

New nuclear: from choosing technologies to building platform-scale industry

October 2026

Nuclear power is entering a new phase of development. Until recently, debate has concentrated largely on the technology itself, particularly the design of new reactors and the merits of competing technologies. Yet recent developments suggest the focus is shifting, with the ability to finance and industrialise these technologies at a competitive cost moving to the fore.

The return of nuclear power is reflected in the emergence of new financing mechanisms and the return of private investors alongside governments. Announcements around the financing of **Sizewell C** in the United Kingdom, the structuring of the **EPR2 programme** in France, the commercial successes of **Rolls-Royce SMR** in the United Kingdom, the Czech Republic and now Sweden, as well as successive fundraising rounds by developers such as **X-energy**, **Newcleo** and **Proxima Fusion**, all point to this profound shift.

For large-scale reactors, strategies are increasingly being built around **fleet** economics. The **EPR2 programme** aims to recreate the benefits of series production through equipment standardisation, industrial continuity and greater visibility over future revenues. In the United Kingdom, **Sizewell C** marks an equally significant shift: the innovation lies not in the reactor – which is identical to Hinkley Point C – but in its financing. The adoption of the **RAB** (Regulated Asset Base) financing mechanism is intended to reduce the cost of capital by sharing risks more effectively between the state, consumers and private investors, thereby opening the way to a new class of long-term investors.

Innovative and smaller-scale reactor technologies – **SMRs** and **AMRs** – are following a path converging towards large-scale reactors. After an initial phase focused on technological demonstration, recent fundraising rounds show that investors are now financing **industrialisation pathways** designed to deploy fleets rather than just demonstrators. Companies able to secure industrial partnerships, commercial outlets and long-term financing are therefore gradually gaining the upper hand. The arrival of new buyers of low-carbon electricity, particularly major digital players facing surging data-centre demand, could also accelerate this transition by providing **PPAs** (long-term contracts) capable of securing revenues for the first projects.

This evolution is profoundly changing the sector's sources of competitiveness. Reactor performance remains essential, but it is no longer, on its own, a decisive advantage. The ability to **replicate a design, standardise equipment, secure fuel, organise a robust supply chain, attract abundant, low-cost capital** and then deploy a fleet of reactors is becoming just as critical.

For **Europe**, the issue therefore goes beyond choosing between competing technologies. The continent has a recognised industrial base, unquestionable expertise in nuclear powerplant operations and the fuel cycle. However, it **does not yet have capital markets as deep as those of the United States**. The creation of the Scaleup Europe Fund is an encouraging sign, as is the France 2030 initiative in France. But these mechanisms primarily meet innovation financing needs; **financing the transition from prototype to first commercial units is for the most part yet to be structured**.

It is likely at this stage that the reality of the nuclear revival in Europe **will be decided**. The challenge today is to create the conditions that will enable the most credible projects to reach critical mass, namely: securing initial orders, financing first-of-a-kind projects and then facilitating the gradual transition from public capital and equity to debt and infrastructure investors. **Without this financing continuum, Europe risks having the technologies but lacking the platforms capable of industrialising them.**



