

NUCLEAR POWER FINANCING AND ECONOMICS IN EAST ASIA

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ABSTRACT

Nuclear power is poised for major expansion in East Asian countries. This is based on long-term improved economic trends, rising demand for electricity, need to control pollutant emissions from electric power plants and lack of adequate supply of relatively non-polluting fossil fuels. The People's Republic of China (PRC) projects 20 GWe of installed nuclear capacity by 2010, 40-50 GWe by 2020 and 70-90 GWe by 2030. Once its near-term economic problems are resolved, Korea might resume its nuclear power program. This program may gain even greater urgency in case of a merger with North Korea, possible within the next decade. Ultimate capacity expansion of about 30 GWe could well be projected within the first quarter of the next century. Other industrializing countries in the region requiring least-polluting expansion of their electric sectors may wish to install an additional 10 GWe of nuclear plants by 2025. While exact projections may well change, a phenomenon we are all familiar with, clearly a large nuclear capacity growth trend is evident in East Asia.

Financing this new generating capacity may be a daunting challenge. Assuming about 80 GWe of nuclear power built in East Asia during the next 25 years, and assuming, on average, \$1.5 billion per installed GWe, the total nuclear plant construction cost requirements may well exceed \$120 billion. At least half of that amount may have to be funded from external sources. Furthermore, once a nuclear plant is built, annual operating, maintenance and fuel requirements may amount to about \$100 million per year. Assuming approximately 100 GWe of nuclear plants operating in all East Asian countries except Japan at the end of the first quarter of the next century, and assuming about 10-20% of the operations cost dedicated to equipment and services supply from outside of the region, then an additional \$1-2 billion annually will need to be financed from external sources. Finally, by 2020 a relatively modest decommissioning market may well develop in East Asia. Assuming \$400 million per GWe for a complete dismantlement project, expecting 50% of the cost to be dedicated to support from outside the region, and projecting up to 5 GWe retired by 2025, then an additional billion dollars for externally-funded decommissioning costs will be required. We should remember that these funding needs will have to compete with investment requirements for non-nuclear power projects and all other major infrastructure projects. Evidently, external financing requirements for East Asia will be enormous, and nuclear funding needs will have to compete for their share of the pie.

Providing for the large investment requirements in nuclear projects in East Asia will thus require the concerted action of international banking institutions, export credit agencies (ECAs), private lending institutions and private investors. In the near term, utility-owned projects with government backup will likely be the main

model for new nuclear plants. Financing will be provided in part by the host utility and/or government, and in part by cofinancing arrangements among several ECAs and private lenders. In the longer term the concept of a nuclear independent power producer (IPP) may emerge, relying on financing models of the Build-Own-Operate (BOO) or Build-Own-Transfer (BOT) arrangements. The recent opening of the Japanese electric sector to IPP projects, the potential similar opening of the Korean energy market, and the growth of the IPP market in the PRC and other South and East Asian countries will all provide the required experience in this type of project financing in the East Asia region. We have already seen interest in several countries in applying the IPP model to nuclear plant construction, possibly also including countertrade as a part of the funding sources. In time, as more experience is gained in funding various non-nuclear IPP projects in East Asia, and as the regulatory, legal and insurance frameworks are set in place, it may be possible also to apply IPP models to nuclear projects. Recent studies have indicated that nuclear IPPs may not be the optimal first-of-a-kind funding option in an industrializing country, given the large return on investment required by private investors and the relatively short loan terms required by major lenders. It may be important for East Asian governments interested in the nuclear IPP model to support such projects by providing risk control measures that will bring nuclear projects' risks down to the level of fossil fuel IPP risks. As experience and confidence in IPP projects are gained in the East Asia regions, and as investment and lending requirements - due to risk perception - become less severe, then nuclear IPP projects, with some host government guarantees, may well become viable economic options.

Other issues further reviewed in this presentation are the impact of pollution taxes on the nuclear/fossil relative economics comparison, and the need to consider the entire fuel supply logistics chain in a full-fledged economic comparison. Evidently fuel transportation by ship, barge, train or pipeline may add to the total investment required in a power plant project, and will be reflected in the fuel cost to the plant operators. These factors need to be considered in evaluating the relative economic merits of a fossil or nuclear project at any given site. It seems that full review of each of the above issues will tend to improve the relative economic competitiveness of the nuclear option compared with other fossil alternatives. Finally, we will briefly review Bechtel's capabilities and role in providing financing to energy projects in East Asia. Our recent participation in the Qinshan CANDU nuclear plant in the PRC, and our role in securing the required US-origin financing for our scope, are but an indication of how Bechtel can support nuclear power development in East Asia. Bechtel's participation in the various aspects of the Qinshan project has set a milestone as to what is already done in nuclear project financing and has provided a starting point for the larger scope for participation that will be required in future nuclear projects.