacy to accelerate time-to-market
- **Jean Dhers** (newcleo) & **Vincent Schryvers** (SCK CEN) (EAGLES-NEWCLEO), Strengthening Europe's Leadership in Advanced Reactors: The EAGLES–newcleo Alliance
- **Mariusz Dąbrowski** (NCBJ), Current Advancement of HTGR-POLA Project
- **Stéphane Sarrade** (CEA/GIF Chair), Fuel cycles for Advanced Modular Reactors (AMR) & Generation IV : What needs for a sustainable deployment?
- **Wolfgang Denk** (Denk Nuclear AG), Advanced Nuclear Reactors: How fast can they be deployed?
- **Ferry Roelofs** (NRG Pallas), The THESEUS Proposal: Thermal Hydraulics Experiments and Simulations for EUropean innovative Systems

This session focused on the role of AMRs and Gen IV and their associated fuel cycles in enabling a sustainable, secure, and competitive low-carbon energy system. While momentum is building globally, significant challenges remain in transitioning from technological innovation to large-scale industrial deployment. The session offered also the possibility to initiate reflexion on the challenges for increasing private or public investors' appetite for nuclear technology and more particularly emerging ones such as AMR and Gen.IV.

The presentations and the discussions of the session structured around three key dimensions: strategic drivers for advanced nuclear, deployment challenges, and the enabling conditions required to achieve scale.

A first key dimension concerns the renewed global interest in nuclear energy, driven by energy security, decarbonisation, and industrial competitiveness. As highlighted during the discussions, nuclear energy is increasingly recognised as a low-carbon and dispatchable solution that complements renewable energy and strengthens system resilience.

In this context, AMRs and Gen IV technologies are gaining strategic importance, supported by growing public investments and international cooperation.

However, this renewed momentum also creates pressure to accelerate deployment timelines, making industrial readiness a critical factor.

The second dimension focuses on the gap between technological potential and real-world deployment. While AMRs concepts offer significant advantages—including improved resource utilisation, waste reduction—their commercial maturity remains limited.

Compared to conventional light water reactors, which benefit from decades of operational experience and established supply chains, most Gen IV technologies are still at early stages of commercial deployment. Key challenges include new licensing processes, limited industrial infrastructure, and uncertainties regarding performance and economic returns.

Fuel cycle considerations further reinforce this complexity. As highlighted in the presentations, the fuel cycle is no longer a backend issue but a strategic enabler, directly affecting resource sustainability, waste management, and security of supply. Closed fuel cycles. based on multi-recycling can significantly extend resource availability and reduce long-lived waste, but require substantial investment and technological development that should be looked at in a holistic approach including the monetisation of the impact on the final HLW disposal and the security of supply in a geopolitical scene completely new with very uncertain perspectives.

Overall, we can say that the main bottleneck is no longer innovation itself, but the ability to industrialise these solutions at scale.

The third dimension addresses the key conditions required to unlock large-scale deployment of advanced nuclear systems. A central requirement is the development of an integrated industrial ecosystem, combining reactor technologies, fuel cycle infrastructure, and supply chains supported by a strong R&D tissue with structural funding.

Investment frameworks play a critical role in this process. From an investor perspective, long-term certainty, risk mitigation, and predictable electricity/energy generation are essential to mobilise the significant capital required. Without clear visibility on revenues and regulatory conditions, deployment will remain limited.

In parallel, regulatory adaptation and innovation are necessary to accommodate new reactor designs and fuel cycle technologies. This includes the development of harmonised frameworks, demonstration at pre-industrial scale of the building bricks of the innovative systems and their associated fuel cycles as well and their safety features, and integration of modern tools such as digital twins and AI to accelerate licensing and operation.

Finally, deployment requires coordinated action across policy, industry, and research. This includes investment in fuel cycle facilities, development of skills and workforce, and strengthened international cooperation to reduce risks and accelerate learning.

Conclusion:

The discussion during this session shows that AMRs will be essential components of a sustainable and resilient energy system. While their potential is widely recognised, their large-scale deployment will depend on the ability to bridge the gap between innovation and industrialisation among other via pre-industrial demonstration that should be looked as an investment phase that will be generating a social-economical return on investment and reduce the large uncertainties that are today still a hurdle for the decision-makers for industrialisation.

Fuel cycles, in particular, emerge as a strategic asset, underpinning resource efficiency, waste management, and energy sovereignty. Ensuring their development alongside reactor technologies is therefore critical.

Ultimately, achieving the full potential of AMRs and Gen IV systems will require a coordinated approach, combining technological progress, industrial scale-up, and supportive policy frameworks to deliver secure, competitive, and decarbonised energy systems.

