

NEA Workshop on FINANCING, MARKET DESIGN AND PROJECT MANAGEMENT IN NUCLEAR NEW BUILD

11 July 2023, Paris, France, OECD Boulogne-Billancourt, Room BB12

Nuclear energy is recognised as an indispensable part of the clean energy transition and instrumental to achieving the objectives of OECD and NEA member countries to radically reduce carbon emissions by mid-century. However, like most other low carbon technologies, nuclear energy is highly capital-intensive. Financing costs are thus a key determinant in realising the full contribution of nuclear power. The cost of capital is the cost of risk and in 2022 the OECD Nuclear Energy Agency (NEA) thus studied the issue in *Financing New Nuclear Power Plants: Minimising the Cost of Capital by Optimising Risk Management*. The report showed that the costs of financing nuclear new build can be radically reduced by optimally managing construction, price and policy risk by transferring each one individually to the party best able to carry them. For very large and complex projects such as nuclear power plants these may be, under certain conditions, public entities. The NEA report also showed that low carbon projects can offset general financial portfolio risk, also referred to as systemic risk, as stringent carbon constraints cause the profitability of low carbon projects to evolve in a manner that is contrary to the evolution of the average profitability of projects in the rest of the economy.

A new NEA project on “Financing, Market Design and Project Management in Nuclear New Build” is building on this earlier research to explore further the links between the costs of financing, the market environment, in which new nuclear power plants will be built, the governance models of their parent companies and project management structures. Standard economic approaches, including the IEA/NEA *Projected Costs of Generating Electricity* series, often consider the cost of financing as being exogenous to technology choice. Real-world investors, of course, pay close attention to project- and technology-specific risks. The need to reduce such “idiosyncratic” risks in the case of nuclear new build was already highlighted in earlier NEA reports. They pointed out that market designs offering stable long-term prices for electricity were particularly important for capital-intensive low carbon technologies such as nuclear and renewables.

Yet, electricity market designs not only affect the risks, financing costs and likely pay-offs of nuclear new build projects through the level and volatility of prices for electricity and heat. They also strongly impact and often determine the governance, organisational structure and reporting requirement of utilities and project companies formed for nuclear new build. This, in return, determines project management models, contractual relations, incentive structures and, ultimately, performance. Regulated electricity markets are thus closely associated with vertically integrated monopoly providers with public or semi-public long-term owners. Historically, the construction of new power plants, mainly coal or nuclear, was thus financed by a low-cost combination of equity and debt, both underwritten by public guarantees. Supply chains were characterised by a mix of vertically integrated in-house provision and long-term “preferred partners”.

Deregulated electricity markets instead were explicitly designed for “unbundled” utilities to provide maximum scope for competitive bidding at marginal costs. New generating capacity was supposed to be financed in the form of “merchant power plants” by private investors. The prevailing project management model was referred to as the EPC model, where a logistics coordinator would contract engineering, procurement and construction services following competitive bidding processes at each level of the value chain. Competitive dispatch was a key feature in designs, yet some models would

also include locational or nodal pricing with different prices according to location, a back-handed attempt to revert to the co-optimisation of generation and network investment.

The benefits and drawbacks of the two major market design models are well known. In a nutshell, regulated markets offer a low risk, low reward environment and tend towards over-investment as well as a lack of efficiency and technological dynamism. Deregulated markets offer a high risk, high reward environment and tend towards under-investment as well as a decline in the quality of service and the security of supply. Technology development is not neutral in this process. The low capital cost and high variable costs of the combined cycle gas turbine favoured deregulated markets. **The energy transition with its shift towards capital-intensive low carbon technologies requires market designs offering long-term stability. This will not only reduce financing costs for investors but will also favour corporate governance models with greater public involvement and more vertically integrated project management structures.**

Going forward towards low carbon electricity markets however, neither the regulated markets of old, nor the deregulated markets of the past 25 years will constitute the relevant model. Future low carbon power plants will be built in *hybrid markets* that will combine elements of regulation, especially with respect to the conditions for long-term investment and a long-term energy mix heavily influenced by political decisions, with market-based elements, in particular competitive short-term dispatch. The new NEA project on “Financing, Market Design and Project Management in Nuclear New Build” will explore three major questions in this context:

1. Which features of future hybrid market designs are critical to bring forward nuclear new build?
2. Which governance, ownership and financing structures of electric utilities are likely to emerge in such hybrid markets?
3. How will supply chains, project management, contractual structures and incentive mechanisms evolve in this new environment?

