



Perspectives of Nuclear Energy Development
International Conference, May 14, 2026
Vilnius Gediminas Technical University, Vilnius, Lithuania

A New Nuclear Renaissance in Europe:
relevant policy changes and main technology trends

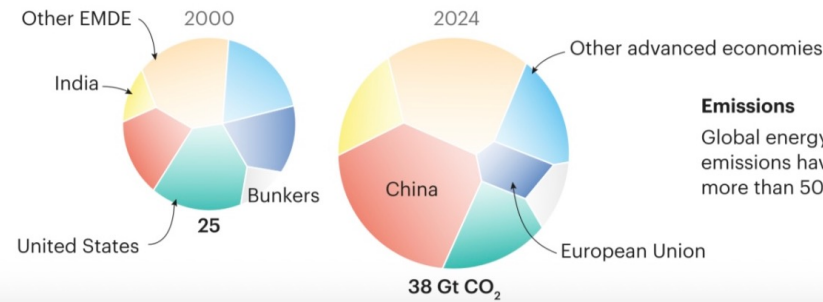
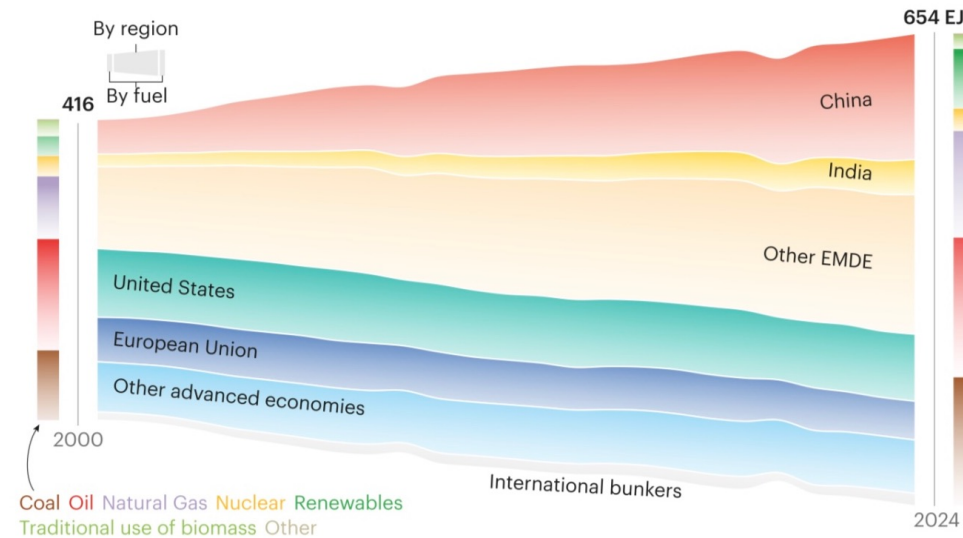
Stefano Monti
Italian Nuclear Association



The world is still very far from net-zero

Global energy demand and emissions continue to grow

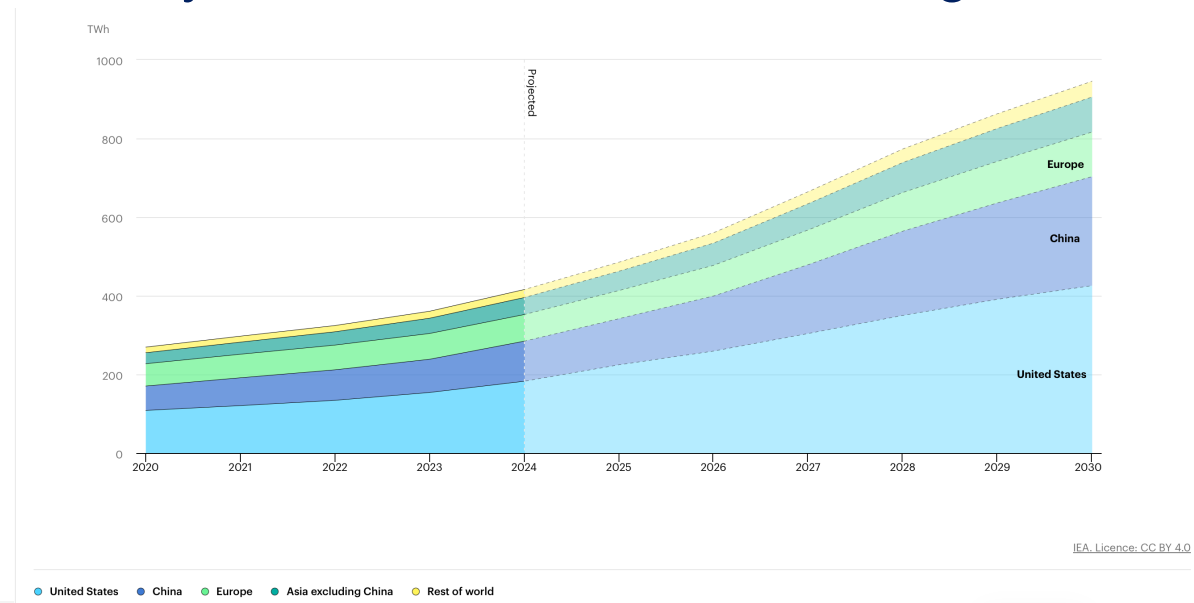
Global demand has grown by nearly 60% since 2000, with all the increase coming in emerging market and developing economies. All major energy sources grew over the period.



Emissions
Global energy-related CO₂ emissions have increased by more than 50% since 2000.

Nuclear back in agenda of the world

- Double shock:
 - energy crisis which rises big concerns regarding security of energy supply;
 - realisation that renewables alone can't power a heavy industrial economy.
- AI-driven electricity demand is also accelerating nuclear renaissance



Nuclear Energy Today



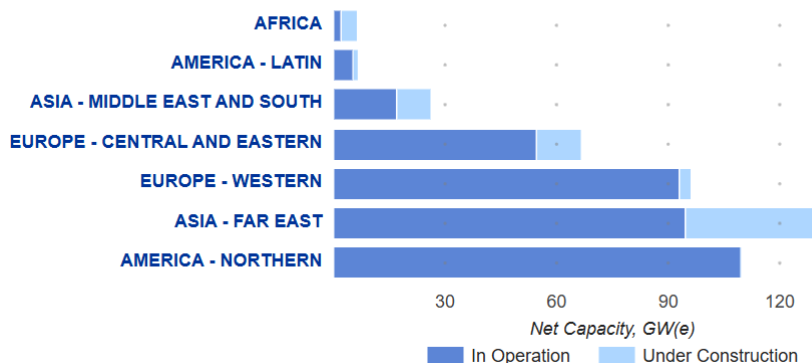
415 NUCLEAR POWER REACTORS
IN OPERATION
375 980 MWe TOTAL NET INSTALLED
CAPACITY

23 NUCLEAR POWER REACTORS
IN SUSPENDED OPERATION
19 687 MWe TOTAL NET INSTALLED
CAPACITY

62 NUCLEAR POWER REACTORS
UNDER CONSTRUCTION
65 064 MWe TOTAL NET INSTALLED
CAPACITY

20 539 REACTOR-YEARS OF
OPERATION

REGIONAL DISTRIBUTION OF NUCLEAR POWER CAPACITY



Year 2025

New connections to the grid

RAJASTHAN-7	(630 MW(e), PHWR, INDIA) on 17 March
ZHANGZHOU-2	(1126 MW(e), PWR, CHINA) on 22 November

