

Editorial **Nuclear energy: Reforming the electricity market and building a skilled workforce to drive revival**



Claude Fischer Herzog
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The 22nd edition of Les Entretiens Européens focused on vocational training in the nuclear sector across France and Europe. In collaboration with the Université des Métiers du Nucléaire (UMN) in France, the European Nuclear Education Network (ENEN), universities and industry partners, we engaged with institutional stakeholders to address the pressing challenge of attracting young talent to this field. This issue is dedicated to that discussion.

These questions are particularly pertinent in the context of Europe's nuclear revival – a battle we've fought and we could win after more than two decades. While nuclear energy has been experiencing a global renaissance, Europe had been retreating under pressure not only from environmentalists but also from Germany and the European Commission, who envisioned an energy mix without nuclear power. The Green Deal proposed an electricity mix comprising 80% renewables by 2050 and 100% by 2100,

effectively advocating for the complete dismantling of our nuclear fleet. Such a proposition was, frankly, absurd. We have vigorously defended and worked to renew our nuclear fleet, and develop forward-looking technologies not only for energy and the electrification of our economy but also for applications in healthcare, the arts, space exploration and digital technologies. More recently, we've campaigned for nuclear energy to be recognised as a low-carbon energy source – a scientifically indisputable fact – and for its inclusion in the EU taxonomy. We've advocated for market reform, established the *Assises européennes du long terme* (European long-term investment forums), secured recognition for SGEIs for public goods in the Lisbon Treaty and proactively proposed an energy solidarity pact in Europe. We've also called for a permanent structured cooperation among states that have chosen nuclear energy, enabling them to collaborate and invest collectively. The competitive, short-term market not only discourages long-term investments but also hinders cooperation. Under such conditions, how can we build a European nuclear industry?

We've achieved partial market reform, allowing for exemptions from competition through long-term contracts such as Contracts for Difference (CfDs), the Regulatory Asset Base (RAB) model and Power Purchase Agreements (PPAs). The next imperative is to establish an European market for nuclear skills. This is a particularly challenging endeavour given the social disparities between European states, even within the Nuclear Alliance. The Alliance member states have proposed building 150 GW of nuclear capacity by 2050 (up from the current 100 GW), which entails constructing 35 EPR-type reactors and investing €800 billion – a sum comparable to the investment proposed by President von der Leyen for rearming Europe. We must choose: power plants or weapons? We hope that young people – and those seeking career changes – will be inspired to work in the civil nuclear sector, which offers fertile ground for innovation and employment, contributing to energy security, prosperity and peace. Should the right choice be made, we will need to recruit 450,000 individuals across a diverse range of professions. Aligning supply and demand will necessitate robust cooperation and the development of networks among universities, vocational schools, businesses and regional stakeholders.

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Les Entretiens Européens 2024
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Full mobilisation for training and employment in the nuclear sector
Companies, schools, universities and institutions join the debate



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Rethinking the power system in France and Europe

Since the Belfort announcement three years ago, aimed at reviving nuclear energy, and with the forthcoming Multiannual Energy Programme (PPE) set to define the major orientations of France's energy policy, technology by technology, statements about the future of the electricity system and nuclear energy have abounded, often contradicting one another.



Claude Fischer Herzog spoke with Xavier Ursat, EDF Group Executive Director for Strategy, Technology, Innovation and Development, and newly appointed President of NuclearEurope. An opportunity to reaffirm EDF's full mobilisation across all its teams to ensure the successful revival of nuclear power – something Ursat insists must be conceived in harmony with the broader electricity system, both in France and Europe. "We must be careful", he cautions, "not to pit nuclear against renewables, or large reactors against SMRs." We need every tool available to develop our electricity system and decarbonise our economies.

Claude Fischer Herzog - What progress has been made since the Belfort declaration?

Xavier Ursat - A great deal has happened. Flamanville, France's first EPR, is nearing commissioning – a tremendous source of pride, especially for the teams involved. Receiving the green light from the French Nuclear Safety Authority was an emotional milestone, and marks the prelude to a

new series of six next-generation reactors announced by the French government.

Thanks to the EPR, Europe is a serious player in the global nuclear market. EPRs are already operational in China and at Olkiluoto in Finland, with discussions ongoing in India. We are currently preparing the next UK project at Sizewell C, following Hinkley Point C. The latter has helped restore key industrial capabilities in France, notably for Framatome. Hinkley Point C will act as the reference model for Sizewell. Repetition is key to improving performance – it's what made France's nuclear fleet such a success.

Over the past three years, EDF and the wider French industry have been working hard to re-establish serial production capabilities.

CFH - Regarding the work timeline, recruitment strategy and contracts with supply chain partners and civil engineering groups, could you provide an update on the progress made so far and how EDF is preparing to initiate the construction phase?

XU - In 2023 and 2024, EDF made significant headway resolving corrosion issues without ever compromising safety. This helped us regain credibility and efficiency, with nearly 362 TWh of production last year. Nuclear played its role as a baseload provider while demonstrating flexibility. Amid surplus electricity capacity¹, it managed to modulate output by as much as 30 TWh – a level of flexibility that played a key role in stabilising the power system, and one that reflects a uniquely French skillset, unmatched worldwide.

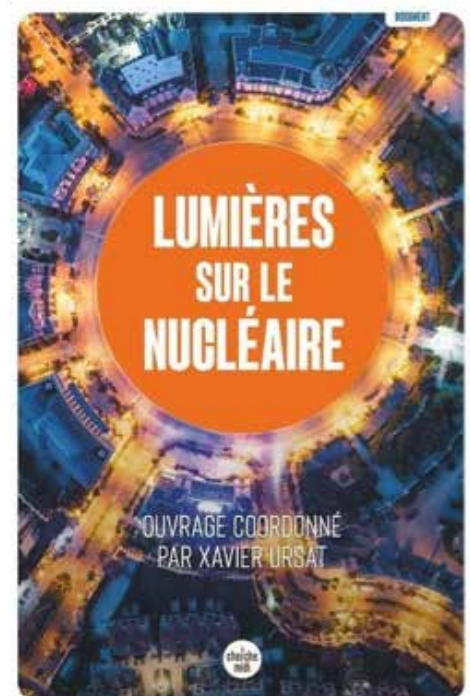
Meanwhile, we are gearing up for the next programme: three pairs of EPR2s². The basic design is complete; detailed design and execution planning are underway. To date, half of the contracts – worth several billion euros – have been awarded to compa-

nies within the sector, creating significant employment opportunities. This includes not only large industrial groups but also a wide range of SMEs and mid-cap firms throughout the country.

Nuclear is a long-term industry. Preparations are underway across the board, with initial works having started at the Penly site. Eiffage, the contractor selected for the works, is constructing the platform intended to accommodate two EPR units at the site. Framatome has announced plans to invest in a new forging workshop in Le Creusot, located in the Saône-et-Loire region. EDF is also working with GIFEN and UMN³ to train and recruit 100,000 workers over the next decade – a fantastic employment opportunity for France.

CFH - There's clear preparation with industry partners. What about with local communities and regions?

XU - At Penly, Gravelines and Bugey, we're



¹ In recent years, electricity demand has remained below the pre-Covid average (2014–2019), and despite a rise compared to 2023, it was still 12.7% lower than before the pandemic. Rather than reducing electricity production, the priority should be to increase electricity's share in overall energy consumption.

² There are plans to develop 14 EPR2 reactors by 2050.

³ The GIFEN (French Nuclear Industry Association) MATCH report quantifies the recruitment efforts the sector must undertake over the next ten years. UMN (Université des Métiers du Nucléaire), established in April 2021, has outlined the necessary actions to meet this challenge. The 22nd edition of Les Entretiens Européens, held in 2024, was devoted to these training and employment issues, which are the focus of this issue of La Lettre.

in the midst of active public consultations, an essential step to ensure public ownership of the issues. This is true for any major infrastructure project. Our aim is to ensure that project developers have a clear understanding of local expectations. Nuclear's revival hinges on societal support for the energy transition, which is about decarbonising our economies, regaining energy sovereignty and reindustrialising our regions.

Electricity supply and demand are intrinsically linked. Today, most energy consumption still relies on fossil fuels. The priority is to boost the use of low-carbon electricity. This requires measures targeting electricity demand, with the electrification of end uses set as a strategic imperative.

CFH - From supplier design to scheduling, final costing and funding plans – the government is pushing for a decision by 2026, aiming for first commissioning in 2038, as proposed by EDF. But how does the EU factor in? Can you clarify the European conditions at play?

XU - Our discussions with the European Commission will follow the State Aid framework. Just as with Hinkley Point C and more recently in the Czech Republic, the Commission will review our proposed financing models.

CFH - But is the current competitive market fit for nuclear, which serves public interest missions in France and solidarity needs across the EU? Shouldn't we reform market organisation and regulation to ensure affordable, coherent tariffs aligned with long-term, high-yield investment?

XU - Each Member State must define its energy mix based on its resources and economic model, aiming for a "carbon-neutral mix". In France, the government is finalising its energy roadmap to 2035. At the European level, we're calling for a level playing field where all players adhere to the same rules. We must adhere to economically viable approaches that prioritise the public good and ensure the effective operation of the power system. Both European and national energy strategies need to better reflect supply-demand dynamics. Only a complementary approach – nuclear alongside renewables – can deliver an effective, equitable electricity mix.

CFH - What's at stake for Europe?

XU - The stakes are enormous. Around fifteen countries have opted for nuclear

energy. Europe can build a competitive industry, but it must embrace "repetition" – standardised industrial organisation that leverages economies of scale. The French model alone won't suffice. There's room for several approaches, provided we're effective and cooperative. The scale of demand is immense: Nuclear Alliance member states plan to install 150 GW of nuclear generation capacity in Europe by 2050 (currently 90 GW), which will entail maintaining and upgrading the existing fleet, as well as constructing 35 medium-sized reactors (1,000 MW) and deploying SMRs.

CFH - The Commission is backing SMRs. Is this at the expense of EPRs?

XU - Most states will pursue large reactors. SMRs are geared toward complementary markets: replacing small fossil plants or supplying industrial heat. Start-ups are innovating and raising capital. The Commission helps fund and promote them, which is a welcome move.

For large reactors, we need series effects, an open framework and a level playing field. EDF has potential projects in Sweden, Slovenia and the Netherlands, where discussions are progressing well.

Europe must now commit decisively to widespread electrification of energy usage. The real issue is the electricity system at the European scale – developing robust technological and industrial supply chains to ensure decarbonisation and energy sovereignty.

Paris, le 7 mars 2025



From Hinkley Point to Sizewell

The UK is building its nuclear future as Europe grows stronger

Since 2018, the Hinkley Point C site has engaged 10,500 workers to build two EPRs, with the first set to come online by 2029. This will be the first reactor of a new series in the UK, which has not constructed a nuclear power station in three decades, and the fifth of its kind worldwide – drawing on the operational feedback from China, Finland and France. This offers a significant advantage in terms of safety, but also created scheduling difficulties, with the first unit requiring 7,000 design changes. Although the EPR has faced major delays (exacerbated by the Covid period), raising construction costs to £40 billion, the second reactor is advancing more efficiently thanks to design refinements and the experience acquired by the workforce, thereby reducing associated costs and risks.

EDF, which has borne the entire construction cost following the exit of Chinese firm CGN, will only begin to receive returns once the plant is operational and producing electricity. In doing so, the French group has supported the UK's revival of its nuclear sector, contributed to its continued leadership in the European market, and helped position companies such as Framatome as key industry players. Repetition is clearly a major asset, both for industry and for the UK, which has now confirmed it will proceed with two more EPRs at Sizewell in the south of England. A promising future for EDF, the British industry and Europe's nuclear sector.

The recruitment challenge

Patricia Austin, CEO of the UK's National Skills Academy for Nuclear (NSAN), speaking at the April 2024 Les Entrepreneurs Européens, stated the workforce must grow from 93,000 to 123,000 by 2032. A tough challenge: recruitment has stagnated for two decades, 35% of workers are over 50, and 43% of vacancies are unfilled.

A ten-year national skills plan is underway, focusing on four key areas: project control, welding, safety and radiation protection. A number of measures have been launched, such as a "Boot Camp" scheme that provides job interviews after accelerated training, alongside a major national awareness campaign highlighting job opportunities – garnering 11 million views in three months. The sector is funding 51,000 scholarships to promote university-level industry training. A dedicated outreach programme is also targeting career changers with no prior nuclear experience.

CFH

LES FOSSILES ÇA S'IMPORTE, L'ÉLECTRICITÉ ÇA RAPPORTE.

L'électricité rapporte 5 milliards d'euros à la balance commerciale française. Les énergies fossiles, elles, coûtent au pays 64 milliards d'euros*.

L'ÉLECTRICITÉ,
ÇA NE FAIT QUE COMMENCER

* Bilan électrique 2024, RTE, page 26. [edf.fr/climat](https://www.edf.fr/climat)

L'énergie est notre avenir, économisons-la!

NUWARD: The SMR complementing the EPR



Julien GARREL

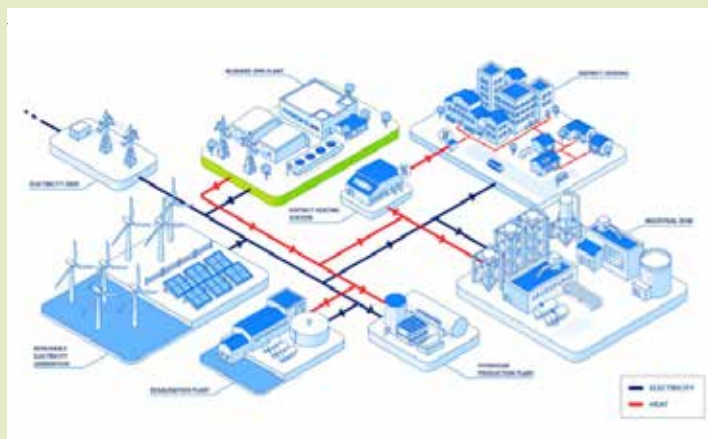
Director,
NUWARD

According to the International Energy Agency (IEA), achieving carbon neutrality by 2050 could require the deployment of around 100 small modular reactors (SMRs) in Europe (equivalent to 30 to 50 GW) and between 500 and 700 globally (representing 160 to 300 GW).

In France, the NUWARD SMR is being developed by NUWARD, an EDF subsidiary. This third-generation small reactor aims to become a key driver of competitiveness and decarbonisation in Europe and beyond. It targets two major application areas:

- **Power generation** to replace coal-fired plants and meet the surging demand from data centres and other energy-intensive industries, in complement to renewable sources.
- **Heat production** for energy-intensive industrial processes (such as food processing, paper manufacturing, chemicals and low-carbon hydrogen production), as well as for industrial hubs and urban heating networks.

The NUWARD SMR will be capable of delivering up to 400 MWe of electrical output and up to 100 MWth of thermal output in cogeneration mode.



Designed for simplicity, modularity and prefabrication, the NUWARD SMR aims to ensure cost competitiveness for its clients. The project draws on EDF's 60 years of experience and expertise in pressurised water reactor (PWR) technology, across design, construction and operation. To optimise both cost and construction timelines, the NUWARD design is based on proven technology blocks and equipment already used in nuclear plants worldwide. Modularity is a core design principle, enabling maximum prefabrication and pre-assembly in factories, thereby enhancing control over project delivery and construction timelines. NUWARD is advancing this aspect of its SMR design within a European partnership strategy.

The NUWARD SMR project will also strengthen European sovereignty by relying on a European supply chain. It benefits from the industrial capabilities of France's nuclear sector – particularly Framatome – and from EDF's established international supply chain. NUWARD is engaging European partners, especially in the area of modularisation, to accelerate the deployment of its technology by the 2030s. The goal is to build the first unit in France, while simultaneously pursuing international opportunities, particularly in Europe.

NUWARD SMR complements EDF's fleet, alongside the EPR family, enabling the group to respond to a wide range of grid and site constraints in countries seeking to develop nuclear energy. Its high degree of standardisation and modularisation, together with the economies of scale made possible by prefabrication and partial factory assembly, are key features that will support competitive electricity generation costs.

PPE3 : Towards a coherent law this autumn

As France prepares to adopt its third Multiannual Energy Programme (PPE3), opinions are divided. Some are calling for a revision of the government's draft proposal¹, while others argue that the urgency of transitioning to carbon neutrality demands swift action – without setting energy sources against one another². A new law, expected this autumn, would be preferable to a simple decree. However, it must go beyond the current PPE's inconsistencies and fill in its many gaps.

The law should be grounded in projections for electricity demand, which in turn depend on economic growth forecasts and assumptions around a balanced energy mix. Achieving the urgent objectives of reducing fossil fuel consumption and electrifying end uses³ will require additional low-carbon electricity production capacity, with renewable energy sources playing a complementary role alongside nuclear power – as Hervé Fischer explores in his article⁴.

Incoherent figures

The current PPE is flawed in its projections for intermittent power sources – wind and solar – which are known to create strain on both the grid and the market. If, as foreseen in the programme, France can deliver an additional 260 TWh by 2035 – split between 40 TWh from existing nuclear capacity and 220 TWh from thermal renewables (heat, biogas, biofuels) – what is the rationale for adding another 85 TWh of intermittent renewables by 2030 and 180 TWh by 2035?

