Investing in Nuclear energy

A multi-decade asset class, fueled by massive demand, innovation and political will

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While some countries have never stopped building their nuclear energy industry (China, Russia and India among others), Western ones are transforming a policy liability into an investable asset, driven by a need for massive baseload electricity, mature yet innovative technologies and a political engagement that will make nuclear development more attractive.

The nuclear industry is likely a multi-decade investment opportunity, but investors and corporates alike need to answer the right questions before any cash outlay.

A. The opportunity for nuclear power to be the answer to growing electricity needs is massive

The global demand for electricity is expected to grow by 50% to 75% by 2050

Global demand is expected to grow at 2% p.a. in conservative scenarios (+50% by 2050) and 2.3% p.a. in more aggressive ones (+75% by 2050), while in the US, +50% growth by 2050 is also considered a conservative estimate, fueled by positive, and accelerating, trends**:**

The electrification of everyday life, including the development of EVs and data centers, requires an additional 19 GW to 35 GW by 2030 in the US alone. The upcoming ubiquity of AI / ML requires even more powerful data centers, for which an additional 85-90 GW could be required for this use case alone by 2030[1].

The reshoring of select energy-intensive industries, as illustrated by the recently pledged investments in semiconductor manufacturing, with more than $500 billion announced since the 2022 CHIPS Act, is going to increase demand of electricity, beyond what can be currently produced.

Additionally, other use cases such as desalination projects in drought-prone states like California (e.g., Carlsbad plant), the electrification of energy-intensive refining clusters along the Gulf Coast, and the decarbonization of large-scale district heating systems in major Northeastern urban centers are going to further increase the demand for electricity.

[1] Source: Goldman Sachs

Nuclear is the only clean large-scale baseload electricity generation technology available today with almost no CO_2 emission

Due to their lifecycle CO_2 emissions and their broader environmental footprint, fossil fuels are not considered clean sources of energy.

While renewable sources like wind and solar are expanding rapidly, their intermittency remains a structural challenge. Current battery storage technologies are not economically viable for the long-duration storage required to replace baseload assets during extended periods of low renewable output.

The high-capacity factor in Nuclear (90-95%) offers a unique advantage in land-use efficiency and grid stability compared to onshore wind (30-45%) and solar PV (20-30%). While the Levelized Cost of Energy (LCOE) of renewables has fallen, Nuclear provides baseload power that reduces the need for expensive grid-level redundancies and overbuilding, making it a critical component of a cost-effective, decarbonized energy mix.

Since the 1980s, the need for more nuclear generation in the US and in Europe has been mostly addressed through life extensions and power uprates; both are slowing down

Over the last five years alone, life extensions have been granted to more than 60 reactors globally.

Life extensions in the US and in Europe added up to 40 years of operations, and up to 10% of capacity, both thermal and electrical, mostly through digital I&C and larger equipment, amounting to the equivalent of eight 1-GW power plants, but additional installed capacity from these initiatives is slowing down.

Most reactors in the US have already received life extensions once (nearly 90% of US reactors have received 20-year life extensions, taking their operating life to 60 years), but are uncertain of further ones, for life extensions offer a comparatively cheaper alternative to new constructions but still require significant investment to replace and refurbish key components that are facing obsolescence.

In Europe, life extension of French NPPs approved by the ASN added 10 years of operation to 20 of the 56 French reactors, and the Belgian Long Term Operation framework allowed the extension of 2 reactors by 10 years, but European reactors face the same challenges going forward.

Additionally, more stringent operating regulations [NRC 10 CFR Part 54 (License Renewal Rule)], together with lower wholesale electricity and carbon prices, make certain plants financially unviable.

Lastly, power uprates[2] peaked in the early 2000s in the US and have since consistently slowed down: only an average of 1 power uprate per year has been recorded since 2021 vs. 11+ from 2001-2005.