16. Technical session – Safety and licensing (Role of R&D)

This technical session was moderated by **P. Kinnunen (VTT) & T. Ethvignot (ASNR)**.

The speakers were:

- **Javier Dies** (CSN), Nuclear Energy and nuclear skills
- **Aleksi Valkeapää** (STUK), Nuclear Legislation Reform in Finland and Its Implications for SMRs
- **Fernando Cebriano** (Westinghouse), Fire Event Sequence Families Quantification for the eVinci® Microreactor Using New Licensing Methodologies (LMP - NEI-18-04) for ANLWR
- **Laurent Billet** (EDF), How to ease SMR licensing with codes and standards?
- **Erlend Hagen** (Traneberget AS), A framework for enabling and governing a pan-European Closed Fuel Cycle (CFC), compatible with safeguards, industrial scalability, and EU regulatory realities
- **Michele Frignani** (Ansaldo Nucleare), The path to a common nuclear safety approach for EAGLES-300 and its precursors
- **Faiza Sefta** (OECD-NEA), NEA International RegLab Project

This session had speakers from industry (large companies and startups), safety authorities and TSOs, to academic and international organizations. It gathered an audience of about 50 participants. It was meant to address, in particular, an adaptive licensing pathways for advanced technologies (materials, fuels, digital, IA, robotics,…) / enabling faster innovation while maintaining safety, and risk-informed licensing approaches adapted to novel reactor designs.

M. Javier Dies (CSN-CEIDEN) spoke of nuclear energy and nuclear skills in Spain. He presented himself and the CEIDEN, which is an equivalent to SNETP for Spain (100 members – 10 groups focused on SMR in particular). Out of the 33 companies of CEIDEN, 10 are members of the EU industrial alliance on SMRs. He insisted on the worldwide needs for nuclear skills, in particular for specialists, with an increasing number of NPPs requesting lifetime extension. In Spain, the NPPs had “sister plants” in the US that are older than the Spanish ones. He also indicated that CEIDEN is monitoring new higher education. During the questions, he explained the challenges for the Regulatory Body (CSN) about skills and recruitment.

M. Aleksi Valkeapää (STUK) presented the nuclear legislation reform in Finland and its implications for SMRs. The need for the reform in Finland was motivated by a clear interest to new nuclear in the country

as well as to modernize the legal framework which is based on an old nuclear energy Act that had already be amended 40 times. The goal was to adopt a risk informed law, enabling the designer to demonstrate safety (derisking). The main other changes to consider were: potentially numerous parts built outside the plant, multiple reactors in same building (HOF), new build not anymore in sparsely populated area, small reactors etc. He was asked particularly about potential similarities with naval reactors. The Finnish nuclear energy Act is now in parliament investigation.

M. Michele Frignani (Ansaldo Nucleare) presented a path to a common nuclear safety approach for EAGLES-300 and its precursors. The biggest challenge would be to avoid lead freezing. He also pointed out the benefits of distributed research infrastructure, pre-licencing (Joint Early Review-JER), and the participation of this international pilot project to IAEA/NHSI. During the questions, he said that the JER was more challenging than the one for NUWARD which is based on robust technology.

M. Erlend Hagen (Traneberget AS) presented a framework for enabling and governing a pan-European Closed Fuel Cycle (CFC), compatible with safeguards, industrial scalability, and EU regulatory realities. He indicated that he was focussing on governance not technology and illustrated his talk with a recent example (France reaffirmed its policy for a CFC). Beyond that example, in his view “Europe was to engage in CFC with a cross-border flow: the fuel should be designed for CFC, the used fuel should not be considered waste, Europe should move stepwise and start with setting up a European Fuel Cycle Facility agency”. He announced a conference on the subject in Halden (Norway) 21-23 September 2026. The question of insurance was raised by the audience.

M. Fernando Cebriano (Westinghouse) talked about fire event sequence families quantification for the eVinci® microreactor using new licensing methodologies (LMP-NEI-8-04) for ANLWR. He focussed in particular on the Probability Risk Assessment (PRA) team of the project. A discussion was engaged at the end on to what level PRA is adequate with such an innovative design. He mentioned open items for the analysis still to be done, e.g. cable routings and components separation.

M. Laurent Billet (EDF) addressed the question of how to ease SMR licensing with codes and standards. In particular, he presented the work of the EU IA SMR working group on codes and standards. For LWRs, he indicated that the demarch was easier. He also said that the use in the JER as an input data was to be targeted. A discussion was engaged on the compatibility of ASME-US in Europe/France. It is obvious that there still exist many gaps to be studied for future reactor technologies.