Additional intermittent renewables may indeed be needed in the interim, pending the arrival of new nuclear generation, or greater use of cogeneration from the existing nuclear fleet, which holds a potential of at least 400 TWh. But this need should not exceed 90 TWh by 2035, a figure equal to the surplus exported in 2024 due to lack of domestic demand. This is half the volume proposed in PPE3 and should be sufficient to meet the rising needs of electrification.

Questions of effectiveness

If thermal renewables are to carry the bulk of decarbonisation in heating, transport and industry – at affordable prices – then the value of expensive, intermittent electricity for converting these uses warrants scrutiny. Equally questionable is the resource waste implied by the current business model in the wind and solar sectors, which relies heavily on subsidies and financial incentives. Several European countries, including Sweden, are rethinking the market model imposed by the European Commission – one that has led to inflated energy prices.

So why insist on rapidly ramping up intermittent renewable generation despite well-documented challenges in technical integration, economic viability and social acceptance? Unless there is serious doubt about the capacity of thermal renewables to deliver the expected 200 to 300 TWh without unsustainable pressure on biomass, biodiversity and carbon sinks – as some studies suggest – or unless there is a lack of political will to restore the performance of the existing nuclear fleet, there seems little justification for producing 180 TWh of additional intermittent renewables by 2035.

It is also legitimate to question the absence of any comprehensive plan for flexible electricity solutions (beyond pumped storage), without which both the electricity market and the grid risk collapse. Likewise, the PPE3 remains silent on assessing and minimising the cost per tonne of avoided carbon. Finally, how can one not be concerned that this forward-looking programme to 2035 says nothing about fourth-generation nuclear deployment, leaving the future to be defined solely by start-ups?

Let us hope that the upcoming parliamentary debate will lead to a coherent, forward-looking text – one that encourages business investment in the technologies essential for decarbonising both our energy systems and our economy.

Claude FISCHER HERZOG

CNDP - Moving beyond the binary debate



The President of the Republic has pledged to revive nuclear power in France. The Nuclear Policy Council has proposed initiating work to extend the lifespan of current reactors and

set the roadmap for constructing six new EPR2 reactors. But there is a long journey ahead before any final implementation decisions are made... In France, a country defined by its procedural rigour, there exists the national public debate authority: the Commission nationale du débat public (CNDP). This body organises months-long consultations on major decisions – sometimes even after laws have been passed. It effectively reopens the “for or against” debate regardless of the subject at hand, as occurred with the nuclear waste management discussions and, more recently, the projects for reactors at Gravelines and Penly. ASCPE contributed comments on the legislative objectives framing the EPR2 projects and the European electricity market reform that will allow France to finance these investments. On this occasion, ASCPE also questioned the role of the CNDP. In our view, the Commission should not delay decisions, but rather reinforce them by fostering societal ownership of this major choice for France's and Europe's future – a choice that commits the entire society: the State, EDF (its leaders and employees), the entire nuclear industry, companies in other industrial and tertiary sectors, the regions and citizens themselves. The CNDP has a specific responsibility to move beyond the simplistic “for / against” framing, to clarify the terms and context of the debate, and thereby support civic participation and mobilisation. This is essential to ensure the success of the nuclear programme reboot – without which any energy transition or sustainable growth will remain empty rhetoric!

¹ See reports, opinions and statements from the academies of science and technology, the High Council for the Climate, the Environmental Authority, the High Commissioner for Nuclear Energy, the National Council for Ecological Transition, as well as from SLC, PNC-France and the Sustainable Environment Federation.

² See the joint statement by around twenty energy federations and professional organisations, including renewable energy stakeholders, the French Union of Electricity (UFE), the French Nuclear Industry Association (GIFEN) and the French Nuclear Energy Society (SFEN).

³ The aim of the PPE (Programmation pluriannuelle de l'énergie [Multiannual Energy Programme]) is to reduce fossil fuel consumption, targeting 60% decarbonised final energy by 2030 (approx. 850 TWh), and 70% by 2035 (770 to 910 TWh depending on the total final consumption target of 1,100 to 1,300 TWh).

⁴ “Why are synergies necessary between renewables and nuclear power?” – see his article on page 6.



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WHY ARE SYNERGIES NECESSARY BETWEEN RENEWABLES AND NUCLEAR POWER?



The electrification of the 1,200 TWh of energy to be consumed in France – and of the 9,000 TWh projected across the EU by 2030 – is no longer optional.

The deadly squeeze of mounting constraints on fossil fuel supply, combined with the effects of climate change, leaves us no choice.

In France, the Multianual Energy Plan targets 60% decarbonised final energy by 2030. Achieving the “Factor 4” emissions reduction by 2035–2040 – and carbon neutrality by 2050 – will require at least 200 TWh more low-carbon electricity in 2035 than in 2023. Restoring France’s historic nuclear fleet and bringing new EPR reactors online could deliver 50 TWh, but the remainder will need to come from renewable sources. Pending the commissioning of EPR2 reactors, we will need to produce three times more renewable energy than additional nuclear energy by 2035. In Europe, where nuclear capacity is more limited, the share of renewables will need to be even greater, incorporating significant volumes of non-electrical renewables such as renewable heat, biogas and biofuels.

Building genuine complementarity between sources

There is no longer time for hesitation – a strategic alliance between nuclear and renewables is now an absolute imperative. But we must develop genuine complementarity between sources and put an end to renewable schemes that undermine performance, price stability and security of supply across the European grid¹.

Let’s consider the stakes. By 2035, average daily French electricity consumption from non-dispatchable renewable sources (run-of-river hydro, wind and solar) will exceed

500 GWh – double today’s level – and will regularly surpass 50% of available dispatchable capacity during the summer. With the current system, this mix will generate frequent periods of negative prices and severe curtailment when excess renewable output overwhelms the grid. Conversely, it will also result in equally frequent episodes of price spikes and dark doldrums, when renewable generation drops off entirely.

We are already seeing these phenomena across Europe². Containing them by 2035 will require the deployment of a mix of solutions: storage systems, demand-side response and dispatchable

backup capacity, totalling several dozen gigawatts of flexible, controllable power – along with updated market regulations. Yet France’s 5 to 6 GW of pumped storage (STEP) and batteries offer less than one hour of coverage at the current average output level of variable renewable energy (VRE). Our demand response capacity is limited to just over a dozen GWh. This underscores how far we have to go if we want to increase the share of VRE in the energy mix while keeping prices and grid stability in check, and the cost of doing so if we refuse to include nuclear backup and continue to undermine its performance with inadequate rules.

Encouraging electricity consumption

To make the system work, we must first align the pace of connecting new VRE with the speed at which fossil fuels are being replaced by low-carbon sources. What good is tripling VRE capacity if there is no outlet for the energy produced, if it destroys the economic viability of dispatchable generation, and simultaneously drives up prices for end users? France’s 90 TWh of electricity exports in 2024 illustrate just how much the domestic market struggles to absorb its own decarbonised output. Accelerating

the transition requires targeted price signals and incentives to encourage electricity consumption:

- lowering electricity taxes while increasing taxes on fossil fuels – France currently taxes a kilowatt-hour of electricity twice as heavily as one of gas³;
- strengthening incentives for electric vehicle purchases – while Germany has eliminated its scheme and France is cutting back its own;
- increasing support for replacing oil and gas boilers with heat pumps – despite these measures being reduced in the latest French budget.

Ensuring a level playing field for nuclear

Given the pace of decarbonisation required across energy consumption, the regulatory frameworks and market rules must be adjusted to mitigate the adverse effects of large-scale deployment of VRE and to ensure that nuclear receives equitable treatment:

- align the post-Arenh system with the feed-in premium mechanism used for VRE installations, or extend Contracts for Difference (CfDs) to nuclear;
- replace national targets for renewable shares in the energy mix with shared targets for low-carbon energy consumption, and include nuclear in all European Green Deal support mechanisms and the Fit for 55 package;
- require VRE installations operated by commercial entities to participate in both upward and downward balancing mechanisms, penalise the failure to provide reliable generation forecasts, and ban automated curtailment currently triggered by a single price signal – a practice that, by 2030, could involve such volumes of VRE that it would exceed primary reserve capacity.

Improving supply and demand flexibility

The system’s flexibility must also be increased by scaling up both supply-side

¹ I previously analysed the problems caused by the non-cooperative integration of intermittent renewables (VRE) into the energy mix in *La Lettre des Entretien Européens*, October 2019 and January 2021 issues.

² France recorded 147 hours of negative electricity prices in 2023, rising to 233 hours in just the first half of 2024. In Germany, the figure is twice as high. During such episodes, VRE curtailments exceeding 10% of demand are not uncommon – enough to threaten grid stability. In November 2024, Germany’s wind and solar fleet, with a total capacity of 166 GW, delivered less than 1 GW for 16 consecutive weekday hours, providing less than 0.2% of the 5 p.m. peak demand. These high-risk “dark doldrums” events resulted in spot prices and carbon intensities exceeding €800/MWh and 500 gCO₂/kWh, respectively. Yet France plans a similarly sized VRE fleet by 2035.

³ That’s 20 times more than heating oil or gas when taxes are calculated per kilogram of CO₂ emitted!

⁴ By 2035, France’s low-voltage solar PV fleet is expected to exceed 30 GW. If feed-in tariffs guaranteeing fixed profits remain in place, these installations will remain unresponsive to price signals or grid-balancing needs.

and demand-side solutions for storage and response. The diffuse sector⁴ must be part of this effort – moving from a passive role in the electricity system to an active contributor to grid balancing. This calls for the phase-out of feed-in tariffs, replaced by feed-in premium mechanisms that include mandatory participation in balancing markets, with penalties and bonuses tied to proportional intra-day storage and self-consumption solutions. New contracts could even take the form of CfDs indexed to the average full cost of supply, with any surpluses and penalties used to fund bonuses that help operators meet their new flexibility obligations – and to compensate for nuclear production that is curtailed to offset capacity shortfalls. Rapidly deployable batteries and other storage devices⁵ will play a critical role, with charging and discharging incen-

"The regulatory frameworks and market rules must be adjusted to mitigate the adverse effects of large-scale deployment of VRE"

tivised through finely tuned price signals. The potential of STEPs also remains underutilised – it is urgent to unlock additional GW of capacity. None of this will function effectively by 2035 and beyond unless the share of nuclear energy increases in parallel. Without this, VRE deployment will be compromised⁶, CO₂ emissions will not fall fast enough (by 4-5% per year over several decades), and the cost per tonne of carbon avoided will be prohibitively high – all without even guaranteeing the security of the power system, which our future will depend on more than ever. Bringing all fourteen planned reactors in France into operation as quickly as possible, without reducing output from the existing fleet, is therefore a minimum requirement. Moreover, decarbonising industry and agriculture, as well as enabling inter-

seasonal energy storage via hydrogen, will require an equivalent increase in low-carbon generating capacity.

Hervé FISCHER

President, EuroLorraine



Electrifying uses! In 2010 and 2011, ASCPE organized Les Entretiens: « Clean Car » and « Sustainable Agriculture », coordinated by Hervé Fischer. Then, in 2019, an edition brought together electro-intensive sectors with nuclear industry stakeholders in Helsinki « A New Electric Era with New Nuclear Power ».

⁵ Electric water heaters already offer 10 GW of storage capacity, and government incentives will be needed to phase out oil- and gas-fired models. Meanwhile, EV batteries will soon be able to absorb and feed back several dozen GWh of electricity daily – but the infrastructure to enable this still needs to be built.

⁶ VRE operators who have failed to anticipate the rapid rise in hours of negative pricing and curtailments outside of balancing mechanisms now require a broader base of flexible nuclear capacity to keep their business models viable.



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Too much intermittent renewable energy in PPE3: Concerns from *Les Gardiens du Large*

The third Multiannual Energy Programme (PPE3), which runs until 2035, proposes tripling installed capacity of intermittent renewable energy from 42 GW to 138 GW – without increasing dispatchable power capacity, which remains at 92 GW.

What contribution to climate action in France?

The graph (from the 2023 report of the RTE (Réseau de transport d'électricité [French transmission system operator])) illustrates the evolution of greenhouse gas emissions from France's electricity generation between 1950 and 2023. It highlights the dramatic positive impact



of nuclear power since the 1980s and the limited influence of intermittent renewables, despite massive deployment (42 GW) between 2008 and 2023 – a period when electricity demand stagnated.

To justify the growth of intermittent renewables, the authorities are banking on a sharp increase in electricity demand over the next decade. But the facts are stubborn: demand has been flat or falling for 20 years (RTE 2023), and anticipated growth in new uses of electricity is being held back by current economic conditions.

A steep rise in electricity bills

Experience shows the enormous investment required for intermittent renewables. Depending on the source and methodology, the 42 GW installed by 2023 cost between €100 and €300 billion (I4CE), resulting in a doubling of household electricity bills – driven by soaring taxes (CSPE, TCPE, TURPE, VAT).

For the coming decade, grid investments by RTE and Enedis attributable to

intermittent renewables are estimated at €200 billion (RTE, p. 13), not including subsidies, externalities and related costs.

Offshore floating wind, still industrially immature, will certainly exceed the average cost of fixed offshore wind, which the CRE estimates at €195/MWh by 2025 – excluding grid connection and external costs.

Missing from PPE3: Assessment of environmental and socio-economic impacts

Warnings from the French council for nature protection have gone unheeded (here and here). Yet with 3,000 km of coastline and its position as Europe's western maritime frontier, France bears major responsibility for the health of the ocean and its biodiversity (here and here).

The same neglect applies to socio-economic impacts, including food security (agriculture, artisanal fishing).

Les Gardiens du Large

Breton environmental association
www.gardiensdularge.org

What game is the Cour des Comptes playing?

The Cour des Comptes (France's supreme audit institution) is not short on contradictions. On 14 January 2024, it praised France's nuclear revival via the EPR fleet, suggesting that 30 reactors – not just 14 – would be needed to address energy security, emissions reductions and Paris Agreement targets. Yet months later, it sowed doubt by raising concerns over costs and profitability, pointing to the Flamanville experience¹ and questioning synergies between national and international programmes – without adequately addressing EDF's rebuttals. What the sector needs now is not more recommendations, but support from an institution that puts figures into context – aligned with France's strategic interests.

The Cour's profitability analysis is based on Flamanville – forgetting it is a first-of-

its-kind unit that helped restart the French industry. Funded entirely from EDF's own capital, it received no state aid. One might have hoped the Cour would propose that nuclear – now entering a new investment cycle – receive support equivalent to that granted to renewables², including, for instance, a guaranteed feed-in tariff and a zero-interest loan during construction, as seen with Dukovany 5 in the Czech Republic.

Is it not counterproductive, as the Cour proposes, to await European Commission approval for investment financing (a process likely to take a year) if it means slowing the momentum of industry engagement in these projects? It also asks EDF to ensure new international projects generate quantifiable synergies with the EPR2 programme, without slowing the do-

mestic timetable. A difficult balancing act. Furthermore, the recommendation that EDF hold off on Sizewell C until it lowers its financial exposure to Hinkley Point C fails to recognise the strategic necessity of developing serial production – both in the UK and across Europe – as a key lever for cost reduction. Isn't one of the main goals of EDF's international expansion to elevate the French nuclear sector to industrial scale – and to avoid, as CEO Luc Rémond warned, the "risk of our industry being marginalised in Europe by aggressive Korean and American competitors"?

Claude FISCHER HERZOG

¹ The Cour des Comptes provided an updated investment cost for Flamanville 3, now expressed in 2023 euros (€2023), whereas the previous estimate was in 2015 euros (€2015). Accordingly, the construction cost, which EDF had revised to €13.2 billion (€2015) in late November 2023, is now assessed at €15.6 billion (€2023), accounting for inflation. According to SFEN, this is the figure that should be compared to the initial construction estimate of €3.3 billion (€2005).

² As a reminder, the offshore wind farm at Saint-Brieuc has, since commissioning in 2023, benefited from a guaranteed feed-in tariff of €155/MWh over 20 years – a rate that, among other outcomes, enabled the construction of the Le Havre factory for turbine manufacturing.

Financing investments: The responsibility of the State and the Union

In his article, Philippe Herzog, former advisor to the Directorate-General for Internal Market and Financial Services at the European Commission, highlights the political responsibility of our leaders in today's complex macroeconomic context. The unique nature of nuclear investment demands innovative solutions in electricity market regulation, pricing and financing. He advocates for a coherent financial framework underpinned by new financial instruments – specifically bond-based funding in both France and Europe.

The financing of France's nuclear fleet is currently the subject of discussions between the State and EDF, which remain behind closed doors. Here, we propose a few principles and pressing questions on the matter.

These investments are public goods. They aim to provide continuous, affordable baseload electricity for all. Estimates place the cost for six EPR2 reactors at €100 billion.

These are long-term investments. It is essential to distinguish between the preparation and construction phase – lasting around ten years and characterised by high costs and risks – and the operational phase, spanning several decades, when returns will begin to materialise.

While the societal benefits are clear, the costs and risks require patient capital and guaranteed future revenues.

A dual political responsibility

EDF must maintain strict industrial cost control and mitigate operational risks. It can do this more effectively if it benefits from economies of scale within the wider European nuclear revival.

Patient investors will only engage if financial risks are reduced – which can only be achieved through risk-sharing mechanisms.

