Financing Nuclear Energy in Poland

Executive Summary

Decarbonising Poland's economy requires a comprehensive, sector-specific approach. Assessing all viable clean energy solutions – while also considering supply chains, land availability, social license, infrastructure needs, critical raw materials, the availability of alternative options, and geopolitical shifts, among other factors – is vital to further reduce dependencies on third world imports and thus enhancing energy security. The uncertainties of a multipolar world underscore the need for a diversified solutions portfolio: over-reliance on a narrow set of technologies is inherently risky in case of major disruptions or a lack of availability of certain fuels or technologies, which could hinder the energy transition.

Scaling up nuclear energy has been recognised as part of the solution for Poland's transition to a zero-carbon economy by 2050. Achieving this goal requires robust and transparent financial models, effective risk management strategies, and proactive public communication. Learning from international experiences with these undertakings and adapting them to local contexts are key in overcoming the challenges inherent in this significant energy transition.

Recommendations

1. **Pursue decarbonisation pathways inclusive of a diverse range of clean energy options:** In the face of geopolitical uncertainty and complex socioeconomic challenges, Polish policymakers should adopt a climate and energy strategy that is de-risked, long-term, and technology neutral.
2. **Develop and maintain clear financing structures:** Polish nuclear energy initiatives should establish financial structures that are not only robust but also transparent, aligning with EU regulatory standards and ensuring public accountability.
3. **Implement comprehensive risk management strategies to minimise the cost of capital:** Poland should utilise international best practices in risk sharing and mitigation to secure stable investments while maintaining clear communication about these strategies to stakeholders. Political, market price, and construction risks should be properly evaluated with the Polish government and appropriate authorities best placed to organise such risk distribution.
4. **Enhance public and stakeholder engagement:** Ensuring ongoing and transparent engagement with the public and stakeholders is crucial. Communicating clearly about the benefits, risks, and progress of nuclear energy projects is essential for building and maintaining trust.
5. **Address transparency and public concerns:** Specifically address public concerns about transparency in project financing and governance. Providing clear, accessible information about the financial mechanics, risks, and benefits of nuclear energy projects will be key to gaining and retaining public approval.

Context and Importance of Nuclear Energy in Poland and the European Union

The world is going to need more energy, not less. Global electricity demand is expected to grow by about one-third to three-quarters by 2050, requiring strategies that limit increasing emissions while meeting this additional demand. Renewable energy sources like wind and solar will be critical to this effort worldwide, but they can be constrained by daily and seasonal variability as well as their land footprints and other administrative obstacles. Additional clean firm power will be required in order to limit the overall system cost and enhance energy security.

Nuclear energy can contribute to national energy security in a numbers of ways:

- Nuclear power is nearly always on at a predictable price (once constructed), boasting capacity factors of over 90%
- Technology is available globally from a number of vendors worldwide
- Fuel itself is incredibly energy dense – allowing for storage of years' worth of supply on site
- Fuel costs are only a small proportion of the total cost of nuclear energy
- Uranium markets are global and significantly more stable than the fossil oil and gas markets

Therefore, in the face of geopolitical uncertainty and complex socioeconomic challenges, Polish policymakers at the heart of Europe should adopt a climate and energy strategy that is de-risked, long-term, and inclusive of a diverse range of clean energy options. Nuclear energy is certainly one of these options.

Clean firm power refers to power sources that generate electricity on-demand, regardless of weather or time of day, with minimal emissions. Clean firm technologies can achieve very high-capacity factor. Technologies such as nuclear fission, fusion, geothermal (including superhot rock geothermal), combustion with carbon capture and storage, and zero-carbon fuel combustion are considered to be clean firm (this is not an exclusive list). These technologies are key to achieving deep decarbonisation of the energy systems by delivering a number of benefits including lower total system cost of the transition, lower need for costly and rarely called upon long-duration energy storage, lower requirement for transmission grid buildout, and overbuilding of the power infrastructure.

More information is available here.