Year 2024

New connections to the grid

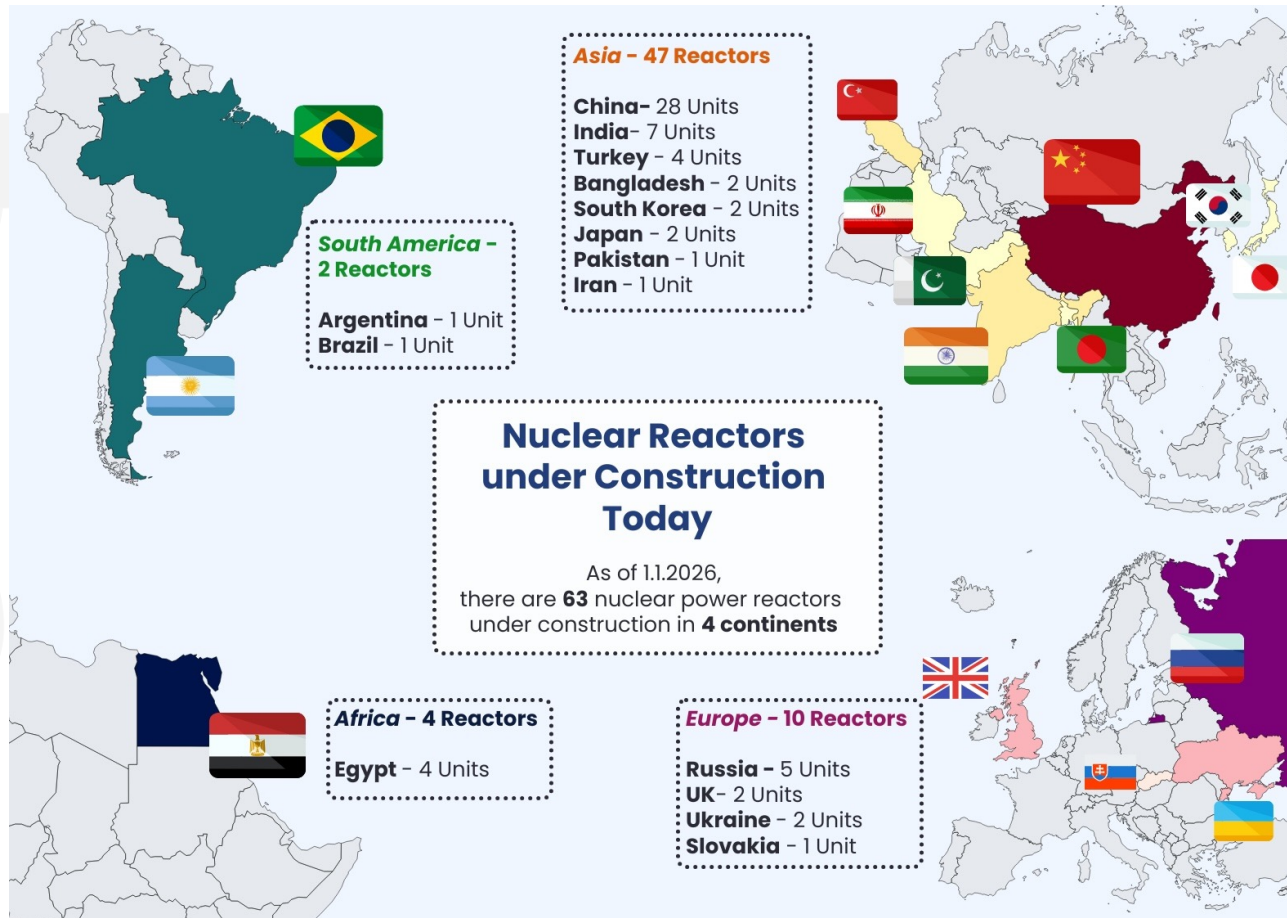
BARAKAH-4	(1310 MW(e), PWR, UAE) on 23 March
FANGCHENGGANG-4	(1000 MW(e), PWR, CHINA) on 9 April
FLAMANVILLE-3	(1630 MW(e), PWR, FRANCE) on 21 December
KAKRAPAR-4	(630 MW(e), PHWR, INDIA) on 20 February
VOGTLE-4	(1117 MW(e), PWR, USA) on 6 March
ZHANGZHOU-1	(1126 MW(e), PWR, CHINA) on 28 November

Restart after suspended operations

ONAGAWA-2	(796 MW(e), BWR, JAPAN) on 15 November
SHIMANE-2	(789 MW(e), BWR, JAPAN) on 12 December

Resource: IAEA PRIS, January 2026

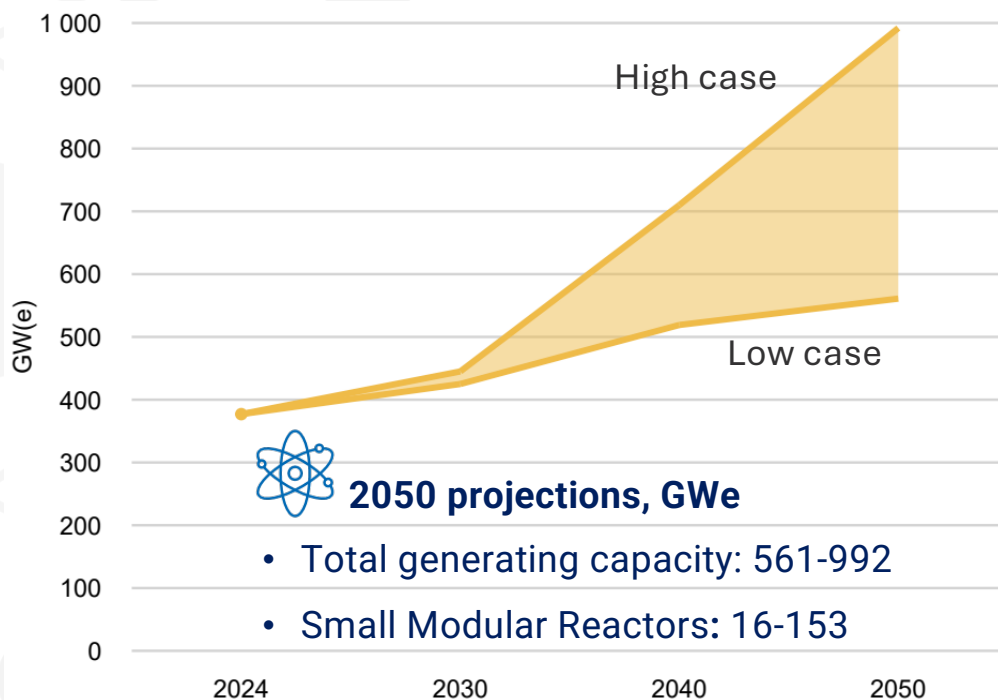
NPPs currently under construction worldwide



World Nuclear Electrical Generating Capacity

IAEA Energy, Electricity and Nuclear Power Estimates for the Period up to 2050, RDS-1 2025 Edition

Expectations for nuclear expansion



2050 projections, GWe

- Total generating capacity: 561-992
- Small Modular Reactors: 16-153





Geographical Europe

Nuclear Reactors In Europe

Legend

- Operational
- Under construction
- Permanently shut down

Nuclear in Europe Key Statistics

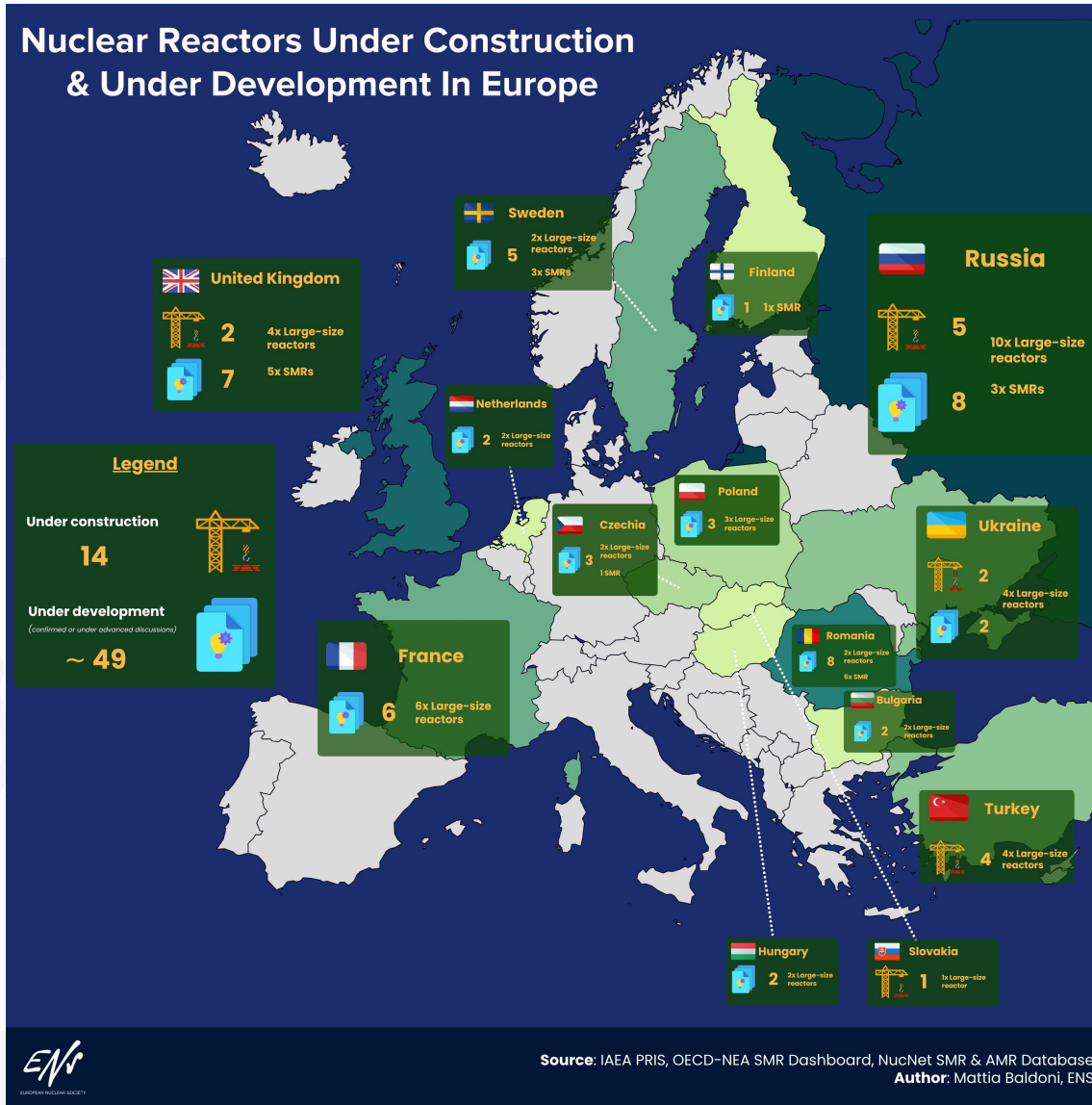
- Operational reactors: **164**
- Total net capacity: **148 GW**
- Under construction: **9**
- 12 out of 27** EU members states use nuclear

