



White paper

New nuclear: boosting sector attractivity

A private investor perspective

Second Edition

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The regained interest in nuclear energy

Major global long-term challenges and ongoing regional issues

Climate change mitigation → modern economies still rely a lot on fossil fuels, that cause CO₂ emissions. The IPCC proved scientifically that anthropogenic CO₂ emissions are the greater cause for global warming

To allow an economy to permanently grow, capitalism had to rely on an abundant and cheap source of energy since the 19th century. Using first coal, then oil and natural gas, these fuels were burnt, the resulting heat transformed to mechanical energy or into electricity.

These three hydrocarbons were easily extracted from below the surface in large quantities, they are “fossil fuels” (i.e. made of old organic matter that has fossilized and kept only its hydrogen and carbon structure). Unbeknownst to us then was that burning these fuels came with serious negative consequences: the release of carbon dioxide (CO₂) into the atmosphere.

The IPCC (Intergovernmental Panel on Climate Change) was created by the United Nations in 1988. Since then, this body has scientifically demonstrated that climate change is the result

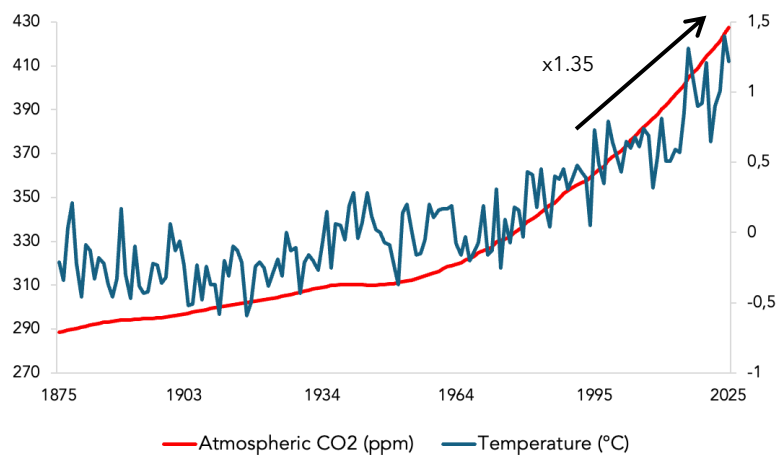
of global warming, which is driven by the increased concentration of greenhouse gases in the atmosphere, mainly CO₂, primarily caused by anthropogenic activities.

The problem is that CO₂ is a light dispersed gas, with a lifetime of up to several centuries, which makes it hard to capture and with effects lasting long after the emissions. Even if there are carbon dioxide sinks like oceans, forests and rocks, the absorption capacity of the earth is not enough in comparison with what humanity generates by consuming carbon-intensive products.

Figure 1 shows the average concentration of carbon dioxide in the atmosphere today is ~415ppm versus ~275ppm in 1790. It is obvious that this concentration has accelerated with the growth of fossil fuel combustion in the 20th century. One can also note the close correlation between the CO₂ concentration and the temperature increase.

The scientists of the IPCC have built evolution scenarios of the impact of global warming on climate change adjusting temperature increase hypothesis.

Figure 1: Global CO₂ concentration progress (ppm) and temperature increase (°C) from 1875 to 2025



Source: NOAA Global Monitoring Laboratory

The results indicate that the average atmosphere temperature should not exceed +2°C compared with 1990 to limit catastrophic consequences of climate change and to ensure a viable world to future generations.

To do so, the panel concluded that it was urgently necessary to limit anthropogenic CO₂ emissions to net zero by 2050 and thus stop increasing the CO₂ concentration in the atmosphere. In other words, we need to replace fossil fuel energy sources by clean energy sources as fast as possible.

Energy demand → Clean energy transition drives a shift of total energy demand towards an increasing weight and role of electricity demand

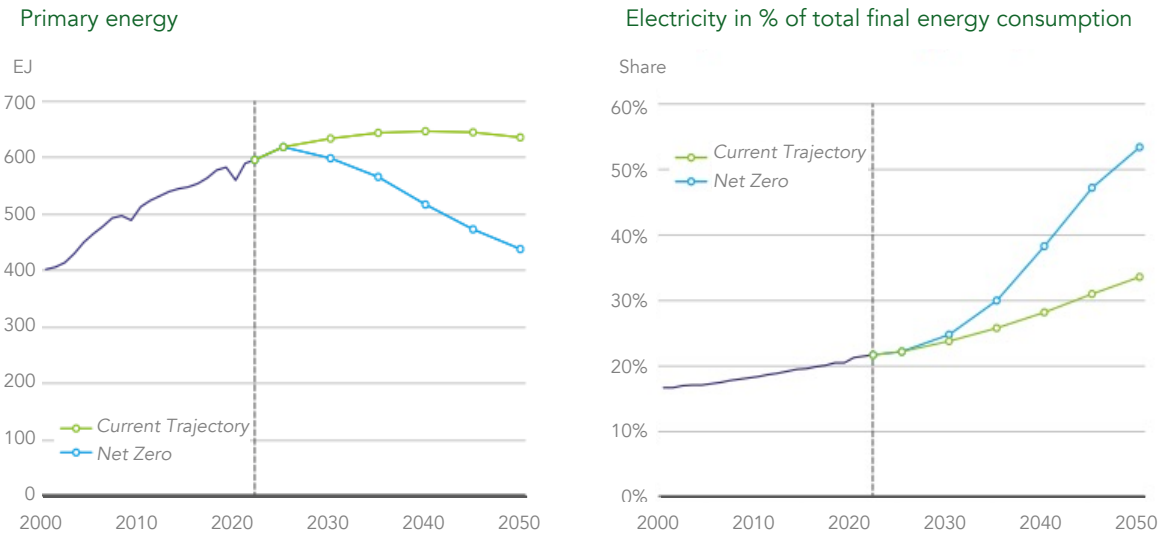
As of today, there are two forms of final energy that are mostly needed in anthropogenic activities: electricity and heat. Heat is mainly provided by the direct combustion of fossil fuels these days; it can also be marginally provided by geothermal sources which are a natural carbon-free source of energy.

The challenge is that heat cannot be transported on long distances, and there are some carbon-intensive industries needing heat in their production processes (process heat), involving low to high temperature levels and flux intensities.

Electricity is typically generated by turbines converting mechanical forces from hydro or wind into power or heat generated from coal, gas, and nuclear. However, electricity can be transformed back into heat if needed, it is easy to transport on long distances, and it doesn't emit anything when used.