Nuclear power plays an important role in Europe's energy security and decarbonisation initiatives. The European Union currently operates 100 nuclear energy reactors, with plans to expand this number by 32 to bolster energy independence and stabilise the grid. The EU's nuclear energy R&D strategy includes the Euratom Research and Training Programme, which complements the Horizon Europe programme. For the 2021-2025 period, the Euratom Programme, emphasising development, innovation, and security enhancement, has been allocated a budget of EUR 1.38 billion. For Poland, a strategic shift towards clean firm energy sources such as nuclear energy can also contribute to the EU's broader goals to reduce carbon emissions substantially.

European Union and Nuclear Energy

Until recently nuclear energy technologies had been a complicated and politicised question within the European institutions, as Member States decide on their energy mix and they have very diverging views on the role of nuclear energy. However, this tide is beginning to shift as a result of the invasion of Ukraine and as more Member States are actively pursuing deployment of new nuclear energy technologies to bolster their energy independence and progress towards deep decarbonisation.

EU state aid rules can limit the options of Member States to support national projects, including on nuclear energy. State aid needs to be compliant with EU state aid rules and approved by the European Commission. While state aid rules were loosened in 2023 for some key clean technologies, nuclear energy was not included in the list.

The inclusion of nuclear energy in the sustainable activities list under the EU Taxonomy underscores its essential role in meeting decarbonisation targets. This framework supports Member States, including Poland, by identifying funding and investment in nuclear energy projects as aligned with environmental and sustainability goals.

Additionally, the launch of European Industrial Alliance on Small Modular Reactors (SMRs) signals growing interest in deploying these technologies across the European continent and willingness of the EU institutions to support it. This interest has been cemented by the first-of-a-kind Nuclear Energy Summit in Brussels at the heads of state level voicing the need for collaborative action towards accelerating nuclear energy deployment and innovative ways to finance new build nuclear energy.

The current shift towards the Clean Industrial Deal is well aligned with EU industrial Alliance for SMRs aimed at boosting European competitiveness, where content of SMRs could play an important role. The recently published report by Mario Draghi, "The Future of European Competitiveness," stresses the role of nuclear energy as an important part of Europe's energy mix. Nuclear power, alongside renewable sources, such as wind and solar, is 'essential' to provide a stable, low-carbon electricity supply and 'crucial' for grid stability, meeting climate targets and ensuring energy security. The potential of small modular reactors is also highlighted in the report.

In spite of the growing interest and enthusiasm for nuclear energy technologies, a number of challenges remain unresolved. Most notable is a lack of nuclear energy regulatory harmonisation across EU borders or overseas, fragmented supply chain, lack of suitable workforce, and access to affordable finance. This paper addresses the last challenge in the context of the current Polish nuclear energy programme and beyond.

Financing Nuclear Energy: Challenges and Strategic Approaches

The financing of nuclear energy projects is intricate and fraught with challenges, primarily due to the high initial capital requirements, the risk of delays, and market fluctuations. In a project's early stages, state support is often crucial in obtaining favourable financing rates and managing the substantial risks associated with these projects. Given that the cost of capital is one of the primary drivers of the final cost of nuclear electricity, government support in derisking these early projects is essential. Financing costs can vary widely, with the weighted average cost of capital (WACC) ranging from 3.8% to 7%, significantly affecting the economic feasibility of nuclear energy projects.[1]

Figure 1: Effective Frameworks and Strategies for Financing Nuclear Energy New Build