Ms. Faiza Sefta (OECD-NEA) presented the NEA International RegLab Project. The project was manly focussed on Artificial Intelligence, but it was applicable to other disruptive technologies. The method was to use a “regulatory sand boxing”. The results of the exercises will be published. A question was posed on the accessibility of the project to industrial companies. Future RegLab topics are being investigated and the Reglab approach has been well accepted and found usable.

Conclusion:

This session touched upon a broad range of interests about R&D for new but also older nuclear power projects, their challenges (skills, fuel cycle) and strengths (State/EU, industry and academic dynamic). It is obvious that R&D will have an important role also in the future if the standardisation will be realised. Several technological questions are still open for future technologies and there is no clear answer for some topics on how to proceed. Recruitment and training of new experts will play a very important role.

17. Technical session – Waste management and decommissioning

This technical session was moderated by **A. Banford (UKNNL) & Giuseppe A. Marzo (ENEA)**.

The speakers were:

- **Erika Holt** (VTT), Snapshot of ongoing predisposal and disposal R&D within the EURAD-2 partnership
- **Diego Espejo** (ENRESA), Enresa´s volume optimization strategies and R&D for radioactive waste management and decommissioning
- **Reka Szoke** (IFE), End-User Driven Digital Twins for Geological Radioactive Waste Disposal: EURAD-2 DITOCO2030
- **Sylvain Benazet** (EDF), Overview of the EDF R&D supports on Waste & Decommissionning
- **Samir Dziri** (Tractebel), Radiological characterisation for dismantling waste classification using underwater gamma-ray spectrometry at ENGIE Electrabel nuclear power plants
- **María Ines García Lodeiro** (IETcc-CSIC), Innovative conditioning matrices for the immobilisation of problematic radioactive waste streams (EURAD-2 STREAM)
- **Elena Torres Álvarez** (CIEMAT), Lessons Learned from European Collaborative Projects and the FEBEX Programme for Enresa's R&D Plan: Supporting Next Steps on DGF Implementation

This session addressed the safe, efficient, and sustainable management of radioactive waste and decommissioning across Europe. The session brought together representatives from research organisations, waste management authorities, utilities, and engineering companies to discuss strategic, technical, and operational advances supporting long-term nuclear back-end solutions.

Overview and Scope

Radioactive waste management remains one of the most complex long-term challenges of the nuclear fuel cycle. The session explored this challenge through European research coordination, national strategies for deep geological disposal, advances in digital technologies, waste characterisation innovations, and the development of sustainable conditioning materials. Emphasis was placed on aligning long-term safety with operational efficiency, sustainability, and the preservation of knowledge across multi-decade timescales.

European Research Coordination

The EURAD-2 European Partnership (2024–2029) was presented as the cornerstone of European radioactive waste management research. Involving 142 organisations from 21 Member States, EURAD-2 integrates predisposal and disposal research within a unified framework structured around Waste

Management Organisations, Technical Safety Organisations, and Research Entities. Seven strategic themes address the entire waste management lifecycle, while a strong knowledge management focus supports competence transfer between advanced and early-stage national programmes.

National Programmes and Repository Development

National strategies demonstrated how European coordination translates into implementation. Spain's programme focuses on waste-volume optimisation, innovative decontamination and characterisation during decommissioning, and progressive development of a Deep Geological Repository (DGR) with operations targeted around 2073. France's programme supports long-term operation and new reactor construction while advancing the CIGEO geological repository supported by coupled THM modelling, large-scale experimental validation, and improved waste-conditioning matrices.

Digital Transformation and Innovation

Digital technologies were identified as transformative enablers for the nuclear back-end. The DITOCO2030 initiative promotes the development of integrated Digital Twins linking BIM, GIS, and multi-physics models to support repository design, operation, and safety assessment. Autonomous robotic platforms, AI-assisted 3D modelling, and advanced spectrometry systems are already improving safety, reducing human exposure, and enhancing decision-making across decommissioning and waste management activities.

Waste Characterisation and Conditioning

Accurate waste characterisation was shown to be critical for safety and optimisation. In-situ gamma spectrometry of irradiated core components revealed discrepancies between predicted and measured activation levels, demonstrating the importance of measurement-driven validation. Consequently, current efforts target problematic waste streams by developing low-carbon binder systems, such as geopolymers and magnesium phosphate cements, to enhance chemical compatibility and align with EU sustainability objectives.