Nuclear Share Top Countries (2024)

- France: 67.3%
- Slovakia: 60.6%
- Hungary: 47.1%
- Belgium: 42.2%
- Bulgaria: 41.6%



Nuclear Reactors Under Construction & Under Development In Europe



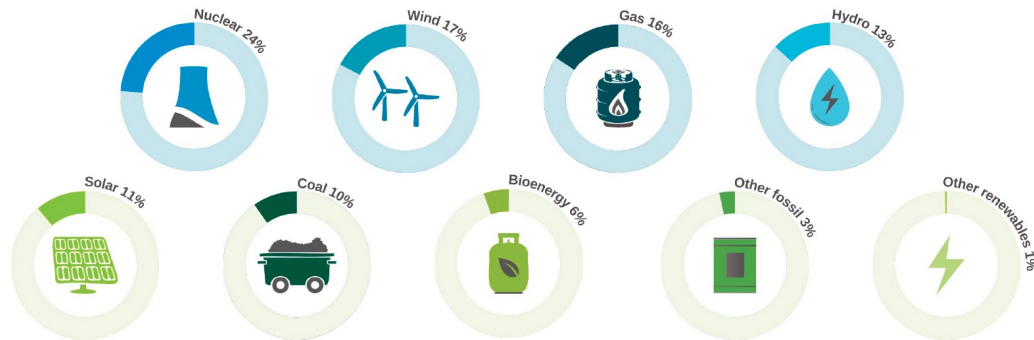


European Union

NE still the single largest source of electricity in EU



Electricity generation by technology (% in 2024)



© nucleareurope - Source: EMBER

The nuclear sector in Europe



Is responsible for over

€250Bn

in EU economic output



Generates nearly

€48Bn

in public revenues



Leads to

€38Bn

in disposable household income



Supports around

900.000

jobs covering a broad range of skill sets, from construction to nuclear engineers

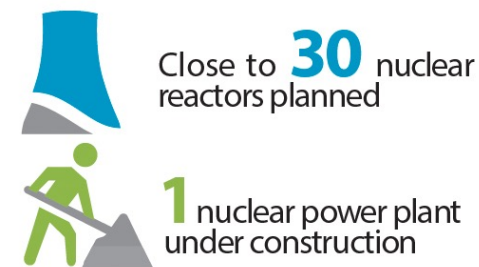
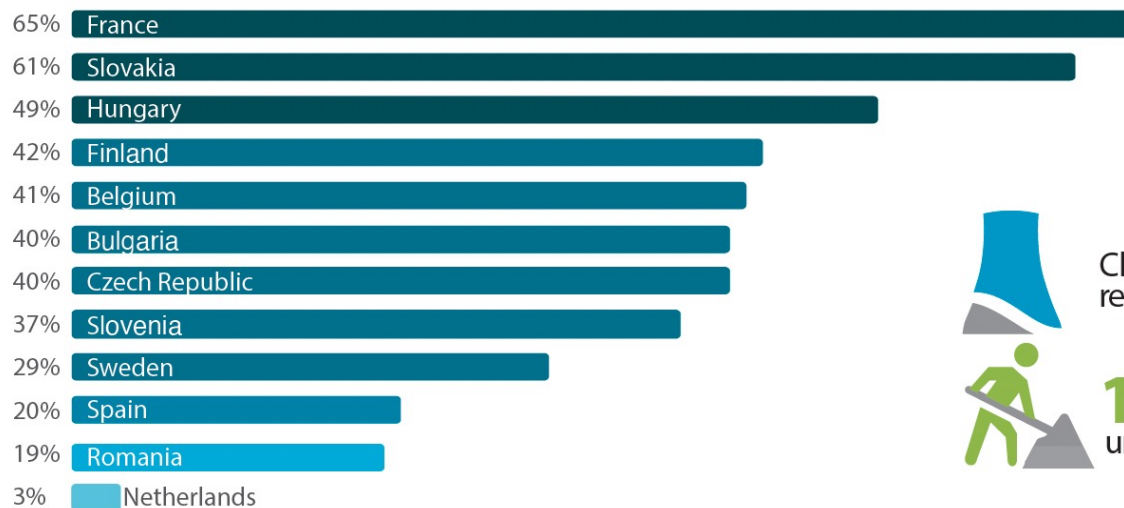
Source: Economic and Social Impact Report, Deloitte, 2025

In EU only 1 NPP currently under construction

In the single year of 1981, France alone was connecting 8 nuclear reactors to the national electric grid

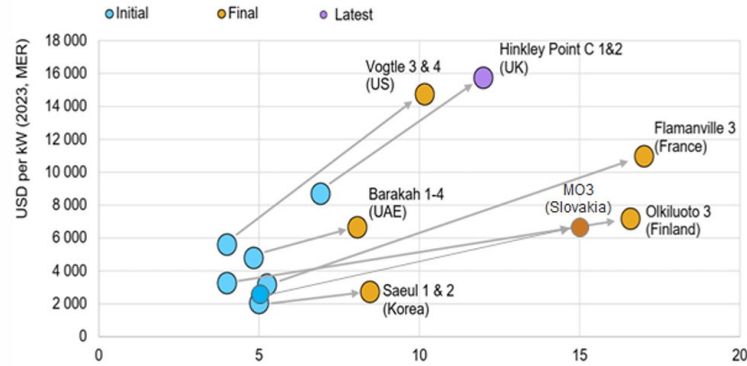
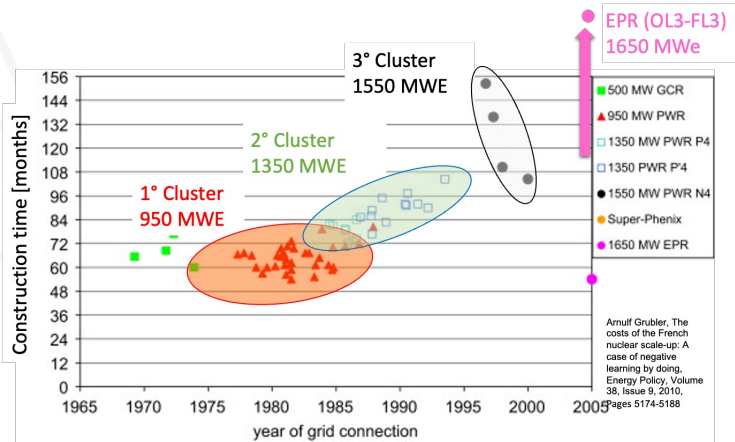


