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## How to finance a nuclear programme?

### Key Issues

It is increasingly recognised that an expansion of nuclear power could play a valuable role as a source of secure, low-carbon energy. However, there are significant challenges associated with financing the construction of new nuclear power plants (NPPs).

### Special Factors in Financing NPPs

Nuclear power plant construction projects have many characteristics in common with other types of large infrastructure investment, both within the power generation sector and elsewhere. However, nuclear power itself has a number of special features that can make nuclear financing particularly challenging.

These features include:

- The high capital cost and technical complexity of NPPs, which present relatively high risks during licensing, construction and operation.
- The relatively long period required to recoup investments or repay loans for NPP construction, which increases the risk from electricity market uncertainties.
- The often controversial nature of nuclear projects, which gives rise to additional political, public and regulatory risks.
- The need for clear approaches and financing schemes for radioactive waste management and decommissioning.

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- The financial need for NPPs to operate at high capacity factors, preferably under baseload conditions.

The higher capital costs of a NPP mean that its overall economics are very dependent on the cost of capital, or discount rate, which applies to the investment during its construction period. With any investment, higher risks demand higher returns. Thus, the cost of capital will depend on potential investors' assessment of the risks involved. This will vary depending on who the investors are, the legal and regulatory framework in which the plant would be built, as well as national energy policy and the level of political support.

During the previous major expansion of nuclear power in the 1970s and 1980s, many nuclear projects suffered very large construction delays and cost overruns. These had several different causes, ranging from licensing and legal problems to technical difficulties. Given also the lack of recent experience with new NPP construction in most countries, the legacy of such problems increases the risks perceived by potential investors.

A recent study jointly undertaken by the IEA and the NEA shows that the competitiveness of nuclear power strongly depends on the cost of financing, due to the high share of fixed capital costs in the total lifetime costs of nuclear power. At low interest rates – usually reflecting a stable and predictable economic and regulatory environment – nuclear power is very competitive compared with alternative sources for electricity base-load generation such as coal, gas and, under certain circumstances, renewable energy sources. This advantage, however, decreases as interest rates increase, when technologies with lower capital costs such as coal and gas are more competitive.

Quite obviously, the pricing of climate change inducing CO<sub>2</sub> emissions also significantly improved the competitiveness of nuclear power. A key issue in this context is the long-term predictability of such carbon pricing arrangements, which, for the time being and despite positive evolutions in this respect, most notably in Europe, does not yet exist. A uniform global carbon pricing regime, perhaps on the basis of a unified carbon tax, would most likely provide a significant stimulus for the expansion of nuclear power construction.

## Mitigating and Sharing Risks

Many of the risks presented by the special factors noted above can be mitigated by appropriate government actions, which will be necessary before any NPP project can move forward. Other risks, including those inherent in any large construction project, can be transferred to or shared with other parties by appropriate structuring of the project, in order to reduce the risks to investors. Nevertheless, a large share of the risk will remain with the utility and other investors in the plant.

Strong and consistent government support is an essential prerequisite for initiating or expanding any nuclear programme. Given the long time frame involved, a broad-based political consensus is likely to be needed on a nuclear contribution to energy supply as part of a comprehensive long-term national energy strategy.

Specifically, where nuclear is part of the national energy strategy, the government needs to put in place an efficient regulatory framework, that allows appropriate opportunities for public involvement but allows clear and definite decision-making within a reasonable timescale. Additional legal frameworks dealing with liability issues, radioactive waste management and decommissioning are also necessary. In addition, the government has an important role in providing public information and leading national debate on the role of nuclear power, to establish the necessary political consensus.

Electricity market risks can be mitigated by long-term agreements with large consumers or electricity distributors, where these are available. Where possible, a direct involvement of such consumers in the structure of the project may be an attractive option. Governments have a role here in that they set the regulations which govern electricity markets, which if badly designed can unduly favour short-term investments.

Another important factor affecting electricity markets is the cost of carbon dioxide emissions under existing and planned carbon trading schemes. This should benefit nuclear power by raising the costs of fossil-fired competitors. However, doubts about long-term political commitment to such policies and carbon price uncertainty may limit the benefits for nuclear investors. Again, governments may be able to take steps to reduce these uncertainties if they wish to encourage nuclear investments.

However, it is the construction phase of a nuclear project which is generally considered the most risky for investors. This is especially true for “first-of-a-kind” plants and for new nuclear programmes. Large amounts of capital must be invested early on, while returns will not begin to flow until the plant enters operation some years later. Traditionally, construction risk was passed on to electricity consumers through regulated prices, but in liberalised markets this is no longer possible. This is a possible area for targeted government support to reduce the risk to investors to acceptable levels, at least for a limited number of plants in order to start or re-start a nuclear programme.

To some extent, construction risk can be shared with NPP vendors and other contractors actually building the plant, either through fixed price “turnkey” contracts or through performance-related contract clauses, but in practice vendors have only a limited capacity for such risk taking. Debt investors will not normally accept such risks, and loan guarantees will not usually cover additional

costs due to delays, etc. Thus, in most cases the risks of delays and cost overruns will fall mainly on equity investors. They can reduce these risks by choosing standardised NPP designs that are already in operation elsewhere, built by experienced and well-managed contractors.