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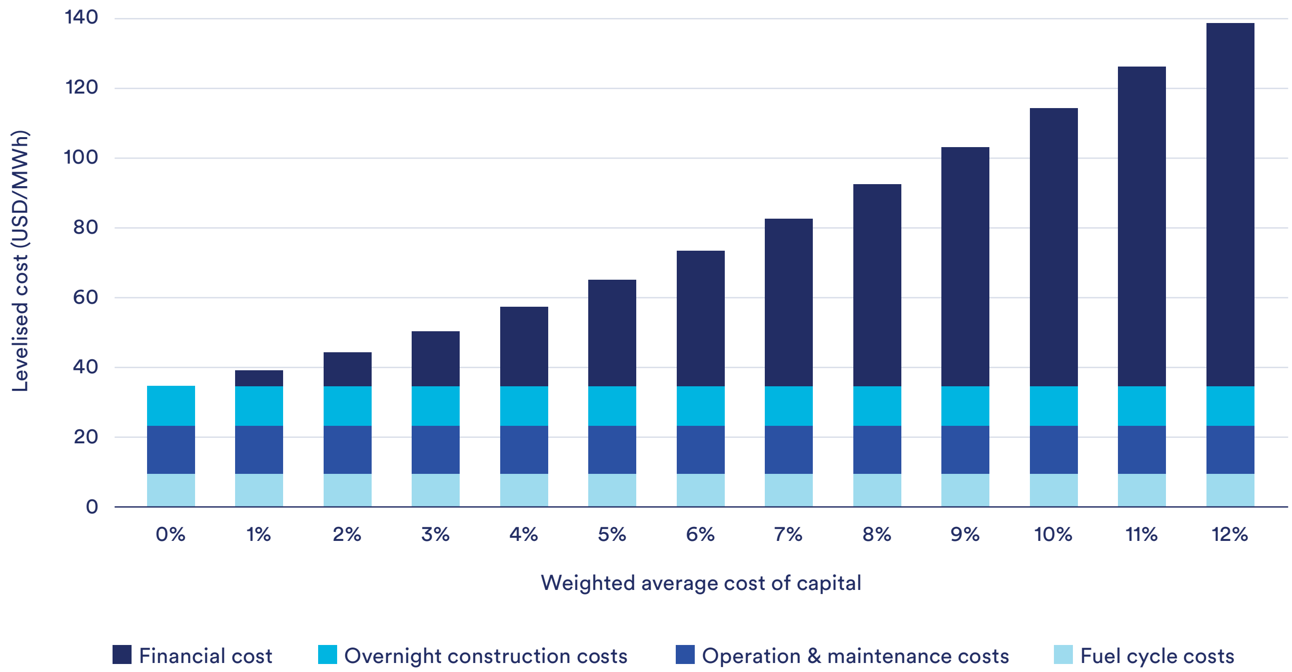
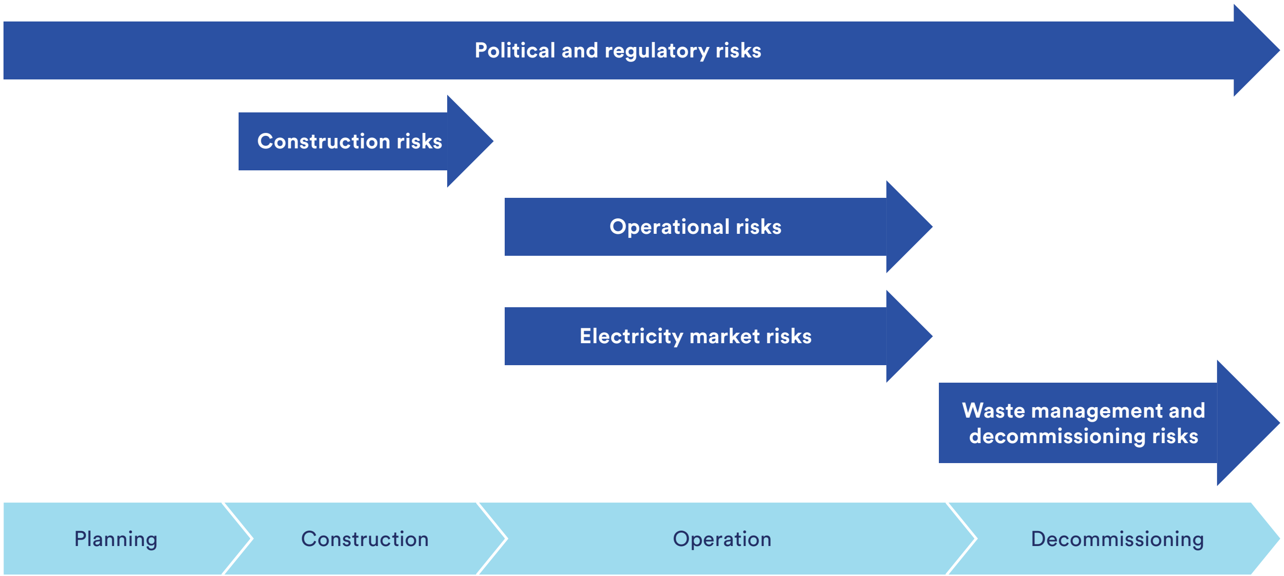


[1] *Scenario Study Nuclear Energy Conclusions and Summary Ministry of Economic Affairs and Climate Policy*, 26 September 2022

Risk Allocation in Nuclear Energy Projects and the Role of the Government

While nuclear energy projects are complex and subject to multiple risks and uncertainties, one can distinguish three types of risk: (1) political risks, (2) market price risks and (3) construction risks (as defined in the NEA report) that can significantly affect the final cost of nuclear energy. Each of these risks can be reduced or mitigated with appropriate measures relevant to the Polish context.