Generates electricity in 12 countries



© nucleareurope - Source: PRIS 2024

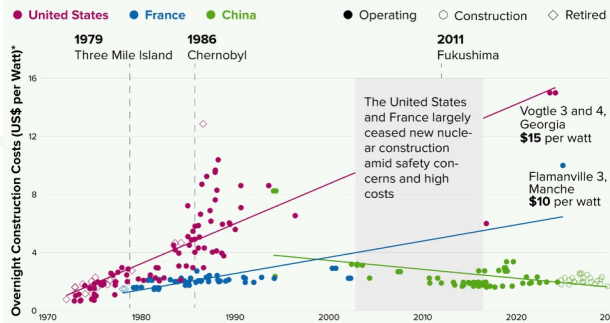
Significant cost overruns and construction delays in recent NPPs realizations in Europe (but not in China, Russia and South Korea)



1 IEA | 2 NUCNET Unlocking reductions in the Construction Costs of Nuclear: A practical Guide for stakeholders, OECD,

Costs of Nuclear Decreasing for China, Growing Sharply for US

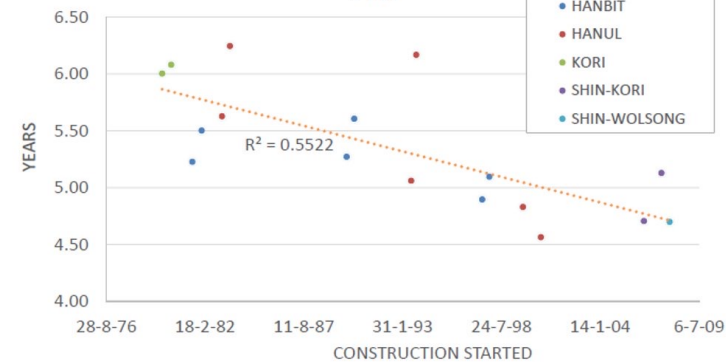
While China has managed to rein in the costs of commercial reactors since the 1990s, the US has seen ballooning costs, in particular following the 1979 Three Mile Island accident.



*Overnight construction costs are the cost of building a project as if it were completed overnight, without taking financing costs (interest during construction) into account. All costs are converted to their equivalent 2020 value; Direct cross-country cost comparisons should be interpreted with caution because of differences in exchange rates and inflation.
Source: Nature (Liu et al. 2025)



CONSTRUCTION TIME FOR THE STANDARD 1 GW KOREAN PWR



Technical Meeting on the Economic Analysis of HTGR and SMR - IAEA 25 to 28 August 2015

Lessons learned from recent NPP realizations in Western World



- Some Western Vendors recklessly decided to begin FOAK construction well before completion of the detailed design
- Single project approach: the Vendor's original product is adapted to the needs of the specific Customer and the national Regulator (often dealing with a new concept for the first time)
- Limited number of Customers: very large LWRs represent a national megaproject which only a few high GDP countries can afford
- Very long construction times: consequence of previous point and exacerbated by the enormous volume of activities to be accrued out on site: civil works, on-site completion of large SSC, etc.
- ROI heavily delayed over time: increase of financial risks perception
- Lack of planning and depauperated supply chain (due to limited # of projects)

Inequitable financial framework re investments in NP

- EU Taxonomy for Sustainable Finance (Regulation EU 2020/852): nuclear is “tolerated temporarily” as a transitional activity, labelled as a sustainable investment under **specific strict conditions**
- As a consequence:
 - Eligibility perimeter for a European Green Bond incorporating nuclear is extremely narrow
 - A hostile ESG (Environmental, Social, and Governance) rating system
 - *De facto* nuclear power is excluded from e.g. pension funds

A more favourable framework for NP also in EU?



- EC President Ursula von der Leyen at NES2026 (March 2026):
 - *“...We have home-grown low-carbon energy sources: nuclear and renewables. Together, they can become the joint guarantors of independence, security of supply, and competitiveness – if we get it right – now”.*
 - *“....The reduction in the share of nuclear was a choice, I believe that it was a strategic mistake for Europe to turn its back on a reliable, affordable source of low-emissions power”*
- However,... Von der Leyen’s announcement of a 200 million Euro financial guarantee to support private investment in innovative nuclear technologies (for 27 countries and by 2028) is just symbolic and doesn’t affect the underlying architecture

EU regulatory & policy ecosystem must become more positive towards nuclear



- **EU Taxonomy** should recognize nuclear reactor technology (and related fuel cycles) as a real sustainable investment (as a green activity and not only as a transitional activity).
- **AccelerateEU**: need to include concrete measures to “accelerate” on nuclear. At the moment provisions only for electrification, heat pumps, large-scale solar thermal projects, renewable hydrogen production, biomethane.
- **Clean Industrial Deal** and associated **Industrial Accelerator Act** which promotes “Made in EU” should recognize that nuclear sector is one of the few strategic net zero value chains based in Europe

On the positive side:

- Nuclear included in **Net-Zero Industry Act** and **REpowerEU**
- **SMR Strategy**: EU actively shaping a dedicated Small Modular Reactor strategy

PINC2026: EU's Nuclear Illustrative Programme targets 144 GWe by 2050



Figure 2 – 'Base case' scenario of large-scale power generation capacities in the EU, 2024 - 2050. LTO denotes long-term operation (lifetime extensions).

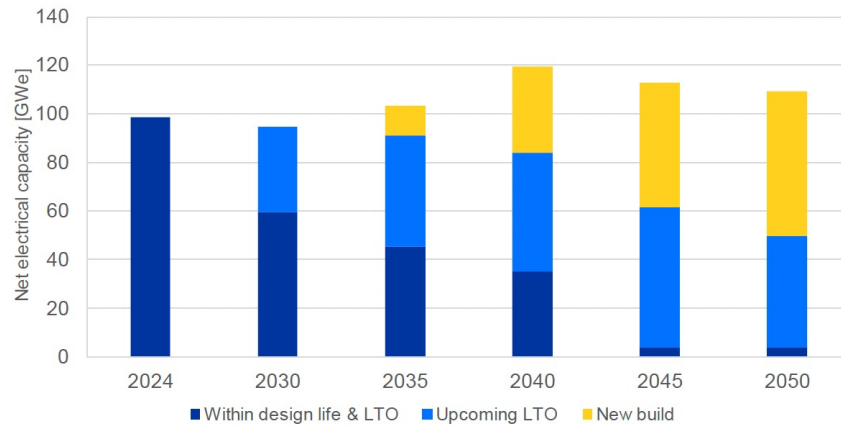
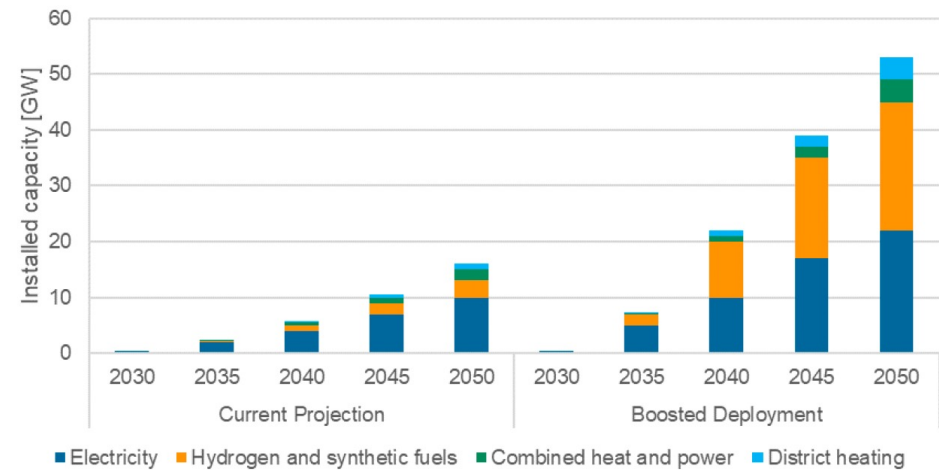
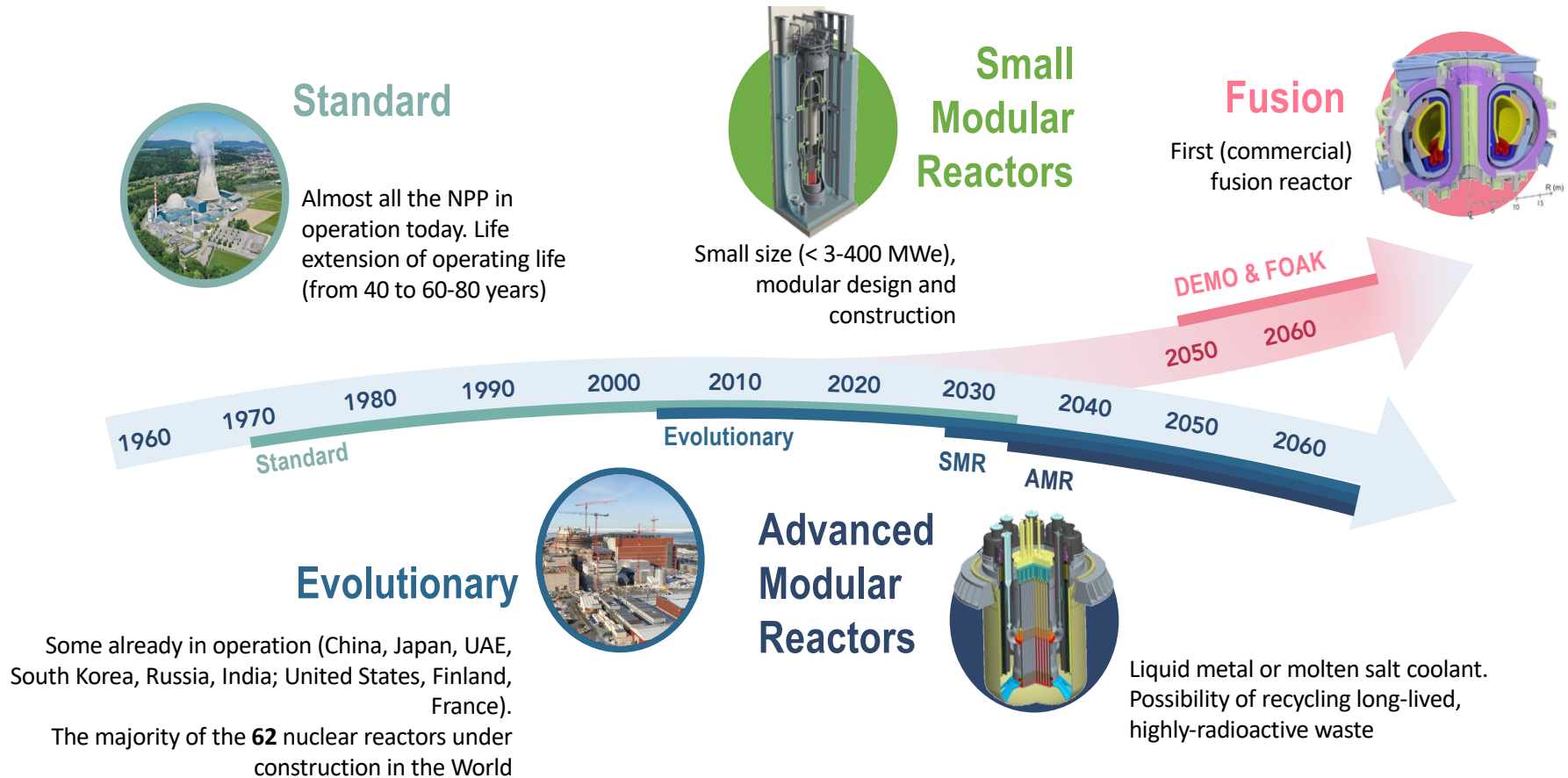