Engineered Barriers and Long-Term Safety

Confidence in deep geological disposal relies on long-term experimental validation. The FEBEX experiment provided unique full-scale data on bentonite barrier performance over 18 years, supporting the validation of THM models. A multi-scale testing strategy, from laboratory to in-situ experiments, was emphasised as essential for robust safety cases across repository lifetimes extending beyond a century.

Key Takeaways

The session highlighted European collaboration as a structural enabler, the growing role of digitalisation and AI, the importance of linking measurement with modelling, and the shift towards innovative low-carbon waste-conditioning solutions. Knowledge management emerged as a strategic priority, ensuring continuity of expertise over long timescales whilst the need for predisposal R&D remains high. Collectively, these developments point towards an integrated, data-driven, and sustainable future for European radioactive waste management and decommissioning.

18. Conclusion

The SNETP Forum 2026 once again demonstrated the strength, diversity, and forward-looking vision of the European nuclear community. Through three days of rich discussions and exchanges, the Forum highlighted the essential role of nuclear energy in delivering a low-carbon, secure, and resilient energy system for Europe. It also reaffirmed the importance of sustained collaboration across industry, research, and policy spheres to accelerate innovation and ensure the safe and efficient deployment of current and future nuclear technologies.

The success of the SNETP Forum 2026 is the result of the collective efforts and strong commitment of all those involved in its preparation and delivery. SNETP would like to warmly thank the sponsors, the members of the Organising Committee, the local hosts and partners, the Scientific and Industrial Innovation Committee (SIIC), session chairs, speakers, and all contributors whose expertise and dedication made this edition possible. Their continued engagement is instrumental in strengthening the SNETP community and shaping the future of nuclear energy in Europe.

19. Appendix 1: SNETP Forum programme

SNETP Forum 2026

PROGRAMME

(version: 24 March 2026)

Day 1 – 25 March – SNETP Forum

10:00	**SNETP GENERAL ASSEMBLY MEETING – J. Maritain Room** (4th floor) **(restricted to SNETP members)**
12:15	Lunch (restricted to SNETP GENERAL ASSEMBLY members)
13:30 14:00 14:20	**Welcome and Opening of the SNETP FORUM 2026 - AUDITORIUM** - **Bernard Salha,** President of SNETP (EDF) - **David Serrano**, Director of IMDEA Energy - **Yolanda Benito Moreno,** Directora General del CIEMAT - **Javier Dies**, Commissioner of the Spanish Nuclear Safety Council (CSN) and chairman of the Spanish Nuclear Energy Technological Platform R&D (CEIDEN) **Presentation of the SNETP Governing Board members** - **B. Salha,** President of SNETP (EDF) **Plenary session: The role of nuclear fission in Europe's energy systems - AUDITORIUM** • **Moderator: B. Salha,** President of SNETP (EDF) **Topics of discussion:** ➢ *Incentives for Long term operation* ➢ *Ensuring Economy/Competitiveness/availability and security of energy* **Panellists** - **B. Salha: Nuclear Landscape in Europe and SNETP strategy** - **Aline des Cloizeaux**, Nuclear Power Division Director, IAEA - **Neva Espinosa,** Senior Vice President & Chief Generation Officer, EPRI - **Stefan Kopecky**, European Commission, Joint Research Centre (JRC) - **Andrei Goicea,** Policy Director- nucleareurope - **Sergi Milà**, Tecnatom-Westinghouse group General Manager

	- **Stephane Sarrade,** CEA/GIF Chair (France)
15:30	Coffee break
16:00	**Technical parallels sessions:** **A1 - New Nuclear projects (financing, planning, construction) – AUDITORIUM** ***Moderators:*** *P. Nevitt (UKNNL) & I. Darby (UKNNL)* **Topics of discussion:** • *Experience on international and European project financing* • *Review of and updates about the new European nuclear projects in development.* • *Viewpoints on the establishment of a new European nuclear skills base and supply chain.* **Speakers** • **Lou Martinez** (Westinghouse) • **Steve Chengelis** (EPRI), Advanced Manufacturing and supply chain • **Zbigniew Krysiak** (SGH Warsaw School of Economics) • **Mathieu Scherer** (NUWARD), NUWARD SMR's strategy regarding constructability, including prefabrication and modularization • **Pieter Dehairs** (Tractebel), Code selection for European SMRs considering ASME and RCC-M differences, supply-chain standardization and the European regulatory framework • **Isabel Parrado** (Westinghouse), A training simulator for the eVinci microreactor and beyond • **Salim El Bouzidi** (Metroscope), The role of AI-based expert systems in enhancing collaboration and knowledge management in nuclear power plants • **Federica Pancotti & Valerio Piscini** (Sogin), Advanced Technologies for Large Scale Steam Generator Dismantling: The Latina Boilers Project --- **B1- Long-Term Operation – J. Maritain Room** (4th floor) ***Moderators:*** *P. Ferroni (Westinghouse) & J.C Huchard (EDF)* **Topics of discussion:** • *Modernization, modification, refurbishment projects or power uprate projects for LTO* • *Safety analysis for design modification considering internal/external hazards* • *Verification and validation of new technologies* **Speakers** • **Faiza Sefta** (OECD-NEA), NEA Nuclear Reactor Safety Research in support of LTO • **Federico Rocchi** (ENEA), The need for robust and anticipated safety assessments in European LTE/LTO projects: ETSON's perspective • **Pieter Hellings** (Tractebel), Long-Term Operation (LTO) of Doel 4 and Tihange 3 Nuclear Power Plant: Design Upgrades and Test & Inspection Strategy • **Marie Bertholot** (EDF/MAI), The Materials Ageing Institute: An international consortium driving excellence in nuclear long-term operation