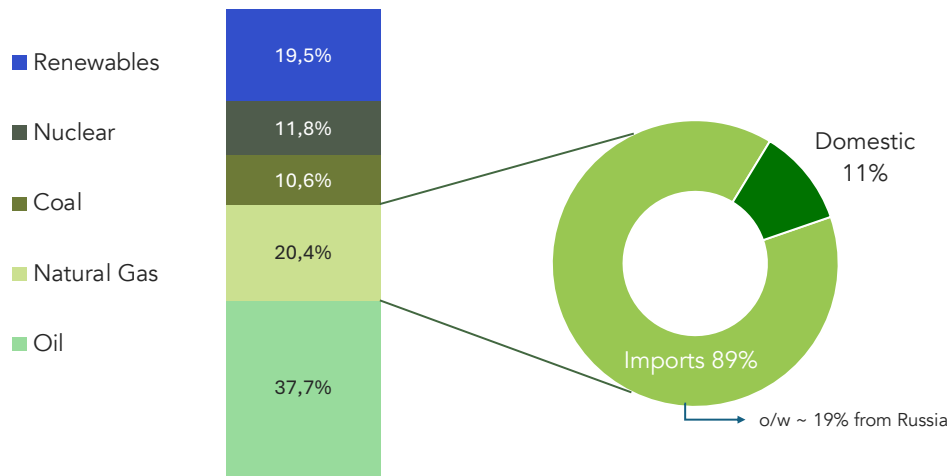
So even if technology is not yet ready to electrify heavy industries, one day soon it will be, and electricity could likely become the dominant form of final energy in modern economies. There is a clear understanding that electrifying most of our energy needs is the best way to decarbonize, provided that the source to generate electricity is sustainable. Demand for power should thus explode by 2050 as electricity will replace most fossil-based sources of energy, while total energy demand could decrease thanks to efficiency levels.

Figure 2: Primary energy and electricity consumption forecasts by 2050



Source: BP Energy Outlook 2024

Figure 3: EU's Energy Mix in 2024



Source: Eurostat, Council of the European Union

Energy security → Ukraine - Russia war and middle east crisis (US/Israël – Iran war) revealed the high dependence of Europe on Russian oil and gas imports, its vulnerability vs supply disruptions and the need for European energy sovereignty

Europe's energy system is under pressure since 2022 as the Ukraine-Russia war and resulting tensions with Russia highlighted its weaknesses.

Figure 3 shows the dependency of European countries on Russian gas: almost half of Europe's imported gas came from Russia at the start of the conflict. The war has cut imports radically and the continent has had to face shortages and major energy price increases due to the marginal cost pricing system. As gas power plants are quick to start and stop, all energy prices were impacted by the increase of gas prices.

Liquefied gas imports through LNG carriers from the United States or Norway and massive renewables investments was the direct substitute. But Europe should look to the medium-long-term, as gas is a fossil fuel, and this crisis is the occasion to stress the value of

replacing it by a sustainable, sovereign and cheap source of energy like nuclear energy.

This shock highlights Europe high energy dependence, explains vulnerability from energy supply disruptions, and amplifies calls for sovereign strategies.

More recently, the crisis in the Middle East and particularly around Iran and the strategic Strait of Hormuz, have further exposed Europe fragility. A significant share of global oil and liquefied gas transits through this narrow maritime chokepoint, making it a critical artery for global energy trade. This disruption triggers sharp price spikes and renewed supply uncertainty for global economies.

For Europe, which still relies heavily on imported hydrocarbons, this represents a second major geopolitical vulnerability after Russia. It highlights that diversifying suppliers is not sufficient if supply routes themselves remain exposed to geopolitical tensions.

Today new advanced nuclear technologies can offer manageable power generation solutions as do gas plants and they are able to provide powerful sources of heat for heavy industries

currently still unable to use electricity to decarbonate their production processes.

Fortunately, in the context of climate urgency, economic drivers and an energy supply crisis, the reason and science-based decisions are crushing ideologist opinions.

The fact that nuclear should be a key investment in response to climate change, soaring electricity demand and serious energy security issues is gaining traction amongst people and policy makers in Europe.

One is more prone to hear that this source of energy (i) does not emit CO₂, (ii) kills less than coal, (iii) gives more independence than renewables, (iv) is a European specialty in terms of skills and (v) is undergoing major technical breakthroughs that calm worries over safety issues and hazardous waste challenges.

All of these comforting facts translated in great policy initiatives and framing decisions from European governments and global institutions.

EU strategy → the EU sustainable taxonomy and Net-Zero Industry Act (NZIA) define nuclear power as a strategic technology

The EU has progressively reinforced its support for nuclear energy. It was first classified as a “clean energy source” in the sustainable taxonomy, enabling sustainable investments.

Then, in 2023, it was officially designated as a “strategic technology” under the Net-Zero Industry Act, despite opposition from some countries. This status grants advantages such as faster approvals and improved access to financing.

At the global level, COP28 (Dubai, 2023) marked a turning point, with 22 countries committing to triple nuclear capacity by 2050.

This momentum continued at COP29, where additional countries joined, confirming nuclear

energy as a key pillar of future energy strategies.

Renewed French support → President Emmanuel Macron's speech at Belfort in February 2022 spurred an historical U-turn of the former energy policy trend in the country

France, once a nuclear energy leader, had seen declining support due to underinvestment and rising anti-nuclear sentiment, culminating in decisions like the closure of the Fessenheim plant.

However, growing climate concerns and energy security risks linked to the Russia–Ukraine conflict led to a policy shift.

In February 2022, President Emmanuel Macron announced in Belfort a renewed commitment to nuclear power, including plans to build 8 new EPR reactors by 2035 and increased public funding through the France 2030 program.

European convergence on nuclear revival → alignment with French leadership and new nuclear technologies

At the European level, a convergence is emerging in favour of nuclear energy, driven by calls for sovereignty, energy security and decarbonization goals. France plays a leading role, with President Emmanuel Macron advocating for a European nuclear revival, notably through the 5th CPM (*Conseil de politique nucléaire*) and the Second World Nuclear Summit both in March 2026.

This shift is reinforced by evolving positions across Europe. German Chancellor Friedrich Merz recently acknowledged that the nuclear phase-out was a “serious strategic mistake”, highlighting the limits of previous energy policies.

At the EU level, Ursula von der Leyen also stated that turning away from nuclear energy was a “strategic mistake” for Europe during the Second World Nuclear Summit.

Fundamental advantages to complement renewables

Thanks to its inherent qualities, nuclear energy stands out as the best complement to renewables for a decarbonized energy mix. First and foremost, nuclear power has an extremely low carbon intensity producing just 7g of CO₂ per kWh which starkly contrasts with fossil fuels and even with most renewable technologies. On top of that, nuclear fission fuel has an unmatched energy density: the output of 1 kg is equivalent to the output of 100 000 kg of coal.

This helps nuclear energy to have the best land use efficiency (lowest m²/MW).

Another significant advantage is nuclear power's unparalleled reliability, as nuclear plants have the highest capacity factor of any other energy source, operating on average at over 90% of their total capacity, which means they consistently produce power throughout the year.