These three questions pertain to both large Generation III reactors and smaller modular reactors (SMR). Intriguingly, the answers might not be the same for both technologies. However, while the project will certainly include a number of remarks on SMRs, its focus is on current Generation III reactors. The NEA will pursue a specific follow up-project on SMR economics sometime later.

When studying the implications of hybrid market designs for governance and project management, the new NEA project will focus on an additional question touching on all three questions:

- How can the complementarity of the contributions to all aspects of nuclear new build of public and private actors best be ensured?

In this context, it is useful to recall that the risk profile of a nuclear new build project has two distinct phases. During construction and up to the date of commissioning it is a high risk project. In the following, during operations, it is a low risk project. While phase one will most likely require some form of public involvement, there are distinct opportunities for private actors during phase two.

The NEA in-person workshop of 11 July 2023 will provide an opportunity to explore possible avenues for answers to these questions. Each session will be introduced by the impact presentations of two leading international experts and the synthesis of a discussant to prepare for an in-depth discussion amongst all participants of the determinants of nuclear new build regarding financing costs, market design and project management.

Preliminary Programme (Speakers TBC)

9:00-9:30 Introductory remarks

- **William D. Magwood, IV**, NEA Director-General (TBC)
- **Diane Cameron**, Head, NEA Division of Nuclear Technology and Economics
- **Jan Horst Keppler**, Senior Economic Advisor

9:30-11:00 Session 1 – Financing costs as a function of market design, technical design maturity and project management

The cost of financing is the cost of risk. Other than access to liquid financial markets able to price risk, these costs will depend on expectations concerning the long-term performance of electricity market designs, the proven maturity of technical designs and the efficiency of project management in nuclear new build. Session 1 aims at identifying those specific features in market designs, technical designs and project management that are most likely to reduce price and construction risk and thus contribute to minimising financing costs.

Impact presentation 1: **Charles Weymuller, Chief Economist, EDF**

Impact presentation 2: **Jigar Shah, Director, Loans Program Office, US DOE**

Discussant: **John Parsons, Deputy Director, CEEPR, MIT**

11:00-11:30 Coffee break

11:30-13:00 Session 2 – Market design, organisational structures and project management

Electricity market design not only directly affects the likely pay-offs of nuclear new build projects through the level and volatility of prices for electricity and heat. It also indirectly impacts the governance, organisational structure and reporting requirement of project companies. This in return impacts the choice of project management models, incentive structures and, ultimately, performance. Future nuclear power plants will likely build in hybrid markets with a variety of features, some more, some less important in determining success. Session 2 aims at better understanding the nexus between electricity market design, organisational structures and project management both on the basis of conceptual considerations and currently explored real-world models.

Impact presentation 1: **David Newbery, Director of CEPRG, University of Cambridge**

Impact presentation 2: **Julien LeGoff, Director of regulation for new nuclear, EDF**

Discussant: **Dr. Tomáš Ehler, Director General Nuclear Energy, Ministry of Industry and Trade of the Czech Republic**

13:00-14:30 Lunch

14:30-16:00 Session 3 - Optimising the complementarity of private and public actors

The risk profile of a nuclear new build project goes through two very distinct phases. During construction and up to the date of commissioning it is a high risk project. In the following, during operations, it is a low risk project. While phase one will most likely require some form of public involvement, there are distinct opportunities for private actors to be explored during phase two. Session 3 aims at better understanding the contractual commitments, their timing and conditionality (including metrics for assessing “fair value”) that would be required in order to optimise the complementarity of public and private involvement.

Impact presentation 1: **Milton Caplan, President, MZConsulting**

Impact presentation 2: **Stephen Vaughan, Co-head Energy and Power, Rothschild & Co**

Discussant: **Anurag Gupta, Chief Risk Officer, Sequoia Investment**

16:00-16:30 Coffee break

16:30-17:30 Concluding discussion

This session will conclude the workshop with an open discussion on the different topics raised, as well as on the primary focus of the new NEA report.

17:30 End of workshop