Figure 5 – SMRs deployment scenarios with shares of heat/hydrogen supply.

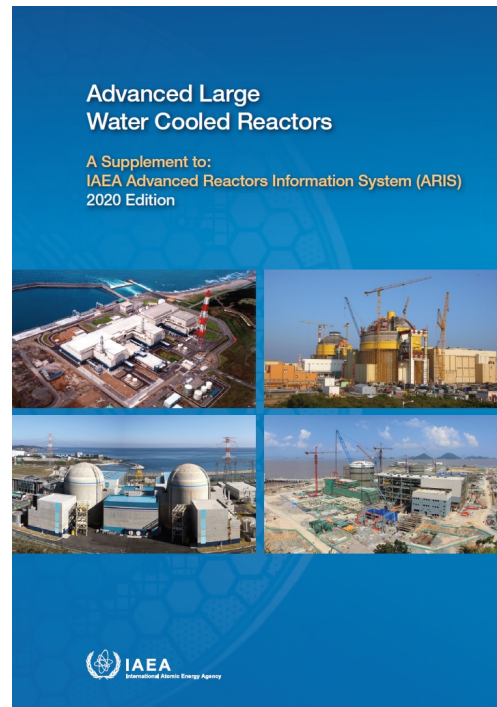


Nuclear Reactor Technologies: *present and future*



Evolutionary (Advanced) Large LWR for Immediate Deployment

Canada	
EC6	740 MWe
ACR1000	1165 MWe
China	
HPR1000	1000 MWe
CAP1400	1400 MWe
France	
EPR	1630 MWe
EPR1200	1200 MWe
Japan	
ABWR	1315 MWe
APWR	1700 MWe

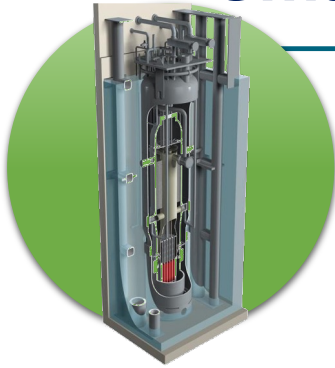


Republic of Korea	
APR1400	1416 MWe
OPR1000	993 MWe

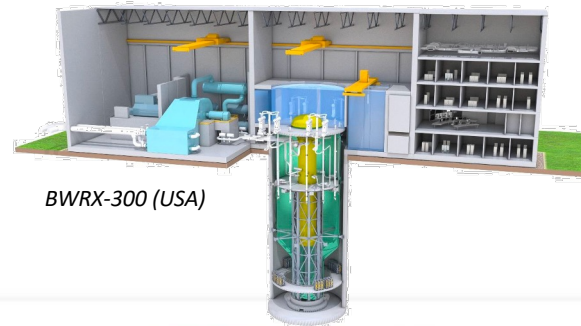
Russian Federation	
VVER-1000	917 MWe
VVER-1200	1114 MWe
VVER-TOI	1175 MWe

United States of America	
ABWR	1315 MWe
AP1000	1117 MWe
ESBWR	1520 MWe

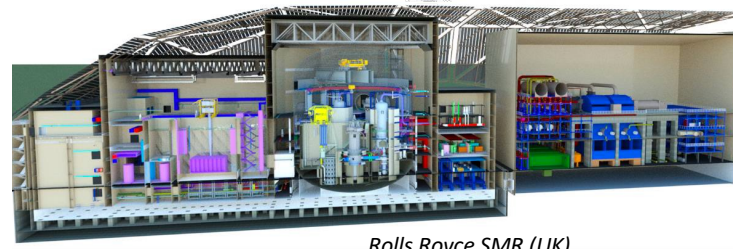
Small Modular Reactors: *change in paradigm*



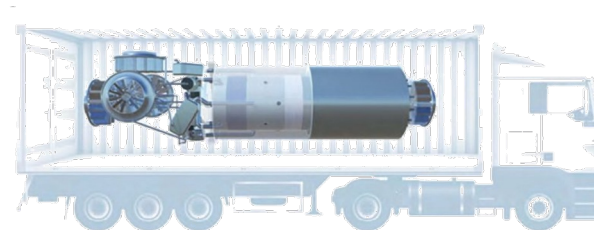
LWR and HTGR of limited capacity/size (< 300-400 MWe) & modular



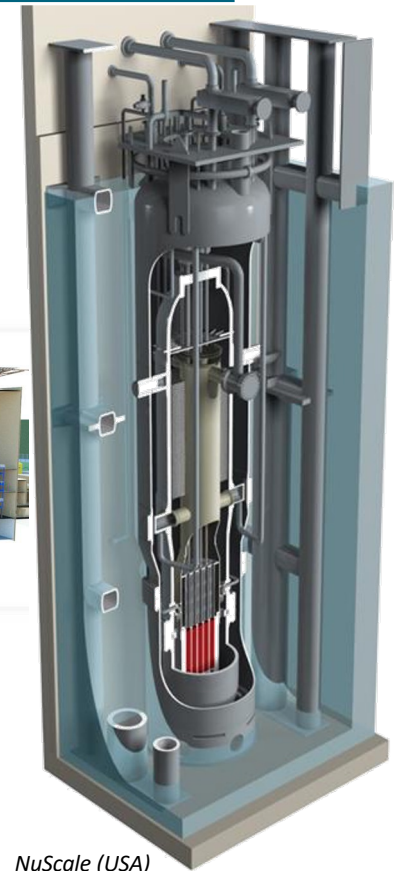
BWRX-300 (USA)