This is where politics comes in. The State's decision to nationalise EDF significantly increases its own responsibility. The European Union shares this responsibility, having pursued an energy policy that failed to ensure supply security. The long-standing exclusion of nuclear energy has increased Europe's reliance on fossil fuel imports. Today, this policy legacy is reflected in a marked

decline in grid stability and rising system costs, driven by a regulatory framework that prioritised intermittent renewables over domestic energy sources. Recent grid disruptions in Spain and Sweden underscore these vulnerabilities.

A fragile macroeconomic environment demands public guarantees

Electricity demand is expected to rise with the electrification of end uses. This necessitates a revision of the current energy pact. It is true that the macroeconomic environment for financing long-term investments places significant constraints on political choices. France is over-indebted and under pressure to reduce public spending. The EU continues to impose constraints via the Stability Pact, while failing to assume a direct role in financing, lacking both a unified capital market and a venture capital industry¹.

Nonetheless, even in the face of pronounced macro-financial volatility, substantial liquidity exists among international investors, which could be directed toward long-term projects – if underwritten by public authorities.

Solutions to nuclear financing exist. They concern both market regulation and financing structures, and must be brought into public debate.

Towards a market regulation that supports long-term investment

EDF remains a national company, but it also plays a vital role in the European market. The EU must put an end to the disproportionately favourable treatment of intermittent renewables, which now dominate and have destabilised the electricity system. Long-term contracts are needed to guarantee nuclear project returns. France has opted for Contracts for Difference (CfDs), as in the UK with Hinkley Point C. But EDF must resist pressure from energy-intensive industries pushing for unrealistically low long-term tariffs that ignore actual production costs. Moreover, the EU must accept responsibility for restoring grid resilience and ensuring equitable access to affordable electricity.

A coherent financing structure

Financing must be structured around the two phases of the investment cycle. During the first, capital-intensive phase with no immediate return, substantial bank credit is essential. **A syndicate of national banks may be urgently needed.** In parallel, long-term investors must be mobilised. EDF could fund part of the investment through retained earnings – if the State stops siphoning them off as dividends.

Being state-owned, EDF has no shareholders on the stock exchange – a possible advantage given current market volatility.

Instead, abundant private savings offer a major funding source via bond issuance.

For this to work, savers must be offered decent returns. The State has indicated that the Caisse des Dépôts could manage the transformation of savings into nuclear investments. But with significant defence funding needs also on the table, can it finance both? And what about infrastructure priorities like healthcare?

Additionally, European borrowing capabilities must be reconsidered. Particularly as investors are calling on public authorities to offer alternative investment options to the government bonds of heavily indebted states (*Financial Times*). Nuclear investment could provide a credible and attractive alternative. A dedicated European financial asset for nuclear investment is conceivable. Existing and future national debts could be pooled. Such an approach is already envisaged for defence, with the EU announcing €150 billion in pooled debt, to be managed via a defence investment fund.

Financial creativity is abundant; it is political commitment that remains in question.



Philippe HERZOG

Economist, former
Member of the
European
Parliament

¹ These proposals were first introduced in 2009 by the *Assises européennes du long terme*, launched by *Confrontations Europe* with the participation of Philippe Maystadt, during the time when Claude Fischer Herzog and I chaired the association. See the 40 proposals for an action plan in the special issue of *L'Option: Contribution to a European Investment Strategy*, Philippe Herzog, April 2014.

European Commission: One step forward, two steps back !

After two decades of denying its nuclear policy, the European Union has seemed to be making progress on this issue over the past three years, during which, let's face it, some civil society actors have spared no effort to give nuclear power a future... But we must not spare our future efforts, says Marc Deffrennes, because nothing is definitively won yet.

Significant but limited steps

Including nuclear power in the taxonomy was the first step towards its recognition, in line with environmental objectives. It's certainly not perfect, as nuclear power is considered alongside gas as a «transition» energy, but given where we came from, it was a notable achievement. Then, the inclusion of nuclear power as a strategic technology for which the industrial base must be (re)deployed in Europe in the NZIA (Net-Zero Industry Act) was another significant step. But here again, this is limited, since the Commission did not consider it necessary to include nuclear power in a study launched in March 2024 on how to revive the industrial sector in low-carbon energies. As for the reform of the electricity market, the Commission introduced the CfD (Contract for Difference) and the PPA (Power Purchase Agreement) for financing investments, including the life extension of existing nuclear plants. This is another step in the right direction, even if it does not yet represent the necessary deep structural reform of a market that has become shaky. Finally, the launch of the Industrial Alliance for SMRs opens the door to a potentially significant contribution from nuclear power to the production of heat and electricity for the decarbonization of entire sectors of industry, beyond the supply of electricity to the grid.

Do not relax our efforts.

This is not the time to relax our efforts, because the battle is not over. Just look at how Germany is maneuvering in the Gas-Hydrogen file to combat the proponents of a very low-carbon Hydrogen approach, including via nuclear power. And one can only be surprised by President Von der Leyen's proposal to jointly place in key positions in her new Commission, Ms. Ribera as Vice-President, who oversees the Competition, Climate, and Energy files for a streng-

thened Green Deal, and Mr. Jørgensen as Energy Commissioner, whose anti-nuclear positions have been published. Nothing or almost nothing on nuclear power during their hearings in Parliament. For Mr. Jørgensen, no «Nuclear Act», a mention of SMRs, but business as usual questions on «safety and waste» and a focus on the need for independence from Russia for nuclear fuel and technology... No respect for the promotional spirit of Euratom Treaty on the part of the Commissioner in charge of Energy!

Nuclear, renewables: reversing the trend

It is high time to restore the balance between the environment, the economy, and reliable energy supply. Energy is the lifeblood of society; it is a common good. We must abandon the green dogma, of which the Green Deal is and remains the symbol, and not miss the opportunity to replace it with the Clean Industrial Deal. In terms of electricity, we must reverse the trend and prioritize nuclear power over the massive and prioritized deployment of intermittent renewables. Indeed, the total costs associated with managing intermittency—costs of adapting transmission and distribution networks, costs of gas-fired power plants with carbon capture and storage, costs of battery farms, and, for those who believe in P2P (Power to Power), the cost of the hydrogen sector—are enormous. The 2019 NEA system cost study, like that of the MIT, shows that beyond a fraction of around 40% of intermittent renewables in the decarbonized electricity mix, it is no longer economically optimized. Another illustration comes from Germany and their Energiewende. The Germans spent the equivalent of 100 EPR2s at 10 billion each on intermittent renewables and adapting the high-voltage grid over 20 years, which could have produced 15 times more baseload electricity for the same amount of money spent... A German example not to be followed. Once and for all, it must be said loud and clear, and repeated over and over again. We propose producing 50% nuclear electricity for basic consumption, supplemented by other low-carbon means for the rest, including intermittent renewables, a far cry from the 85% renewables of Vice-President Timmermans, high priest of the Green Deal... not to men-

tion the 100% renewables of the gentle green dreamers.

Structural reform of the market.

Obviously, this also implies that the electricity market must be structurally reviewed. The order of merit based on marginal cost can no longer do the job. If nuclear is the cheapest when all costs are integrated, it must have priority to supply the base, and the order of merit must be modified. We could even imagine removing nuclear from the market with a kWh price reflecting its costs. Other sources, including renewables, would compete on the market with all their costs in their backpacks—basically, by becoming dispatchable so as to respond to demand flexibly. Utopian, many would say. True... but it shows that the system we've been led to believe is ideal for lowering prices is unsatisfactory. It needs to be reformed from top to bottom. Will the European Union, and the Commission in particular, be capable of this? We fear not, given the current state of affairs. Member States that consider nuclear power a priority at home must therefore work together in enhanced cooperation. They will have to ensure that the massive deployment of intermittent renewables elsewhere, which have priority access to the network, does not disrupt the advantage their nuclear power gives them. Otherwise, they might consider limiting electricity exchanges and interconnections with certain neighbours. This could be a final bargaining chip with anti-nuclear Member States to make them see reason.

Marc DEFRENNES
President of weCARE



Nuclear power in Belgium: a tumultuous history with a happy ending

Belgium has a rich and complex history with nuclear energy. Since the 1960s, the country has developed a significant nuclear infrastructure that plays a crucial role in its energy supply, as Henri Marenne points out in his article. Intense debate - fuelled by environmental concerns - has just resulted in the abolition of the nuclear phase-out law.... A victory for our friends at 100TWh and WeCare... and for Belgium!

Nuclear power: a valuable heritage and an asset

Belgium was one of the first European countries to have a nuclear reactor, and has always been at the forefront of research in this field thanks to its Nuclear Energy Centre in Mol. The first BR1 reactor, commissioned in 1956, has been immortalised by Hergé in the Tintin comic strip 'Destination Moon'. But it was not more than a research reactor.

Belgium's real entry into the commercial nuclear age came in 1975 with the commissioning of the Doel power station near Antwerp and the Tihange power station near Liège, built to meet the country's growing demand for electricity and to reduce its dependence on imported fossil fuels in the context of the oil crisis.

Both sites host 7 nuclear reactors which, at their peak, supplied more than 50% of the country's electricity, nearly 50 TWh. This production capacity has been a major advantage for Belgium, providing a stable and inexpensive source of energy without any major incident for more than 40 years.

Nuclear power under pressure as ecologists enter government

The ecologists' participation in the government in 2003 was conditioned on the gradual closure of nuclear power plants in Belgium. The former director of Greenpeace, Olivier Deleuze, who became Secretary of State, promulgated a law that reflected more the concerns of the ecologist movement about the safety of nuclear power stations and the risks of an incident for a small, densely populated country, than environmental and social preoccupations. The issue of long-term storage and management of nuclear waste was also highlighted, despite the existence of the Hades laboratory at the Mol Centre, which was already preparing innovative industrial technologies for deep clay storage.

A successful energy transition

The law, then disapproved not only by a fraction of the population but also by industry and academia, is still in force 21 years later. However, we must recognise that it has not only had negative effects. The development of renewable energies and the improvement in energy efficiency throughout the country has enabled Belgium to increase its share of solar and wind energy from a few percent in 2000 to almost 20% by 2020. This has allowed the closure of all the coal-fired power stations still in existence at the beginning of the 21st century.

And although the law required the closure of the first three nuclear power stations in 2015, it was systematically circumvented by realistic energy ministers who were aware of the risks to security of supply. In so doing, Belgium has made a genuine transition to a low-carbon electricity mix, whereas the German Energiewende, held up as a model for neighbouring countries, closed its nuclear power stations AND continued to use coal and lignite.

A first victory towards a nuclear revival

The ecologists, back in power in 2019 to form a federal majority, have imposed a 'green' Energy Minister. She really started the definitive closure of our nuclear power plants : in 2022 with Doel 3, in 2023 with Tihange 2, and she was preparing to do the same in 2025 for the remaining plants. At the end of 2021, in the presence of the Prime Minister and the head of Elia, the state-owned monopolistic electricity transmission operator, the new minister announced her plan

to close all the nuclear power plants and to compensate for the loss of production by building new gas-fired plants, soon to be hydrogen-fired (sic), and by importing up to 38% of the country's electricity needs.

It was at this point that various citizens' movements came to the front to point out the government's irresponsibility. The 100TWh association filed a lawsuit against the Minister for Energy, demanding an immediate halt to the dismantling of the power plants. It intended to consulting a panel of experts, rather than relying on the opinion of the boss of a company under her orders, and that was incidentally a beneficiary of the replacement of national production by imports passing through its high-voltage lines. These reactions and the energy crisis, exacerbated by the Russian invasion of Ukraine, have forced Belgian politicians to question the 2003 law. As a result, the government decided to extend the life of the 2 most recent reactors by ten years, until 2035.

But these circumstances also prompted most of the political parties to include the revival of the nuclear industry and the extension of all the nuclear power stations still in operation in their programmes for the June 2024 elections. And the that took this engagement won the elections... Finally, just 3 months after taking office, the Belgian Minister for Energy won a favourable vote from the Federal Chamber of Deputies to abolish the 2003 law!

Henri MARENNE
Chairman of 100TWh



After the fight, the victory



Henri Marenne, who demonstrated yesterday to save nuclear power plants, celebrates victory with Mathieu Bihet, the Belgian Minister of Energy... Now we have to win the battle to reopen the plants... To be continued!

Poland: Advocating for a just transition

Poland's energy mix remains heavily reliant on coal, which still accounts for 60% of the total. This situation is rooted in our historical and geographical realities. While the idea of moving away from coal is gaining traction, it must contend with the deep-rooted acceptance of coal among Poles, for whom it is an asset – an economic and social resource, our very own "black gold".

Support for nuclear energy exists, but we advocate for a just transition in diversifying the energy mix – ensuring protections for workers and regions by maintaining social gains and mitigating losses. Transforming our economic model will take time, and we must avoid short-term repercussions on our international competitiveness.

Public acceptance of nuclear power is steadily increasing. Two regions are currently under consideration for nuclear plant development, with the aim of generating 15–20% of the country's electricity from nuclear by 2045. This is a significant target for a developing economy, which is also expanding its use of natural gas and renewables. Companies such as PGE are actively involved, and permit approvals are currently pending.

It is clear that Poland will need a skilled workforce – several thousand employees in the nuclear sector alone. Polish workers are already overrepresented on nuclear construction sites across the EU, including in France. Poland intends to capitalise on this experience to boost domestic competencies. Around one-fifth of the required workforce will be directly involved

in nuclear energy, but we will also need construction and materials workers to deliver a successful energy transition. A Polish Human Resources plan has identified the labour needs of relevant industries. We are now offering multidisciplinary education programmes at the primary, secondary and tertiary levels, both for students and for re-training workers in collaboration with local authorities.

Grzegorz TCHOREK
Director, Institute of
Energy Engineering



Denmark: Winds of change

After 40 years of a nuclear energy ban, Denmark is poised to reverse course. Long seen as a flagship of 100% renewables, the country is now reopening debate around compatible nuclear energy. The ongoing energy crisis and growing realism about the limits of intermittent energy sources are making nuclear a credible option for delivering low-carbon electricity – central to Denmark's climate goals. Once again, the strategic complementarity and reconciliation of energy sources emerge as a winning combination.

¹ According to Polish miners' unions, Poland has shut down two-thirds of its coal mines over the past 30 years, with employment in the sector falling from 300,000 to 80,000. Given that each mining job supports four related roles, the closures could ultimately affect some 400,000 jobs. A phased closure agreement has been signed with the government, setting a timeline that extends to 2049. However, as coal remains essential for the country's metallurgical industry, Poland is planning to invest in clean coal technologies, including coal gasification.

Michał Kurtyka
Pierre-Philippe Crépin
Jean-Charles Arrago
**L'énergie :
source et avenir de l'Europe**



Boleine

Michał KURTYKA is a long-standing friend of Les Entretiens Européens. In 2023, we co-organised a session in Warsaw – decentralised to Krokowa – focused on public engagement with nuclear power in Poland. Kurtyka has participated in numerous discussions over the years.

The photo captures him at the podium during the 21st edition of Les Entretiens Européens, themed "Market reform and alliance: A new beginning for nuclear power in Europe?" – Paris, 2023.

Les
Entretiens Européens

La Lettre des Entretiens Européens – Supplément June 2023

Rapprocher - Débattre - Partager

Open letter to the institutions

**Europe's nuclear revival requires
structural market reform
with long-term contracts**

Mrs Claude Fischer Herzig
Director of Les Entretiens Européens

To Mr Prime Minister of Sweden,
President of the European Union
Mr President of the European Council,
Mrs President of the European Commission, Mr General
Director of DG Competition
Mrs General Director of DG Energy
Ministers of the Member States of the European Union,
Members of European Parliament,

As we approach the June 2023 Summit, I am pleased and honoured to send you these options and recommendations put forward at the Entretiens Européens conference held in Paris on 30 June on the theme "Market reform and alliance: a new beginning for nuclear power in Europe?"
The Entretiens Européens conference brought together 380 prominent figures from the energy sector, from energy-intensive industries, banks and from local authorities, for dialogue with the

Will Czech nuclear plants be Korean?

The Czech Republic currently operates two nuclear power stations – Temelín and Dukovany – in the south of the country, accounting for 40% of national electricity production. The country has decided to build two additional reactors in a project worth €8 billion, awarded in summer 2024 to South Korean firm KHNP, to the detriment of EDF.

EDF suspects that KHNP may have received public subsidies from South Korea, potentially distorting competition within the European market. EDF has expressed

concerns to this effect, and has lodged a formal complaint.

It has to be said that the rules of the game are not the same for everyone in the European market*, which prompted the EU to adopt a new regulation in July 2023 to safeguard the integrity of public procurement procedures.

Were the rules followed? The European Commission, through its Industry Commissioner, has asked the Czech Republic to suspend the contract signing until judicial clarity is obtained.

To be continued...

Still, regardless of the outcome, it is hard not to lament the absence of a common industrial policy that could foster a competitive European nuclear sector within its own market – especially when Poland chooses the US, the Czech Republic chooses Korea, and Hungary chooses Russia.

CFH

* See also: The Entretiens Européens newsletter – "Public support for nuclear: A telling Europe/World comparison", December 2021: <https://www.entretiens-europeens.org/wp-content/uploads/2022/08/lettre-ee-supplement-decembre-2021.pdf>

Nuclear energy in the Balkans: Opportunities and obstacles

Faced with pollution from ageing coal-fired power plants, rising CO₂ emission prices and a growing reliance on electricity imports, several Balkan countries are considering the introduction of nuclear power into their energy mix. Although there is broad support for nuclear energy in the region, progress is being hindered by the European Commission and the Energy Community.