Figure 2: Categories of Risk Over the Project Life Cycle



The financing model and overall structure of the project will determine how these risks are allocated (i.e., which party bares the risks) and mitigated. Varying approaches have been adopted by nations in the past to optimise risk allocation and, as a result, achieve a low cost of capital. However, selecting the appropriate approaches for the first Polish nuclear energy build and subsequent projects will depend on national circumstances, policy goals, and the fiscal capacity of the government and private parties.

Political risks, such as sudden policy change altering the outlook of nuclear energy projects under development, are most effectively handled by governments, responsible for providing long-term legal and business certainty for investors. On the other hand, market price risks (e.g. future electricity prices being lower than expected) or construction risks (construction taking longer than anticipated) may require sharing those risks with a large base of ratepayers or taxpayers. Distributing risk among many participants – especially when markets are incapable of doing so – can help lower the economic costs associated with those risks (e.g., government backed loans come with lower service fees than private bank loans). Such risk distribution can be best organised by the Polish government and appropriate public authorities. Common mechanisms used in low-carbon generation, aside from direct public investment, such as guaranteed tariffs (such as Contracts for Difference, CfDs) that mitigate price risk for investors, as well as regulated asset base (RAB) and construction work in progress (CWP) mechanisms for addressing construction risk.

Unpacking Contracts for Difference (CfD)

Contracts for Difference (CfDs) have been endorsed by EU law as a primary state aid support mechanism for new, low-carbon power generation technologies. In March 2024, the European Commission approved the Czech Republic's plans to grant direct price support in the form of a power purchasing contract with a state-owned special purpose vehicle. This form of state aid ensures stable revenues for the planned new nuclear unit at Dukovany for 40 years, with a subsidised state loan to cover a majority of construction costs as well as a "protection mechanism against unforeseen events or policy changes." With this precedent, it can be expected that support for future Polish nuclear plants is likely to take a similar form.

What Are CfDs?

Contracts for Difference (CfDs) are financial agreements used in the energy sector to stabilise income for energy producers. Under a CfD, the government or a designated body agrees to pay the energy producer the difference between the 'strike price' – a pre-agreed fixed price per unit of electricity – and the actual market price achieved at the time of sale. If the market price falls below the strike price, the producer receives a payment; if it exceeds, the producer pays back the difference to the government fund.

Purpose of CfDs

The primary purpose of CfDs is to offer stability and predictability to energy producers, reducing the financial risks associated with fluctuating market prices. This security encourages investment in new, especially low-carbon energy technologies by ensuring a stable return on investment. This kind of stability enables projects to become 'bankable'[2] when the market price risk is reduced to a level at which private investors are willing to engage.

Benefits of Using CfDs

1. **Market price risk reduction:** CfDs reduce the market-related risks for energy producers, by provision of stable revenue stream regardless of the uncertainties on future market prices.
2. **Encouragement of investment:** By providing a guaranteed price for electricity generated, CfDs make investments in new energy technologies more attractive to financiers.
3. **Support for low-carbon energy:** CfDs are crucial for supporting the transition to low-carbon energy sources, aligning with global and national goals for reducing carbon emissions.
4. **Compliance with EU electricity market design:** The use of CfDs to support investments in nuclear energy is allowed under the new EU electricity market design, as outlined in Regulation (EU) 2024/1747 of the European Parliament and of the Council of 13 June 2024, which amends Regulations (EU) 2019/942 and (EU) 2019/943 to enhance the Union's electricity market design.

Disadvantages of CfDs

1. **Support begins when plant is operational:** Needs to be supplemented with additional measures e.g. credit guarantees, because the cash flow starts only after NPP operations begin.
2. **Contract price can be set too high:** Creating inefficiencies in the operation of the energy markets and potentially exposing customers to unnecessary costs over period of the contract.
3. **CfDs will place some financial responsibility on rate or taxpayers**, making society a risk-bearing stakeholder.