Rolls Royce SMR (UK)



NuScale (USA)



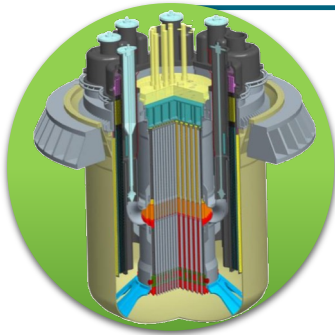
Advantages:

- **Simplified** design
- **Passive safety** strategy: natural circulation (no Fukushima-Daiichi)
- **Modular** design and construction, mostly in workshop
- **Cogeneration** (hydrogen, thermal storage, district heating, desalination, biofuel)

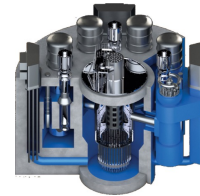
Challenges:

- International market, series deployment
- On-time and on-budget deployment

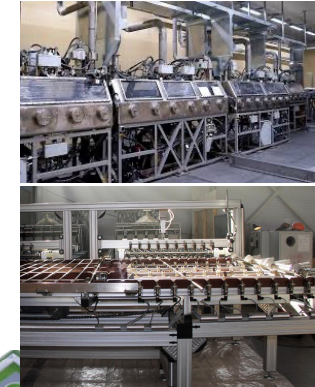
Advanced Modular Reactors: *fast neutron systems*



Cooled by liquid lead, liquid sodium, molten salts
«different physics»: excess of neutrons



BREST-OD-300 (Russia)

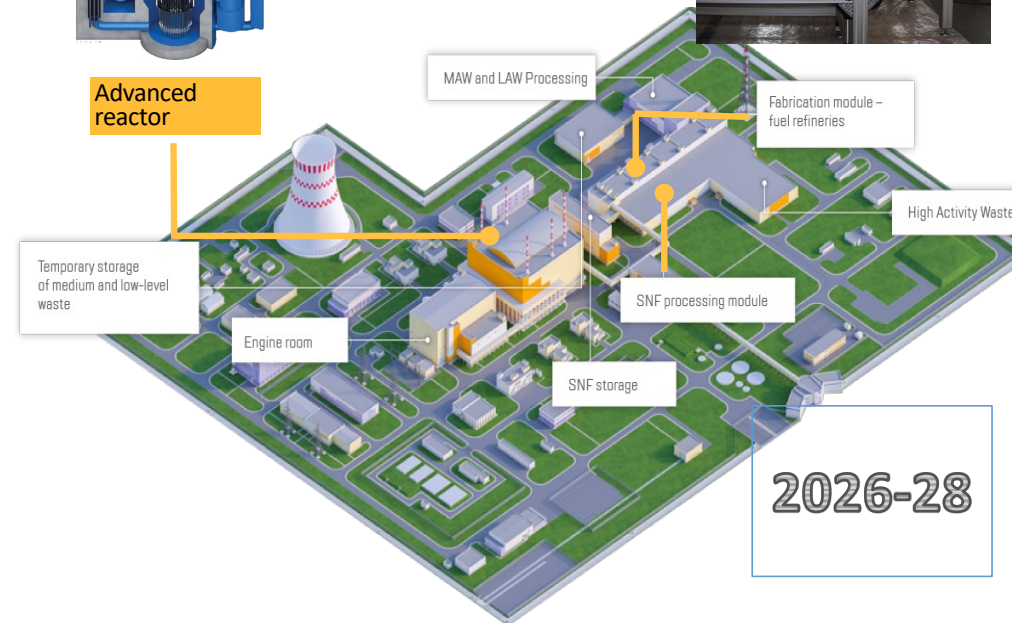


Advantages:

- Same of SMRs (several Advanced are of small modular type)
- Better **efficiency**
- Possibility of **dramatically reduce the high-level radioactive waste**

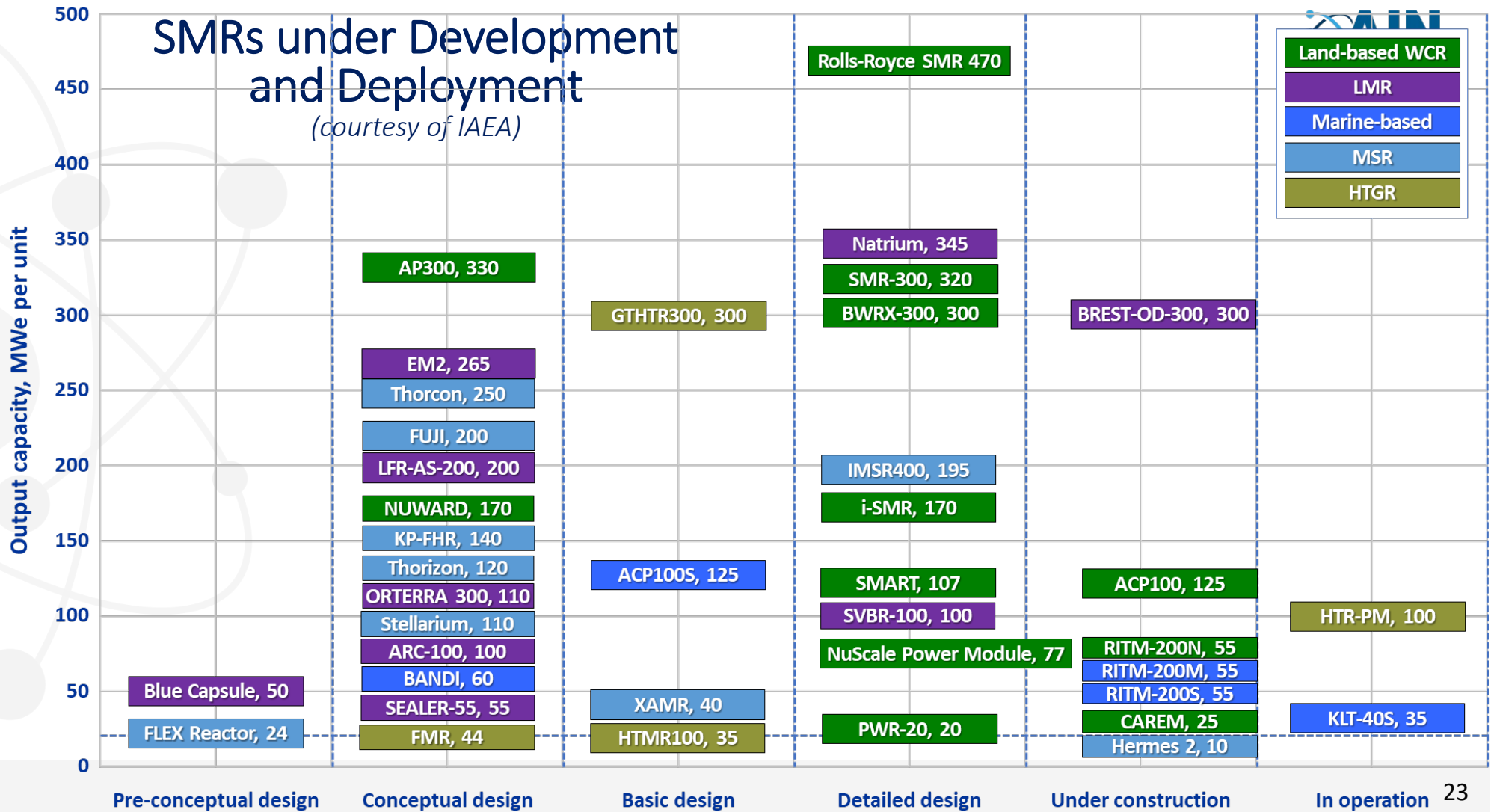
Challenges:

- Economics
- Fuel and fuel cycle facilities
- proliferation concerns



SMRs under Development and Deployment

(courtesy of IAEA)



Challenges for SMRs / AMRs

- Demonstration of safety and operational performance
 - ✓ Low TRLs/LRLs
 - ✓ Lack of operational experience
 - ✓ AMRs: R&D and testing facilities needs, design and safety codes and validation
- Need to develop and test new fuel, systems and components
 - ✓ Fuel qualification; develop the supply chain, factory for modules
- Demonstration of Economic Competitiveness through Serial Construction
 - ✓ Build prototypes or commercial demonstration units
- Harmonization of Regulatory and Industrial Approaches for global deployment
 - ✓ Towards joint reviews and considerations of safety reviews / certification
- Newcomer countries deploying NPPs for the first time
 - ✓ Establishment of Nuclear Infrastructures –including HRD
 - ✓ Need a reference design in country of origin...