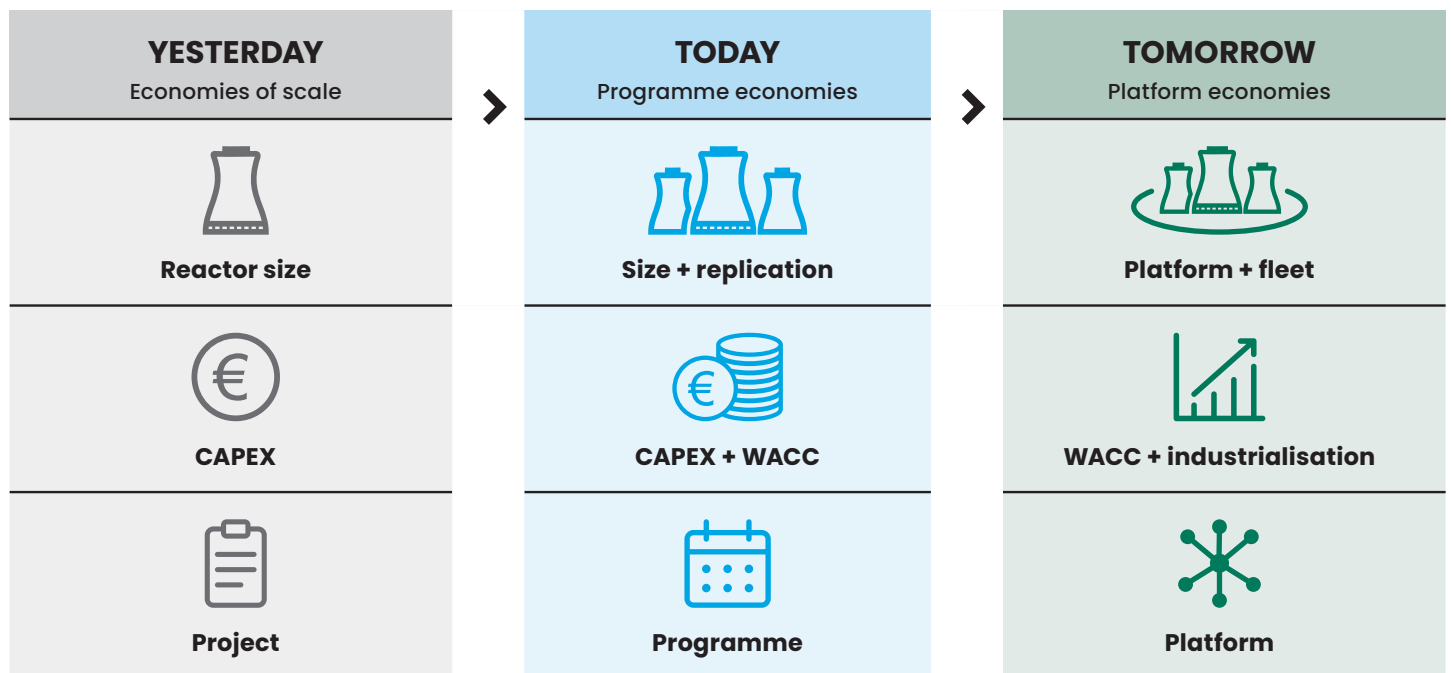
1. From economies of scale to economies of repetition

The economic history of nuclear power can be read as a succession of productivity models. For several decades, the sector developed around a logic of economies of scale. Increasing reactor output should, in theory, reduce the unit cost of the electricity produced by spreading fixed costs, pooling infrastructure and optimising operating resources. This approach largely shaped the major nuclear programmes developed in France, the United States, Japan and South Korea. Competitiveness gains came above all from the increasing size of facilities and the continuity of construction programmes.

Recent experience has, however, revealed an important limitation of this model. Economies of scale can in practice be partly offset when projects become complex enough to generate cost overruns. Extended delivery schedules on several major Western projects (Flamanville, HPC, Vogtle), the loss of industrial skills, fragmented supply chains and the rising cost of capital have all illustrated this phenomenon.

In this new environment, size remains important but is no longer sufficient. It now comes with a second source of competitiveness: economies of repetition, namely the ability to reproduce the same design several times, reuse engineering work, stabilise the supplier base and benefit from learning effects over successive builds. This logic is visible both in large-scale programmes and in SMR projects – with unit gains of up to 30% on certain cost categories – helping to shift the economic centre of gravity of these projects towards the ability to replicate an industrial model and rely on a robust financial platform.

Figure 1: From economies of scale to platform economies



Value is shifting from the reactor itself to the ability to replicate it at scale.

2. The return of large-scale nuclear depends on financial innovation

Innovation in nuclear power is not only about advanced reactors or new entrants. Large-scale programmes are also undergoing a profound transformation, driven primarily by economics and finance. Two European projects in particular illustrate this: the EPR2 programme in France and the Sizewell C project in the United Kingdom.