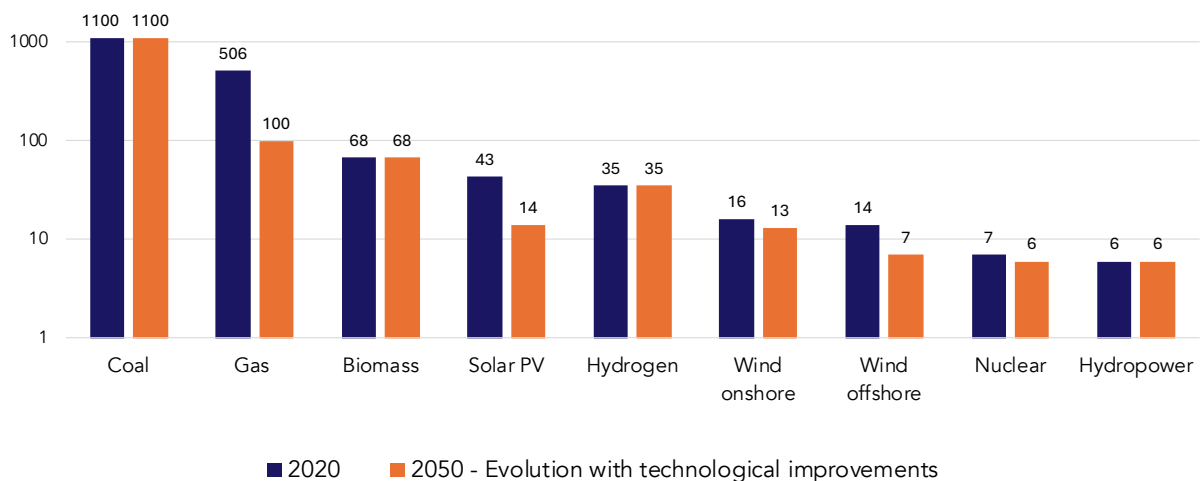
So, nuclear energy serves as a baseload for electricity generation that is needed for grid balancing. As it is also dispatchable, meaning

its production can be ramped up or down which is not the case of wind and solar power, nuclear energy can complement the intermittency of these renewable sources. Indeed, even if renewables are cheap, they require back-up power as their energy production is directly dependent on weather conditions. A vast number of batteries would be required to manage the fluctuations in renewable energy production even on a small scale. This strategy would increase the stress on critical materials and, of course, increase costs significantly.

We also must take into consideration that nuclear power prices are expected to drop significantly through the forthcoming new nuclear technologies based on smaller scales, simpler designs and modularity.

In a nutshell, nuclear energy gathers the major characteristics that should make it a popular source of heat and power: it is reliable (abundant), clean (no CO₂ emissions) and affordable (high energy density and optimized production costs).

Figure 4: Carbon intensity of energy produced by source of production



Source: RTE

The game-changer potential of the new nuclear

A brief history of nuclear reactor generations

The first conceptual designs of nuclear reactors conceived to produce energy for civil utilizations date back to the immediate aftermath of World War II. While at the beginning both fission and fusion (notably in Russia) were considered as possible sources of energy, only fission reactor designs reached the degree of technological maturity to give rise to the first nuclear power plants (NPPs) in the 1950s.

Since then, three generations of nuclear power reactors have been developed:

Generation 1 (GEN I), referring to early prototypes from the 1950s and 1960s. This kind of reactor typically ran at power levels responding to “proof-of-concept” features. The last commercial Gen I plant, the Wylfa Nuclear Power Station in Wales, ceased operation in 2015.

Generation 2 (GEN II), a class of commercial reactors designed to be economical and reliable, that began operation in the late 1960s and made up the bulk of the about 650 commercial reactors commissioned to date worldwide.

These reactors, mainly Light Water Reactors (LWRs), need relatively large power grids, have a defined safety envelope based on western safety standards, and produce significant quantities of spent fuel that require final disposal in a high-level waste repository or reprocessing as part of a *partially or fully closed fuel cycle*. Designed for a typical operational lifetime of 40 years many of them went through life extension programs to extend lifetime up to 60 and then 80 years. Consequently, GEN II reactors are still operating today.

Generation 3 (GEN III), essentially Gen II reactors with evolutionary, state-of-the-art design improvements (the distinction between the two generations is sometimes arbitrary). These improvements are in the areas of fuel technology, thermal efficiency, safety features (especially the use of passive rather than active systems), and standardized design.

In particular, GEN III + reactors make a more extensive use of passive safety systems (i.e., those that take advantages of natural forces or phenomena such as gravity, pressure differences or natural heat convection) that require no active devices and no operator actions to mitigate design-basis accidents.

Passive systems optimize the need for redundancy and lead to higher levels of reliability. Examples of GEN III + reactors are the French EPR and the American AP1000.

Generation 4 (GEN IV), corresponding to the advanced reactor designs that originate from the Generation IV International Forum (GIF), set up in the early 2000s by the US Department of Energy to coordinate the international development of new types of nuclear reactors.

This reactor generation represents a technological disruption with the GEN II and GEN III reactors currently in operation around the world. Indeed, these new reactors are designed to meet many major objectives and challenges: enhancing safety, minimizing nuclear waste, saving natural resources, reducing construction and operating costs, and limiting the risk of nuclear proliferation. With more than a 100 possible reactor designs, members from GIF selected six concepts that satisfy these objective requirements.

Table 1: The 6 AMR technologies of Gen 4 selected by the Generation IV International Forum (GIF)

Type	Fuel	Coolant	Moderator	Spectrum	Outlet T	Fuel cycle
MSR (Molten salt reactor)	U/ Pl/ Th/ MA - TRU (...F/Cl- salts)	Molten salt	None/ graphite	Fast/ thermal	700-800°C	Closed
LFR (Lead-cooled fast reactor)	U/ Pl/ Th (...MOX)	Lead	None	Fast	400-500°C	Closed
SFR (Sodium-cooled fast reactor)	U/ Pl/ Th (...MOX)	Sodium	None	Fast	500-550°C	Closed
SCWR (Supercritical water-cooled reactor)	U/ Pl (...MOX)	Water	Water	Thermal/fast	500-600°C	Open/ Closed
GFR (Gas-cooled fast reactor)	U/ Pl (...TRISO)	Helium	None	Fast	800-850°C	Closed
VHTR (Very high temperature reactor)	U/ Pu (...TRISO)	Helium/ sodium	Graphite	Thermal	>900°C	Open/ Closed

Source: GEN IV International Forum, Nuclear Energy Agency (NEA), Exergon research

What do we mean by new nuclear?

The renewed global interest in nuclear energy that has emerged in recent years has been accompanied by what may be considered a historic transformation of the sector: the flourishing and rapid growth of startups attracting private capital to finance the development of new nuclear technologies. technologies.

These companies are significantly accelerating progress along the technological roadmaps of new reactor designs, novel concepts, and advanced systems.

In the fission space, when these new designs are based on concepts of GEN III + they define a type of reactor called Small Modular Reactors (SMRs).

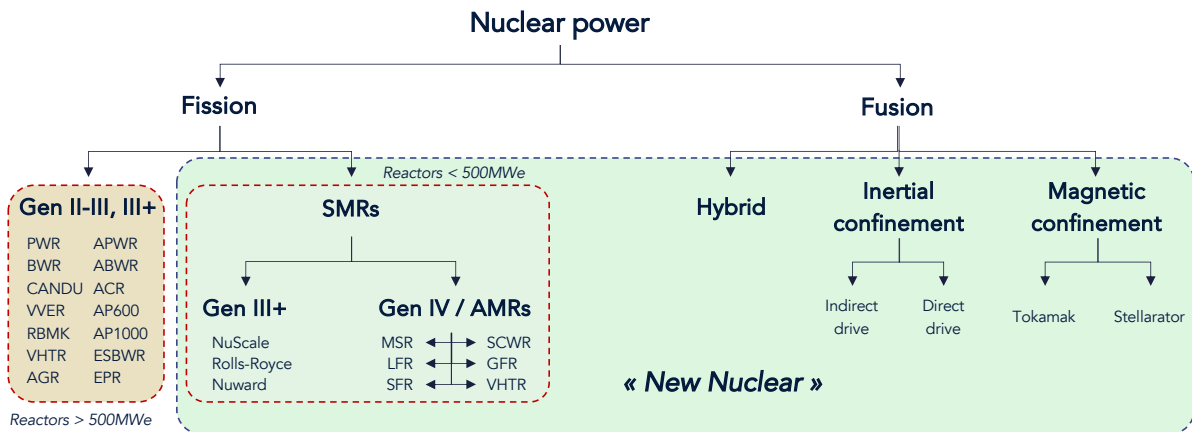
When they are based on the new emerging concepts of the GEN IV they are identified as Advanced Modular Reactors (AMRs).

