Financing Solutions for Nuclear Programs

FOREWORD

Nuclear power plants are long-term investments that require many years of planning and construction. During this period, both market situation and energy policy may change, and this risk may increase the cost of financing.

In recent years, Western countries have increasingly understood the value of nuclear power plants in climate change mitigation, as a grid stabilizer, and as a reliable source of energy. Because other forms of energy production enjoy various direct and indirect subsidies in many countries, many countries have also introduced or are introducing financing and support mechanisms for reducing risks for nuclear power projects.

This overview, originally commissioned by the Nuclear Committee of Finnish Energy (Finnish version), presents financing solutions and risk management mechanisms in use in Europe and the United States.

The review is divided into three parts:

- Ownership and project structure,
- Funding sources,
- Funding models and market risk management.

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OWNERSHIP AND PROJECT STRUCTURE

The ownership and project structure of a new nuclear power plant affects the interest rate of its funding and how risks are shared and managed. The ownership structure of a nuclear power plant project can be divided into three rough cotegories:

- State ownership (sovereign),
- Private corporate,
- Project finance.

These can also be mixed together.

STATE OWNERSHIP

In a state-owned project, the state either finances it directly from its budget or borrows money from the market. The interest rate on a loan depends on the country, but is often lower than the rates for private sector companies or project companies. The government's involvement in the project is often also seen as a factor that reduces political risk.

PRIVATE CORPORATION

The simplest and most straightforward ownership structure for a nuclear power project is that a large private company finances the project either by borrowing money from the market or by issuing shares.

Two recent examples of this are Flamanville 3 in France and Shin Kori 3 and 4 in South Korea, although both developer companies are state-owned. As nuclear projects are usually very large, with investments of up to tens of billions, this ownership structure is only used by large companies. Smaller reactors (SMRs) entering the market also enable smaller companies' projects.

PROJECT FINANCE

In the project finance model, a special company (often called SPV, Special Purpose Vehicle) is established for the project, which acquires funding for the project. This separates the ownership of the companies behind the project from the project and its risks. This reduces the risks of these companies, but on the other hand, the SPV often does not have significant holdings, so there is much less collateral for loans. This increases the risk and the cost of financing during the construction phase. After the completion of the project, there will be collateral (a functioning power plant), so financing and ownership will be rearranged.

The project finance model has recently been the most popular ownership structure for nuclear power projects (e.g. Taishan 1&2, Vogtle 3&4, Barakah 1–4, Hinkley Point C).

Since the project company has limited collateral, its construction and market risks must be reduced in some other ways. These include, for example, long-term purchase contracts (PPAs), contracts for difference (CfDs), RAB, tax credits for production and investment, and rewards for valuable services provided to the grid, such as a capacity market. More on these below.

CASE VATTENFALL

Swedish Vattenfall is a wholly state-owned company, although it operates in the energy market basically like a private company. However, when it comes to nuclear power, it has been under strict political control: from the 1980s to 2022, the owner, in practice the Swedish government, took a negative view of nuclear power, and Vattenfall even shut down several operating plants. Now, with the change in the government in the autumn of 2022, the owner has reversed the course by 180 degrees and demands urgent action from Vattenfall to build new nuclear power plants. The Swedish government has also set aside nearly EUR 40 billion in loan guarantees for nuclear construction. This loan guarantee significantly reduces the cost of financing. In Sweden, it is estimated that electricity consumption will grow rapidly as the industry is electrified, and that demand will come especially for reliable baseload energy.

FUNDING SOURCES

GOVERNMENT FUNDING, LOANS AND GUARANTEES

States can finance and support large infrastructure projects such as nuclear power plants in many ways. For example, direct financing can be provided as a low-interest loan or by purchasing a share of the project. The state may also offer loan guarantees (Sweden), budget for direct financing (the Netherlands) or give a government loan (the Czech Republic) for the nuclear programme.

CASE CZECH

In the Czech Republic, the state decided in 2020 to offer a zero-interest loan to the nuclear company CEZ to construct a new reactor at the Dukovany nuclear power plant. The loan covers the construction period and 70% of the construction costs. When the plant is launched, the interest rate on the loan rises to 2%. The state also plans to purchase electricity from the new plant at a predefined price (PPA) to reduce CEZ's market risk[1]. The goal is to guarantee reasonable electricity prices for consumers and improve energy independence.

EXPORT CREDIT AGENCY

A nuclear power project is a major industrial and financial effort for the supplier country, and compares, for example, to large cruise ship projects. Export guarantees and credits are provided by specialized export credit agencies or organizations.