At first glance, the two approaches appear very different. France relies on a historically dominant integrated player and substantial public support. The United Kingdom, by contrast, places greater emphasis on opening up to private investors and on sophisticated risk-sharing mechanisms. Yet both models pursue a similar objective: reducing the full cost of capital.

EPR2: rebuilding a fleet economy

For a long time, the competitiveness of the French fleet was associated with unit size and the centralisation of the system. The logic currently being pursued for the EPR2 programme is different: in addition to the construction of several new reactors, the aim is to rebuild industrial continuity.

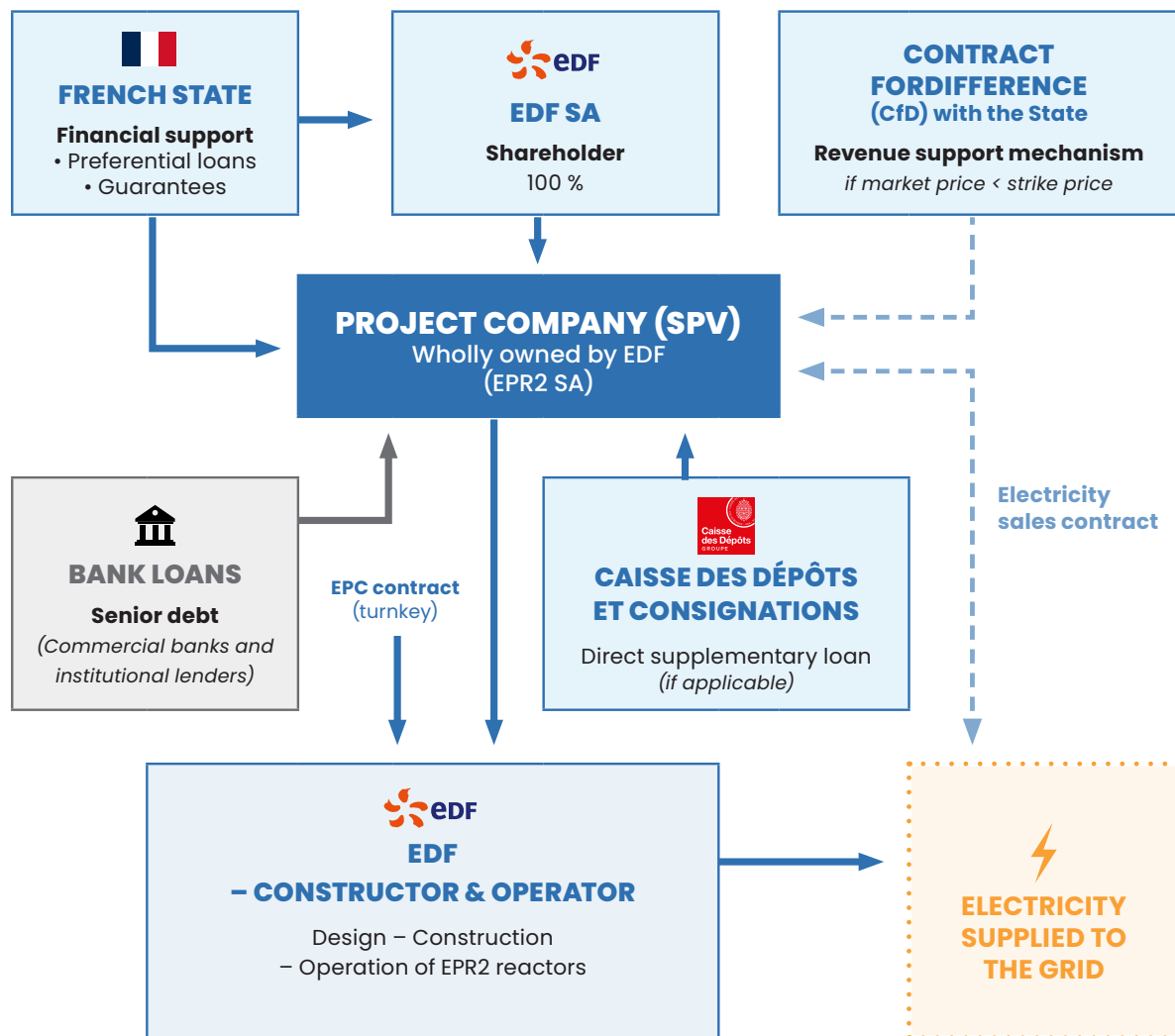
The programme is based on an initial series of six units (at a cost of around €100bn), with a possible extension pathway of up to fourteen reactors, representing nearly 23 GW of installed capacity in total. The economic objective is to improve the cost trajectory of the programme as a whole, aiming to reduce the cost of the latest reactors deployed as opposed to focusing narrowly on the first reactor alone.