European Industrial Alliance on **SMALL MODULAR REACTORS**



Main Objective

Facilitate & accelerate the development, demonstration, & deployment of SMRs projects in Europe in the early 2030s.

Specific Objective I

Provide **customised support** to all SMR projects deemed eligible for support under the Alliance

Specific Objective II

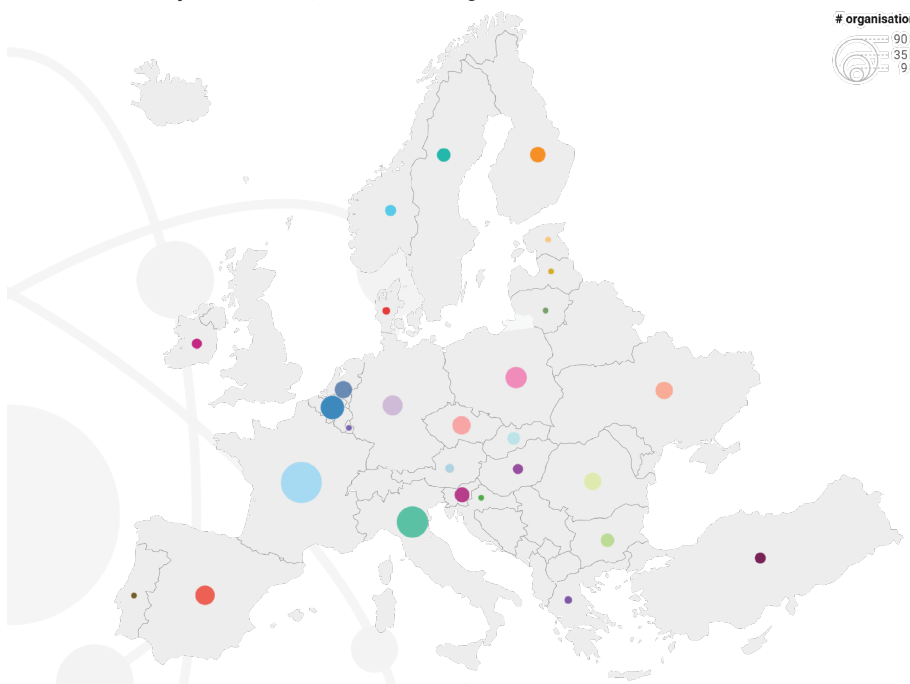
Enabling conditions to ensure the further deployment, operation, and maintenance of SMRs in the **medium and long term**.



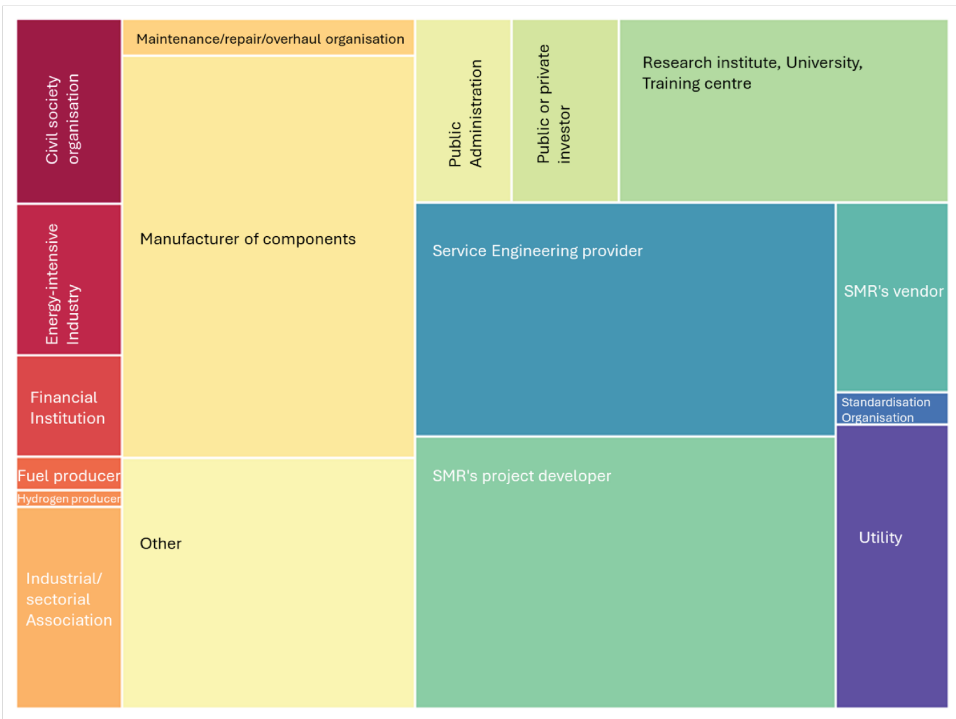
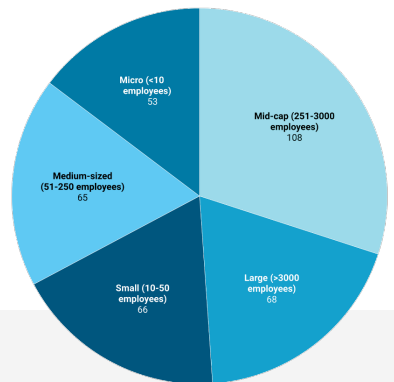
<p>Application</p> <p>SCAN ME</p>	<p>FAQ</p> <p>SCAN ME</p>
<p>Declaration</p> <p>SCAN ME</p>	<p>ToR</p> <p>SCAN ME</p>

grow-EU-SMRS-ALLIANCE@ec.europa.eu

[Country distribution, members] August 2025



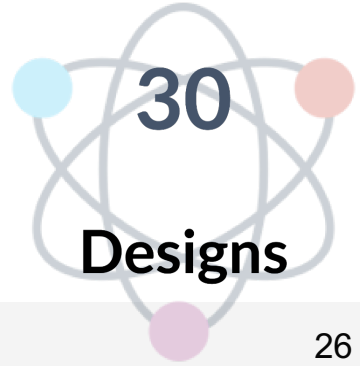
[Size of Organisation] (August 2025)



5 Technologies



LW-SMR, AMR



European IA on SMRs – TWGs



TWG1: Industrial Applications

Chair: N.Regia (CEFIC)
Vice Chair: A.Georgescu (Eurometaux)



TWG2: Technology and R&D&I

Chair: P.Baeten (SCK-CEN)
Vice Chair: M.Pasquet (Framatome)



TWG3: Supply Chain

Chair: V. Ramany (EDF)
Vice Chair: M.Tacconelli (Walter Tosto)



TWG4: Skills

Chair: M.E. Ricotti (POLIMI, CIRTEN)
Vice chair: O. Bard (GIFEN).



June 2024
October 2024



TWG5: Public Engagement

Chair: M. Martell (GMF)
Vice Chair: M. Ilnicki (SGE)



TWG6: Nuclear Safety & Safeguard

Chair: O.Kymäläinen (FORTUM)
Vice Chair: A. Jeleu (Nuclearelectrica)



TWG7: Fuel cycle & waste management

Chair: H. Baars (URENCO)
Vice Chair: T.Louvet (ORANO)



