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Fission for Funds: The Financing of Nuclear Power

Greenpeace policy briefing based on a study by Jens Weibezahn and Björn Steigerwald

Greenpeace European Unit, June 2024

This briefing provides a short outline of a report [Fission for Funds: The Financing of Nuclear Power Plants](#) by Jens Weibezahn from the Copenhagen School of Energy Infrastructure, and Björn Steigerwald from the Technische Universität Berlin, commissioned by Greenpeace Germany.

The report provides a detailed overview of the various financing models currently in use or under development for nuclear power plants (NPP) in Europe, and highlights their unique risk profile. This risk is notably due to high upfront costs, combined with long construction periods, financing costs, fluctuating levels of public acceptance, and geopolitical factors. Nuclear projects also face revenue risks during the operating phase, because of market price volatility, ageing problems, and nuclear fuel supply challenges.

While the majority of the world's economies are focusing on the "renewable path", a few EU countries, including France, the Netherlands, Poland, Sweden, Slovakia, Slovenia and the Czech Republic, are betting heavily on nuclear power to meet their net-zero targets. Yet these countries scramble to find funding for new projects and to maintain their existing ageing fleets, and the nuclear industry has stepped up its lobbying efforts to get public funds. With EU countries' financial room for manoeuvre reduced by higher interest rates, [high deficits and austerity measures](#), this new report shows that government support for expensive, long-term, high-risk projects such as nuclear power plants is increasingly difficult to justify.

The key take-aways are:

- **Highly unreliable NPP projects mean dwindling investor interest:** Budget overruns, construction delays, and reliability problems in the operational phase are currently keeping private investor appetite low to non-existent, which means that governments are having to step in time and again to fill funding gaps in ongoing and planned projects.

- **Nuclear power is a black hole for taxpayers and consumers:** NPPs generally only become profitable if a government is heavily involved in de-risking the investment for private investors, with taxpayers and/or electricity consumers bearing the risks.
- **Polluters do NOT pay:** If the cost of liability insurance, decommissioning and waste management were fully included in the calculation, the cost of NPPs would be even higher. Failure to do so means that taxpayers will bear even more (financial) risk when the government has to step in as a last resort to cover these costs.
- **Small Modular Reactors are not coming to the rescue:** Persisting uncertainties regarding their overall economic viability compared to traditional reactors mean no small reactors are being produced at a significant commercial scale, with notable cancellations like NuScale's, due to escalating costs.
- **Nuclear is more expensive than renewables:** The cost of solar and wind energy, including the required infrastructure and taking into account the fluctuating nature of wind and solar, is already much lower than new nuclear capacity, so our money would be better spent on energy savings and renewables.
- **Financial dependence creates geopolitical risks:** Some European projects are further exposed to geopolitical risks from the involvement of Russian state-owned companies and their fuel supply, giving Russia geostrategic influence for decades to come.

Main findings of the report:

Financing models

Financing models and examples from different countries outlined below show that in order for NPPs to become bankable, the government has to de-risk the investment for private investors, with taxpayers and/or electricity consumers bearing the risks.

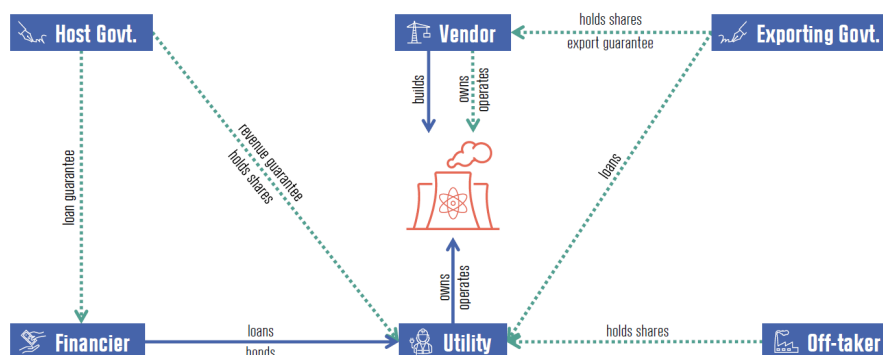


Figure 1: Schematic overview of financing models. Solid lines represent standard relationships, dashed lines optional ones.