In the fusion space, the new advanced designs of fusion systems are essentially based on the concepts of magnetic confinement fusion (MCF), inertial confinement fusion (ICF) or a combination of both.

While these concepts have historically been explored through large-scale national and international research projects (e.g. the ITER project), the new designs proposed by private fusion companies — primarily startups entering the market — focus on smaller reactor sizes, novel materials, and the use of advanced numerical simulation and digital modelling tools and techniques.

The whole set of new concepts and designs in nuclear fission reactors, either SMRs or AMRs types, as well as the new advanced designs in nuclear fusion which are proposed by private companies, essentially startups, is what we refer to as "New Nuclear"

Figure 5: New Nuclear Technologies



Source: Exergon research

Advantages of SMRs/ AMRs

In accordance with the aforementioned advanced conceptual designs and with the challenges targeted by the GEN III + and the GEN IV reactors, SMRs and AMRs show some major advantages with regard to different dimensions when compared with large conventional nuclear reactors (CNRs). Both SMRs and AMRs share the following features:

- 1) **they have enhanced safety features** thanks to advanced designs and passive systems that minimize and can eliminate the risk of severe accidents;
- 2) **they minimize the production of high-level waste**, and they are capable of multi-recycling plutonium through internal closed fuel cycles;
- 3) **they are less dependent on uranium supplies**, as consumer countries are extremely dependent on producer countries (Kazakhstan, Australia) for Gen III reactors;
- 4) **they are smaller in size** and power (electric nominal power below 500MWe) than CNRs;

- 5) **they match modularity criteria** for their construction; and
- 6) **they require less capex** for their commissioning, which is more appealing to private companies and private investors.

These features result in some techno-economic advantages of SMRs/ AMRs in comparison to CNRs and other low carbon energy supply technologies, including:

- **drastically reduced construction times** which implies lower project risks - the smaller scale and modularity allow to keep cost overruns under control and minimise delays as any single component can easily be replaced;
- **power and heat flexibility** – SMRs and in particular AMRs offer flexibility in power and heat generation and co-generation options, for a variety of use cases demanding low carbon energy solutions on a massive scale;

- **deployment flexibility** – the smaller size of SMRs/ AMRs enables greater deployment possibilities as sites close to the points of demand and opportunities connected to the large range of sizes and power outputs of the SMRs/ AMRs designs;
- **direct replacement opportunity** – SMRs and AMRs can support the replacement of existing fossil fuelled thermal power plants on site, minimizing land use, and with minimal or no changes in transmission infrastructures;
- **speed of deployment** – despite many SMRs and AMRs plans, projects are not predicted to deploy until the late 2020s, the rationale of their factory production and modular deployment enables a more rapid continued expansion following FOKs.

While SMRs are generally based on more mature concepts and mainly developed by large nuclear players and energy groups,

AMRs develop the new advanced concepts of GEN IV and they are typically proposed by startups.

In respect with SMRs, AMRs offer a broader range of reactor technologies that have the value-added qualities to address different challenges to accelerate the energy transition on the pathway to net zero emissions.

Standing out for possibly targeting several markets and for having a wide variety of use cases, AMRs have the highest potential to be game changers.

These markets are essentially made up of power generation, process heat, district heating and civil naval propulsions.

Use cases include base load power production, services for grid balancing, decarbonized hydrogen production, low to high temperature heat for various industries (including iron & steel, cement, chemicals, aluminium, glass and light industries), desalination and remote place energy supply (power, heat or both of them).

Figure 6: Addressable Markets and Use Cases of New Nuclear

		Wind	Solar PV	Hydro	Geother.	Biometh.	CNRs	GEN III+ SMRs	GEN IV AMRs	Fusion
Power	Power generation	✓	✓	✓			✓	✓	✓	✓
	H ₂ production	✓	✓	✓			✓	✓	✓	✓
Heat	Process heat	Iron & Steel					✓		✓	✓
		Cement					✓		✓	✓
		Chemicals					✓		✓	✓
		Aluminium					✓		✓	✓
		Glass					✓		✓	✓
	Light industries*	✓	✓	✓		✓	✓	✓	✓	✓
	District heating				✓	✓	✓	✓	✓	✓
	Desalination						✓	✓	✓	✓
Others	Remote places	✓	✓					✓	✓	
	Naval propulsion	✓						✓	✓	
Addressable markets										

Source: IEA, Exergon research

Advantages of new advanced fusion systems

The rapid emergence and increasing momentum of the private fusion industry over recent years offer the best way to tentatively respond to the major concern surrounding fusion energy:

when will fusion power show its technological feasibility and become ready to be exploited for industrial and commercial utilisation?

There is a growing consensus that fusion power could reach TRL 9 by the end of the next decade thanks to progresses made by private fusion companies, mainly startups, in developing new advanced designs of fusion systems pushed by competition pressure and investor interests.

The key advantage of advanced fusion systems over large-scale public research projects lies in their ability to stimulate and accelerate private investment dynamics and market expansion, thereby offering a pathway to fusion power on a timeline compatible with the energy transition and the goal of achieving net-zero emissions by 2050.

These advantages build on the inherent characteristics and benefits of fusion power, including::

- **no CO2 emissions** – fusion doesn't emit CO2 or other greenhouse gases into the atmosphere. Its major by-product is helium, an inert gas that doesn't harm the environment;

- **inherent safety** – fission-type accidents or nuclear meltdown based on uncontrolled chain reaction are impossible. Fusion reactions depend on the continuous input of fuel, and the process is self-limiting;
- **no highly radioactive, long-lived waste** – there is no radioactive waste by-product from fusion reactions. Only system components become radioactive; the level of activity depends on the structural materials used.
- **energy efficiency** – one kilogram of deuterium-tritium (DT) could provide the same amount of energy as 10 million kilograms of fossil fuel. A 1-Gigawatt fusion power station will need less than one tonne of fuel during a year of operation.
- **no proliferation risks** – fusion doesn't employ or produce fissile materials that could be exploited to make nuclear weapons. In deuterium-tritium (DT) reactions tritium is continuously consumed and reinjected into the system and its amount is never sufficient to trigger risks of proliferation.

Once fusion power will reach technological maturity thanks to some advanced system designs providing scalable and commercially viable fusion reactors, this source of energy could become the ultimate game-changer.

What are the most critical factors making new nuclear appealing for private investors?