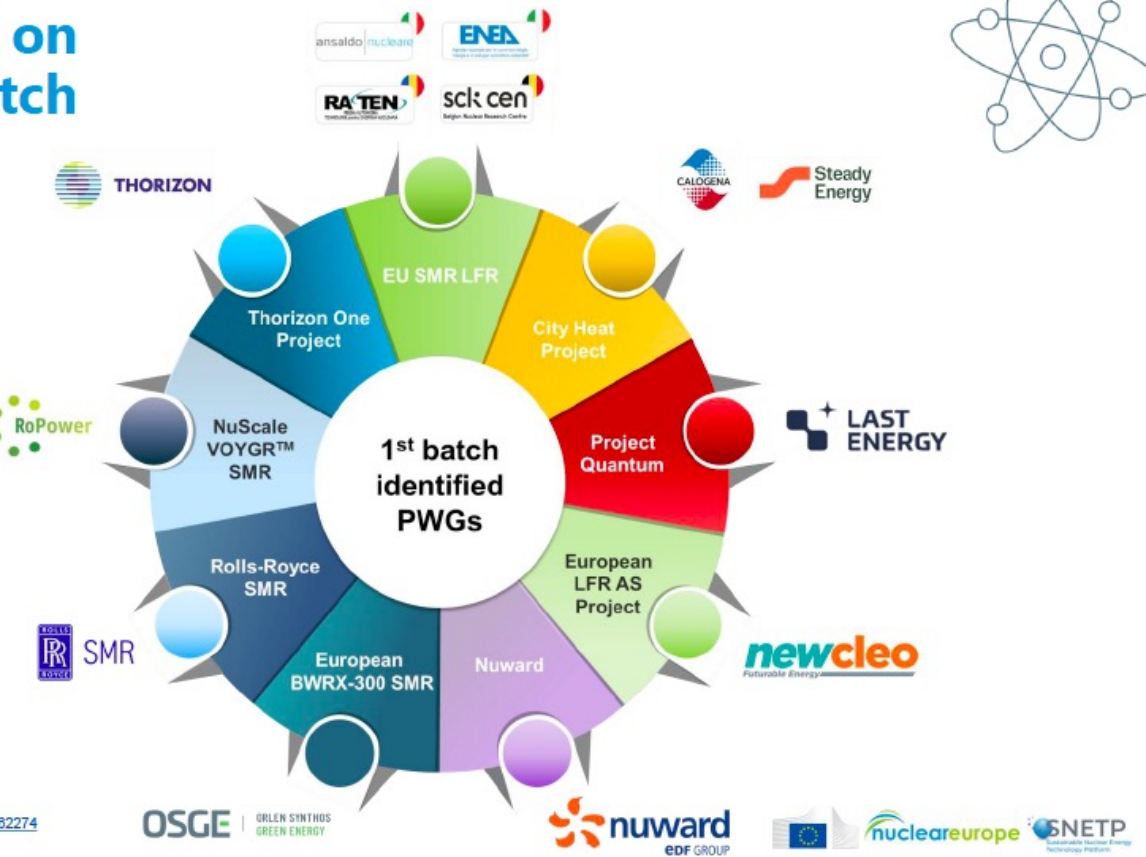
TWG8: Financing

Chair: M.Jedlička (ČEZ)
Vice Chair: K. Abramovič (GEN energija)



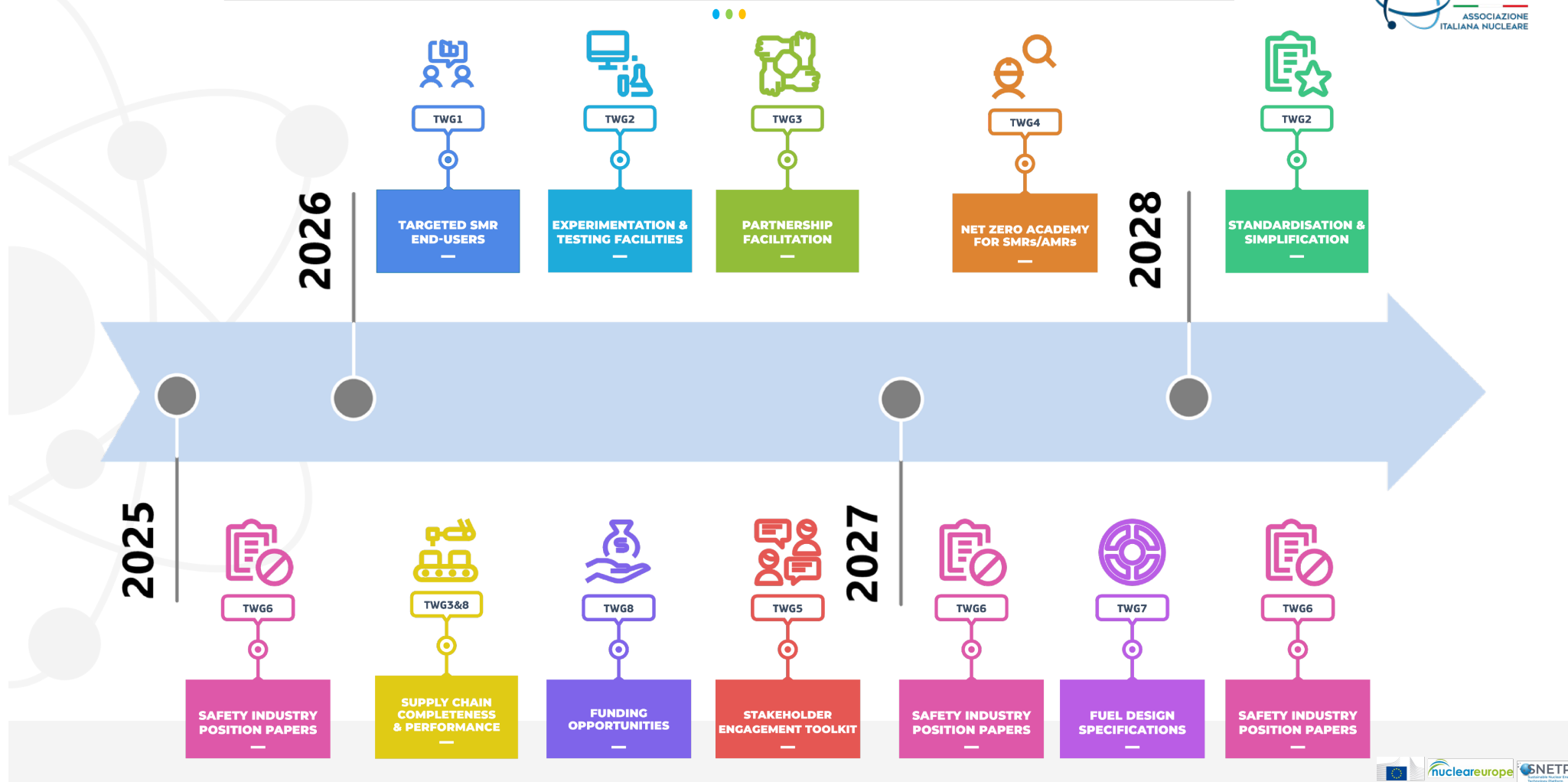
European IA on SMRs 1st batch PWGs*

CityHeat project (Calogena, Steady Energy)	<i>PWR for district heating, 50 MWth, FRA + FIN</i>
Nuward (EdF)	<i>PWR, loop type, around 200 Mwe, FRA</i>
European BWRX-300 SMR (OSGE)	<i>BWR, full natural circulation, USA</i>
Rolls-Royce SMR (Rolls-Royce SMR Ltd)	<i>PWR, 3 loops, around 400 MWe, UK</i>
NuScale VOYGR™ SMR (RoPower Nuclear S.A)	<i>PWR, integral type, 77 MWe, USA</i>
Project Quantum (Last Energy)	<i>PWR, loop type, 20 MWe, USA</i>
EU-SMR-LFR project (Ansaldo Nucleare, SCK-CEN, ENEA, RATEN)	<i>LFR, pool type, 120 Mwe, ITA + ROM + BEL</i>
European LFR AS Project (Newcleo)	<i>LFR, pool type, 200 MWe, ITA</i>
Thorizon One project (Thorizon)	<i>MSR, cartridge type, 100 Mwe, FRA + NED</i>



*Announced on 11 October 2024
<https://ec.europa.eu/docsroom/documents/62274>

Strategic Action Plan: Ten Top Actions for the next 3 years



Conclusions

- Europe is at a decisive energy crossroads.
- To stay competitive, resilient and on track for climate neutrality, EU must take tough decisions fast.
- The challenge is clear: decarbonise, secure our energy supply and protect industrial competitiveness.
- Measures also need to be implemented to render energy in Europe more affordable.
- Nuclear is one of the few strategic net zero value chains that is almost entirely based in Europe, spanning the entire lifecycle of the industry.
- Science shows that nuclear is part of the solution of the energy trilemma.
- Let's not allow bureaucracy and bad politics to prevail over science.



Stefano MONTI

Presidente

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<https://associazioneitaliananucleare.it>

Advanced Reactors

- ✓ **Current advanced designs:** already licensed and in operation
- ✓ **Evolutionary designs (including SMR)** to achieve improvements over existing designs through small to moderate modifications
- ✓ **Innovative designs** to incorporate radical conceptual changes in design approaches or system configuration.