[2] A project is bankable, whether from public or private sources, when its risk-return profile meets investors' criteria and can secure financing to implement the project. Key criteria for bankability include the probability of meeting the project's financial, environmental, and social goals, sufficient estimated cash flows to cover costs and produce returns that meet investor expectations, and whether the project will be implemented by a creditworthy entity (Source: https://citiesclimatefinance.org/publications/what-is-bankability).

When utilised with nuclear energy projects, CfDs can stabilise revenue streams through fixed price contracts, thus providing financial predictability and alleviating the market price risk during the contract period. While CfDs can facilitate project bankability, they do not prescribe specific financial structures, allowing for the integration of various financial instruments to accommodate changing market and regulatory conditions. Since CfDs provide support to projects once plants become operational, construction and political risk still need to be addressed with other tools.

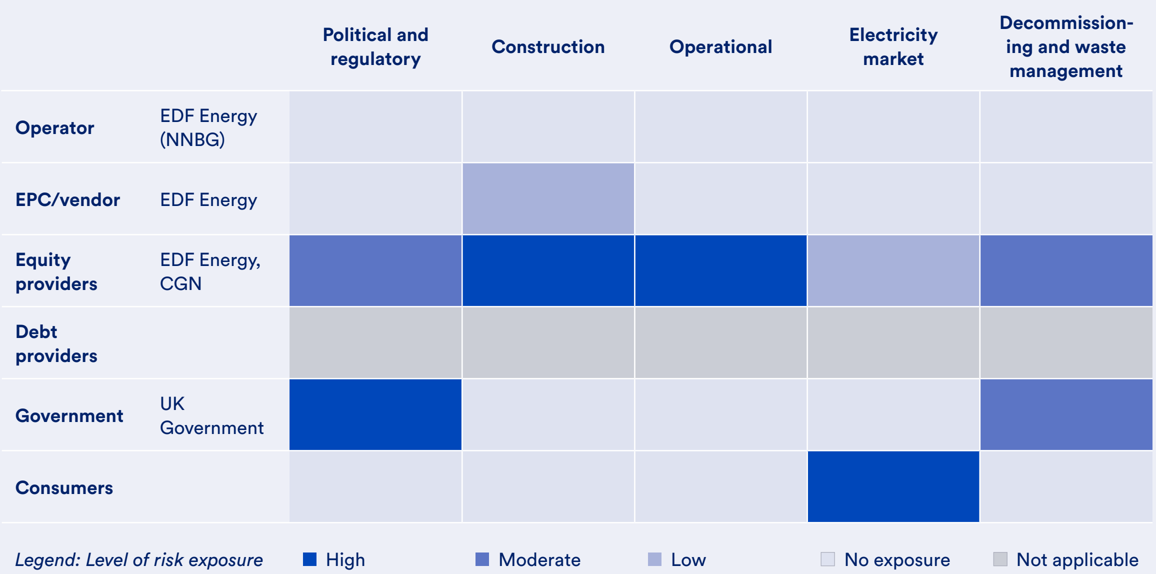
Case Study: New Build Nuclear Energy in the UK

CfDs have been implemented in various countries, including the United Kingdom, where they have supported projects like the Hinkley Point C (HPC) nuclear power station. The aim of this tool was to provide more certainty in terms of future energy prices and therefore unlock the project which is going to contribute to national energy security and sustainability goals. However, the efficiency of this solution was found lacking, when HPC project experienced a series of delays and cost overruns exasperated by COVID-19.

Case Study Insight: Hinkley Point C and Transparency Concerns

The Hinkley Point C project in the UK, now estimated to cost GBP 35 billion, highlights both the complexities of nuclear energy project management and the critical need for transparency. This project has faced significant public scrutiny over escalating costs and delayed timelines, underscoring the importance of maintaining clear and open communication with stakeholders. CfD support chosen for HPC project does not insulate the project investors from the escalating costs – embodiment of the construction risk. Cost escalation during HPC project has ultimately resulted in the lack of investor interest in pursuing future nuclear energy projects under CfD model due to lack of risk sharing during construction period. This is the primary reason the Regulated Asset Based model was developed for future nuclear energy projects in the UK.