	• **Alec McLennan** (Amentum), A Decade of Euratom-Horizon 2020 Environmentally Assisted Fatigue Research • **Hannu Malmberg** (Fortum), Loviisa NPP LTO in I&C technologies: current state and plans for remaining life time • **Yves Derriennic** (Westinghouse Belgium), LMD & Cold Spray to repair critical components • **Mohamed Ben Chouikha** (GeePs - Sorbonne Université), AI-augmented Sensor Interface for NPPs safety assessment and Long Term --- **C1 - Non-electric Applications** – **Newman Room** (1st floor) ***Moderators**: M. Fütterer (JRC) & C. Boudet (CEA)* **Topics of discussion:** • Cost competitiveness of nuclear heat, H2 and other energy products • The European market for decarbonised heat • Pathways to demonstration and deployment of co-generation **Speakers** • **Józef Sobolewski** (NCBJ), The role of the Nuclear Cogeneration Industrial Initiative • **Michael Fütterer** (JRC), Highlights from the GIF Working Group on Non-Electric and Cogeneration Applications • **Alina Constantin** (IAEA), IAEA activities on HTGR Technology Development and their Non-Electric Applications • **Allan Simpson** (Equilibrion), Update to the 2011 EUROPAIRS Report on European Industrial Heat Demand • **Fabio Nouchy** (Tractebel), Perspectives for SMR in industry and in future integrated Nuclear Hybrid Energy Systems • **Gianni Bruna** (Calogena), Bridging the District Heating Gap: The Competitiveness of Calogena's Low-Temperature SMR
18:30	Cocktail reception (all) – Área del Encuentro

Day 2 – 26 March – SNETP Forum

9:00	**Plenary session: Small Modular Reactors advancement in the EU - AUDITORIUM** **Moderator: P. Baeten -** SNETP Vice President (SCK CEN) **Topics of discussion:** ➢ *Technological maturity of new designs and the role of R&D in accelerating a multi-lateral licensing process* ➢ *Need for new energy and decarbonization means for the industry* **Panellists** - **Michele Frignani,** Vice-President of Ansaldo Nucleare - **Kiki Lauwers,** CEO, Thorizon

	- **Nicolas Zweibaum**, Deputy CTO of HEXANA - **Pascal Charles**, R&D Director of production at EDF
10:00	Coffee break
10:30	**Technical parallels sessions:** **A2: Hybrid Energy Systems** – **Newman Room** (1st floor) ***Moderators**: C. Vaglio-Gaudard (CEA) & A. Cagnac (EDF)* **Topics of discussion:** ➢ *Modelling tools for HES (suitability for including nuclear, tool validation)* ➢ *Modelling of economics (LCOE vs. LCA, impact of assumptions, how to ensure the reliability of results)* ➢ *Effect of flexibility (e.g., power ramping) on lifetime, performance and economy* **Speakers** ○ **Marco Ricotti** (POLIMI), Modelling approach for Hybrid Energy Systems analysis ○ **Cecilia Herrero-Moriana** (Westinghouse), Advancing Hybrid Energy Systems: Technical, Economic, and Operational Insights from Nuclear–Hydrogen Integration ○ **Nicolas Moulin** (NEEXT), Hybrid & Flexible Energy from SMRs: The Key Role of the Conventional Cycle and Its Multiphysics Modelling ○ **Sylvain Takenouti** (EDF), EDF experience and perspectives on nuclear cogeneration ○ **Iain Darby** (UKNNL), FlexMix Insights – The power of industry collaborations on Integrated Energy Systems analyses ○ **Martin Scheepers** (TNO), Small modular reactors in the Dutch energy system: combined heat and power production in industry --- **B2: Digitalization & Artificial Intelligence (Demos)** – **AUDITORIUM** ***Moderators**: C. Schneidesch (ENGIE) & S. Szabolcs (AEMI)* **Topics of discussion:** ➢ *Enhanced Predictive Maintenance and Anomaly Detection (machine learning model, sensor data analytics, real-time monitoring)* ➢ *high-fidelity digital twins of nuclear plants for simulation, optimization, and operator training* ➢ *AI-driven risk assessment tools* **Speakers** ○ **Aurélien Schwartz** (Metroscope), Harnessing AI to improve the performance and reliability of nuclear power plants ○ **Agnieszka Czeszumska** (EPRI), AI in Action: Applied Research Projects for the Nuclear Sector at EPRI ○ **Nicolas Bousquet** (EDF), AI R&D at EDF: methodologies and tools serving the nuclear industry ○ **Sergio Canil** (NFQ), Generative AI for Nuclear Documentation. Achieving Automated Precision for Technical and Regulatory Alignment