This strategy seeks to recreate several levers of competitiveness: equipment standardisation, reuse of engineering work, supplier stabilisation, training of teams and continuous improvement in construction processes. In other words, the unit remains large, but the economics become those of a fleet.

The financing structure currently under consideration reflects this logic. In particular, it relies on a public loan covering around 60% of the programme's cost, supplemented by a CfD-style mechanism with a strike price capped at around €100/MWh. The programme's competitiveness will depend as much on this financial structure as on the technical performance of the reactor itself.



Figure 2: Financing structures for the EPR2 programme and Sizewell C



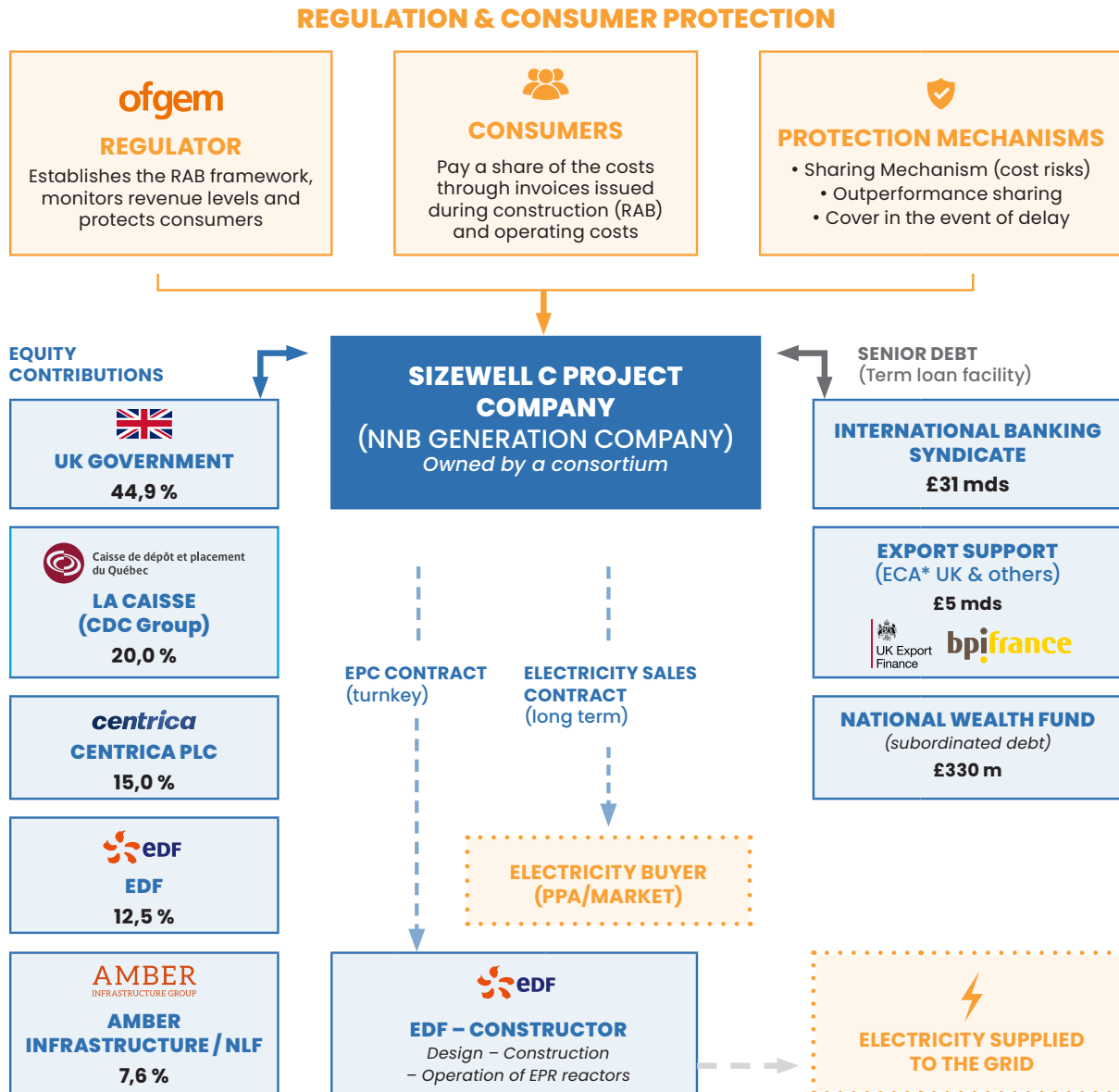
MAIN FLOWS

-  Ownership / Control
-  Financing (debt)
-  Commercial / regulated contracts

KEY FEATURES

- Significant government support (preferential loans, guarantees, CfD)
- SPV wholly owned by EDF
- Debt financing largely secured through public-sector support
- Reduced cost of capital through government backing

Figure 3: Financing structure for Sizewell C



MAIN FLOWS

- Ownership / Capital contributions
- Financing (debt)
- Regulated revenue stream (RAB)
- - - Commercial contracts
- - - Electricity flows

KEY FEATURES

- Stable revenues from the construction phase onwards (RAB)
- Risk sharing between the government, consumers, shareholders and lenders
- Extensive use of private debt and ECA-backed debt
- Access to new long-term investors

* ECA: Export Credit Agencies



SIZEWELL C: transforming the risk structure

The United Kingdom is pursuing a comparable objective by a different route. For the Sizewell C project (two reactors, with a combined capacity of 3.3 GW and a budget of more than £38bn), the main innovation is not technological – the design is identical to Hinkley Point C – but economic and financial.