Unlocking the “game changer” potential

The potential of new nuclear to be a sector game changer relies on the successful continuation of its development and on its further structuring. Its sustainable, disruptive technologies will go through an important selection based on multiple factors including private investor support, competitive advantages, public policy backing, technological challenges, compliance with regulatory frameworks, and drive from the most relevant use cases.

An essential role → private investors are key to promote, sustain and drive new nuclear innovation that is largely carried out by young players like startups

Traditional sources of financing for the nuclear industry relied on the large balance sheets of big technology suppliers and state-owned utilities especially to provide initial R&D funding and then secure recourse loans and collaterals for the debt facilities of project financing.

New nuclear technologies are mainly proposed and developed by startups that do not have the required balance sheets to target these traditional sources of financing.

As a result, for startups, the support of private investors as venture capital (VC) and private equity (PE) funds becomes essential to develop their new concepts and designs and unlock their game changer potential.

This new paradigm in the financing of the nuclear industry has an historical dimension as for the first time this sector is being financed by private capital for its development from roadmap milestones to further project deployment.

Shifting business model → nuclear energy business is moving from a current bespoke project-based model to a product-based model which is supposed to reduce costs substantially

In contrast to the initial approach adopted in the 70s and the 80s in the commissioning of GEN II and GEN III American designed CNRs, particularly in Europe, GEN III+ reactors like EPRs match a bespoke, one-at-a-time, project-based model whose great weaknesses are long construction times and costs overruns.

New nuclear technologies are shifting back to a standardized product-based model that is further improved in terms of delivery times and cost reductions thanks to the smaller size of the “product”, smaller capex, modularity and design simplifications.

Based on experience from the shipbuilding industry, the Clean Air Task Force (CATF) estimates that modularization alone could reduce final costs by up to 23% while reducing delivery times by up to 50%.

A staged funding process → beginning with design and then financing demonstration and deployment

Private investors are going to play an essential role at two key stages: initially by selecting and supporting the development of the most relevant new nuclear technologies, notably via equity investments in the fund-raising rounds of startups.

Then at a second stage, once conditions are met, by supporting deployment though project financing thus unlocking the industrialisation of the sector in a similar way as it was the case for renewables.

A strong capital markets momentum → accelerating investment and enabling exit pathways for advanced nuclear

A strong financial market momentum is emerging in the United States, driven by substantial inflows of private capital into next-generation nuclear technologies.

This dynamic is notably reinforced by the rise of SPAC transactions.

Those transactions have provided a credible and accelerated pathway to public markets for several advanced nuclear players such as Oklo (valued via SPAC around 800 M\$ at opening price), NuScale (valued via SPAC 1.9 bn\$ at

opening price), and Terrestrial Energy (valued via SPAC around 1 bn\$ at opening price).

Beyond facilitating access to large pools of capital, these vehicles contribute to structuring tangible exit scenarios for early investors.

This growing alignment between financial markets and industrial ambitions is playing a pivotal role in de-risking the sector and accelerating project pipelines.

A similar momentum could progressively emerge in Europe where SPAC and other exit mechanisms may become key enablers to scale the new nuclear ecosystem.

The first stage: financing technology

In this phase private investors are mostly represented by high net worth individuals (HNWIs), VC funds, and family offices (FOs).

They have the major opportunity to inject equity in innovative companies, mainly startups, that propose new disruptive concepts and designs starting typically from TRL 3-5 in the fission space and TRL 2-3 in fusion.

Equity injections take the usual format of fundraising rounds beginning with pre-seed rounds, and then seed, series A and series B or C, with further rounds depending on a case by equity story.

Investing at the early stage of technology development allows investors to benefit from appealing value-creation drivers that include:

- attractive ROI potential through disruptive technological milestones;
- accelerated shortening of time-to-market;
- strengthening rationale in favour of controllable, low-carbon, energy production assets;

- continuous lowering of technology risk thanks to digital and AI-based modelling and advanced materials;
- increasing pressure on market consolidation based on SMRs/AMRs technology;
- favourable public-policy framework.

In addition to specific critical factors, nuclear startups share common investment criteria with other technologies, they focus on the strength of the company management, in terms of scientific credibility and internal cohesion, the feasibility of the proposed solution, the scalability from lab-size to commercial size, and the expected market demand for the addressed use cases.

VC funds typically make their earnings as capital gains from the sale of equity investments according to exit strategies backed by a possible planned liquidity event.

The most popular exit opportunities are the IPO, strategic sale to a large corporation and the growing perspective of a sale to an infrastructure fund.

A key appealing element for VC funds to invest in new nuclear is the sound increase in enterprise value (EV) resulting from each milestone reached on the roadmap.

Indeed, each milestone qualifies and validates one more step of technology development and one more level of project de-risking.

At this stage, the key risks for investors are mainly provided by the following factors:

- deeptech dimension → disruptive innovations can present technology barriers;
- fuel cycle → innovative and not yet available fuel types need to be secured;
- regulatory risk → possible licencing barriers and lack of harmonization across countries need to be overcome;
- economic competitiveness → the expected levelized cost of energy (LCOE) must be competitive;
- industrialisation → new concepts and designs need to fit industrialisation criteria.

As showed in other technologies, an important amount of capital invested provides the most important factor to overcome engineering and technological barriers, address risks and allow faster progress compared to estimations based on historical trends.

The second stage: financing deployment

This is the phase characterised by TRLs 7 to 9 in which investors are often large corporations like energy groups and infrastructure funds that look to finalise technology demonstration and move to project deployment.

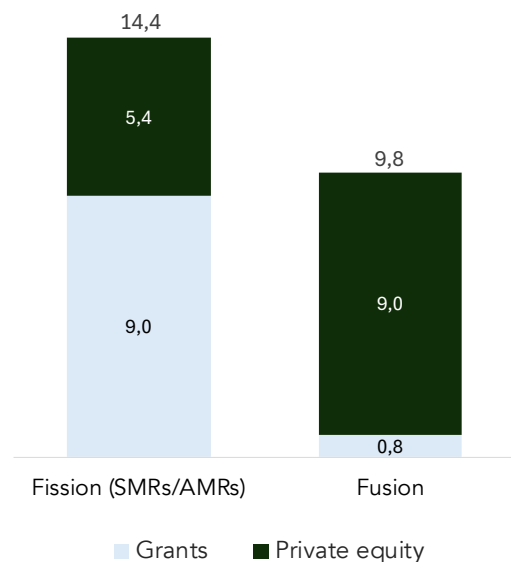
These investors normally acquire a majority stake in the company or the entire company capital.

Capital investments → they significantly spur innovation and reduce time to market by increasing available resources

In this respect, notable examples are provided by the Covid-19 vaccines and PV modules price curve in the period 2007-2017.

Based on most recent data available new nuclear global funding for AMRs (estimated) and advanced fusion systems are reported in figure 7 in billion dollars.

Figure 7: New nuclear global funding as of 2025 (bn\$)



Source: Exergon research

They are used at employing project financing solutions through SPVs (Special Purpose Vehicles) to finance the construction of First-of-a-Kind (FOAK) and Nth-of-a-Kind (NOAK) SMRs/AMRs. Their investment drivers include:

- ROI potential through company technology development;
- leveraged returns from take-off arrangement contracts;

- attractive medium to long-term outlooks on power and heat market demand;
- increasing recognition of climate benefits from new nuclear generation assets;
- flexibility and wide choice of possible use cases;
- sector-friendly public framework.