	○ **Mateo Ramos** (Westinghouse), Nuclear-Specific AI in Practice ○ **Manuel Sainz** (EAG), Digital Twin of Almaraz NPP in Spain ○ **Louis Bal-Dit-Sollier** (EDF), LLMs4EU Project --- **C2: Advanced Fuels & Materials** – **J. Maritain Room** (4th floor) ***Moderators**: M. Bertolus (CEA) & J. Van den Bosch (SCK CEN)* **Topics of discussion:** ➢ *Fuel resilience under accident conditions(including ATF development)* ➢ *Materials for high burnup and closed fuel cycles* ➢ *Multi-scale modelling of microstructural evolution under irradiation* ➢ *Corrosion-resistant materials* **Speakers** ○ **Lorenzo Malerba** (CIEMAT), Accelerating innovation in nuclear materials: the CONNECT-NM partnership ○ **Murthy Kolluri** (NRG Pallas), Irradiation Testing and Qualification of Fuels and Materials at HFR for Advanced Reactor Systems and proposal ideas for the current EURATOM call ○ **Didier Bardel** (Framatome), Framatome involvement in Advanced and Additive Manufacturing: a focus on LPBF developments for fuel assembly applications ○ **Alberto Saez Maduero** (CIEMAT), Highly Corrosion-Resistant Cladding Alloys: Results from the ECC-SMART Project and Future Applications (PRECISE Project) ○ **Tommaso Barani** (CEA), Advancing MOX nuclear fuel knowledge in Europe: from recent Euratom achievements to a future proposal for integrated fuel cycle strategies ○ **Jorge Sanchez Torrijos** (NFQ), Simulation of several ATF fuel rod concepts performance under LOCA conditions using TRANSURANUS and TRACE ○ **Antoine Claisse** (Westinghouse), Westinghouse orientations for near-and long-term fuel material developments
12:30	Lunch
14:00	**Plenary session:** **Current status of Nuclear energy in the Spanish energy mix - AUDITORIUM** **Moderator: E. Gonzalez –** SNETP-Governing Board (CIEMAT) **Topics of discussion:** ➢ *How to meet the increasing electricity demand in the future while maintaining the grid stability?* ➢ *LTO approach and value creation* ➢ *Supply chain and other industries in Spain* **Panellists**

	- **Antonio González Jiménez,** Director de Estudios y Apoyo Técnico, Foro de la Industria Nuclear Española - **Paulo Jorge Domingues dos Santos**, President of the Spanish Nuclear Society (SNE) - **María Teresa Domínguez Bautista**, Director de proyectos avanzados en Empresarios Agrupados (EAG) - **Alberto Martin Garcia**, Consultant in Energy Practice, PwC España - **Pablo Teofilo Leon Lopez**, President of CEIDEN - **Rafael Triviño Fernández,** General Director of ENSA
15:30	Coffee break
16:00	**Technical parallels sessions:** **A3: LWR Small Modular Reactors – AUDITORIUM** *Moderators: N. Sobecki (EDF), M. Vázquez Cabezudo (EAG) & I. Horvatovic (SCK CEN)* **Topics of discussion:** ➢ *Passive safety features and severe accident mitigation strategies tailored for SMR designs* ➢ *Innovations in factory fabrication and modular assembly* ➢ *Standardization of design codes and licensing frameworks for multi-country deployment* **Speakers** ○ **Antti Tarkiainen** (Steady Energy), Key Challenges involved in integrating passive safety systems into the LDR50 design to support its licensing ○ **Oscar Campos** (Westinghouse), Advanced passive safety of the AP300 ○ **Céline Poret** (ASNR), Main Human & Organisational Issues regarding Passive Safety Systems in LW-SMRs ○ **Elena Bernardo Quejido** (CIEMAT), Developing a qualification pathway for additive manufacturing ○ **Arturo Suarez Reales** (Tractebel), Standardisation challenges for BWRX-300 Design Codes in the European context ○ **Karel Deknopper** (NUWARD), NUWARD Joint Early Review: pragmatic multi-regulatory engagement for multi-country deployment --- **B3: Innovation in the Nuclear sector (including case studies from Young generation) – J. Maritain Room** (4th floor) *Moderators: B. Pothet (Framatome) & E. Guillaut (Orano)* **Topics of discussion:** ➢ *Fostering cross-sector collaboration between industry, research institutions, and authorities to accelerate deployment.* ➢ *Leveraging EU open innovation ecosystems to integrate AI, digitalization, and cross-sector applications for safety and competitiveness.* **Speakers**