A nuclear legacy

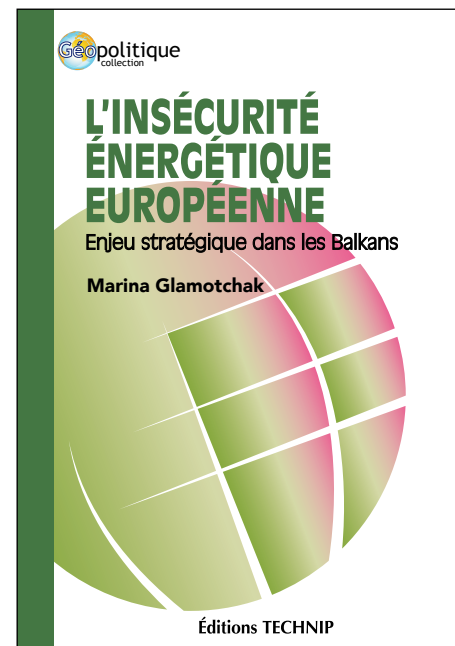
Communist Yugoslavia left a significant nuclear legacy. With two major uranium deposits located in Slovenia (Žirovski Vrh) and Serbia (Kalna), it once ranked as the world's fifth nuclear nation and had plans to build 23 nuclear power stations¹. Between 1947 and 1951, Yugoslavia established several nuclear research institutes² and employed between 1,300 and 2,000 engineers and scientists, alongside 600 to 1,000 technicians in the nuclear sector.

Today, however, only one nuclear reactor remains operational in the Western Balkans. Located in Slovenia, this US-designed Westinghouse reactor is jointly owned with Croatia (50/50) and has had its operating life extended by 20 years, until 2043.

Prospects for cooperative development

Slovenia plans to construct a second reactor (Krško 2) by 2034, a project which Croatia is prepared to co-finance. Croatia is also pursuing several regional partnerships to build a nuclear power plant, including with Hungary (Paks), Albania (Skadar) and Bulgaria (Belene). Bulgaria, for its part, has invited Montenegro, North Macedonia, Croatia and Serbia to help finance its expensive Belene nuclear power project on the Danube. While initially interested, Serbia and Croatia ultimately declined the offer.

Surrounded by countries with operational nuclear plants – Croatia, Hungary, Romania, and Bulgaria – Serbia shares in the regional risks without reaping the benefits of nuclear energy. With 70% of its electricity still derived from coal and rising energy demands, nuclear development presents an optimal, albeit capital-intensive, solution. Serbia also possesses relevant expertise through its Vinca Institute. In August 2024, Serbia signed a Declaration of Intent with France to cooperate on nuclear energy. A subsequent tender for a preliminary technical study on the potential for civil nuclear



energy in Serbia was awarded to Electricité de France (EDF) and Egis Industries.

European influence slows progress

Despite generally favourable public opinion towards civil nuclear energy, economic and political conditions – along with the stances of neighbouring countries – continue to complicate and delay nuclear initiatives.

While Balkan states pursue nuclear strategies individually, the European Union is attempting to shape the region's energy geopolitics – particularly through Chapter 15 of the integration process. Via the Energy Community (a separate institutional body tasked with implementing regulatory frameworks for energy policy), the EU is prioritising environmental aspects of energy security. It seeks to promote a costly green economy (wind turbines, solar panels) – which fails to offer a viable large-scale alternative to domestic coal – while downplaying concerns around the security of supply (gas and electricity).

Marina GLAMOTCHAK

Doctor of Sociology, Researcher
Consultant in Strategic Political
and Economic Analysis

Roundtable discussion on energy insecurity in Europe



Held at the Maison de l'Europe, February 2024, and moderated by Claude Fischer Herzog
With Marina Glamotchak, Sami Ramdani and Florent Marciacq

France-China: A lasting partnership



In the early 1980s, China chose France to assist in launching its nuclear programme. In his article, Hervé Machenaud, former Director of EDF's Asia-Pacific branch, reflects

on the 1986 "pact of trust" between France and China, formalised through the construction of the Daya Bay nuclear power plant and the establishment of the Guangdong Nuclear Power Joint Venture Company (GNPJVC). According to Machenaud, this trust has remained unwavering.

This "pact of trust" extended beyond the training of several dozen Chinese engineers in France. China entrusted EDF with the project's overall management, technical responsibility and assurance of successful completion.

A pact of trust, because very quickly, the hundred or so highly qualified Chinese engineers – initially tasked with observing, questioning and monitoring our practices – were, at their own request, integrated into EDF's engineering teams. EDF was no longer "under scrutiny" but a partner, part of a truly integrated team.

A pact of trust, because when EDF conducted a review of potential upgrades after ten years of operation at the Gravelines plant – the reference model for Daya Bay – it offered GNPJVC access to 110 modifications, a priceless distillation of expertise drawn from hundreds of reactor-years of experience. China recognised the value of this gesture.

China achieves autonomy

Another act of trust came shortly before the commissioning of Daya Bay, when GNPJVC asked EDF to take responsibility for the plant's initial years of operation. EDF dispatched around 60 operators to initiate the plant and train Chinese teams, who assumed full control within a few years.

By 1995, as Daya Bay commenced operations, CGNPC embarked on constructing a second plant of the same model at the same site. EDF retained only a technical advisory role, while French companies continued to act as subcontractors to Chinese firms. Ling Ao became a Chinese-led project, marking China's attainment of autonomy in nuclear power development.

Despite this, close cooperation continued between French and Chinese operators, with experience sharing, spare parts exchange and mutual support during incidents. Daya Bay and Ling Ao participated in performance competitions with French plants, often securing top rankings. This collaboration persists today among operators of France's 56 reactors and China's 36 reactors based on French technology.

Two EPRs in China: A new chapter of trust

In 2007, CGN invited France to construct two EPR reactors at the Taishan site, with EDF investing alongside. This agreement – unprecedented in China's history – was signed to cover the plant's 50-year operational lifespan.



Taishan Nuclear Power Plant, commissioned in 2018

The subsequent phase, in 2013, saw CGN partnering with EDF for the construction and operation of two EPRs at Hinkley Point in the UK, with prospects for two more at Sizewell and two Hualong reactors at Bradwell. This cooperation is envisioned to span a century.

The partnership peaked with Chinese Premier Li Keqiang's visit to France in June 2015, culminating in a joint declaration to deepen civil nuclear cooperation. The joint declaration on deepening France-China cooperation in civil nuclear energy was made public during his visit. It sets out a comprehensive cooperation framework – "from mining to reprocessing" – covering all areas of operations, the design of medium- and large-scale reactors, their construction in China, France and third countries, the involvement of industrial players from both nations, and the development of a reprocessing facility in China. All French compa-

nies – starting with AREVA, Alstom and the hundred or so firms within the France-China Electricity Partnership (PFCE) – are involved in this agreement, which opens up vast new opportunities. Article 3 of the declaration states: "France and China call upon nuclear sector stakeholders in both countries to enhance cooperation across all areas of the comprehensive partnership."

This historic partnership resulted from the efforts of men and women who placed their faith in joint projects and built mutual trust. Today, they are bound by deep ties of friendship.

A shared future for the entire sector... yet to be realised

Ultimately, the joint declaration was never implemented due to internal and external political pressures. While subsequent cooperation has waned, its foundations remain solid, and revitalising it would serve the mutual interests of both nations.

Currently, new avenues of cooperation are being explored. China is constructing ten reactors annually, achieving record commissioning speeds (five years) and cost-efficiency (€2,000/kW installed). Meanwhile, EDF is approaching 2,500 reactor-years of operational experience and is preparing to relaunch a programme potentially encompassing several dozen reactors in the coming decades. The potential benefits of a renewed partnership between the world's largest reactor builder and the most experienced operator are immense – not only for both countries but also for advancing a critical technology essential for low-carbon electricity production.

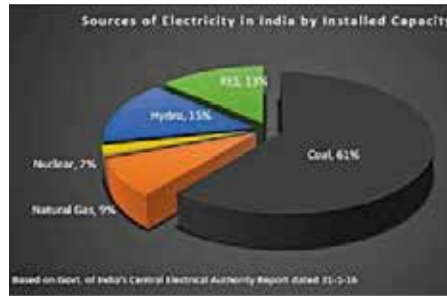
Hervé MACHENAUD



India's ambitious nuclear policy programme

As recent announcements from the Indian government illustrate, France now stands at a pivotal moment, with all the necessary tools at its disposal to advance its nuclear projects, backed by stakeholders on both the French and Indian sides. India's growth prospects make energy a critical issue: it is the world's third-largest energy consumer and the second-largest importer of fossil fuels.

-To balance economic development with its goal of achieving carbon neutrality by 2070, India views nuclear energy as a cornerstone of its future energy mix, capable of providing reliable, round-the-clock electricity and ensuring strategic sovereignty. In February, the Indian government announced a target of 100 GW of nuclear power capacity by 2047, building upon the current 8 GW in operation and 14 GW under development¹.



Major structural reforms have been announced, including:

- Revision of the Atomic Energy Act of 1962 to permit private sector participation in nuclear initiatives, notably Small Modular Reactors (SMRs).
- Amendment of the Civil Liability for Nuclear Damage Act (CLND) to facilitate the involvement of industrial players and international technology vendors.

Strategic implications for EDF and the French nuclear sector

India's nuclear expansion presents an opportunity for EDF and the French nuclear industry to strengthen Franco-Indian industrial ties and find markets for large-scale reactors and SMRs. The strategic France-India partnership on nuclear energy was central to discussions at the France-India CEO Forum held in Paris last February, on the sidelines of the AI Action Summit co-hosted by President Macron and Prime Minister Modi. The joint visit to ITER in Cadarache by Prime Minister Modi, accompanied by President Macron on 12 February, to celebrate scientific and technological collaboration, also highlighted the importance of nuclear energy within the France-India strategic partnership.

¹ L'énergie nucléaire est aujourd'hui la quatrième source d'électricité en Inde qui possède 20 réacteurs répartis au sein de 7 centrales nucléaires.

What purpose do the COPs serve? COP29 dashes remaining hopes

COP29, held under the auspices of the United Nations, took place from 11 to 23 November in Baku, Azerbaijan, a hydro-carbon-producing country described as a "gift from God" by Azerbaijani President Ilham Aliyev in his opening address. Is it any surprise, then, that there was no explicit mention of phasing out fossil fuels, a commitment made at COP28, nor any meaningful outcomes from yet another inconsequential international gathering, asks Claude Fischer Herzog.

What, if anything, can be taken from Baku in the global fight against climate change? While COP28 in Dubai had sparked some optimism with agreements on transitioning away from fossil fuels and establishing a "loss and damage" fund to aid vulnerable countries, COP29 dampened these hopes.

The international climate landscape is fraught with tension, marked by state fragmentation, renewed conflicts in Europe and the Middle East, and the rise of populist and climate-sceptic rhetoric, particularly in the United States and Argentina. The absence of key leaders, including Ursula von der Leyen, Emmanuel Macron, Olaf Scholz, Joe Biden, Xi Jinping and

Lula da Silva, further undermined the conference's impact.

The unanswered questions in the agreement establishing a new carbon market outnumber the actual decisions taken – and more seriously, the new target intended to strengthen financial solidarity from the Global North towards the Global South is, in the words of Indian delegate Chandni Raina, "derisory".

While countries of the Global South were calling for \$1.3 trillion, the financing pledged – whose terms of implementation remain unclear – amounts to \$300 billion, which, when adjusted for inflation, corresponds to the \$100 billion promised in Copenhagen in 2009, according to members of the Africa Group. Several states have also criticised the nature of the funding, particularly the partial use of loans, which risks exacerbating the debt crisis affecting economies in the Global South. In protest, the most vulnerable countries dramatically exited the negotiations during COP29's overtime sessions.

The lack of solidarity was a defining feature of COP29, falling short of the ambitions set in 1992. Major economic powers like China, Singapore, South Korea and certain Gulf states – among the largest



greenhouse gas emitters – refused to join the group of contributors, limiting their participation to voluntary contributions.

Nevertheless, the next meeting is scheduled: COP30 in Belém, Brazil, is anticipated to be a "turning point" and the "COP of COPs", aiming to address other "crucial" issues – in plain terms, a deeper examination of topics that were mishandled or deferred in Baku, notably the financing mechanisms for the NCQG (New Collective Quantified Goal), the adoption of the mitigation text, the "loss and damage" fund and the updating of national commitments... first made at the Paris COP. Additionally, deforestation – a particularly symbolic issue in the Amazonian context – will be a focal point.

Claude FISCHER HERZOG

22nd edition of Les Entretiens Européens Paris, 2024

General mobilisation for nuclear training and employment

Businesses, schools, universities and institutions come together to debate the issue at the Les Entretiens Européens conference



At the invitation of ASCPE and its director Claude Fischer Herzog, brought together some 300 people to take part in person or through Zoom in Les Entretiens Européens conference held on 30 April in Paris to tackle "Training: a challenge crucial to nuclear revival in France and Europe".

Co-organized with the UMN, the University of Nuclear Professions in France, chaired by Hélène Badia, and the ENEN, the European nuclear education network, directed by Gabriel Pavel, this 22nd edition of Les Entretiens Européens brought together representatives of companies, major schools and universities or associations from several European countries (Belgium, France, Poland, United Kingdom), the French government, the European Commission, and IAEA, International Atomic Energy Agency, in the very beautiful room of the Federation of Public Works, partner of the event.

Nineteen speakers took to the podium for

a rich, interesting and original debate. They spoke of the concrete measures being taken on these challenges of training and employment. It is an essential issue that is now entering the public debate, and a natural extension of previous symposiums organised on the reform of the electricity market and cooperation between nuclear states to build an industrial sector in Europe. The commitment and motivation are remarkable. Having spent so many years of arguing in favour of nuclear power, it is good to see.

Many young discovered the problem and understood the opportunities open to them in this growth sector, involving a diversity of professions and levels of excellence, from specialised labour to nuclear and civil engineering, sheet metal work, and chemistry and health. After more than two decades of vilifying nuclear power and ostracising the technology, the horizon is clearing and the industry has recovered its appeal.



22nd edition of Les Entretiens Européens Paris, 2024



In her conclusions, Claude Fischer Herzog listed ten recommendations for tackling the challenges. She raised the issue of compulsory internships in international companies, required by young people as part of their degree courses, and proposed the creation of a European digital platform to match supply and demand, which could be the first step towards building a European labour and training market. This will be necessary if we are to create a European nuclear industry that will restore Europe's position as leader in a world in the throes of nuclear renaissance! The Chairman of EDF hopes to create a series effect by building reactors throughout Europe to pool the costs and risks associated with investments, which should mobilise our companies and the member states of the Alliance under France's lead.

The Entretiens Européens were extended by a preview screening of Oliver Stone's film "Nuclear Now" in the presence of Catherine Schofer, Managing Director of Paris Première. It was hailed on its release

by Werner Herzog, another great filmmaker, this time German, which makes his review even more interesting. It is a film we need to screen in companies, and in schools! Cinema has a decisive role to play (in addition to information, education and training initiatives) in raising awareness and ensuring "societal acceptance" of nuclear energy, which is at the heart of the Entretiens Européens' fight, and more broadly in promoting knowledge of the world, its peoples and their cultures, which is a key objective of the ASCPE "Open World, Regards croisés" film society.

ASCPE intends to use this new edition, the posting of its discussions on YouTube and the publication of a special issue of the Entretiens Européens newsletter based on its presentations to continue serving as an interface between society and institutions and influencing public policy for a competitive and united Europe.

May 9, 2024.

The highlights on YouTube

- **Introduction: The appeal of an industry with a future**
<https://www.youtube.com/watch?v=38S-NNbBm2M>
- **1st round table: Attractive training opportunities meeting the needs of business and regions**
https://www.youtube.com/watch?v=oOPP_VJDcJE
- **Hearing: Developing skills worldwide**
<https://www.youtube.com/watch?v=H9LTvc3Xgkc>
- **2nd round table: Promoting cooperation and mobility in a European labour and training market**
<https://www.youtube.com/watch?v=SOEq1jCGRPY>
- **Conclusions: Ten recommendations to promoting human capabilities**
<https://www.youtube.com/watch?v=UWu1-SgJ5sE>



Acknowledgements

Les Entretiens Européens have long benefited from the valued partnership of Andra, CEA, Orano and EDF – organizations that placed their trust in us from the very beginning and were still by our side for this 22nd edition. A heartfelt THANK YOU to each of them.

We would also like to thank the European Commission, which, despite some differences, even the occasional divergence, supported ASCPE in organizing the public debate. On this last edition, it was Euratom that took part. It's been a fascinating journey – and one that's certainly been worthwhile!

My thanks also go to UMN and ENEN, along with EuroLorraine and 100 TWh who contributed to the publication of this final newsletter. And a special thank-you to Monteiro for offering to fund its English translation.

Warm THANKS as well to our interpreters, Isabelle Vandenplass and her team, who have supported us for 23 years; and to Katherine Mèrignac, who has translated our invitations, newsletters and reports into English over the years. Loyal partners to the end, they were once again present for this final edition.

I'd also like to acknowledge those behind the scenes who have helped us shine: our cameraman François Maury, photographer Laurent Lô, webmaster Dominique Guillemet, and graphic designer Christophe Le Nours always ready to lend a hand.