The expected ramp-up of project financing could play a key role in fostering a maturing of the industry, particularly the industrialisation of component manufacturing through a proliferation of investments and increased competition between equipment suppliers, but also between project developers, and even between potential capital providers.

In this second stage of project deployment, the key risks for investors are mainly provided by the following factors:

- construction → schedule and budget delivery require securing land and permits;
- operating → running and maintaining a NPP implies a certain number of uncertainties;

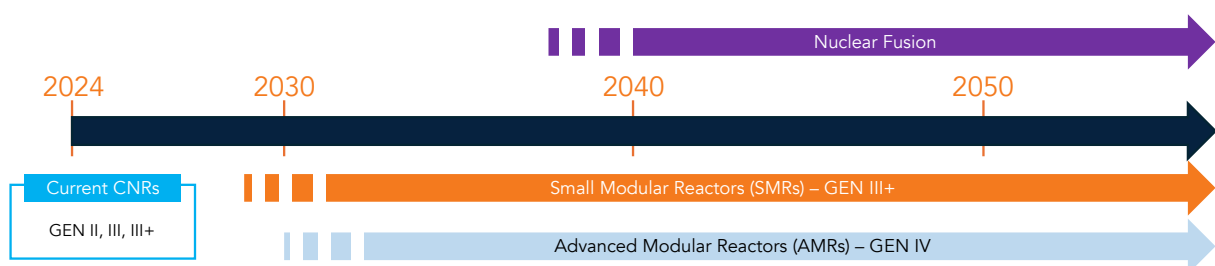
- revenues → capital intensive projects require high asset utilisation and buyer creditworthiness;
- regulatory risk → government actions can lead to changes in regulatory frameworks and licencing procedures;
- currency → the international dimension of new nuclear markets requires hedging possible exchange rate volatility.

The deployment phase is usually preceded by the set-up of a prototype demonstrator followed by a first-of-a-kind (FOAK) that can already lead to an estimated 20%-40% cost reduction thanks to industry best practices and using NPP subcontractor skills.

Then through modularization, co-siting, learning and standardization, a further 30%-50% drop in cost can be reached for the n-of-a-kind (NOAK) that represents the final industrialised reactor.

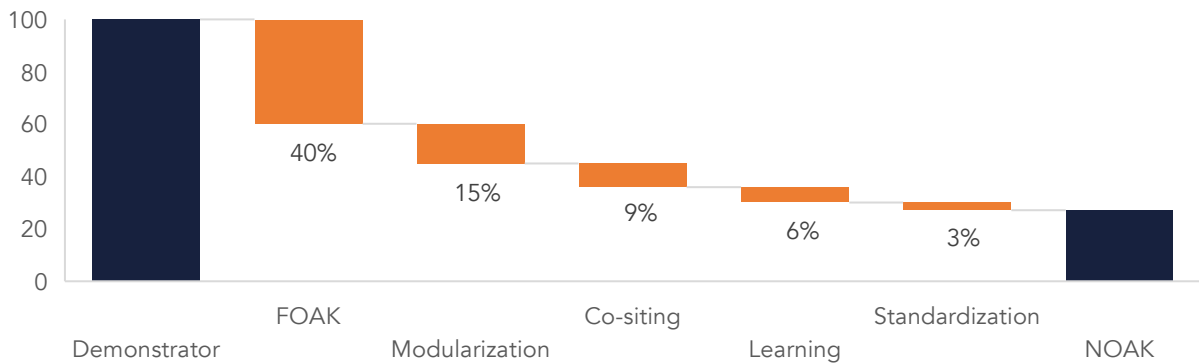
In total, about 60% of cost reductions can be targeted in the project deployment phase

Figure 8: Forecasts on Time-to-Market for New Nuclear Technologies (bulk of projects)



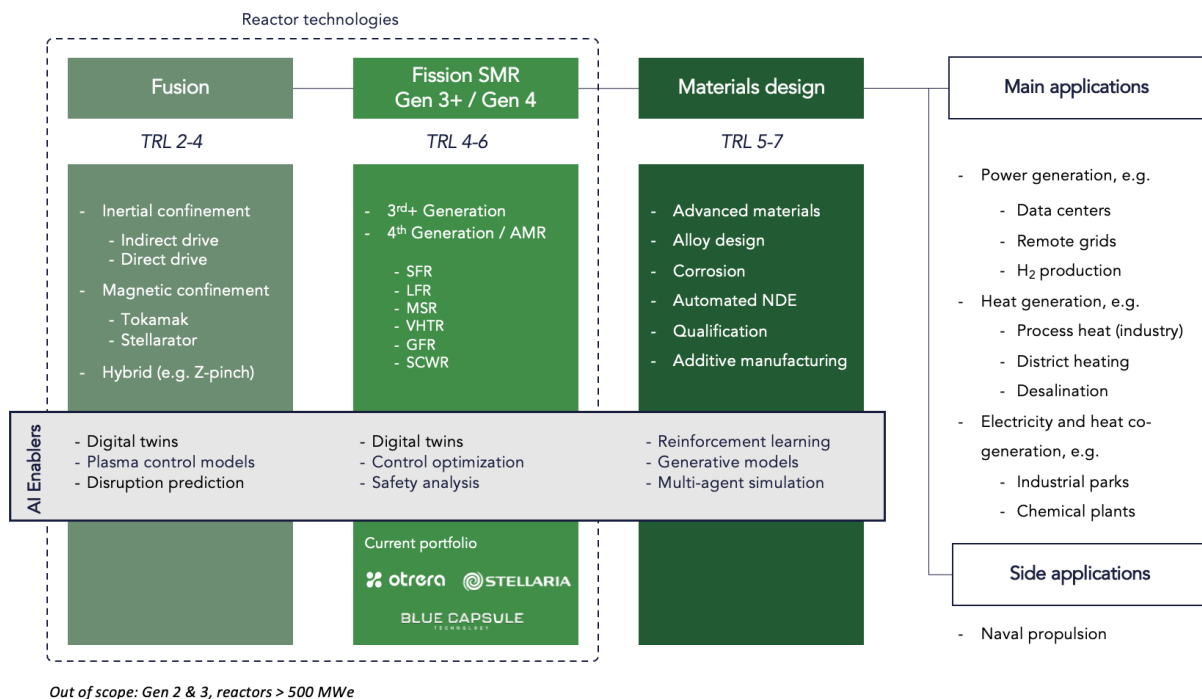
Source: Exergon research

Figure 9: SMRs/ AMRs potential cost reduction breakdown (%) in the deployment phase



Source: EY Parthenon "The true Power of SMR on the road to a sustainable energy future"

Figure 10: New nuclear TRL scale, AI enablers and applications



Source: Exergon research

A booming ecosystem of new nuclear technologies

Projects and startups are flourishing around the world

Projects and startups proposing fission-based SMRs/ AMRs technologies and fusion-based energy systems are already widely spread across the globe and their number is fast growing.

According to last available data we identified 78 designs under active development around the world in the fission space that are carried out either by large technology suppliers and utilities (mainly in the case of SMRs) or by startups (mainly in the case of AMRs).