The **Regulated Asset Base (RAB)** mechanism adopted for the project profoundly changes the allocation of risk between the various stakeholders. Whereas the **Contract for Difference (CfD)** model used for Hinkley Point C mainly provided visibility over future revenues after commissioning, the RAB allows a partial return on invested capital from the construction phase onwards.

Its main effect is to reduce the period during which investors tie up capital with no revenue, improve the project's monetisation and help lower its average financing cost and, consequently, the levelised cost of energy (LCOE) by £10–20/MWh – equivalent to a 200–300 basis point reduction in the cost of capital (as a reminder, HPC's LCOE stands at over £130/MWh).

More fundamentally, the RAB changes the nature of the nuclear project. It moves beyond reliance on a utility's balance sheet or direct state support and becomes an infrastructure asset whose risks are shared between public authorities, consumers, lenders and private investors.

Financial innovation therefore reduces construction costs, but it also reshapes the risk structure itself, making projects more attractive to capital providers and gradually bringing them closer to other major regulated infrastructure assets.

3. SMRs and AMRs: from financing demonstrators to industrial platforms

One of the most striking changes in advanced nuclear concerns the way investors now assess developers.

For several years, most private funding was directed towards demonstrating the technical feasibility of a concept. Fundraising essentially supported reactor design, testing, licensing procedures or the construction of a first demonstrator.

