NEA
NUCLEAR ENERGY AGENCY

NEA Policy Brief

June 2020

More information at: http://oe.cd/nea-covid-19-3

Unlocking financing for nuclear energy infrastructure in the COVID-19 economic recovery

- Governments should incentivise investments in resilient low-carbon energy infrastructure, such as nuclear energy, in the aftermath of the COVID-19 pandemic.
- Proper policy and market frameworks to incentivise investment in essential infrastructure that supports low carbon electricity security and economic development are needed.
- Transitional, targeted government support for nuclear energy projects will be indispensable to unlock the benefits of nuclear energy in the post-COVID-19 economic recovery.
- Government support can and should be leveraged to attract cost-effective private financing to deliver nuclear energy infrastructure projects.
- There is currently a window of opportunity for governments to support sustained cost reductions in nuclear energy projects through timely new build decisions – thus reinforcing the process of learning by doing and allowing these designs to move along their learning and cost curves.

What's the problem?

The COVID-19 pandemic has highlighted the vitally important role played by stable sources of electricity generation. Nuclear energy is a proven low-carbon technology that produces large amounts of round-the-clock, baseload electricity. Nuclear facilities have proved to be invaluable during the pandemic, in which reliable, high-quality electricity was produced on a continuous basis.

There is a growing recognition around the world that nuclear energy can play a significant role in decarbonising energy systems cost effectively while ensuring electricity security and resilience. While some countries have adopted policies that eschew the use of nuclear energy in the foreseeable future, others have specifically included nuclear energy in their long-term energy plans or have adopted technology-agnostic, "all of the above" energy policies that allow for future nuclear energy deployment.

However, the construction of new nuclear power plants is a complex industrial undertaking that can result in significant financial risks in a number of dimensions. Specifically, the challenge lies in the capital-intensive nature of nuclear energy projects and the multi-decadal project lifetimes over which costs are recovered. These lifetimes are often deemed too long by traditional private sources of capital to be acceptable without a robust allocation of construction and market risks.

In order to maximise the benefits and minimise the costs, the different risk dimensions of new nuclear projects need to be carefully defined and the risks allocated to those parties that can best manage and carry them. National governments have an essential role to play in this endeavour, as they do not only provide the general long-term policy framework for nuclear energy, but also the regulatory framework for a resilient low-carbon electricity sector.

As preparations are made for our long-term energy future, governments can establish the investment and policy frameworks needed to assure that nuclear energy continues to enable resilient stable electricity supply systems for the future.

This requires, in particular, frameworks that allow investors to have clarity on the long-term revenues of low-carbon generation technologies (nuclear, hydro, variable renewable energy), which are all characterised by very high fixed investment costs even though their variable operating costs are low. In addition, specific regulatory provisions for sharing risks between vendors, investors, operators and electricity consumers can minimise the costs of bearing those risks and substantially contribute to lower the overall financing costs of nuclear projects. This can be accomplished in a technology-neutral manner applicable to all low-carbon technologies.

The fact that progress towards the effective deployment of nuclear technologies remains limited, can be attributed to a mismatch between governments' stated policies on the possible role of nuclear energy in the energy systems of the future and concrete commitments by the same governments and industry towards the development and deployment of nuclear energy technologies.

Why is this important?

As countries seek to shore up their economies to counteract the repercussions of the ongoing pandemic, trillions of dollars have already been committed by governments in stimulus packages. Even larger commitments are likely in the near future, particularly in the immediate aftermath of the COVID-19 crisis. Among these future commitments, sustainable infrastructure, and in particular a resilient low-carbon energy infrastructure, is likely to be a key area of focus as the mid-century deadlines for decarbonisation approach rapidly.

A recent OECD analysis finds that institutional investors within the OECD area alone hold USD 63.7 trillion in assets, versus the roughly USD 50 trillion that are needed to transition to low-carbon energy systems worldwide (OECD, 2019). The potentially available funds increase significantly when considering pension funds and other long-term private investment funds whose timelines for expected returns may be well aligned with those of infrastructure development.

Nuclear energy creates several positive environmental and socio-economic externalities that create a strong rationale for direct and indirect government financing support to incentivise and to complement private financing. Nuclear energy has a clear role as a reliable baseload source of energy, with positive contributions to electricity security, and a key role in the decarbonisation of energy supply. Just as importantly, nuclear energy's wider socio-economic benefits in the form of high-skilled jobs, boosted local, regional and national economies, as well as other trickle-down benefits such as stimulating cross-sector innovations and the development of high-technology facilities (including manufacturing), all serve to support a strong case for government intervention.

Existing nuclear energy facilities already face challenges in deregulated electricity markets that do not recognise the value of baseload sources of power, disregard system costs and preferentially dispatch variable renewables that benefit from off-market subsidies. As shown by several recent analyses, price signals in deregulated electricity markets are inadequate to stimulate long-term planning and investment in adequate generation capacity and infrastructure, and specifically to incentivise investments in the least-cost energy mix. In the absence of assurances of secure, long-term revenue streams, financing new nuclear construction projects may be especially tricky.