[2] Regulatory approvals to increase the maximum power output of reactors

B. New levers are emerging to boost nuclear capacity growth and sustain the current nuclear renaissance

A second nuclear renaissance is under way in Europe and in the US, recovering from the abrupt slowdown following the Fukushima disaster

This renaissance began in Europe, where the shift started with new plants in France, Finland, the UK (EPR) and Eastern Europe (VVER) in the mid-2000's.

In the US, expansion is again top of mind, as demonstrated by the Trump administration's 2025 executive order to quadruple nuclear capacity to 400 GW by 2050.

Outside of Europe and the US, China's nuclear growth has been uninterrupted since Qinshan, then Daya Bay in the 80's/90's, and 29 of the 63 units currently under construction globally are located in China[3].

[3] Source: IAEA

This renaissance has picked up speed recently through new build orders: 41 reactors are planned worldwide, notably 23 across China, Japan, and India, and 16 across Russia, Hungary, and Finland[3]. Additionally, various countries have multiple reactors in the proposal stages as they further develop their nuclear programs.

Leveraging existing plant designs is the first lever to address nuclear capacity growth

In the US and Europe, many initiatives are under way, in increasing degree of complexity:

Planned shutdowns are being delayed: e.g. Diablo Canyon 1 and 2 in the US, and Heysham 1 and Hartlepool in the UK.

Plants are being de-mothballed: Constellation Energy is planning to de-mothball a dormant nuclear power plant (Three Mile Island in PA), and Holtec International is re-opening a recently shut down nuclear power plant (Palisades Nuclear Plant in Covert, MI).

New builds have been proposed with current designs, e.g. the 2024 US DOE's Nuclear Energy Deployment Framework envisions 35 GW of new nuclear capacity operating or under construction in the US by 2035 through a mix of new large gigawatt-scale reactors, or Westinghouse announcing a plan to start 10 AP-1000s in the US by 2030.

Innovative designs are also being developed…

SMRs (based on LWRs), with first designs already approved by the US NRC and with capacity between 50-500 MW, together with micro-reactors that produce 50 MW or less, are an integral part of the US DOE framework and advanced reactors (molten salt, etc.). Fusion, albeit a more remote prospect, could also fit in the mix.

… and new non-utility players are entering the fray to secure power supply to their datacenters

Google and Kairos Power signed a Master Plant Development Agreement in 2024 to develop a 500-MW fleet of SMRs, to be gradually brought online between 2030 and 2035.

Microsoft inked a 20-year Power Purchase Agreement with Constellation Energy, which envisions restarting the 837 MW Unit 1 of the Three Mile Island nuclear power plant, renamed "Crane Clean Energy Center"

Meta announced in January 2026 the signature of three nuclear agreements: a 2,600 MW nuclear PPA with Vistra; a funding agreement with Terrapower for 2 and up to 6 units by 2035; an agreement with Oklo to develop 1.2GW from fast breeder reactors.

Amazon Web Services signed a 1,920 MW Power Purchase Agreement with Talen, sourced from its Susquehanna NPP, in PA.

C. However, the road to the first kWh can be long, and to the first dollar of return even longer

Regulations have been a major sticking point, but are evolving

New nuclear facilities are still subject to lengthy and complex regulatory approval by the national nuclear regulation authorities (e.g. the NRC in the US and the ASN in France), with a positive impact from a safety perspective; however, some nuclear regulatory bodies are exploring ways to shorten approval processes and are generating regulatory frameworks for integrating SMRs and Data Centers. Examples include:

The ADVANCE Act passed in the US in 2024, enables the NRC to reduce certain licensing application fees and authorizes increased staffing to expedite, review and approve processes. For microreactors, the Act directs NRC to develop guidance to license and regulate microreactor designs within 18 months, down from 5 years

The 'European SMR Partnership', created by the European Commission in 2023, institutes a cooperation scheme to develop frameworks to streamline regulations and potentially shorten regulatory processes, especially around SMRs. Its objective is to facilitate SMR development and compliance with EU legislative frameworks, with the aim of deploying SMRs in Europe by 2030.

In addition, after the Jobs Act (2021) and Inflation Reduction Act (2022) were passed under the Biden administration, political will and support for nuclear power under the second Trump administration is superseding support for alternative renewable energy sources in the US.