	○ **Roger Garbil** (EC DG RTD), Building Tomorrow, Today: Scaling R&I Desks from Horizon to Euratom ○ **Hidde Baars** (Urenco), Nuclear fuel: today and tomorrow ○ **Thibault Louvet** (Orano), Fuelling Nuclear Ambition to Sustain Small, Advanced and Large Reactors ○ **Annick Elie** (Framatome), Fueling the Future of Advanced Nuclear Technologies ○ **Sergii Pugach** (National Science Center Kharkiv Institute of Physics and Technology) & **Kateryna Piliuhina** (ENEN), Nuclear education and industry collaboration in Ukraine: joint e-learning system ○ **Vinicius Alves Fernandes** (EDF R&D, METI2S): Methodologies and Tools Innovation and Industrialization for Seismic Risk Assessment --- **C3: Advanced Modelling & Simulation (incl. high performance, fidelity, computing)** – **Newman Room** (1st floor) *Moderators: F. Roelofs (NRG Pallas) & L.E. Herranz (CIEMAT)* **Topics of discussion:** ➢ *Advanced Modeling and Simulation for accurate predictions of reactor behavior and safety margins including uncertainty quantification, verification and validation* ➢ *Integration of HPC with real-time monitoring and digital twins for nuclear plants* ➢ *Data-Driven Approaches and AI Integration* **Speakers** ○ **Mohamed Hibti** (EDF R&D), Quantum Computing in Safety Assessment: Present Status and Future Outlook ○ **Kevin Zwijsen** (NRG Pallas), DRAKCAR: A Horizon Europe Project Proposal on Flow-induced Vibrations in Prototypical Configurations ○ **Aya Barakat** (NEEXT), Chemically Reactive Working Fluids for High-Efficiency Secondary Thermodynamic Cycles in Next-Gen Nuclear Plants ○ **Patrick Blaise** (Framatome), AMETIST: Advanced Models Evaluation and Tools for Improved reactor Simulation during Transient ○ **Luis Herranz** (CIEMAT), Consolidation of UaSA application in severe accident analysis ○ **Sofiane Benhamadouche** (EDF), Experimental and numerical perspectives for predicting the flow in a dead branch
18:00	End of the day

Gala Dinner – 20:30

Venue: Perrachica

Address: C. de Eloy Gonzalo, 10, Chamberí, 28010 Madrid

Day 3 – 27 March – SNETP Forum

9:00

Technical parallels sessions:

A4: Advanced Modular Reactors (AMR) & Generation IV – AUDITORIUM

Moderators: H. Aït Abderrahim (Myrrha) & A. Goicea (nuclearеurope)

Topics of discussion:

- *Innovative Reactor Concepts and Coolant Technologies*
- *Fuel Cycle Innovation and Sustainability*
- *Accelerating the time to market of AMRs (maturity of design, licensing, …)*

Speakers

- **Nicolas Zweibaum** (HEXANA), HEXANA: building on the EU's SFR legacy to accelerate time-to-market
- **Jean Dhers** (newcleo) & **Vincent Schryvers** (SCK CEN) (EAGLES-NEWCLEO), Strengthening Europe's Leadership in Advanced Reactors: The EAGLES–newcleo Alliance
- **Mariusz Dąbrowski** (NCBJ), Current Advancement of HTGR-POLA Project
- **Stéphane Sarrade** (CEA/GIF Chair), Fuel cycles for Advanced Modular Reactors (AMR) & Generation IV : What needs for a sustainable deployment?
- **Wolfgang Denk** (Denk Nuclear AG), Advanced Nuclear Reactors: How fast can they be deployed?
- **Ferry Roelofs** (NRG Pallas), The THESEUS Proposal: Thermal Hydraulics Experiments and Simulations for EUropean innovative Systems