Despite these challenges, a number of light water reactor designs are moving beyond the challenges faced by first-of-a-kind (FOAK) projects and – with timely decisions for future projects – offer the opportunity for large-scale cost reduction. Small modular reactors and some fourth generation reactor systems are also making steady progress toward demonstration projects. For both sets of nuclear energy technologies, the difficulties securing affordable financing for new nuclear plant construction projects presents a significant hurdle towards timely and cost-effective deployment.

Financing costs, which are part of the capital costs of a nuclear plant, are a function of the construction period as well as the weighted average cost of capital. Financing costs can have a significant impact on the escalation of the capital costs of a new plant, especially if projects run into construction delays. Evidence from recent nuclear projects in China, Korea, Russia and UAE highlights that nuclear plants can indeed be completed on time and within their estimated budgets. The evidence from these successful projects suggests that design standardisation and commitment to a programme with multi-unit and serial construction are critical for on-time, on-budget project completion. Conversely, embarking on nuclear projects after long periods of inactivity, as has recently been the case in Europe and the United States, is likely to result in difficulties due to atrophied skills and eroded supply chains. Instances of project delays can in turn create a vicious cycle and lead to investors demanding risk premiums for future construction projects. Breaking this vicious cycle will be key to reducing the costs of nuclear electricity and stimulating future investments. With the completion of several FOAK third generation nuclear reactor construction projects in OECD countries, the nuclear industry and its supply chain have, in large part, redeveloped their capabilities. As a result, there is currently a window of opportunity for governments to support sustained cost reductions in nuclear energy projects through timely new build decisions. Doing so would drive a continuation of the process of learning by doing and thereby allow these designs to march down their learning and cost curves.

What should policy makers do?

Leverage government support to attract cost-effective private financing to deliver nuclear energy infrastructure projects

There are a number of financing models that can be applied to the financing of large-scale infrastructure projects while supporting an efficient allocation and mitigation of construction and market risks. These models would be well suited to support near-term nuclear new build projects and could help deliver significant reduction in the expected cost of capital. In turn, this would significantly reduce the ultimate levelised cost of nuclear energy.

Where appropriate, governments may consider direct support by undertaking equity ownership in initial projects or by issuing public loans. Government ownership of initial projects would inspire confidence among private investors for both early and later projects. Alternatively, a public finance approach is likely to lead to a lower cost of capital as governments, considering electricity as an essential national infrastructure, are likely to accept lower rates of return than the private sector. Indirect approaches of government support such as power purchase agreements and regulated asset base (RAB) models may also be considered.

Recent analyses suggest that public-private partnership frameworks used to finance large-scale infrastructure projects (such as the RAB model) can be applied to future nuclear projects to deliver electricity at a significantly lower levelised cost relative to other approaches such as the use of a contract for differences. The RAB model, after being successfully applied in the UK to the Thames Tideway Tunnel and several other major infrastructure projects, is being considered for upcoming nuclear plant construction projects. This particular model is designed to attract low-cost private financing by redistributing the construction risks while delivering higher value to end consumers. Such an allocation of construction risks is particularly advantageous when technologies, such as the current third generation reactors, are in an early phase of their learning curves.

Direct government support for nuclear energy projects could be applied in a transitional, targeted way for initial projects with the specific aim of attracting private sources of capital. Direct and indirect government support to initial projects would further reduce the risk of subsequent projects and support a virtuous cycle of risk and cost reductions.

Figure 1: **Creating a virtuous cycle of risk and cost reductions**

Reforms in the designs of energy and electricity markets applied in conjunction with direct and indirect forms of government support will assure the long-term financial viability of new nuclear construction projects.

Unlock financing for nuclear energy projects in developing countries as a key to support global decarbonisation goals and sustainable economic development

Looking further afield, it is also important to bear in mind the global nature of markets for new reactors as well as the need to decarbonise electricity systems globally. It is not surprising that several economies in transition and developing countries are evaluating nuclear energy as a potential component of their long-term decarbonisation plans. Many of these countries may lack the ability to finance such nuclear new build independently. Historically, export credit agencies (ECAs) from the vendor country have played a central role in financing such projects. Some examples of financing by ECAs include the financing provided by the US Export-Import Bank for the Barakah project in the UAE and by the French Coface for projects in Finland and China.

While the World Bank and the European Investment Bank have financed nuclear projects in the past, only the Development Bank of Latin America has done so recently. With a sustained interest in nuclear energy in roughly 30 countries, particularly in many developing countries, there can be a significant role for multilateral banks and national export agencies in support of new nuclear projects – especially with the advent of advanced technologies such as small modular reactors. The role of these institutions in supporting the development of sustainable and economic energy infrastructures is highlighting in the recommendations of the Intergovernmental Panel on Climate Change. As such, it is important that their policies be informed by the latest technology developments and recent analyses.

Successful government support for financing arrangements in the vendor country for immediate new build is likely to spur confidence in investments overseas and pave the way for additional capacity deployment in the early 2020s and beyond.

Further reading

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