The use of export credit agencies to finance part of international nuclear projects has become more common recently. They are regulated by the OECD and, within the framework of this regulation, they can provide services such as:

- Loans with a longer repayment period than normal
- More flexible repayment schedules
- Fixed-interest rate environment for long-term loans
- Loan guarantees for commercial loans
- Export Services and Commodities Insurance coverage
- Direct financing up to the amount of the Export Credit Agency's domestic export earnings.

[1]http://www.neimagazine.com/news/newsczech-government-approves-financing-model-for-new-dukovany-unit-8041080

CASE NETHERLANDS

In December 2022, the Netherlands decided to earmark EUR 5 billion to be spent by 2030 on promoting the design and construction of two large nuclear reactors, the continuation of the current Borssele power plant, and the promotion of small reactors[2]. In the spring of 2024, the Netherlands updated the plan for four large reactors. The EUR 5 billion in question is part of the EUR 35 billion allocated by the Netherlands for the energy transition. The background is that without new nuclear power, it will be too difficult for the Netherlands to reach its emission targets, and state involvement would enable faster construction of nuclear power by reducing its risks.

COMMERCIAL FINANCING

Commercial financing includes bank loans, international bonds and various syndicated loans. A new financial institution, the International Bank for Nuclear Infrastructure (IBNI), has also recently emerged on the market[3]. Its purpose is to act as an “anchor” or lead investor for nuclear projects, to finance 20–60% of the project, and thereby open up new funding channels for projects. .

ESG-FUNDS, TAXONOMY

Sustainable investment has been on the rise, as more and more investors are reluctant to invest in harmful activities for various reasons, such as reputational risk. Various sustainable ESG investment funds have emerged for this need, often with a lower ROI target than regular funds. ESG stands for Environment, Society, and Governance. In recent years, nuclear power has also started to be accepted as part of sustainable investments. For example, Microsoft and Amazon have included nuclear electricity as part of their environmental programs to meet the energy needs of data centers.

The EU Taxonomy for Sustainable Activities aims to list sustainable activities using standardized criteria and metrics, thereby facilitating the ESG funds' finding suitable funding targets. After years of discussions, nuclear power has also, under certain conditions, been included in this list. According to estimates, the interest rate of a project included in the taxonomy can drop significantly. For example, a two percentage point drop can lower the levelized cost of electricity by tens of euros per megawatt hour[4].

[2]https://www.grs.de/en/nuclear-energy-netherlands-01022023

[3]http://nuclearbank-io-sag.org

[4] The two percentage point estimate is based on communications with experts. Projected Costs of Generating Electricity 2020 – Analysis - IEA, https://www.iea.org/reports/projected-costs-of-generating-electricity-2020

FUNDING MODELS AND MARKET RISK MANAGEMENT

The financier's risk should be managed and reduced, especially in the project financing model, where the project company does not have significant collateral. This need is highlighted in an energy market that may not be able to provide reliable price signals far enough into the future for nuclear projects. To this end, several funding models and risk management mechanisms have been developed and adopted for the nuclear sector.

POWER PURCHASING AGREEMENTS (PPA)

Power Purchasing Agreements (PPAs) are a market-driven way to manage the risk of both the producer and the buyer. In a PPA agreement, the buyer (which can also be the state) promises to purchase a certain amount of future production at a predetermined price. The PPA agreement is somewhat similar to buying electricity futures in the electricity market, but from a specific seller and often during a longer period than electricity futures, which reduces the producer's risk as well.

The Finnish Mankala model is a cost-based PPA agreement between the producer company and its owners. Unlike the usual PPA, the Mankala model also binds the buyer's capital, as the buyer is also a co-owner of the production asset.

CASE POLAND

Poland is planning to use contract-for-difference (CfD) to support their nuclear power program. According to the Climate and Energy Minister, CfDs are the only accepted form of price subsidy in the EU's recent electricity market reform.

Using CfDs does not exclude the use of state loan guarantees. Poland's previous government also discussed export credit financing with the United States. Poland has also considered Sa-Ho Fundings, which is similar to the Mankala model. In it, the government would build the plants, and when finished, the facilities would be sold to a consortium of electric utilities and heavy industry[5].

CASE UNITED ARAB EMIRATES

The Barakah Nuclear Project, with four large reactors, cost around $24.4 billion and is considered to be the most successful nuclear program in recent decades. It succeeded despite constructing nuclear plants in a country that did not have existing nuclear power or significant expertise. Barakah's financing combined direct government funding from the United Arab Emirates (66% of the project), a state loan guarantee for the remainder, and a PPA purchase agreement for the plant's production. In addition, the plant supplier offered a fixed-price delivery contract and capital to the project company.

