

Nuclear power – an economic solution for Asia’s power needs

Nuclear energy is prevalent in most western nations and we wonder whether Asian nations will jump on that bandwagon. Stephen W. Kidd, Head of Strategy and Research at the World Nuclear Association, outlines the challenges Asian nations face when posed with the question on whether nuclear power on a large scale would be the way to go.

Photo: Bloomberg

In December 2005, the World Nuclear Association issued a report titled “The New Economics of Nuclear Power”, highlighting the economic case for new nuclear builds. It draws on the range of recent reports by various bodies covering the economic factors underlying the choice of technology for new generating capacity. Its conclusions are pertinent for Asian countries now considering nuclear as a way of enhancing energy security and mitigating greenhouse gas

emissions.

The critics of nuclear power assert that it is not economically viable. The industry evolved from post-WWII military nuclear programmes, and the R&D work there did not always lead the subsequent civil sector down the optimum technical paths. Governments moved away from widespread intervention in energy markets. Electricity liberalisation comes in many guises, but the general trend is clear. The nuclear industry

today recognizes that all plants must demonstrate cost-effectiveness whilst maintaining very high safety standards. Safety and economic viability tend, in any case, to go hand in hand.

Electrical power generation, including nuclear, was largely developed by public bodies in a regulated environment that permitted long term investment, but passed on the full cost to consumers. In some countries, nuclear plants were primarily built for national security of supply, although the promise of cheap electricity with a stable cost base was clearly very important. Even today, reducing the dependence on imported fossil fuels with price uncertainties remains important in countries without substantial domestic oil, gas and coal reserves, notably Japan and the Republic of Korea. The expected long-term stability of costs was also an important consideration in favor of nuclear and remains a strong argument today.

As global power markets get liberated, an electricity generating station should remain on-line if its forward (or marginal) costs are competitive with those of alternative power sources. Previous costs of construction are effectively sunk. These capital costs may or may not be amortized in the accounting books of the plant owner, but this should not affect the decision on whether a plant continues to operate.

Nuclear power plants constructed over the past 30 years are able to meet the economic challenges posed by liberalised power markets. Plant load factors have increased significantly, squeezing more output out of an unchanged amount of capacity. Owners have found it worthwhile to invest in plant refurbishment and in capacity up-rates, as marginal costs of generation from nuclear plants have been below that of most other generating modes. Marginal costs tend to be low, stable and predictable, in contrast to those of fossil fuel-powered plants, where volatile fuel prices are an essential part of the electricity cost. This has generated good profitability for nuclear plant owners, which has encouraged them also to seek operating license extensions for many reactors.

As far as new electricity generating plants are concerned, the basic economic question can be presented quite simply. Are the lower and stable fuel costs of a nuclear plant compared with local

competition from alternative generating modes sufficiently attractive enough to offset the higher initial capital costs?

The general move to liberalise electricity markets certainly poses challenges to the economic viability of new nuclear plants. It can be assumed that investments in new nuclear generating capacity will only happen if the rate of return to investors is sufficiently high compared with other potential options to invest the funds and taking account of their appraisal of the risk level. The early stages of the shift to competitive electricity market regimes have attracted investors to favour investments where the need for capital is small and the construction times are short. Volatile fuel prices make such investments risky and where major power users seek long term price stability, nuclear power plants offer a good solution. In addition, the uncertainties surrounding the character of power markets are not helpful for securing a rational and secure supply infrastructure built on large slugs of capital.

The key parameters in the economic competitiveness of new nuclear plants are their capital costs (strongly influenced by the construction time and the rate of interest to be paid on financing) and the fuel prices of gas and coal plants, the main alternatives in base load generation. Recent studies demonstrate that if new nuclear plants can be built with low capital costs, and with coal and gas prices are at current levels or higher, they can be cheaper on a level cost basis than the alternatives. Initial plants of new designs, however, face substantial first-of-a-kind engineering (FOAKE) costs and may need some public assistance to become economically viable. Several schemes have been suggested for this. Beyond these, learning by doing and other benefits of building a significant number of plants holds out the realistic promise that plants can be fully economic. This may be true even when the cost of capital is at a high level, perhaps above 10%.

This is particularly so now that the outlook for fossil prices is changing. Assumptions made in the reference cases in recent studies of generating plant competitiveness may now be regarded as too low, at least in the short term. The current

trend of oil, gas and coal prices certainly suggest that they will remain volatile in the future, in contrast to key nuclear operating costs.

If fossil fuel use is significantly penalised by carbon taxes or emissions trading regimes, the competitiveness of new nuclear plants clearly improves. This is particularly so when the comparison is being made with coal-fired plants (because they are so carbon-intensive) but also applies, to a lesser extent, to gas-fired plants. The case for nuclear plants to be included in greenhouse gas avoidance schemes is very strong but the industry cannot necessarily rely upon much help from this to make its case in an economically viable sense. If it comes, it will be regarded as an added bonus so the industry will continue to strive to do everything possible to influence things over which it does have some direct influence, namely the costs of building and operating reactors.

Significant FOAKE costs attributed to new reactors must be recovered with early orders, but the lack of recent experience in building nuclear power plants in many countries means that subsequent units may become substantially cheaper though the experience gained. Some creative public assistance with initial units could be justified in a number of ways, related to energy supply security concerns, diversity of power sources and avoidance of carbon emissions. They could take the form of loan guarantees, accelerated depreciation allowances and investment or production tax credits. Those opposed to nuclear would see these as subsidies, but they are familiar measures taken in favor of certain power generating options (such as wind power) and other industrial objectives in many countries.

There are clearly substantial challenges in financing investments of \$2-3 billion when the only revenue comes from electricity sales in potentially unsteady markets. In liberalized markets where prices are set hourly by marginal cost offers, the risks of new investment are substantial, yet longer term needs of customers have to be met. However, as markets mature, longer-term commitments may be easier to make.

One approach is for major power customers to take equity stakes in nuclear plants. This is the

model adopted in Finland where the owners of the fifth nuclear plant, ordered in late 2003, will take most of the power produced. Assuming the reactor is built on schedule and operates as expected; the owners should have long-term power supplied at 2.5 Euro cents per kWh, including all capital and interest repayments. Similar opportunities with major power users should be explored by the nuclear industry. The need is for a major part of the electricity to be effectively pre-sold, with the remainder sold on the spot market or through shorter term contracts.

Given the ability of the financial sector for innovation, it is likely that other ideas will be introduced to cope with the unpredictable developments of electricity markets. Consortia may be put together which have the confidence to invest in nuclear. Investors such as pension and life assurance funds should find nuclear plants attractive as their returns should be stable and predictable over long periods. It may also be possible to introduce long term forward contracts for power sales, to allow major capacity additions to take place.

In conclusion, new nuclear plants should now be regarded as good, conservative long-term investment prospects. Once the burden of the initial significant capital cost is overcome, they can offer electricity at predictably low and stable costs for up to 60 years of its operating life. Investment in nuclear should therefore be attractive to industrial companies who require significant amounts of cheap power for their operations, but also fund managers in the financial sector who are managing pension and life assurance funds.