Figure 3: Allocation of Key Project Risks for the Hinkley Point C Project



Case Study Insight: Sizewell C and Improved Risk Sharing Model

After difficulties encountered during HPC construction the government enabled a new financing model for nuclear energy – Regulated Asset Based model (RAB). RAB enables risk allocation between investors and consumers, meaning that consumers contribute indirectly toward the construction of a project by paying a small amount through their energy bills. The effects of such risk sharing can be significant. According to NEA report if the financing were entirely private, the weighted average cost of capital (WACC) for Sizewell C would stand at 8%, leading to a levelized cost of electricity (LCOE) of GBP 96 per MWh for the completed facility. However, with a 60% share of public funding in the project, the WACC would decrease to 3.5%, and the LCOE would fall to GBP 52 per MWh. Furthermore, by integrating construction expenses into the electricity tariff from the outset under the RAB model and utilising a public discount rate of 2%, the LCOE could drop to as low as GBP 50 per MWh. The additional burden of this advance financing of construction costs for each of the 27 million households in the UK would be approximately GBP 4 annually (Newbery et al., p. 48). Overall, the total cost for each household associated with the project would be GBP 10.5 per year (The Times, 8 July 2021).[3]

Figure 4: Expected Allocation of Key Project Risks for the Sizewell C Project

		Political and regulatory	Construction	Operational	Electricity market	Decommission-ing and waste management
Operator	Sizewell C	No exposure	No exposure	No exposure	No exposure	No exposure
EPC/vendor	Multiple contractors / EDF Energy	No exposure	Moderate	No exposure	No exposure	No exposure
Equity providers	EDF Energy, UK Govt., adt. TBD	Low	Moderate	High	No exposure	Moderate
Debt providers	TBD	Low	Low	Low	No exposure	No exposure
Government	UK Government	Moderate	Low	No exposure	No exposure	Low
Consumers		Moderate	Moderate	No exposure	High	Moderate

Legend: Level of risk exposure ■ High ■ Moderate ■ Low ■ No exposure ■ Not applicable

[3] It is worth noting the figures quoted here were calculated in 2021 and 2022 before a major inflation spike. Since then, inflation rates in many geographies have decreased, yet it still is likely to impact the cost of capital in the short term. Inflation rate, average consumer prices globally: 8,7% in 2022 and 6,8% in 2023 (Source: https://www.imf.org/external/datamapper/PCPIPCH@WEO/WEOWORLD).

CfDs in Practice: Polish Context

Since CfDs are likely to be the support mechanism chosen for not only first Polish nuclear power plant but also for future projects, the Polish government has a unique opportunity to shape its implementation by adopting some of the lessons learned in the UK.

- First, adopting lessons from Hinkley Point C means ensuring that financial structures and all stakeholder communications for the project are transparent, forthright, and publicly accessible to maintain public trust and support.
- Second, if the Polish government wishes to establish an environment where private investors pursue new nuclear energy construction projects beyond the first government-led plant, the development of construction risk-sharing models will be crucial, at least to support a number of early units until the nuclear energy industry increases the delivery confidence by completing plants on time and on schedule at which point risks and associated lending premiums will decline significantly.
- Third, market dynamics between new nuclear energy and the rest of the power system should be explored to ensure mechanisms are in place for optimal use of the energy assets. New nuclear energy generation, although capable of flexible operation, will deliver the highest value for money to the taxpayers if plants are able to operate in the baseload rather than significantly flexed over long periods of time. The cost of nuclear energy is dominated by the capital costs, thus flexing generation does not provide significant fuel cost savings, however it does reduce the ability of nuclear plant to recover its investment costs with decreased generation.

Transparency Issues in Nuclear Energy Financing

Maintaining high standards of transparency and accountability in the financing structures of nuclear energy projects is crucial. Poland currently boasts some of the highest public acceptance of nuclear energy projects in the EU. However, failing to fully disclose a project's financial assumptions and the specifics of government support mechanisms, like CfDs, can put that public support at risk. Creating space for meaningful multistakeholder engagement to discuss substantial aspects of financing model and risk assessment is key to ensure continued support for nuclear energy projects.