## Structuring and Financing Nuclear Projects

Corporate finance is the most likely generally applicable model for new NPPs. Large, financially strong utilities will be best able to finance new NPPs, especially if they are vertically integrated (i.e. they have direct access to electricity consumers). They will be able to attract loans as required, backed by their existing assets (balance sheet). This is the model followed in France, and which is expected to be used in the UK and other European countries. In countries where such utilities are rare or non-existent, such as the United States, the need for direct government support to share in the construction risks is likely to be all the greater.

In addition to the standard equity and debt modes of financing, there may also be more innovative financing arrangements which can be used in specific circumstances (such as for Olkiluoto 3 in Finland). Although the details of these will usually be specific to local circumstances, some aspects may be more widely applicable (for example, the concept of investment by large electricity consumers, as in Finland, could be extended to other locations). Where governments themselves are willing to provide backing for investment in NPPs, but also wish to involve the private sector, some form of public-private partnership could be envisaged. However, the details of any such arrangement would require detailed negotiation and are likely to be tailored to local circumstances.

It appears that there is very little likelihood at the present stage of development of nuclear technology and the nuclear construction industry to finance a new NPP by using non-recourse financing (where a stand-alone project company raises the capital it needs to build the plant using only the NPP project itself as collateral). Even for hybrid schemes which include a significant proportion of equity, debt investors at present are unlikely to be willing to provide significant funding for a nuclear plant without recourse against the balance sheet of a strong and creditworthy utility.

It should be noted that the financing of a NPP need not remain static over its lifetime, and in particular that re-financing is likely to be possible once the plant has successfully entered operation. For example, a company owning an operating nuclear plant may be able to issue corporate bonds and use the proceeds to repay loans taken out to finance the plant, where this reduces the overall cost of borrowing. With the risks during construction now removed and with the plant expected to generate steady revenues over several decades, a NPP could be an attractive investment opportunity for investors with a long-term perspective,

such as pension funds. In particular, nuclear investments may be of interest where such investors use “asset pooling” to make long-term investments.

## The Role of Governments

As noted above, governments that wish to see a nuclear contribution to energy supply need to take a number of steps to enable and facilitate the necessary investment. Key actions to be considered by governments that wish to see such investment include:

- Provide clear and sustained policy support for the development of nuclear power, by setting out the case for a nuclear component in energy supply as part of a long-term national energy strategy. Winning public acceptance of a role for nuclear power in meeting environmental goals while providing secure and affordable energy supplies must be accomplished at the political level.
- Work with electricity utilities, financial companies and other potential investors, and the nuclear industry, from an early stage to address concerns that may prevent nuclear investment and to avoid mistakes in establishing the parameters for new NPPs. The government will need to take an active role in facilitating nuclear projects, even where investment is to be made by commercial entities.
- Establish an efficient and effective regulatory system which provides adequate opportunities for public involvement in the decision making process, while also providing potential investors with the certainty they require to plan such a major investment. A one-step licensing process with pre-approval of standardised designs offers clear benefits in this regard.
- Put in place arrangements for the management of radioactive waste and spent fuel, with progress towards a solution for final disposal of waste. For investors in NPPs, the financial arrangements for paying their fair share of the costs must be clearly defined. An effective framework for nuclear insurance and liabilities must also be in effect.
- Ensure that electricity market regulation does not disadvantage NPPs. Long-term arrangements may be necessary to provide certainty for investors in NPPs, reflecting the long-term nature of nuclear power projects. Where reducing CO<sub>2</sub> emissions is to act as an incentive for nuclear investments, the government may need to provide some guarantees that policy measures will keep carbon prices at sufficiently high levels. Allowing nuclear projects to generate carbon credits could also provide incentive, provided the policy was sufficiently long-term.

In countries where there are large utilities with the financial strength to invest directly in new NPPs, or where there are well-resourced foreign utilities willing to make such investments, fully commercial financing may be possible. However,

where there are no sufficiently strong utilities, some form of direct or indirect public sector financial support is likely to be necessary if investment in a new NPP is to proceed. This will be especially true where there is no established nuclear programme, and where the government aims for near-term deployment of nuclear power.

Such public sector financial support could involve supporting a state-owned utility in making investments in NPPs, providing support to private sector utilities through sovereign guarantees, tax credits or other measures, or establishing public-private partnerships. However, governments should ensure that an appropriate level of investment risk is borne by private sector investors, who should pay the full costs of any financial assistance they receive.

The export credit agencies (ECAs) of major nuclear exporting countries (including France, Japan and the United States) could play an important role in facilitating the financing of new NPPs where significant contracts are placed with their domestic industry, and there are several cases where this is occurring or is under consideration.

Most relevant ECAs are subject to the Arrangement on Officially Supported Export Credits, organised under the auspices of the OECD. The arrangement has a specific agreement covering the nuclear sector, important revisions to which came into force in July 2009. The changes include increasing the maximum term of loans from 15 to 18 years, allowing mortgage style fixed repayments (rather than repayment of principal in equal instalments), allowing more flexible repayment terms (possibly reducing the need to make repayments during construction), and reducing the minimum interest rate margins to be applied. Overall, these changes should help reduce the financing costs of a nuclear project with ECA support.