And a special shout-out to Liam Fischer, Fabian Briquet and Anthony Pailliez (from left to right in the photo), who transcribed the discussions from this last edition of Les Entretiens Européens. All three are in their final year of engineering studies – we wish them all the best in their next steps!



It's been a real joy to lead Les Entretiens Européens. My involvement in SLC, and more recently in PNC-France, has been deeply enriching, but none of this would have been possible without the unwavering support of Philippe Herzog, André Ferron, Hervé Fischer, Marie-Ange Schilling and the many young interns who have contributed over the years.

The presence of young people during this final edition brought new energy. They joined us in Bure, in Tricastin, in Paris – and came eager to learn more about Les Entretiens Européens. Don't miss the interview Fabian conducted with me, where we look back on the history of Les Entretiens and put it into perspective.

For those who would like to learn more, they can find the biography of the director of ASCPE published in *Le Maitron* along with reports, publications and YouTube recordings of the sessions on the ASCPE website:

www.entretiens-europeens.org.

Claude FISCHER HERZOG



Claude Fischer Herzog sketched by Gazelec during the October 2023 conference

Attracting, training, recruiting: UMN's Skills Action Plan

The resurgence of nuclear energy in France is underpinned by a structured, unifying initiative: the Skills Action Plan, led by the Université des Métiers du Nucléaire (UMN). The ambition is clear – recruit 100,000 professionals to deliver future projects and maintain the existing fleet. This relaunch acts as an accelerator for efforts already undertaken by the sector in recent years. Established in April 2021 by key industrial players, UMN's core mission is to structure these efforts through a coordinated approach.



A sector in motion

UMN is tasked with invigorating training systems, addressing critical skill shortages and enhancing the sector's appeal at regional, national and European levels. The plan, submitted to public authorities in June 2023, is built on the triad: attract, train and recruit. It draws heavily on regional best practices from within the sector, developed in collaboration with training and employment stakeholders, as well as on successful approaches from other industrial sectors.

A comprehensive strategy

UMN plays a pivotal role in revitalising training initiatives. While France's existing educational offering can meet a substantial portion of the sector's needs, it requires adaptation, expansion and greater appeal. UMN operates across all educational levels. For instance, to counteract limited awareness and perceptions of nuclear careers as inaccessible or unappealing, the sector launched an information and guidance portal in 2022: MonAvenirdansleNucléaire.fr. This public-facing website highlights the diversity of careers and training pathways and is the sole platform listing job offers, internships and apprenticeships in the sector – currently over 4,800.

To encourage uptake of key training paths, UMN awards merit-based scholarships

and pairs recipients with industry mentors. A sector-specific credential, the "Nuclear Passport", was also launched in autumn 2023 with support from the Ministry of Education. It offers nuclear-focused modules and practical work aligned with various diplomas to 3,000 students from vocational to postgraduate levels, aiming to inspire them to join the field.

Further actions include creating new training for critical skills, diversifying recruitment pools (e.g. women, career changers) and promoting nuclear careers and related training pathways.

Collaborative approach and regional engagement

The plan fosters unity among stakeholders through flagship events to maximise impact. For example, the first Nuclear Careers Week, organised in 2024 by France Travail, UMN and their partners, drew 16,000 participants, including jobseekers, students and school pupils.

UMN works closely with regional hubs for vocational excellence (Campus des Métiers et des Qualifications), which coordinate local training and employment efforts. Regional anchoring is a cornerstone of this action plan, as the nuclear sector is historically rooted in several French regions. It enables close collaboration with all local training and employment stakeholders and ensures that actions – such as the creation or adaptation of training programmes – are tailored to local contexts and the specific needs of regional industry. National coordination ensures that these actions align with the broader requirements of the

sector, helping to meet workforce needs comprehensively while avoiding duplication across regions.

A European skills strategy

Nuclear skills development is now being considered at the European level, to support both EU-wide projects and the retention of key competencies. The goal is to standardise and harmonise qualifications, enabling recognition of professional credentials and worker mobility across the EU. For example, several European universities have joined forces to establish a European cooperation network on nuclear skills, working alongside research institutions, industry partners and local authorities. Their aim is, in particular, to expand access to training programmes, advocate for the establishment of a common framework and carry out joint, concrete actions to develop a skilled and diverse nuclear workforce across all Member States engaged in the nuclear industry

Hélène BADIA

President

Université des Métiers du Nucléaire



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www.monavenirdansleNucléaire.fr

GIFEN's "MATCH" programme

In the short, medium and long term, France's nuclear sector must recruit and retain a skilled workforce to deliver on its ambitions. The industry trade body GIFEN has developed the MATCH report – a true roadmap for sector performance.



ENEN: A European nuclear education network



ENEN is an association founded in France in 2003 under French law. Since 2018, it has been headquartered in Belgium to be closer to the European Commission, its strongest supporter and main source of funding for nuclear education in Europe.

The network comprises around one hundred members, including educational, research and training institutions, industrial partners, technical safety organisations (TSOs), international bodies and sister networks worldwide. ENEN seeks to promote initiatives that attract young people to the nuclear sector by offering additional educational activities for students and researchers, as well as professional education and training programmes that support lifelong learning for employees.

It brings together individuals committed to expanding the network with new partners and countries. ENEN believes in and actively supports collaboration between academia, research and industry for the common good, with a single objective: to provide the means to build a highly skilled workforce ready to contribute to the peaceful development and use of nuclear technology across various fields.

Its activities are aimed at students and

researchers from European countries, and ENEN also offers attractive educational initiatives and support for non-European students. Over time, the association has received support from the European Commission's Euratom programme (notably from the Directorate-General for Research and Innovation and the Joint Research Centre), the Directorate-General for International Partnerships, and the International Atomic Energy Agency (IAEA).

ENEN also plays an active role in assessing Europe's human resource needs by conducting a number of studies to that effect.

Gabriel PAVEL

Director General of ENEN



Gabriel Pavel, Director of ENEN, moderated the second roundtable. In his opening remarks, he introduced the European nuclear education network.

ENEN educational initiatives

- **ENEN2plus:** Strengthening nuclear skills across all nuclear domains; support for the entire nuclear community.
- **SaTE:** Focus on nuclear safeguards; for non-European participants.
- **Training & Mentoring:** For TSOs, targeting non-European participants.
- **SECURE:** Focus on medical radioisotope R&D.
- **FREDMANS:** Focus on nuclear fuel technology.
- **Go-Viking:** Focus on the impact of vibration phenomena.
- **TANDEM:** Focus on SMR integration into complex grids.
- **ECC-SMART:** Focus on SMR development.
- **Gre@t-PionEer:** Focus on reactor physics.
- **CONNECT-NM:** Focus on nuclear materials.
- **NURECAB:** Focus on aligning Ukrainian research and education with EU standards.
- **EASI-SMR:** Focus on SMR technology development.

More info: <https://enen.eu/>

Towards a European university cooperation on nuclear skills

On 21 March 2024, during the inaugural World Nuclear Energy Summit held in Brussels under the auspices of the International Atomic Energy Agency (IAEA) and the Belgian Presidency of the Council of the European Union, universities from several EU countries – Romania, Hungary, France, Sweden, the Czech Republic, Germany, the Netherlands, Belgium and Slovakia – convened at the Maison Irène et Frédéric Joliot-Curie in Brussels, at the invitation of the University of Caen Normandy. They agreed to explore the establishment of a European sectoral cooperation network focused on nuclear competencies. This initiative aims to bring together higher and secondary education institutions, research organisations and industry stakeholders, with support from local authorities.

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100,000 hires over the next decade: A critical challenge for the sector

Nuclear energy is undergoing an unprecedented global revival, driven by goals of decarbonisation and energy sovereignty, as Hervé Maillart recalled at the opening of the conference. In France, the resurgence of nuclear projects is a key response to meeting energy needs while reducing the carbon footprint. "Given this momentum, the demand for skilled labour is immense," he added. The sector is expecting to create 100,000 jobs over the next ten years – 10,000 hires annually – to offset retirements and meet project demand. The nuclear industry thus faces a crucial challenge: attracting young people and training a skilled, diverse workforce.

France's nuclear industry encompasses the full spectrum of nuclear technologies and activities – from fuel processing to reactor operations – making it unique in Europe. To support the revival, qualifications at all levels are in demand, from vocational technicians to specialised engineers. This diversity of roles is a real asset in drawing a new generation of workers. The sector is actively conducting outreach in schools and universities, promoting the diversity and long-term, well-paid career opportunities it offers.

Enhancing the appeal of nuclear careers

The sector's attractiveness largely hinges on its ability to communicate its opportunities and reshape public perceptions. To appeal to young talent, nuclear stakeholders are highlighting their role in the green transition, offering low-carbon energy in a meaningful and forward-looking sector. In partnership with companies and regional authorities, the Université des Métiers du Nucléaire (UMN) plays a central role by improving access to training and academic pathways, thereby boosting the sector's appeal and visibility to younger generations.

Public policy to support technical training

Given the skills needs, the nuclear industry is in a position to influence training-related public policy. At the request of the ministers for energy and industry, the French Nuclear Energy Industry Group (GIFEN) submitted a study ("MATCH") outlining workforce requirements. This annual initiative contri-



butes to the development of sector-friendly public policies, particularly through efforts to guide young people towards technical training. These actions are enhancing the industry's appeal and ensuring a pipeline of qualified talent ready to tackle tomorrow's challenges.

Jobs and sovereignty: A winning combination for a sustainable energy future

The nuclear revival is not only a powerful lever for job creation, it is vital to France's energy sovereignty. It supports a long-term sustainable vision by supplying reliable, low-carbon energy, with horizons extending beyond the end of the century.

Recent crises in Europe have exposed the fragility of raw material and energy supply chains, with countries still overly reliant on fossil fuels for electricity generation. In this context, nuclear energy offers a strategic solution for a more sovereign, greener and sustainable Europe. Shifts in European energy policy reflect this new direction.

The European Nuclear Alliance brings together countries such as France, Belgium, Poland, the Czech Republic, Sweden and the Netherlands, where nuclear revival is underway. The European Industrial Alliance for Small Modular Reactors (SMRs) illustrates their collective ambition to build a European nuclear sector. However, this will require constructing a robust European industrial base capable of delivering on demand, including major construction projects and the creation of 450,000 jobs across the sector.

Hervé MAILLART

Permanent Delegate for
the Nuclear Sector

 **CSFN**
Comité Stratégique
de la Filière Nucléaire
www.csf-nucleaire.org



The nuclear industry must "train and recruit 100,000 workers over the next decade"



Le Monde de l'Énergie recently spoke with Claude Fischer Herzog, head of the training and consultancy organisation ASCPE and organiser of the Les Entretiens Européens & Euroafricains, to discuss the human resource needs of the French nuclear industry.

Read the full interview (in French):

<https://www.entretiens-europeens.org/claude-fischer-herzog-dans-le-monde-de-lenergie/>

Ten recommendations emerging from Les Entretiens

- Start teaching science from nursery school – with hands-on, playful experiences
- Build a dedicated European platform for internships – Erasmus alone isn't enough!
- Provide real resources for Europe's emerging university network
- Recognise nuclear careers as the future
- Develop common certifications and a European skills passport
- Use public-private partnerships to fund training
- Make training central to social dialogue and HR management (VAD & VADSS)
- Develop training partnerships between the member states of the Alliance
- Create a European service to match academic and corporate training needs
- Develop a labour and training market in the nuclear sector – a strategic project for "net-zero carbon"

Euratom - A shrinking budget in a booming sector



Since COP28, the Nuclear Energy Summit on March 21, 2024, the launch of the European Industrial Alliance for Small Modular Reactors on March 22, 2024, and

the SNETP¹ Forum held in Rome from April 17 to 19, 2024, nuclear energy has been booming in Europe, acknowledged Willem Janssens, Head of the Nuclear Safety and Safeguards Department at Euratom's Joint Research Centre (JRC). This is true not only for electricity but also for many other industrial applications. Yet, the Euratom budget, approved in 2021 for six years, has not seen any increase.

Meeting High Demand with No Additional Resources

Under the Multiannual Financial Framework (EU 2021–2027)², the Euratom Research and Training Programme (2021–2025) and the EU's Horizon Europe (2021–2027) are the main funding frameworks for research and innovation. RTD (Research and Innovation Directorate-General)³, the JRC (Joint Research Centre, the Commission's internal scientific service)⁴, as well as INTPA (International Partnerships) and F4E

(Fusion for Energy) receive allocations from the EU budget. It is therefore with limited means that the JRC's direct actions, in complement to the indirect actions of the Directorate-General for Research and Innovation (RTD)—both responsible for funding training and education in Europe—must respond to the strong demand from the nuclear industry.

Within this framework, they successfully fund projects like ENEN2Plus⁵, OFFERR⁶, and European platforms for training and mobility of researchers, technicians, and engineers, as well as access to nuclear R&D facilities. The European Institute of Innovation and Technology (EIT InnoEnergy, Knowledge and Innovation Community) also finances EMINE⁷, a true European Master's program in nuclear energy involving major industrial partners. The JRC also hosts students for master's theses, PhDs, researchers for training sessions, and its summer schools. It organizes international workshops and contributes to university education in nuclear safety and non-proliferation (SATE Project co-funded by INTPA). Four sites are involved in the R&D programme: Karlsruhe (DE), Ispra (IT), Geel (BE), and Petten (NL). These infrastructures, with their wealth of authentic nuclear materials, are significant assets.

Moreover, the JRC contributes to strengthening nuclear capacities at the level of nuclear safety authorities, waste management, and safeguards capabilities. This funding is provided by DG INTPA through the Instrument for Nuclear Safety Cooperation (INSC), based on the Euratom and TFEU treaties.

A European Observatory for Human Resources

The European Human Resources Observatory for the Nuclear Sector (EHRO-N)⁸ assesses national nuclear workforce needs through networking with many European partners. However, there is still no harmonization of competencies and professions at the European level. A Nuclear Workforce Assessment Workshop was held in January 2024: more than 80% of the nuclear workforce share skills with other industries, and half of the workforce consists of so-called indirect jobs (supply chain, etc.).



Programme	Budget (€)	Main Euratom Nuclear Activities
Euratom RTD (indirect actions)	€1.38 billion (2021–2025)	RTD Fission (€260M), RTD Fusion (€580M, EUROfusion, excluding ITER) JRC Nuclear safety and non-proliferation (€530M, 2021–2025)
Horizon Europe (RTD)	€95.5 billion (total)	Cross-cutting R&D activities and research (materials, digital and AI, excellence promotion, innovation challenges and industrial competitiveness)
JRC (direct actions)	€2.2 billion (total)	JRC Nuclear safety and non-proliferation (€530M, 2021–2025)
INTPA (international partnerships)	€79.5 billion (total)	€300M focused on nuclear development aid outside Europe: Nuclear Safety Cooperation Instrument and preparation for decommissioning of JRC installations
ITER (Cadarache)	€5.61 billion (2021–2027, EU contribution)	Euratom contributes to ITER construction through the Euratom Joint Undertaking F4E, based in Barcelona (ES)

¹ The Sustainable Nuclear Energy Technology Platform, SNETP, <https://snetp.eu/>

² MFF 2021–27 https://commission.europa.eu/about/departments-and-executive-agencies/budget_en

³ DG RTD Euratom https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/euratom-research-and-training-programme_en

⁴ DG JRC Nuclear activities https://joint-research-centre.ec.europa.eu/scientific-activities-z/nuclear-energy_en

⁵ ENEN2Plus E&T Mobility <https://cordis.europa.eu/project/id/101061677> and <https://www.enen2plus.eu/home>

⁶ OFFERR Trans-national Access <https://cordis.europa.eu/project/id/101060008> and <https://snetp.eu/offerr/>

⁷ EIT KIC-Inno EMINE <https://www.innoenergy.com/for-students/masterschool/master-s-in-nuclear-energy/>

⁸ EHRO-N, https://joint-research-centre.ec.europa.eu/ehro-n_en


It is important to highlight the very close interaction with the International Atomic Energy Agency (IAEA). For example, the SENSsett project, aimed at strengthening training and mentoring in nuclear safety, decommissioning, waste management, and nuclear safeguards, will be organized starting in 2024 for a duration of five years in coordination with the Agency. Other projects, worth several million euros, are being proposed in collaboration with the IAEA in neighbouring EU countries and candidate countries, and even in some African nations. Strategic international partnerships also exist, notably with the U.S. Department of Energy and Japan's JAEA, from which European partners can benefit.

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European
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AIEA, Using storytelling to attract new talent



and passing on nuclear knowledge. Since January 2024, these efforts have included a new focus on developing human resources.

The Agency works closely with Member States, industry stakeholders, and training providers. It also collaborates with universities on nuclear education programmes tailored to the needs of the nuclear industry. As part of this work, the Agency provides support throughout the various stages of industrial projects and helps to build skills once those projects are up and running.

It is also actively engaged with younger generations, using storytelling to attract

new talent and highlighting international experience, climate action and the long-term potential of nuclear technology. By promoting student and worker mobility, the IAEA offers internships and hosts young professionals seconded by Member States – while fully respecting the confidentiality of their career choices.



Flamanville, the promise of a European nuclear sector



23

Arts et Métiers: From craft to excellence

ENSAM accepts students for engineering courses in mechanical engineering, industrial engineering and energy engineering in almost all industrial sectors. Admission is contingent on a preparatory course or a BTS (advanced vocational training certificate) or DUT (university diploma) in science and technology. It also provides training for nuclear engineers. Anne Bacquet, then Deputy Director responsible for school-business relations at the École Nationale Supérieure d'Arts et Métiers (ENSAM), participated in Les Entretiens Européens and answered our questions.