This logic appears to be changing, as investors now seek to identify players capable of **industrialising their technology** after building a first reactor. Indeed, value creation increasingly resides in the ability to standardise the design, structure a robust supply chain, secure a portfolio of projects and mobilise industrial partners over time.

Recent developments among several players illustrate this evolution.



SMR

Rolls-Royce SMR is probably the most commercially advanced example in Europe. Having secured its position in the United Kingdom with its 470 MW reactor, the company has been selected in the Czech Republic and Sweden, representing a potential total of more than 10 GW+ and showing that an SMR developer can now build a genuine **Europe-wide commercial platform**. The competitive advantage lies more and more in the ability to deploy the same design across several countries while relying on a common industrial base.



Ontario Power Generation (OPG), for its part, represents the first real industrial test for Western SMRs. With the launch of four BWRX-300 reactors at the Darlington site (c. CA\$ 21bn for 1.2 GW of combined capacity), concept feasibility has been demonstrated. The current challenge is to demonstrate its **industrial reproducibility**. Here again, the project seeks to validate a technology, a supply chain, a cost trajectory and a fleet logic simultaneously.



Newcleo offers a third illustration of this transformation. The company is developing a deeply European industrial project while raising capital on international financial markets through its proposed listing via the NewHold Investment Corp III SPAC, which values the project at \$2.4bn. This separation between the geography of innovation and the geography of capital highlights one of the major challenges facing the European industry: having a solid technological base is not, by itself, enough to secure access to the financial resources needed to scale up. The Newcleo project also illustrates another major development in fourth-generation reactors: competitiveness now also depends on **securing fuel, mastering fuel-cycle infrastructure** and, over time, offering an integrated proposition combining technology, fuel, financing and industrial deployment.



These three trajectories reflect a common evolution: investors are beginning to look beyond the technological performance and select platforms capable of combining innovation, industrial capacity, access to capital and commercial development.

The next generation of nuclear champions may well be defined by the players best able to turn technological innovation into a reproducible industrial platform, not simply by reactor design expertise.

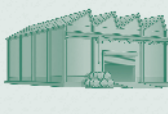
Conclusion – The next battle will be financial

For both large-scale reactors and modular reactors, the ambition is the same: to (re)build series economics. For the former, the challenge is to turn a programme into a fleet; for the latter, it is to turn a demonstrator into a platform.

In both cases, future competitiveness will depend above all on the ability to replicate reactors under controlled industrial and financial conditions. As in the space sector, nuclear power spent several decades seeking to reduce costs by building bigger.

The next phase will likely seek to gradually reduce uncertainty thanks to the construction of several projects. For Europe, the challenge is greater than the availability of nuclear technology. The true risk is that it repeats the same pattern in advanced nuclear as it did in space technologies: retaining excellent scientific and industrial capabilities but failing to create the financial conditions necessary for large-scale deployment.

Figure 4: Is the nuclear industry following the path of the space industry?

PERIOD	SPACE	NUCLEAR
1990s	 ARIANE European technological excellence Dominant position in certain segments	 GENERATION III Proven technological expertise Solid industrial references
	▼	▼
2000s	 EMERGING COMPETITION Emergence of new actors Different industrial approach	 NEW CONCEPTS Innovations (SMR / AMR) Safety, flexibility and modularity promises
	▼	▼
2010s	 SPACE X Integrated platform Reusability, launch cadence, vertical integration, access to capital	 SHIFT IN THE CENTRE OF GRAVITY Financing, industrialisation, supply chain, market access
	▼	▼
2020s+	PLATFORM LEADERSHIP • Cost per launch reduced tenfold • Constellations, services, data • Valuation > \$2 trillion • Paradigm shift	TOWARDS PLATFORM LEADERSHIP • Standardised, repeatable fleet deployment • Integrated offering: reactor + fuel + services + financing • System-wide value creation

Competition is shifting from the product itself to the ability to industrialise and finance at scale.

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