[5]https://tinyurl.com/2us5nffr

CFD - CONTRACT FOR DIFFERENCE

The most famous CfD is probably the £92.5 per MWh guaranteed price (strike price[6]) awarded by the British government to the Hinkley Point C nuclear power plant in 2016[7]. In practice, a CfD means that the developer and owner of a power plant receive the guaranteed price for the electricity they produce, whether the market price of electricity is below or above the guaranteed price.

In the UK, the CfD was used to enable long-term investment in new energy infrastructure and was offered for virtually all forms of clean energy generation. In practice, it eliminated the investor's market risk, and also the risk that politicians in the future would change the rules of the market or distort the market by supporting certain forms of production. It was also agreed that any outsized profits would be distributed to consumers. Also, the risk posed to the investor from changes in laws and policies was mitigated. If the construction project is delayed too much, the CfD contract will also be terminated.

RAB - REGULATED ASSET BASE

In recent years, the Regulated Asset Base (RAB) model used in other long-term infrastructure projects has become a possible financing model for nuclear power projects in the UK (Sizewell C). In addition, at least The Netherlands is also exploring its possibilities. The purpose of the RAB is to reduce the market and construction risk.

With RAB, the regulator estimates the future cost of electricity generation and a reasonable return on investment and guarantees this regardless of the market. It is also possible that the owner of a nuclear project may increase the customer prices of other, already existing electricity production to help finance the ongoing nuclear construction project, reducing the project's financing need and interest costs. The regulator will periodically review the project and its costs and encourage cost discipline. This distributes the risk partially to the consumer but retains the incentives to manage and reduce costs in the project.

The key benefit of RAB is that it transfers construction and market risk partly to consumers, possibly in advance, significantly reducing the risk premium for financiers. In addition, part of the project funding can be collected already during construction in customers' utility bills, significantly reducing the need and cost of external financing for the project. Ultimately, the consumer will also benefit, as the whole project can be built at a lower cost. However, success requires that the regulator understands the cost structure of the nuclear project well and that the project has ongoing active political support to solve emerging problems.

[6] The strike price will drop to £89.5 if Hinkley Point C's sister plant Sizewell C is built. An investment decision on this is expected during 2024. The guaranteed price is determined in 2012 pounds sterling

[7] https://www.gov.uk/government/collections/hinkley-point-c

CONSTRUCTION WORK IN PROGRESS - CWIP

CWIP is an accounting mechanism for recording and monitoring a construction project's direct and indirect costs. In many regulated markets, the energy company cannot start recovering the costs of an unfinished construction project through customer pricing before the plant is completed and commissioned. In the case of large projects, this can lead to serious cash flow problems and an increase in financing costs. To mitigate this, some authorities allow costs to be passed on to customers while the construction project is still ongoing, similar to RAB. This requires close monitoring of costs and project completion rate.

CAPACITY MARKET

One challenge in the electricity market based solely on energy pricing has been the inability to value some of the valuable services or features provided to the electricity system. Examples are projects with long construction periods that build reliable capacity or demand response capability. The capacity market rewards the producer for its grid flexibility and reliability. The capacity mechanisms in place in Europe are dominated by gas-fired power plants. The Finnish government plans to introduce a capacity market which nuclear power can also access.

PRODUCTION AND INVESTMENT TAX CREDITS IN THE US

YIn the United States, various tax credits (production tax credit, PTC, and investment tax credit, ITC) encourage investment in running existing plants and new projects[8]. The Advanced Nuclear Tax Credit (Advanced Nuclear PTC) provides a 1.8 cents tax credit per kilowatt-hour for installations commissioned between 2005 and 2021. The $6 billion Civil Nuclear Credit Program (CNCP), on the other hand, provides nuclear power plants at risk of financial closure with support to continue operations so that valuable plants are not lost.

The recent Inflation Reduction Act, IRA, also includes many tax credits. Like the CNCP, the Zero-Emissions Production Tax Credit aims to keep existing plants running from 2024 to 2032 while under pressure from both cheap natural gas and heavily subsidized renewables.

The IRA Clean Power Production Tax Credit (Clean Electricity PTC) replaces the old clean energy PTC with a new, technology-neutral tax credit starting in 2025, which includes not only renewables but also nuclear power plants. A corresponding technology neutrality update for the Clean Electricity ITC (Clean Electricity ITC) investment is also coming. Pure hydrogen produced with nuclear power can also receive tax credits.

[8] http://www.bclplaw.com/en-US/events-insights-news/inflation-reduction-act-expands-support-for-nuclear-power-plants.html