We estimate there are also between 20 and 30 designs that are not under active development and for which available data are not sufficient to provide further information.

In the case of fusion, according to the Fusion Industry Association, there are at least 53 companies working to develop fusion energy systems around the world.

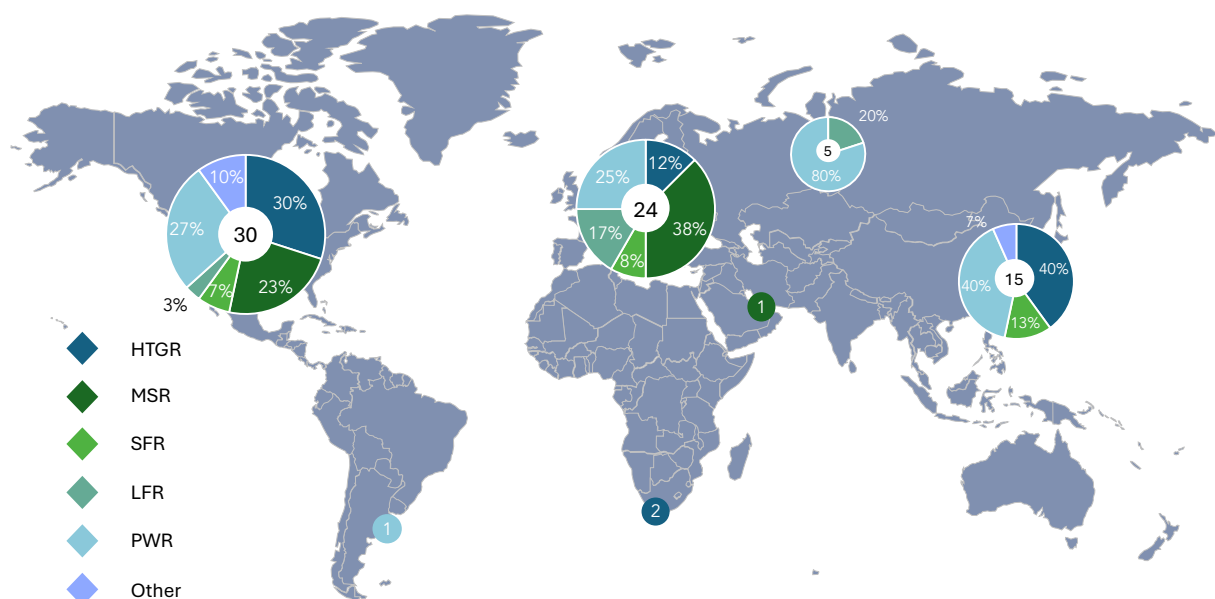
These figures for both fission and fusion should be considered to be very conservative as they do not comprise a certain number of projects and startups in stealth mode.

The wide range of concepts and designs may create opportunities to consolidate global supply chains, increase standardisation and improve the economics for further commercialisation.

Looking back at the fission space, we found that most designs are those of the GEN IV that represent more than 70%.

Among them, high temperature reactors (HTGRs and VHTRs), molten salt reactors (MSRs), and liquid metal-cooled fast reactors (SFRs and LFRs) lead the number of designs under active development.

Figure 11: Identified SMRs/ AMRs designs under active development across the globe



Source: NEA, Exergon research

Focus on Europe

The Holy Grail for Europe → a large concentration of GEN IV designs is under development in Europe which forms a bright pathway to address energy sovereignty issues, energy security, and EU Net Zero strategy

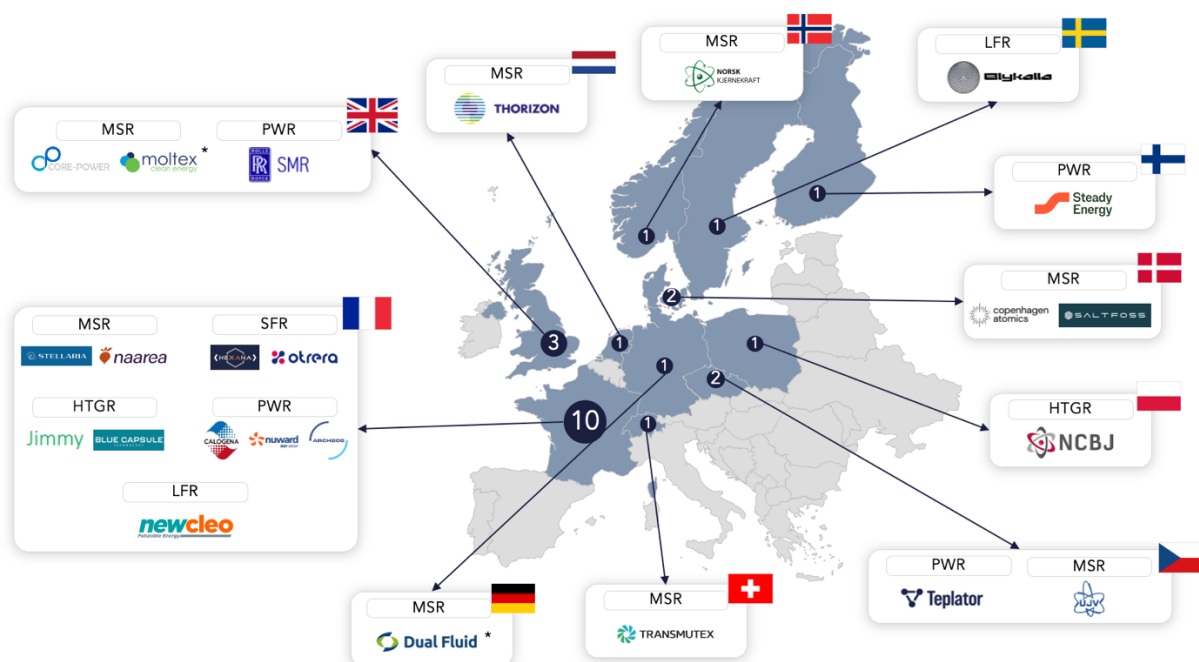
Europe has gathered some of the best nuclear engineers, researchers and scientists, which explains that there are already 23 companies that have cropped up and 24 SMRs/AMRs designs under development.

Most of them are developing GEN IV reactors that could be deployed as soon as the late

2020s or early 2030s. This could address most of the energy-related challenges Europe is facing today and provide an important competitive advantage in the race to master and acquire market power in the near future on the international scene in these technologies.

Indeed, engineering, industrial know-how and production capacities of these reactor designs would give a huge push to Europe as these new sustainable technologies are conceived to solve the current nuclear dilemma (severe accident risk and waste production) and can help meet critical climate management and human development goals.

Figure 12: Identified companies actively developing SMR and AMR designs in Europe as of 2026 (headquarters' location)



* Dual Fluid collaborates with TRIUMF(Canada); Moltenx, though UK-founded, is now primarily developed in Canada

Source: NEA, Exergon research

Fusion private investment in Europe lagging behind → concentrated in UK and Germany, European fusion companies receive nearly 15% (around 1.2 bn€ in early 2026) of global private funding, which remains focused on the United States and China

Europe hosts 14 private fusion companies, with half of them located in UK and Germany.

These countries have also the most well-funded fusion startups in Europe whose capital level, however, is still between 10 and 20 times lower than their American or Chinese counterparts.