Claude Fischer Herzog - Training in nuclear professions has grown over the past two years, but some student hesitancy remains.

Anne Bacquet - Indeed, despite its recognised benefits for the climate, many students remain concerned about the safety risks associated with nuclear facilities and the management of radioactive waste. The Chernobyl and Fukushima disasters still resonate strongly. Additionally, many young people are active in environmental or activist movements that promote renewable energies like solar and wind, and often oppose nuclear power, viewing it as risky or unsustainable.

CFH - How do you plan to expand this specialisation?

AB - We are undertaking several initiatives aimed at families, secondary school teachers and students navigating the Parcoursup system. Our aim is to shift mindsets and to explain the training pathways within the sector's accredited qualifications. Across many of our campuses, we offer specialised expertise - such as in Paris, where we focus on low-carbon and energy-efficient systems - and specialised Master's programmes in nuclear safety, with

some students participating in Les Entretiens Européens.

We have launched the "nuclear passport" in collaboration with the UMN for 22 final-year FIPMECA students at the Aix campus of Arts et Métiers. This involved 60 hours of exchange with 30 professionals from the nuclear sector, covering the full fuel cycle with safety and security as central themes. The initiative is highly promising. It is a commendable initiative and opportunity that helps us enhance the quality of our training and better prepare our students for the challenges of tomorrow.

CFH - Your key strength is your work-study model, offering apprenticeships in industry. Who are your main partners in the sector, and how are you fostering public-private partnerships?

AB - The nuclear sector is making substantial investments in training young people within the education system. Companies like EDF (Nuclear), ORANO, Framatome and Assystem host a significant number of apprentices. Some, such as EDF, ORANO and Spie Nucléaire, even provide in-house training or have established dedicated schools - this too is a way of enhancing the sector's appeal and upskilling its workforce.

The Gadz'Arts profile is ideally suited to the sector's needs. Building a nuclear plant is a highly technical challenge, requiring engineers not only in civil engineering but also in the mechanical development of reactors, particularly at Framatome.

With recruitment on the rise in nuclear, many Gadz'Arts graduates are joining the major players: in 2023, around 1,621 alumni were working in the sector - a 26% increase from the previous year. This has enabled us to forge partnerships with EDF, FRAMATOME, ORANO, TechnicAtome, the CEA, ANDRA (the National Agency for Radioactive Waste Management) and Assystem. These partnerships allow us to design tailored training programmes and expand apprenticeship opportunities.

CFH - You've also established relationships with international partners. How are these taking shape?

AB - At ENSAM, we provide the right environment to support mobility abroad,

starting with a compulsory minimum six-month international placement. Dual international degrees are also a strong driver of mobility.

However, significant barriers remain: visa issues, language barriers and limited cooperation between company representatives and educational institutions. Scholarship systems are not sufficiently targeted, and the preparation for arrival in the host country is often inadequate. Moreover, establishing agreements with companies can be challenging.

This is regrettable, as international mobility fosters academic excellence, supports high-level research, strengthens economic ties and promotes cultural and personal exchange. Student mobility is increasingly essential for enhancing the reputation of educational institutions and the recognition of their programmes.

Verbatim

Emmanuelle Galicher, lecturer and research fellow at CNAM, and apprenticeship training coordinator



Finding an international internship is a real struggle.

Who's to blame - companies, academia? Perhaps the Engineering Degree Commission, which now mandates internships for degree validation. That's where companies and universities must step in - roll out the red carpet! Yet many large groups prohibit placements in foreign subsidiaries (China, Qatar, Saudi Arabia) citing confidentiality. And when students can't find one, their apprenticeship contracts are often terminated. It's a vicious circle.

We must not burden young people with this stress - they are only 20 years old and they are our future.

International internships: A steep climb

Anthony Pailliez and Fabian Briquet, students at Arts et Métiers and apprentices in the nuclear sector with EDF and Assystem, are required to complete an international internship to obtain their engineering degrees. "While particularly enriching, these experiences remain difficult to secure," they explain in their article. Drawing from their own journeys, they propose improvements that could open new pathways for young people interested in nuclear energy and thereby help enhance the long-term appeal and vitality of the sector.

International mobility is now a mandatory requirement for engineering degrees in France. Mandated by the Commission des Titres d'Ingénieur (as per the 2023 Guidelines and Orientations), it aims to foster cultural awareness, language fluency and intercultural competencies – skills essential for career progression in a global job market. Mobility may take the form of an academic semester abroad, but many students prefer internships, which, like apprenticeships, combine theoretical education with hands-on experience. According to 2022 data from the Conference of Directors of French Engineering Schools (CDEFI), nearly 65% of engineering students opt for internships.

An attractive but selective sector

In the nuclear industry, hands-on experience is vital to complement classroom learning and develop a deeper understanding of industrial challenges. However, securing an international internship in this field presents unique hurdles. The nuclear

sector, while attractive, offers limited placements due to the small number of nuclear-enabled countries and the intense competition from local students. Moreover, stringent safety regulations and confidentiality requirements make access to internships particularly selective. A lack of communication around available opportunities further widens the gap between supply and demand, reducing students' chances of finding placements aligned with their career goals.



Anthony speaking at the Entretiens podium, 30 April 2024

"Fabian wasn't able to secure a placement with Assystem abroad but, through sheer persistence, managed to land an internship with the Technical Directorate at Hinkley Point C (EDF UK) in the United Kingdom. As for me, although I was initially focused on nuclear waste management, I had to broaden my search to improve my chances. I was fortunate to find an opportunity in Germany with Edvance, where I'm involved in layout design for the EPR2 project," recounts Anthony. Most internships are secured through well-established networks, but students without such connections often hit a wall. Some are forced to pivot to other sectors – like Hugo from ENSAM, who found a placement in gas transport instead.

This is a lost opportunity for a rapidly developing nuclear sector that could benefit from tapping into such potential. For instance, Quentin, a student at École Polytechnique, completed a research and development internship in Germany at the European Institute for Energy Research (established by EDF and the Karlsruhe Institute of Technology). His work focused on coupling a high-temperature electrolyser with a nuclear plant for low-carbon hydrogen production – a perfect example of how these internships can drive innovation in the energy transition.

Towards a European platform for nuclear internships

These examples underscore the value of international internships, not only in terms of meaningful experience and tangible skills, but also in advancing innovation and preparing engineers for future challenges. For this reason, there is an urgent need to develop tools that make such opportunities more accessible. Inspired by Italy's AlmaLaurea model, we propose creating a European digital platform to facilitate international internships in the nuclear sector. Such a platform would aim to: **better match candidates and opportunities** by directly linking companies with a pool of trained and motivated students; **increase visibility of available placements** through a directory of companies, labs and host institutions, supplemented by alumni feedback on completed internships; **and support students in their search** via a mentoring system involving past interns and personalised guidance tools.

In the context of the nuclear sector's revival and modernisation, such a European platform would bolster the competitiveness of nuclear training programmes across Europe, accelerate skill development and foster loyalty among the next generation of talent.

Anthony PAILLIEZ and Fabian BRIQUET



A proven model in Italy and a blueprint for nuclear internships

Established in 1994 in Bologna, AlmaLaurea is a consortium of Italian universities and a dedicated private company. Together, they provide a comprehensive system focused on students and graduates at every stage – from career orientation and training to professional integration. A true virtual market for education and employment serving young people, universities, businesses and institutions.

For over 30 years, AlmaLaurea has tracked and mapped Italian universities: the degree and postgraduate programmes they offer, the career prospects and the outcomes. It provides a constantly updated overview of both the education and employment landscapes. AlmaLaurea's system rests on four pillars: two annual surveys (one on graduate profiles and one on employment outcomes), a highly functional graduate database and job-matching and intermediation services.

Today, AlmaLaurea includes **83 member universities**, representing over **90% of Italian graduates**, with **4,115,000 CVs** in its database. Employers have access to over 100 search parameters to find candidates who meet their specific needs. This model offers a clear path forward for European universities and industrial sectors like nuclear, which needs to recruit 450,000 young professionals over the next ten years!

A French dynamic



Vincent Le Biez, former Deputy Director at DINN (the Interministerial Delegation for New Nuclear Power), is now Head of the Environment, Energy, Transport and Housing Division in the Prime Minister's Office. He spoke at Les Entretiens Européens in April 2024. Highlights below.

For DINN, France's new nuclear push comprises a range of projects, from EPR2 and SMRs to upstream and downstream cycle initiatives, collectively fuelling long-term sectoral momentum. The State has a vital role to play, acting as a conductor of this orchestration. With the revival of nuclear policy councils in February and July 2023 and again in early March 2024, the entire French state apparatus and nuclear ecosystem have been mobilised.

Achieving technological neutrality in Europe

This momentum is also evident at the European level with the Alliance of Nuclear Countries – comprising a majority within the EU – established on France's initiative. It represents a reversal following milestones such as the taxonomy regulation, the Net-Zero Industry Act, and others. Although large reactors remain a sensitive topic in EU circles, achieving technological neutrality at the European level remains essential.

Meeting the skills challenge

I would like to highlight the rigour and structured approach taken in France through the MATCH programme and the action plan from the University of Nuclear Professions. Clear roadmaps and adherence to them will be critical for success. First requirement: collaboration, bringing together all stakeholders from the nuclear sector and the training world to meet the challenge of filling 100,000 positions. Recruitment will be essential to offset retirements. Second: structured efforts at the territorial level, involving regions and training institutions both locally and nationally.

Sharing successes across Europe

DINNs in other countries, notably the UK and Sweden, have expressed interest. The objective is to share best practices at the European level. There are several initiatives already underway, and we should welcome this positive momentum. It will help us progress together and build a shared supply chain that elevates all stakeholders – beyond economic competition.

Attractiveness and integration

We must revitalise the image of industrial professions more broadly. Beyond nuclear, the overarching challenge remains decarbonisation – humanity's greatest collective cause. More pragmatically, there is a need to meet the demands of large-scale projects, such as Penly, which is an exciting venture. These motivations must be harnessed to drive mobilisation across all levels of training. A further challenge is retention – keeping young professionals engaged as long as possible through good integration practices, more fulfilling conditions and compelling career prospects.

- **Mechanical Design**
- **Project Management in Piping, Boilermaking, and Welding**
- **Manufacturing & New Construction Projects**
- **On-site Maintenance**

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MONTEIRO: The haute couture of piping

Annabel Vigier, CEO of GROUPE M and President of MONTEIRO, delivered a passionate defence of mechanical trades. In her remarks, she outlined the company's policy – a true engine of social mobility – and concluded with a call to young people: working in mechanics within the nuclear sector means engaging in major industrial projects and evolving within a culture of excellence and innovation. It is a choice to contribute meaningfully to society, to support progress, energy sovereignty and the low-carbon transition.

Our family-run industrial group traces its origins to the MONTEIRO company and today brings together a wealth of expertise in support of large-scale mechanical engineering projects. Mechanical professions are everywhere, making a substantial societal contribution – in Energy, Pharmaceuticals, Agri-food and Defence. Manufacturing mechanical components takes on even greater significance when destined for the nuclear sector. We now employ more than 1,900 people across a wide range of trades and areas of expertise, including engineers, technicians and highly specialised operators. Women are fully included in these roles.

In the nuclear sector, the MATCH programme is a key reference. Figures relating to sheet metal work point to a projected workforce growth requirement of 140% over the next decade. For piping, the estimated need is a 20% increase in the same period. This is why all sector stakeholders, led by GIFEN and EDF, are undertaking a profound collective effort.

This initiative hinges on two principal levers: ATTRACTIVENESS and TRAINING

Lever 1: Attractiveness - The attractiveness of these professions is shaped by two core elements: Innovation and Digitalisation. Take the example of welding, which is carried out in highly sensitive nuclear environments using innovative, automated processes, including high-definition screen supervision and "Full Remote" operations.

These technologies, deployed both in our facilities and at nuclear power plants, deliver significant improvements in efficiency, repeatability and traceability – as well as in health and safety, which remains a top priority for us. Our professions are evolving alongside society itself, in a manner not

unlike the advances seen in telesurgery.

At the same time, adopting "Best in Class" industrial practices offers a strong attraction factor. At GROUPE M, this is our commitment: we are building a dedicated nuclear piping manufacturing facility to complement our industrial complex in southern Drôme. Spanning a total of 4 hectares, it includes a technical expertise centre, an R&D "Lab" and a training campus.

Lever 2: Training - There are numerous academic training pathways that form the building blocks of our sector's skill base. Chief among them is the "Atom'Emploi" scheme led by France Travail, dedicated to the nuclear sector.

We are proud partners of the Université des Métiers du Nucléaire (UMN), working together on scholarship programmes and the annual Nuclear Professions Week, which is rolled out across the regions. I urge industrial players to join this movement, particularly by sharing field insights with UMN. These contributions help adapt training courses proposed by the national education system, with the goal of aligning education with the evolving needs of industry.

We also partner with the Arts et Métiers network in the field of mechanical engineering. Each graduating class sees alumni join our ranks. I would also highlight the value of work-study programmes: currently, we employ around 40 apprentices with the intention of offering them permanent contracts once they obtain their qualifications.

In-house schools and second careers supporting youth

In addition, we industrialists provide an added dimension through our in-house vocational schools. At MONTEIRO, this commitment dates back to 2012, when we launched our first training pathway for welders. Since then, our school has expanded to include other tracks combining practical modules, theoretical lessons and e-learning. Last year, 200 employees benefited from in-house training modules. Our ambition is to retain our most experienced staff and enable them to transition into mentoring roles, supporting the skills development of younger colleagues. This approach also helps balance age demographics within our workforce.

Annabel Vigier closed with a renewed call to young people: working in mechanics within the nuclear sector means contributing to major industrial undertakings, advancing in a culture of excellence and innovation, and making a conscious choice to serve society, advance progress, uphold energy sovereignty and promote the low-carbon transition.

Annabel VIGIER

"We are ready!"

The French family-owned Groupe M is now a leading industrial player, unique in Europe, with 1,900 employees across 31 sites – 22 in France, 9 abroad. A clear sign of strong growth and a solid regional presence. Its strengths serve key strategic sectors: low-carbon energy, defence, research, and process industries.

With nearly 50,000 m² of manufacturing facilities in France, including a next-generation metal construction plant inaugurated in early 2025, the group is strengthening its production capacity. These infrastructures and processes, built to the highest performance standards, are especially well suited to the demands of the New Nuclear (NN) programme. The group is also recognised for its design and manufacture of equipment for major projects, including thermal power stations, bioenergy plants and nuclear power facilities in France and for export.

Thanks to deep technical expertise, recognised know-how and continuous investment, Groupe M is ready to meet today's industrial challenges – and build tomorrow's solutions.

AV



Annabel Vigier welcomes Claude Fischer-Herzog to Groupe M's new premises, 22 May 2025

Eiffage: Civil engineering in service of nuclear energy



Preparing the groundwork for the EPR2 builds at Penly

Before addressing the technical and work-force aspects of our nuclear projects, I must emphasise a fundamental principle that underpins all our professions, particularly in civil engineering: prevention. At Eiffage, our safety policy aims for zero risk and 100% safety. This approach, driven by our Group's senior leadership, is built on training, awareness and rigorous procedures, with a strong focus on shared vigilance. It applies across all trades and sites, and is especially crucial in the nuclear field.

Over 1,000 managers have received safety leadership training this year. On the process side, more than 50,000 employees use our safety applications. Looking ahead, this figure is projected to exceed 100,000 full-time equivalent roles in France over the next ten years, according to estimates from the GIFEN-led "Match" plan. I encourage young people exploring career paths to check out the "7 families" game from GIFEN and the wide array of career tracks it showcases.

As the Danish physicist Niels Bohr once remarked, "Prediction is very difficult, especially if it's about the future." With that in mind, let me focus on the near-term needs of Eiffage Génie Civil with regard to the NM 2201 contract at Penly. At the height of activity in 2028/2029, we anticipate requiring around 5,000 workers. While these numbers will be adjusted as the project progresses, this projection is guiding our recruitment – internally and externally – with a strong emphasis on the local labour pool.

To this end, we are working closely with local employment and integration services, particularly France Travail. We have set ambitious inclusion targets: one million hours of employment for those distanced from

the labour market and 300,000 hours for people with recognised disabilities. To meet these targets, a variety of training pathways are being developed in partnership with vocational and academic education providers, including the regional authorities, France Travail and the national education system. Alongside EDF and other industry players, we are active participants in the "Normandy, Nuclear, New Skills" (3NC) programme, a pillar of the France 2030 recovery plan. The 3NC initiative encompasses seven development priorities, aimed at attracting young talent to nuclear projects and enhancing training provision – from vocational certificates (CAP) up to PhDs (Bac +8) – positioning Normandy as a hub for the future of energy in France.

This programme complements France's established education and training framework, which operates along three axes: formal qualifications via the national education system (e.g. BTS and engineering degrees), vocational certification under the Ministry of Labour, and industry-specific qualifications delivered by professional bodies, such as "urban road and utility construction". We recruit at all levels, including candidates without formal qualifications, whom we train in-house. Our standard induction programme covers essential topics such as safety – a non-negotiable priority – and includes job-specific modules, from site traffic management to construction management and low-carbon practices. These training efforts are supported by sectoral institutes and the cross-cutting Eiffage University, which delivers shared competencies across the Group.