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B4: Safety and licensing (Role of R&D) – Maritain Room (4th floor)

Moderators: P. Kinnunen (VTT) & T. Ethvignot (ASNR)

Topics of discussion:

- *adaptive licensing pathways for advanced technologies (materials, fuels, digital, IA, Robotics,…) enabling faster innovation while maintaining safety*
- *Risk-informed licensing approaches adapted to novel reactor designs*

Speakers

- **Javier Dies** (CSN), Nuclear Energy and nuclear skills
- **Aleksi Valkeapää** (STUK), Nuclear Legislation Reform in Finland and Its Implications for SMRs
- **Fernando Cebriano** (Westinghouse), Fire Event Sequence Families Quantification for the eVinci® Microreactor Using New Licensing Methodologies (LMP - NEI-18-04) for ANLWR
- **Laurent Billet** (EDF), How to ease SMR licensing with codes and standards?
- **Erlend Hagen** (Traneberget AS), A framework for enabling and governing a pan-European Closed Fuel Cycle (CFC), compatible with safeguards, industrial scalability, and EU regulatory realities
- **Michele Frignani** (Ansaldo Nucleare), The path to a common nuclear safety approach for EAGLES-300 and its precursors

	○ **Faiza Sefta** (OECD-NEA), NEA International RegLab Project --- **C4: Waste management and decommissioning** – **Newman Room** (1st floor) *Moderators: A. Banford (UKNNL) & Giuseppe A. Marzo (ENEA)* **Topics of discussion:** ➢ *Advanced dismantling technologies and Digital twins for decommissioning: Robotics, remote handling, and AI-driven planning* ➢ *Waste volume reduction techniques* ➢ *Long-term storage and disposal solutions* **Speakers** ○ **Erika Holt** (VTT), Snapshot of ongoing predisposal and disposal R&D within the EURAD-2 partnership ○ **Diego Espejo** (ENRESA), Enresa´s volume optimization strategies and R&D for radioactive waste management and decommissioning ○ **Reka Szoke** (IFE), End-User Driven Digital Twins for Geological Radioactive Waste Disposal: EURAD-2 DITOCO2030 ○ **Sylvain Benazet** (EDF), Overview of the EDF R&D supports on Waste & Decommissionning ○ **Samir Dziri** (Tractebel), Radiological characterisation for dismantling waste classification using underwater gamma-ray spectrometry at ENGIE Electrabel nuclear power plants ○ **María Ines García Lodeiro** (IETcc-CSIC), Innovative conditioning matrices for the immobilisation of problematic radioactive waste streams (EURAD-2 STREAM) ○ **Elena Torres Álvarez** (CIEMAT), Lessons Learned from European Collaborative Projects and the FEBEX Programme for Enresa's R&D Plan: Supporting Next Steps on DGF Implementation
11.00	Coffee break
11:30	**Plenary session:** **Collaboration as a driver for innovation - AUDITORIUM** **Moderator: L. Martinez** SNETP-Governing Board (Westinghouse) **Topics of discussion:** ➢ *Collaboration vs. Competition: where the EU stands?* ➢ *Competitive energy supply as major driver for the industrial competitiveness* ➢ *Artificial intelligence impact in the nuclear sector* **Panellists** - **Aline des Cloizeaux**, Nuclear Power Division Director, IAEA - **Tatiana Ivanova**, Head of Division of Nuclear Science and Education, OECD-NEA - **Roger Garbil,** Head of Euratom Research Fission Sector, EC DG RTD

	- **Patrick Blanc-Tranchant,** Deputy Director of Low Carbon Energy Programs, CEA - **Stephanie Barron,** Nuclear Power Engineer, ESA/ESTEC
12:30	**Wrap up and conclusions, B. Salha**
13:00	End of the SNETP Forum 2026

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The Sustainable Nuclear Energy Technology Platform (SNETP) was established in September 2007 as a R&D&I platform **to support technological development for enhancing safe and competitive nuclear fission in a climate-neutral and sustainable energy mix.** Since May 2019, SNETP has been operating as an international non-profit association (INPA) under the Belgian law pursuing a networking and scientific goals. It is recognised as a European Technology and Innovation Platform (ETIP) by the European Commission.

The international membership base of the platform includes industrial actors, research and development organisations, academia, technical and safety organisations, SMEs as well as non-governmental bodies.

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