Country overview

Finland

The most recent nuclear project to come online, Olkiluoto 3, financed by using the Mankala model, where multiple companies form a cooperative to jointly own and finance the NPP with each company receiving electricity in proportion to their investment, was finally connected to the grid in 2023 with a construction time of 17.5 years, leading to financial losses for the (French) vendor company as well as the Mankala company. A second recent project was cancelled due to the involvement of the Russian state-owned company Rosatom and towering costs.

United Kingdom

The most recent projects were either cancelled or, in the case of Hinkley Point C and the proposed Sizewell C project, are struggling with cost overruns and construction delays while the UK government keeps trying to set up favourable financing models for investors and NPP developers, shifting financial risks onto rate and tax payers.

France

France's European Pressurised Reactor (EPR) projects have faced significant challenges both at home and abroad, including substantial cost overruns and construction delays, leading to significant financial pressure on utilities company EDF, which was finally fully nationalised in 2023. Despite this, the government remains committed to nuclear energy, proposing a "renaissance" with plans for up to 14 new design EPR2 reactors, for which they are working on new and adjusted financial mechanisms.

Hungary

The current project Paks II faced delays and financial complexities, including delaying the start of loan repayments and the involvement of the Russian state. Hungary still counts on government-to-government financing by Russia, including a loan by a now sanctioned bank, despite the ongoing Russian war on Ukraine, which increases the uncertainties surrounding the project.

Poland

In Poland, discussions about nuclear energy date back to the 1950s, but the country has yet to operate any nuclear power plants for commercial electricity generation. The financing of six new reactors until 2043 is now considered to be initially taken on by a state-owned "special purpose vehicle" that is supposed to be sold to investors. Investors have not been found yet.

Czech Republic

The government is currently struggling to engage bidders for their plans of new reactor construction at two plants. At the same time, the majority state-owned NPP operator ČEZ is making efforts to diversify its nuclear fuel supply, marking a departure from previous reliance on Russian fuel.

Romania

Initially planned as a collaboration with international partners, state-owned Nuclearelectrica had to take majority ownership of the planned extension of Cernavodă after the partners pulled out and a decade-long search did not deliver new partners. Majority state-owned Nuclearelectrica is still looking for a private investor to oversee the expansion.

Slovakia

The most recent projects, Mochovce 3 and 4, originally constructed by Rosatom, encountered financing complexities, with Italian and Czech energy companies providing additional loans and revising ownership terms, demonstrating a shift towards balance sheet financing for project completion.

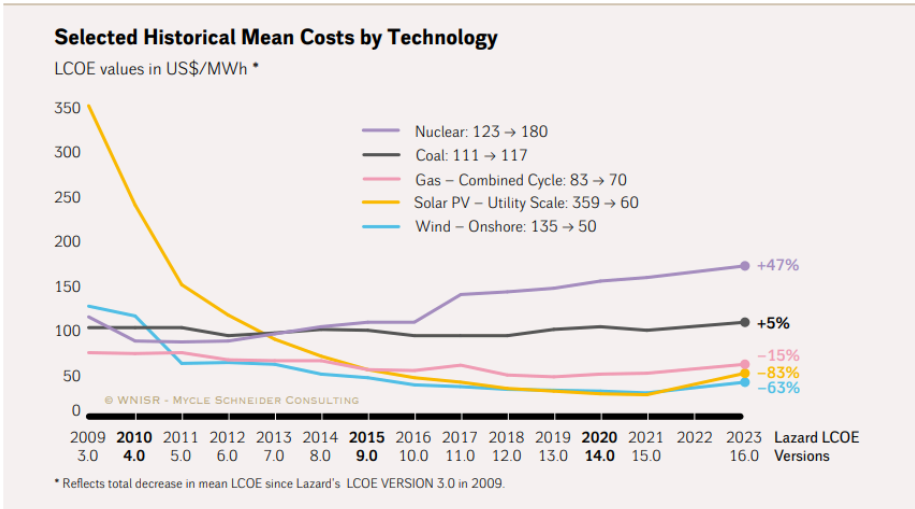
Type of financing	Projects financed in this way	Who pays / who bears the risk?
Project financing	None - not viable for nuclear projects	N/A
Corporate Financing	Slovakia (Enel and EPH)	Lender via loans and/or bonds
Hybrid financing (Mankala)	Finland (Olkiluoto-3)	Shareholders of Mankala company who buy the electricity produced against cost price
Vendor financing	Hungary (Rosatom/Russia) Poland (planned) Turkey (Rosatom/Russia)	Vendor company, if state-owned then indirectly also the owning government's taxpayers
Loan guarantees	US (Vogtle 3 and 4) UK (Hinkley Point C)	Guaranteeing government's taxpayers (either of the home government or the exporting government)
State-owned utilities	France (EDF) Hungary (Paks II Ltd. with Russian financing) Poland (PEJ) Czech Republic (CEZ) Romania (Nuclearelectrica)	Owning government's taxpayers
Export guarantees	Finland (Olkiluoto-3)	Guaranteeing government's taxpayers
Contracts for Difference (CfD)	UK	Taxpayers (if levied via general state budget) or ratepayers (if levied via electricity rates)