Within the EU, Germany accounts for 85% of total fusion private investment.

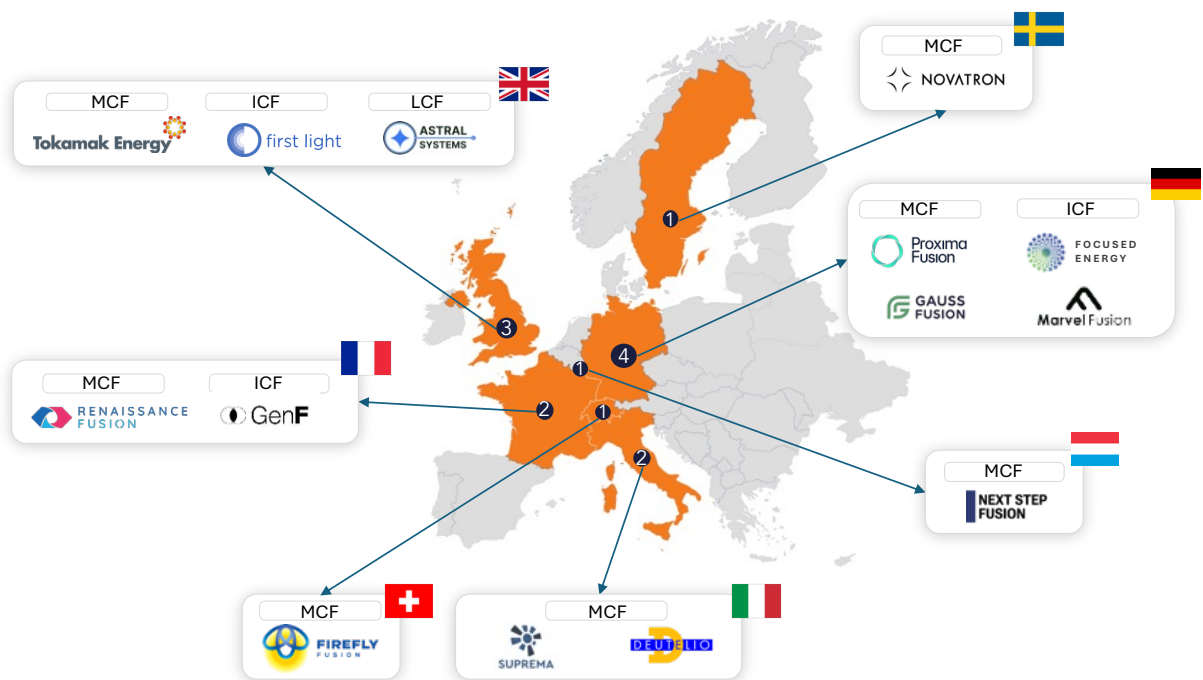
Despite the relatively low levels of private investment to date compared with global figures, Europe provides fertile ground and appealing potential for the growth of companies developing advanced solutions across the fusion value chain.

This is driven primarily by two key factors directly tied to public funding: world record-breaking scientific achievements and an increasingly well-structured supply chain:

- on early 2025, the tokamak WEST, run from the French public research organisation CEA at Cadarache site in southern France, was able to maintain a plasma stable for 1337 seconds at a temperature reaching 50 million °C;
- since 2007, thanks to the ITER international project, located at Cadarache, the EU has invested around 6.8 bn€ in its ITER supply chain, representing more than 1300 contracts across Europe.

Leveraging such factors and accessing large-scale private capital could be the key for Europe to build a competitive private fusion ecosystem and to advance towards capital-intensive demonstration phases.

Figure 13: Identified companies actively developing innovative fusion system designs in Europe as of 2026 (headquarters' location)



Source: Exergon research

Outlook

Up to triple nuclear power capacity

The Nuclear Energy Agency (NEA) and the International Energy Agency (IEA) agree on the growing crucial role nuclear power is going to play in the energy transition.

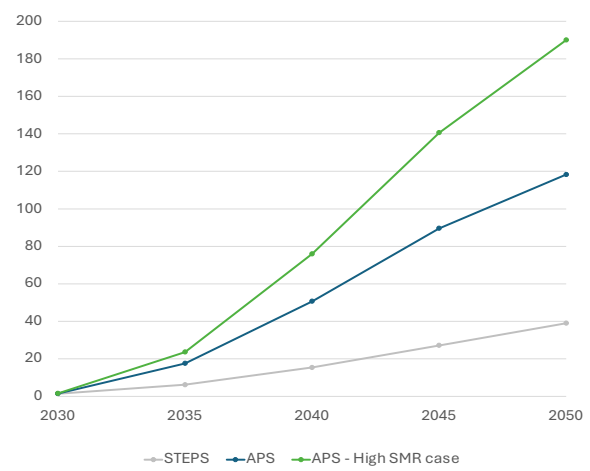
Their scenarios to net zero emissions concentrate on fission technologies and forecast installed nuclear capacity to strongly increase up to triple to 1,160 GWs globally by 2050. This forecast turned into a goal shared by 22 countries at COP28 in Dubai on December 2023.

In this context, what share of new installed capacity SMRs and AMRs could potentially capture?

The IEA anticipates the first reactors being commissioned around 2030, with a real acceleration in deployment in the middle of the 2030s, and an installed capacity reaching

up to 190 GWe by 2050 in the Announced Pledges Scenario (APS) – High SMR case.

Figure 14: SMRs/ AMRs installed capacity (GWe), 2030-50



Source: IEA

Conclusions

The entire nuclear sector is regaining momentum across the globe driven by major global long-term challenges and ongoing regional issues:

- **climate change mitigation urgency;**
- **increasing electricity demand;**
- **energy security issues;**
- **EU strategy targeting net zero by 2050;**
- **the French government renewed support.**

In this context, new concepts, designs and advanced systems, in the fission and fusion space, are entering the nuclear energy game.

They are proposed by young private companies, essentially startups, and they have

the potential to be a game changer, it's what we refer to as "New Nuclear"!

This new sector segment is getting increasing momentum thanks to some key strengths that boost its attractiveness compared to the more mature technologies of CNRs. Focusing on the fission space, the key strengths of SMRs and AMRs include:

- 1. enhanced inherent safety;**
- 2. high-level waste minimization;**
- 3. smaller capex;**
- 4. faster construction times;**
- 5. variety of use cases.**

These 5 key strengths lead to a fundamental change in the financing paradigm: for the first time nuclear technologies become appealing

for private investors who play a major role in funding their development.

While at a first stage, investors like VCs, finance technology progresses, at a second stage investors like energy players support roadmap completion and system deployment through project financing.

Why is the new nuclear ecosystem emerging only today and did not before?

At least two main reasons are part of the answer.

On one side, the increasing evidence that other technologies are not able to address the mentioned long-term challenges and regional issues.

On the other side, improved numerical simulation tools and digital modelling allow the development of advanced technologies at a pace that is faster than even before.

About the author:

Giuseppe J. Sangiovanni is Co-Founder and Managing Partner of Exergon, Energy Transition Ventures.

Giuseppe is a nuclear engineer from *Politecnico di Milano*, and he holds a Master in energy, finance, carbon from *Université Paris Dauphine-PSL*.

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