The construction sector has a long oral tradition – reminiscent of the journeymen's tours of old – and remains highly inclusive, welcoming people from diverse backgrounds. Here, the question of "chicken or egg" becomes moot: training is both an entry point and a means of developing individual and organisational skills.

The "chantier" permanent contract: meeting the nomadic nature of construction

Turning to employment contracts, I'd like to clarify that all contracts are strictly governed by labour regulations. In civil engineering, we generally work with three main types: the fixed-term contract (CDD), which is time-limited; the open-ended contract (CDI), which has a defined start date but no predetermined end; and the

project-based open-ended contract (CDI de chantier), which also has a defined start but ends upon project completion – although the exact end date is not known in advance. At Eiffage, we use very few fixed-term contracts. Given the inherently mobile nature of civil engineering work, the "CDI de chantier" is often the most suitable option for candidates not wishing to relocate. If, on the other hand, employees express a desire for geographical mobility at the end of such contracts, we are legally obliged – and committed – to exploring redeployment options within other Group projects.

Today's younger generation, especially Gen Z, often prioritises working on projects that hold personal significance over long-term affiliation with a single company. This outlook may surprise older generations, but I see it as a positive force – these individuals are highly motivated to see projects through, particularly as they gain valuable new skills that they can carry forward, whether or not they choose to remain in the sector. It is up to us to convince them to stay – by offering large-scale projects with purpose, such as the EPR2 programme.

Philippe DENIER

Technical Director,

Nuclear Safety Expert

Director of the Performance Department,
Eiffage Civil Engineering



Verbatim

Philippe Denier – Eiffage has subsidiaries and projects abroad that can host interns, apprentices, and VIEs. Apply early to make yourself known to the company:
jobs.eiffage.com

Supporting young talent: A learning journey in itself

In the context of the nuclear sector's revival, the skills challenge is immense. With few exceptions, nuclear professions are not unique in themselves – they are practised within a highly specific industrial environment shaped by strict procedures, oversight and a culture of safety. Nuclear energy contextualises a profession, but does not define it at its core. What we need, therefore, are training pathways that produce technicians for industry in general – not exclusively for nuclear.

Traditionally, nuclear newcomers have been mentored by their more experienced colleagues. This is how each individual learns to carry out their role within the specific context of nuclear operations. This model remains very much alive at power plants, supported by a strong emphasis on training and knowledge transfer. It holds true at EDF, as well as among its partner companies.

From mentorship to alumni engagement in training

This mentoring tradition is deeply embedded in nuclear professions and must be managed carefully. Mentorship requires genuine commitment. In the fields of operations and maintenance, this dynamic must be sustained by leveraging the experience of today's plant operators.

But before operations comes construction – a far more complex challenge. The success of the current fleet's construction was due not only to standardisation but also to the accumulation of site-specific expertise, passed from one project to the next. Our parents mastered this 40 years ago; we must ensure our children can do the same.

Learning how to construct such complex installations requires active development of new projects – something we have not done enough of over the past 30 years. Much of this knowledge cannot be found in textbooks. The Flamanville 3 project arguably did not benefit enough from the insights of those with previous large-scale construction experience, despite the changed context. Capturing the lessons from Flamanville 3 – and then from Hinkley Point C – will be critical for future builds. The first EPR2 project at Penly will be a litmus test of our ability to rebuild construction expertise.

Learning from each other

EDF – and indeed, French industry more broadly – has not historically embraced

the skills of retirees. While the "Grand Carénage" initiative brought some progress by retaining late-career staff for mentoring roles, this was largely informal. A few retirees have been rehired by EDF or its partners, mostly to assist in preparing intervention dossiers.

In the face of new challenges, these dynamics must be not only amplified but also deliberately initiated and structured.

Initiating change: We must shift the mindset that views retirees as obsolete, clinging to outdated methods and resistant to innovation.

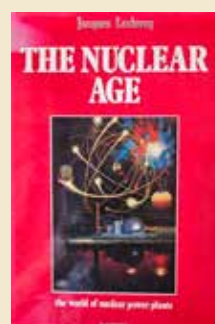
Structuring involvement: Finding willing alumni will not be difficult. Most are eager to share the intricacies of their work. However, former professionals are no longer in active service – they must not become nostalgic lecturers reminiscing about a bygone golden age. What we need are modest but determined alumni, ready to pass on their knowledge with humility.

Young professionals, for their part, must be open to learning and capable of integrating – at least in part – the insights of their predecessors. This mindset, this openness to learning, should be cultivated through vocational training.

Bringing experienced professionals into education pathways would make the realities of the job more tangible and inspire interest. After all, no one speaks more convincingly about a profession than someone who has lived it. Here, too, retired professionals have a role – not to tell their life stories, but to spark vocational ambition.

Eric MAUCORT

Former Director of the
Chinon Power Plant
President of SLC



Tributes

Their names were Jacques – one my brother, the other a friend. Both were passionate advocates for the nuclear cause. And they are no longer with us. These few lines are our way of paying tribute, so they are not forgotten – at least, not too soon.

Claude Fischer Herzog



Jacques Leclercq, man of the "nuclear age"

Jacques passed away on 17 June 2024. He was 81. Born in Void near Commercy, he spent his youth

in Bar-le-Duc, balancing studies with sport. He excelled in everything – mathematics, drawing, basketball and judo, a discipline in which he earned a black belt. He was admitted to École Polytechnique and later graduated top of his class from Ponts et Chaussées.

Jacky – as we called him – was, in his own way, an activist: a champion of the public good, a man deeply committed to public institutions. He worked with Pierre Boulin and was present at the interministerial committee on 6 March 1974, where France set its course for an ambitious nuclear future.

He chose to join EDF. He oversaw construction of the Blaye power plant near Bordeaux, then Gravelines near Dunkirk, and finally Creys-Malville near Lyon. In 1984, he became Vice-President of EDF, in charge of its nuclear fleet. It was the golden age of industrial ambition – the "nuclear age" – which became the title of his remarkable book, translated into 35 languages.



Jacques Masurel, a man of faith and reason

A great humanist, Jacques was a friend of Pierre Teilhard de Chardin.

He often said he was better known in China than in France, recognised there for creating the first map of that vast country – much like Matteo Ricci, who recorded its alphabet! He was Vice-President of the Association of Friends of Pierre Teilhard de Chardin – a role in keeping with his commitment to the climate and the nuclear legacy.

He cherished unlikely encounters and brought together a remarkable range of individuals in his book *À temps et contretemps* – among them Philippe Herzog, proud to be included.

A leading industrialist, he dreamt of technologies like nuclear energy serving society and the planet – forces he sought to reconcile. He loved Schubert, whose works rise skyward, and Verdi, firmly rooted in the history of humankind.

We glimpsed the sky together again at the SLC summer university, high on the Pic du Midi. Dearest Jacques, you have left the "earthly paradise" for the other, among clouds, stars and the soul of the world, to reunite with Teilhard, Gilles, and so many others... Farewell.

L'INSTN: A close relationship with the world of research



Eric GADET
Director of
the INSTN

The National Institute for Nuclear Science and Technology (INSTN) is a higher education and continuing professional development institution administered by the French Alternative Energies and Atomic Energy Commission (CEA).

For over 65 years, the INSTN has delivered training at all qualification levels in nuclear energy, low-carbon energy systems and healthcare technologies. With campuses in Cadarache (near Aix-en-Provence), Cherbourg, Grenoble, Marcoule (near Avignon) and Saclay (near Paris), it offers access to educational platforms and facilities, including on-site training areas dedicated to nuclear operations and radiation protection. It also benefits from access to CEA's laboratories and research infrastructure.

As a higher education establishment integrated within the CEA, the INSTN enjoys close ties with the research community in fields such as energy, health technologies and associated expertise (e.g. risk

management, materials science). Its teaching staff includes 1,100 experts, 60% of whom are CEA scientists, with the remaining 40% coming from industry, healthcare or partner institutions, both national and international.

Productive partnerships with industry and academia

In continuing education, relationships with businesses are central to tailoring training offers, enhancing employability, supporting career transitions and enriching the educational content. These partnerships are founded on a shared commitment to collaborative action.

In initial education, the INSTN – an administrative public institution – grants its own degrees and certifications under the joint supervision of the ministries for industry, energy and higher education. Most degree programmes are delivered in partnership with French and international universities or higher education institutions. The INSTN is a member of the Conférence des grandes écoles, the body representing France's top-tier graduate institutions.

A collaborative international strategy

Internationally, the INSTN's strategy aligns with that of the CEA and with national authorities (ministries, national secretariats, technical committees and safety bodies),

as well as industrial partners. It supports local capacity-building policies through research projects, healthcare-related nuclear technologies and low-carbon energy solutions, working alongside universities, institutes and research centres. Key areas of joint activity include the Middle East, India, Africa and Europe. The INSTN has been a Collaborating Centre of the International Atomic Energy Agency (IAEA) since 2016. In 2021, this collaboration expanded to include nuclear energy, applications and safety.

The INSTN is a member of the network of higher education institutions for sustainable development overseen by the Ministry for Ecological Transition and Territorial Cohesion. It is committed to tackling climate change, promoting diversity, supporting return-to-work schemes and reducing social, territorial, gender, religious and disability-based inequalities. Over 20% of its students are enrolled in apprenticeships, facilitating access to longer study programmes, and it offers social bursaries. Foreign students make up more than 20% of its partnered Master's enrolments. With women accounting for approximately 30% of its degree-course participants, the INSTN exceeds national averages for STEM disciplines. All degrees and training programmes are accessible, on the condition that they lead to viable employment outcomes.

Normandy: A model to follow

As Lamri Adoui, President of the University of Caen, explains, preparing for the future of the nuclear sector in Normandy is an ambitious undertaking spearheaded by the Region.

Normandy is fortunate to host a complete nuclear ecosystem (Paluel, Flamanville and Penly plants; La Hague reprocessing facility) that has fuelled economic development, notably through the growth of SMEs and subcontractors.

The Region also boasts a 50-year history of nuclear physics research involving local universities, CNRS and GANIL, the national heavy-ion accelerator.

This dynamic has attracted numerous partners to the area, including the INSTN, IRSN, EAMEA (the school for military applications of nuclear energy) and a wide array of industrial actors. Backed by political momentum, the Region has expanded

significantly, and the scale of need is such that collaboration prevails over competition. UMN, for instance, works in close coordination with local authorities.

A consortium serving nuclear excellence

The Region leads the **"3NC" Project: Normandy, Nuclear, New Skills**. It is part of the France 2030 recovery plan, and aims to address workforce needs across the entire nuclear value chain. Selected under the "Future Skills and Professions" (CMA) Call for Expressions of Interest, in the small nuclear reactor stream, launched by the French government and managed by the Caisse des Dépôts et Consignations (CdC), the project has been awarded €42 million in funding¹.

3NC revolves around three pillars: promoting enthusiasm for science and industry, training and dissemination. The University

of Caen plays a central role in the project and has spearheaded the creation of a network of universities across eighteen countries interested in nuclear development, with the goal of fostering academic mobility and linking local ecosystems that combine academia, industry, public authorities and civil society.



Lamri ADOUI
President, University
of Caen



¹ See the box on page 20

L'ANDRA: Preserving knowledge and passing the torch

A long-standing partner of the Entretiens Européens, ANDRA was represented by its Director, Pierre-Marie Abadie, recently appointed President of the French National Agency for Nuclear Safety (ASNR).

He spoke about the three pillars of governance essential to managing radioactive waste: local engagement, intergenerational knowledge transfer and international cooperation.

CIGEO is a national project, as are all radioactive waste storage initiatives. Yet in terms of training and cooperation, there is both a strong local grounding – to harness the diversity of regional expertise – and an international dimension, centred on the global exchange of knowledge. While some nuclear roles do not directly involve waste management, many “non-nuclear” professions, particularly in underground works and safety (especially within project ownership), are critical.

A strong local anchor

The long-term nature of storage projects and the longevity of regional partnerships underscore the importance of intergenerational transmission. Initially a research body, ANDRA has now entered an operational phase, with a growing need for skilled professionals and a pressing challenge to attract young people. The agency works closely with the Grand Est Region – an area with both industrial heritage (steelmaking and automotive) and rural character – as well as with the Meuse Department, the PoCES (competence hub for underground works) and organisations such as GIFEN and UMN.

Efforts to make careers in the sector

attractive to young people from diverse backgrounds are grounded in the local area, with initiatives such as site visits and apprenticeship programmes. Another key objective is to bring people back into employment, particularly in rural areas where unemployment is high, and to retain them – a significant challenge given the high turnover among recruits in recent years.

Knowledge management in radioactive waste

This cross-disciplinary managerial approach brings together all the initiatives aimed at sharing the knowledge and expertise developed by ANDRA. It is particularly well-suited to radioactive waste management, especially for young professionals entering the field. These projects unfold over several generations, spanning research, design, regulatory processes and construction, which makes intergenerational knowledge transfer essential.

EURAD: An international cooperation initiative for knowledge sharing

At the European and international levels, a key strand of the EURAD programme is dedicated to capturing and disseminating scientific knowledge. *This marks a major shift in European collaboration towards the safe management of radioactive waste – one in which ANDRA plays a leading role for France.*

Pierre Marie ABADIE



ORANO, A central player in the sector



Jérôme EYMERY

Director of Employment, Training and HR Development

Orano is a European and international company involved in enriching and re-converting uranium, and recycling spent fuel to produce MOX – a resource already in use in some reactors and seen as promising for future SMRs. It also prepares final waste packages for deep geological disposal at Cigeo. In other words, it occupies a central position in an industry up against the challenges posed by the nuclear power revival in France and Europe. Operating in Normandy, the Rhône Valley and the Île-de-France region, Orano is working to attract young people to its highly diverse careers, as **Jérôme Eymery** explained.

Regions and universities have an essential role to play, but Orano also runs its own training centres, offering pathways for individuals who may be far from the labour market. The group has developed an internal mentorship model, enabling young and older employees alike to be supported in its core professions. On the question of international internships, Orano has already recruited young graduates from the Polytechnic Institute of Turin. However, the company questions the practical value of such placements within companies; in its view, university-based placements may better address the challenges of mobility and international exposure, particularly for young people facing language barriers. Orano proposes that major French organisations such as Andra, Orano and EDF should collectively fly the flag for nuclear abroad.



The very first edition of Les Entretiens Européens took place in Nogent, Haute-Marne, near Bure, focusing on the scientific challenges of nuclear waste management. November 2003

Seeing with one's own eyes

ASCPE and Les Entretiens Européens organises delegations to visit nuclear sites, particularly those dealing with spent fuel and radioactive waste – topics still too often demonised . Claude Fischer Herzog, Director of Les Entretiens Européens, has visited numerous nuclear sites – La Hague, Bure, Tricastin, as well as Paks in Hungary, Wroclaw in Poland, Daya Bay in China and Posiva in Olkiluoto – driven by her conviction that only an on-site perspective reveals nuclear energy's real value and the viability of waste management solutions. Known by her peers as a "pilot in the atomic maze", she champions direct engagement. Below, Pierre Filipi, President of Fidéas Capital and participant in the June 2024 Bure delegation, shares his reflections.

CIGEO: 500 metres underground – and for eternity!

France's most radioactive waste will soon be consigned for millennia to a deep geological repository spanning the Meuse and Haute-Marne departments, pending a decision by the Nuclear Safety Authority (ASN). Matthieu Denis-Viennot, Director of Institutional and Territorial Relations at ANDRA (the French National Agency for the Management of Radioactive Waste), guided us through the laboratory where, for the past 20 years, technical solutions for the construction, operation and long-term resilience of the site have been imagined, tested and demonstrated – all at a real-world scale, 500 metres underground.

CIGEO is expected to be developed over more than a century, during which time the already stored waste will remain retrievable should new recycling or treatment methods emerge. The site was chosen for the exceptional characteristics of its rock formation: the Callovo-Oxfordian claystone, formed 160 million years ago, offers remarkable stability and impermeability, ensuring containment of radioactive materials over their full lifespan.

The project will encompass 15 km² of underground space (with connecting galleries and storage vaults). From 2035 or 2040, it will begin to receive 10,000 m³ of High-

Level Waste (HLW) from spent fuel reprocessing, and 73,000 m³ of Intermediate-Level Waste (ILW), such as fuel rod hulls and end-pieces. In the meantime, what happens to the waste already produced? After reprocessing, it is stored above ground, awaiting CIGEO's completion. It must also be allowed to cool down until its temperature falls below 90°C.

At €25 billion over a century, the cost may appear astronomical, yet for electricity consumers, it represents only 1% to 2% of their bill – or around €15 to €20 extra per year for an average four-person household. In fact, most countries with nuclear programmes have opted for geological disposal, though technical approaches vary.

Waste treatment is the key to nuclear energy's public acceptance – an energy source that is both dispatchable and low-carbon, outperforming even renewables in this regard! CIGEO is thus contributing to the low-carbon transition – an effort worth acknowledging. As the Director of Les Entretiens Européens says, managing spent fuel and radioactive waste has become a high-value-added industry in its own right.