Regulated Asset Base (RAB)	UK (planned)	Ratepayers (energy bill payers)
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Context and background

The share of electricity generated by nuclear power in Europe is declining while renewables are on the rise. Since 2007, the EU added 74 EPR reactors' capacity worth of solar and wind¹. One key factor has been the declining cost of renewables - while nuclear cost increased.

Figure 64 - The Declining Costs of Renewables vs. Traditional Power Sources



Source: Lazard Estimates, 2023

Notes: LCOE: Levelized Cost of Energy

*This graph reflects the average unsubsidized high and low LCOE range for a given version of LCOE study. It primarily relates to the North American renewable energy landscape but reflects broader/global cost declines.

Source : https://www.worldnuclearreport.org/IMG/pdf/wnisr2023-figure64_lazard_lcoe_2023.pdf (2023)

EU public funds for nuclear

The priority of the nuclear alliance led by Bulgaria, Croatia, Czech Republic, Finland, France, Hungary, Netherlands, Poland, Romania, Slovakia, Slovenia, Sweden and joined by Italy and Belgium as observers, is to get EU funding and relax state aid rules for nuclear power. So far, EU funding is allocated to the Euratom Research and Training Programme. The European Investment Bank (EIB) has funded some nuclear activities in the last two decades and is now planning to fund Research & Development (R&D) in small modular reactors (SMRs) in the next three years, according to a draft strategic roadmap. EU finance ministers who govern the bank will decide on the R&D funding for SMRs on 21 June 2024 at the Board of Governors meeting.

¹ [Calculation made by Negawatt expert Paul Néau](#) and verified by Greenpeace

Four nuclear power plants connected to the EU grid in 16 years

Projects	Initial construction cost (bn €)	Final construction cost (bn €)	Due date	Expected date
Flamanville 3 (France)	3.3	13.2 (x4)	2012	2024 (+ 12y)
Mochovce 3 and 4 (Slovakia)	2.800	> 6.200 (x 2.2)	2013	2024 (+ 11y)
Olkiluoto 3 (Finland)	3	12 (x4)	2010	2022 (+ 12y)

Under construction in Europe

There are currently four projects under construction in four countries in Europe (EU27+UK): Hinkley Point C (UK), Paks II (Hungary), Mochovce 4 (Slovakia), Flamanville (France). After 17 years of construction, the Flamanville nuclear power plant in France does not generate power yet. Mochovce 4 was loaded with fuel last November and is expected to be connected to the grid in 2024.

Contacts:

Lorelei Limousin, Greenpeace EU senior campaigner: +324770790415, lorelei.limousin@greenpeace.org

Greenpeace EU press desk: +32 (0)2 274 1911, pressdesk.eu@greenpeace.org

For breaking news and comment on EU affairs: www.twitter.com/GreenpeaceEU

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