Economics, construction times and resulting competitive position continue to be a challenge

Scale matters in Nuclear and the nuclear option can be competitive in cost and construction time, but only in cases where a multi-decade program is launched (e.g. in France and China), as to account for specific challenges:

Capital and financing costs are massive ($6-10B for a 1+GW plant) and are much higher than for fossil fuels and renewables (Coal: $600M-$1.4B; Offshore Wind: $650M-$1.2B; Onshore Wind: $240M-$640M; Solar: $250M-$800M)

Construction timelines can be long and unpredictable (e.g. OL3, FA3, Vogtle), making nuclear plants less flexible and slower to deploy than other power sources, e.g. solar PV, wind, or gas

SMR cost and building duration are still uncertain (as all are FOAK plants), and could lack scalability, as unit cost of the kWh generated by SMRs is still much higher than large plants.

Value chain capabilities have decreased and need to be recovered

The amount of labor required to deliver the anticipated nuclear capacity increases is high, especially for highly qualified skills, both for engineering studies (e.g. engineering, project management) and specialized operational tasks (e.g. welding).

However, part of the nuclear know-how has disappeared, as the leaders and skilled workforce of the nuclear birth and first renaissance in the 2000’s have retired; this is the case from utilities and nuclear EPCs to NSSS providers and their suppliers up the value chain.

The security of nuclear fuel supply may also become questionable should international relations continue to degrade (Russia currently accounts for 40-45% of global enrichment capacity and 17% of global fuel supply).

The grid is a constraint and a bottleneck

Nuclear plants may not be able to be deployed where the offtake is needed (e.g. data centers), as they need a cold-water source, so a reliable electricity grid is critical.

The electricity grid, in particular in the US, may therefore require substantial improvement programs to be able to support the transport of massive amounts of electricity generated by nuclear power plants to consumption centers.

Public opinion on nuclear energy and waste is not always favorable

While solutions exist / are being developed for low-level radioactive waste, battles around repositories and potential other treatment methods for medium and high-level radwaste continue.

Local opposition to hosting new nuclear plants (and, even more so, waste sites) is always to be reckoned with.

D. Key considerations for investors – where to invest?

Existing industry participants and Infrastructure funds with a long investment horizon need to have clear rationales and answers to the following questions:

What type of actors to invest in?

- What is the nuclear value chain and where are its profit pools?
- What are the steps in the value chain that will generate scale, growth, and profitability: utilities, individual projects, EPCs, O&Ms, suppliers, etc.?
- Given the focus of investors and potential synergies with their other operations or investments, what are the assets to consider?
- What exit strategies could be contemplated?

Which geographies to prioritize?

- Where are the largest market opportunities for nuclear energy over time, and for what applications? In particular, what is the competitive environment and how does nuclear energy stack up? What geographies are most conducive to building nuclear programs?
- Where is the environment most favorable for its development (regulations, supply chain, depth of expertise, financing availability, off-take guarantees, risk minimization, etc.)?
- Should investments be considered locally or globally?

Which nuclear technologies to focus on?

Most venture-oriented firms (e.g. VCs and new design departments of existing Nuclear Steam Supply System suppliers) will also need to answer prospective technology questions:

- What are the technologies being considered (SMRs vs. scale reactors, LWRs vs. advanced reactors, AI use cases, etc.)?
- What are their applications and which ones are most promising (e.g. grid infrastructure, data centers, H2 production, etc.)?
- What are their stages of development and potential outlook?

The demand for electricity is going to increase so massively in the next 20-30 years that Nuclear, as a reliable baseload, non-carbon emitting, generation source cannot be omitted from the supply mix and the sector is therefore likely to experience significant growth in the future. Challenges remain but there are also very attractive opportunities for savvy investors with long-term horizons.

Emerton partners have advised investors and participants in the Nuclear sector supply chain for 30+ years through various projects such as overall corporate strategy, market scans and analysis, voice of customer, organizational design and NSSS redesign-to-cost.

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