Pierre FILIPI

President, FIDEAS Capital



In the underground gallery with representatives from FIDEAS CAPITAL, CLEEE and MONTEIRO, 25 June 2024



After Bure in 2003, Confrontations at La Hague in 2004



Visit by the Les Entretiens Européens delegation to Posiva, at the Olkiluoto site (Finland), 14 November 2019



Delegation with CLEEE at Tricastin, 31 May 2023



At Bure on 3 July 2023 with students from ENSAM, École Polytechnique and Sciences Po



With companies from CLEEE, EUROLORRAINE and with the participation of Louis Gallois, 7 July 2022

Nuclear power in the spotlight

Cinema has always accompanied Confrontations Europe and ASCPE. During the European Tour and the many conferences on European integration, at both Les Entretiens Européens and Les Entretiens Eurafriens, film screenings have enriched discussions on the future of Europe, the planet, and relations among peoples.

Through images and music, we have discovered, appreciated and shared human stories and adventures from every continent.

Like other great human endeavours, nuclear energy has also been portrayed on screen. Hundreds of films – but all too often, disaster movies! These have fuelled nuclear hysteria, demonised the scientists behind it, simply chasing the thrill that sells... Nuclear innovation in the service of bombs has undeniably unleashed destruction and horror.

What about civil nuclear power for peace? It is all but absent from the big screen – with a few rare and brilliant exceptions. From America, from Serbia. But in France – birthplace of both cinema and nuclear science – our filmmakers have yet to celebrate our innovations or our great minds, especially the women who have led the way! It is hard to find a film about Marie Curie, for instance, beyond a few recent documentaries like the one by ARTE.

OpenWorld
Regards croisés

Iran Colombie Russie
Nouvelle-Zélande Chine
Ukraine Europe Japon
Amérique Arménie Afrique

13^{ème} séance du Cercle cinéphilie d'ASCPE

une soirée atomique

Projection du film de Mervyn LeRoy

MADAME CURIE

Marie Curie ou la beauté de l'aventure scientifique



Through its OpenWorld, Regards Croisés film society, now formally established as an association, ASCPE hosted an "Atomic Evening", during which our guests (some

OpenWorld
Regards croisés

Albanistan Palestine Iran Colombie Russie
Israël Nouvelle-Zélande Chine
Serbie Ukraine Europe Japon
Belgique Arménie Afrique

Cuvari formule
ou Les Gardiens de la formule

Projection suivie d'un débat
avec Dragan Bjelogrić



of them to their great surprise) discovered the many contributions of radioactivity to human prosperity, health, electricity and even art, digital technology and space exploration. They also encountered the scientists who devoted their lives to the discovery of radium and its applications. **Madame Curie**, the 1943 film directed by Mervyn LeRoy, moved audiences with its striking performances and the unwavering determination of Marie and Pierre Curie to bring radium into the light. The next chapter – the story of their daughter Héléne's pioneering work with radiation, which has contributed so much to humanity – has yet to be brought to the screen!

Another deeply moving evening featured a Serbian film depicting a unique moment in our shared history, when fraternity and solidarity triumphed over Cold War tensions and conflict, leading to groundbreaking discoveries that would go on to save millions of lives. **Guardians of the Formula**, by Dragan Bjelogrić, was screened in a Paris preview in February 2024 and highlights the courage of French Professor Mathé, who performed pioneering bone marrow transplants on a group of young Serbian scientists. These scientists had been fatally irradiated during research aimed at providing Yugoslavia with a nuclear bomb. They were saved, and went on to dedicate their lives to peaceful nuclear research. A film that deserves to be shown in schools.

Most recently, during the 2024 Les Entretiens Européens, attendees were introduced to Oliver Stone's **Nuclear Now**, in a Paris premiere. The filmmaker explores how nuclear power can help overcome climate

change and energy poverty. The documentary is based on "A Bright Future: How Some Countries Have Solved Climate Change and the Rest Can Follow" by Staffan A. Qvist and Joshua S. Goldstein. "A powerful, clear and courageous film. I admire it for going against the current," wrote Werner Herzog.

OpenWorld
Regards croisés

Palestine Iran Colombie Russie
Israël Nouvelle-Zélande Chine
Serbie Ukraine Europe Japon
Rwanda Arménie Afrique

22^{ème} séance du Cercle cinéphilie

Soirée Nucléaire
Prosperité - Énergie - Climat

En avant-première et en V.O.

NUCLEAR NOW !
De Oliver Stone

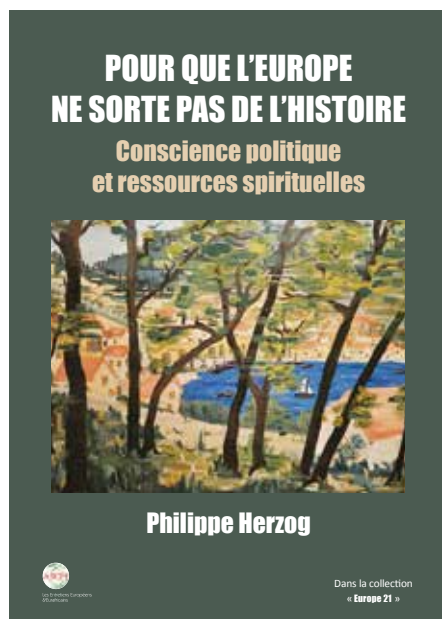


Other films will be shown as well... I'm thinking of the remarkable American miniseries **Chernobyl**, which portrayed the accident unflinchingly, laying bare the human errors that contributed to it, while also paying tribute to the extraordinary courage of the Russian miners who prevented a catastrophic explosion, and of the Russian scientists who, by identifying the design flaw in the first-generation reactors, paved the way for second-generation models that have never experienced a major accident.

Claude FISCHER HERZOG
President of OpenWorld, Regards Croisés

Editor's pick - Essential reading

Advocating for a new economy in Europe



between the state and enterprise. After the war, the American New Deal and European nationalisation policies shaped social and political life. Then neoliberalism and financialisation disrupted that balance: innovation and investment fell to large companies, while states were left to manage welfare, regulation and crisis response. Power structures also changed – in France, industrialists have all but disappeared from government. The state is staffed by administrators, with a glaring shortage of engineers. Former EDF CEO Luc Rémont had the courage to say: "It's hell trying to invest here." Despite delivering strong results, he was dismissed.

Each European state now seeks to regain control over its industrial base – but none will succeed alone, not even Germany. Encouragingly, some willing states have begun forming "enhanced cooperation" arrangements to pool industrial capacity and financing at scale. In nuclear electricity, a positive Alliance is taking shape – though it must not be hamstrung by vetoes from other member states or by the Commission.

In essential public infrastructure sectors such as healthcare and electricity, a new status could be created for "third-type enterprises" – companies tasked with delivering services of European general interest while operating within the single market.

More broadly, transforming European capitalism requires not only a common market production policy but a return to control over long-term investment and its financing. For 15 years, through work with European Commissioner Michel Barnier, the Confrontations Europe business and finance network, and Les Entretiens Européens, we have campaigned for this. We are heartened that Mario Draghi sees this Union dynamic as a top priority. We need deeper integration of national financial markets, a European investment fund industry dedicated to European projects, and a real EU budget.

We've delayed far too long. We have drifted into opaque governance. We failed to anticipate Trump 2. And we are now living through the return of war to Europe. To call this "a time for choices" is an understatement!

Order Philippe Herzog's latest essay (in French)

www.entretiens-europeens.org

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Editor's pick

In selecting this extract, we've chosen to highlight the author's focus on investment policy. It's sure to whet your appetite for the full work, which explores the renewal of the European project in all its dimensions.

If there is one strategic area where the European Union sought to show global leadership, it is ecology. Yet its climate goals are faltering – with projections warning of a +4 °C rise in temperatures in France by 2100 – and its so-called "energy transition" has become a fiasco. Under pressure from Green political groups and successive German governments, the EU imposed market rules that bet everything on renewable energy, while ostracising nuclear power as a source of baseload electricity. The lack of an energy mix suited to the real needs of populations and industry has led to deeper dependence on imported fossil fuels – while China has surged ahead in the production and sale of electrical equipment.

There is now an urgent need for an energy – and more broadly industrial – strategy that focuses on revitalising living, working and production environments, especially for communities already disrupted by climate instability. The essential infrastructures underpinning the common good have aged – healthcare, education and training, electricity, social housing, public transport

...

There is much talk of "structural reform", but at its core, this concerns the relationship

Les Entretiens Européens: A legacy to be proud of!

Les Entretiens Européens held their final edition in April 2024. The theme – Training and Employment – brought 23 years of commitment to a fitting close, in the presence of enthusiastic students from ENSAM eager to learn more. Over the years, the initiative has hosted twenty-two international conferences on the future of nuclear energy, interspersed with hundreds of meetings, lectures and at least as many publications, newsletters and thematic papers. Les Entretiens Européens have steadily grown and evolved over time: Fabien Briquet, a student at Arts et Métiers, apprentice at Assystem and intern at Hinkley Point C with EDF Energy, interviewed its Director Claude Fischer Herzog about the significance, role and future of these dialogues.



Fabien Briquet - How would you define *Les Entretiens Européens*?

Claude Fischer Herzog - Les Entretiens Européens have served as a public forum for debate among sector stakeholders, regional actors and sometimes contentious dialogue with EU institutions. They have earned a reputation for seriousness and quality. Each edition built upon the last, leading to a first decisive victory: the recognition of nuclear energy by a Commission that had to reverse its earlier biases – biases we had identified from the outset, such as those in the electricity market at its inception and the “3x20” targets leading up to the Green Deal. We denounced the persistent refusal to consider nuclear energy as a public good and the sector’s companies as assets for European industry and our economy. This blindness cost us valuable time. Europe’s competitiveness declined over the years, and it took crises to awaken it. Better late than never, but we risk paying dearly for the lost time. More fundamentally, the crisis signals deeper issues: the fragmentation of Europe, its hesitations in global restructuring and a headlong rush into a wartime economy under the guise of protection, with massive defence spending incompatible with the investments

needed to restore our energy industry and other essential infrastructures.

FB - Why did the Commission persist in its choices?

CFH - It’s not for lack of warnings. The misguided energy policy, favouring renewables unilaterally, led to the energy crisis (well before the geopolitical crisis) with soaring gas prices due to skyrocketing demand. It’s unfortunate that institutions don’t listen to civil society – or at least not all its actors. They heeded the Greens, supposedly environmental defenders, whose positions aligned with Germany’s, dominant since the 2010s and overrepresented in European power structures, and which became anti-nuclear after Fukushima.

FB - Yet you engaged in dialogue with the institutions?

CFH - Yes, we engaged in discussions with the European Commission throughout those years! In fact, the Commission was a partner in the very first edition of Les Entretiens back in 2002 – another era, when Loyola de Palacio and François Lamoureux were advocates of an inclusive energy mix encompassing all sources. It was also a time when we were reflecting on how nuclear energy could be embraced by society. François Lamoureux visited Nogent in Haute-Marne, where it all began: the first major international conference, organised with my friend Brigitte Bornemann – already a director in the field of “marine energies” – and in partnership with the departments of Meuse and Haute-Marne. The event brought together participants from 15 European countries, as well as Russia and Japan. Unforgettable. Our discussions centred on nuclear waste management, earning me the nickname “Madame Nuclear Waste Management” for several years, before I eventually became known as “Atomic Claude” when we fully committed to advocating for nuclear energy.

FB - Why start with waste?

CFH - Radioactive waste was central to the nuclear debate. Nuclear energy produces waste – no one denied that. The elected officials I spoke with during a trip to China raised serious concerns... “It’s nuclear’s Achilles’ heel. We don’t know how to manage it. It’s dangerous and could spread radioactivity everywhere, into our fields and rivers. We must abandon nuclear energy...” declared anti-nuclear campaigners in every possible tone. An offensive that met with little resistance, except from a few courageous politicians, such as Christian Bataille

in France, and Rolf Linkohr in Germany, a Member of the European Parliament who became a friend. Together, we organised an edition of Les Entretiens in Berlin in 2006 – the first public discussion on the topic in Germany in a decade, after years of silence driven by fear of confrontations with Green activists who would smash up public venues with baseball bats... It was with them that we launched and then developed Les Entretiens Européens, supported by indispensable partners such as Andra, the CEA and Cogema, soon joined by EDF and Engie, and later by Areva (now Orano) in France, Electrabel in Belgium, Rosatom in Russia, Westinghouse in the United States and Mitsubishi in Japan. Over several years and across four editions – held in Nogent, Bar-le-Duc, Reims and Paris – we explored the topic in depth with André Ferron, a researcher at Confrontations and author of *Electricité. Naissance d’une communauté*. We examined the issue from every angle: scientific, economic, social, ethical, financial and democratic. The conclusion was clear: there are solutions – and they have the unanimous backing of the global scientific community. What was lacking? The courage to make political decisions.

FB - So it was at that point that you opened the debate on the political choice of nuclear energy?

CFH - With Confrontations Europe, we took on what we saw as the real issue: the choice of nuclear energy. It’s a political decision, one that belongs within the democratic sphere. In France, a public debate was needed on the renewal of our reactor fleet; in Europe, to lay the foundations for a nuclear industry. From 2007 onwards, we organised Les Entretiens across Europe in partnership with industrial stakeholders, research institutes, regional authorities, professional and labour unions, associations like Foratom (now NuclearEurope) and SLC, and universities from across the continent – whether pro- or anti-nuclear. We held events in Brussels, Berlin, Budapest, Warsaw, Paris and even Helsinki, including meetings, conferences, and site visits. How could we help societies to take ownership of the issue and engage in the decision-making process? There weren’t many of us, but we stood firm in seeking nuclear’s recognition at a time when almost no one dared to speak up for the technology in Europe – or even in France, for that matter. It was in this context that I consistently defended Flamanville and CIGEO as strategic assets for the future of nuclear energy in our country, in Europe, and globally.

Continued page 36

FB - What were the main focuses of your advocacy?

CFH - Climate change was accelerating; swift action was needed. Our efforts concentrated on nuclear energy's specific advantages: zero CO emissions, large-scale profitability and competitiveness, continuous and affordable production, and sustainability. Safety was paramount, with international institutions establishing standards post-Chernobyl. While investments were substantial, long-term and costly, the cost-benefit analysis favoured nuclear energy, especially if we pooled resources and shared risks. Les Entretiens then embarked on a new campaign: building a European nuclear industry and examining financing conditions.

FB - How did interactions with the Commission unfold?

CFH - We entered into a full-scale standoff with the European Commission to create the conditions necessary for long-term investment in a market that, at the time, actively discouraged it. Our aim was also to have nuclear energy recognised as a Service of General Economic Interest (SGEI), a status made possible under the Lisbon Treaty - following an epic battle won by Philippe Herzog, then a Member of the European Parliament, and Mario Monti, then European Commissioner for Competition. This was all the more urgent as the global landscape was shifting - new players were entering the arena, notably China, Korea and India, backed by their governments and benefiting from public subsidies, thereby distorting competition on the global market. How to maintain our leadership under such conditions? The Commission supported us in organising Les Entretiens; I was invited to participate in ENEF meetings, the European Nuclear Energy Forum held annually in Prague and Bratislava. Massimo Garribba, the Commission's Director-General for Energy, regularly attended, commending us for posing the "right questions" in the debate. However, there's none so deaf as those who will not hear. We got the Green Deal, which prioritised renewables, but failed to secure the market reform that discriminated against nuclear - despite its need for long-term stability and visibility, which ran counter to the prevailing doctrine of competition.

FB - Were there any tangible outcomes?

CFH - We fought battles (for many years!) over taxonomy, long-term investment, greenhouse gas reduction targets, a stable and controllable energy base and a solidarity pact for energy, as well as a structured coordination among nuclear states. Progress was gradual. Then came the crisis, and suddenly nuclear energy was back in

favour. Today, a majority of Member States and their companies are choosing to reintegrate nuclear energy into their energy strategies. We haven't yet built a European nuclear industry, nor achieved a common energy union - but we are moving in that direction. It's now up to the new generation to carry the torch. We are stepping back. With our final edition focusing on training and employment, Les Entretiens opened a new debate, a reflection on a critical condition for success: mobilising young people (and not-so-young) to pursue scientific and technical careers that will enable the sector to train the workforce needed to design the next generation of reactors - safer, more efficient and opening up new prospects for industry and a decarbonised economy.

FB - A European nuclear industry is still to be built... who are the key allies needed to make it a success?

CFH - Stronger cooperation among nuclear states is essential, along with broader engagement across industrial sectors. As early as 2010, alongside Hervé Fischer, we organised Les Entretiens in Paris on "Sustainable Mobility and Clean Cars". Then in 2019 in Helsinki, we discussed "A New Energy Era Underpinned by Nuclear Revival", expanding our partnerships to energy-intensive sectors. Once again, we were somewhat ahead of the curve. Today, this is a pressing issue: electrification of uses is the new frontier. To succeed, nuclear energy must find allies in energy-consuming sectors - construction, transport, agriculture, digital technologies - all of which are undergoing transformation. Their interests are complementary. Instead of each sector competing for minimal savings at the expense of the electricity sector and its companies - who need to invest to keep producing - cooperation and pooled resources could help build a united, competitive industrial base capable of facing fierce global market competition.

Les Entretiens Européens have made their contribution. They will now continue in a different format, supporting the work of the *OpenWorld-Regards* croisés film society, which I have the pleasure of chairing. We promise to hold dedicated sessions on nuclear energy and its contribution to society - another means of fostering societal ownership of the issue.

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