

exports, and could act as a magnet for foreign companies' investments in the country.

Other Projects

Paraguay has been expressing an interest in piped gas from Bolivia since 1996; it could become the third country to import Bolivian gas, after Brazil and Argentina. There is a plan to build a \$700 million pipeline to transport 20 mcm/d of gas from Bolivia to Paraguay, and supply gas-fired plants, including a gas-to-liquids installation and petrochemical and fertiliser plants in (or near) Puerto Casado, next to the Brazilian border. The project could cost between \$2 and \$3.4 billion in total.

If one takes into account only the commercial and geographic aspects, other markets could benefit from Bolivian gas exports. Following Argentina's continuous cuts in gas supplies in the winters, Chile is considering importing LNG from Indonesia or Australia. A pipeline from south Peru to north Chile is also under discussion. However, given the reality of political relations Chile seems unlikely to import Bolivian gas in the near future, but things may change if political relations improve between the two countries.

Another project linking Peru from the Camisea reserves to Argentina, Brazil, Chile, Uruguay and Paraguay is on the table. Peruvian reserves may not be enough to fulfill both its LNG export contracts to North America and the increasing demand from neighbouring countries, which means that there are possibilities for Bolivia to develop new markets for its gas if Peru is unable to fulfill the demand.

The idea of LNG exports has been more or less abandoned for the time being, although it remains a possibility for the medium to long-term future, mostly depending on political conditions.

There is also the 5000 mile pipeline proposed by President Chavez, which would run south from Venezuela through Brazil to Argentina. It is feasible economically and technically, and using Europe–Russia or

Canada–USA as examples, it would make sense if one looks purely at the demand/supply situation. Although Bolivia first dismissed the project as impracticable, it is now believed to be committed to it, and could therefore export some of its gas via the pipeline. However, the 5000 mile pipeline is also a long way from being built, and many potential obstacles (for example, finding the estimated \$20 billion to pay for it, resolving the environmental concerns of cutting through the Amazon rainforest, dealing with competing interests of individual nations) have raised concerns about whether the public promise of unity can survive the difficulties. Countries involved in such a pipeline would become long-term partners, and the decision to be part of it requires careful consideration, more political than economic or environmental.

Conclusions

Despite discontentment and concerns for the future, companies with long-standing investments in the country complied with the terms the government offered. One year after the Nationalisation Decree and its almost unanimous disapproval by energy specialists and liberal economists (the Nobel Prize laureate Joseph Stiglitz

being a notable exception), Bolivia and the companies agreed on new contracts that do not seem to be synonymous with a death sentence for anyone. From the very beginning, President Morales made it clear that he had no plans to develop the gas industry without the participation of foreign investors.

Uncertainties however remain. Companies tend to be averse to political risks unless the rates of return on investment are consistent with a short payback period. Governments of importing countries worried about the security of energy supplies will always seek to diversify the sources of imports and to promote wherever possible domestic production. All that involves long-term risks for Bolivia.

Meanwhile, President Morales saw the new contracts as a big step towards solving the country's social problems. The Bolivian government receives more revenues from higher gas prices and gas tax increases imposed in 2006. In addition, the World Bank cancelled the IDA debt of Bolivia. Having secured extra revenues from gas, his task now will be to spend them wisely, and keep still existing social tensions in check in order to allay companies' and importing countries' fears and attract new investments in the country.

Letters to the Editor

Dear Editor,

In the last Oxford Energy Forum, three articles make the case for nuclear energy. They see nuclear power as the answer to the latest EU energy policy objectives: security, sustainability and competitiveness. Although these articles are not explicit about the role of markets and of governments, I think they reveal a dilemma: while the EU favours liberalisation to promote competitiveness, liberalised markets are not likely to favour nuclear energy. In fact, currently, it is not even clear whether liberalised energy markets are the best way to promote competitiveness, security and sustainability,

The authors do not pretend that the road to nuclear will be an easy one,

but they all point to the desirability and virtual inevitability of a growing role for nuclear. It is true that the prospects of the nuclear energy industry have been revived by the good news (for the nuclear industry) of global climate change and of the imminence of peak oil. Nuclear energy generation creates no greenhouse gases and is potentially a way to mitigate the problems related to peak oil.

Adnan Shihab-Eldin summarises the many important obstacles still facing the development of this energy source including: stubborn public opposition; the absence of a solution to the problem of safe and permanent storage of nuclear waste; the safety and health concerns; and above all the

political and military implications of nuclear proliferation. On balance, and in spite of these concerns, the question for the authors is ‘when’, rather than ‘whether’ the world will wake up and go nuclear. In other words, the benefits outweigh the costs.

However, there is a dilemma that has been ignored by the authors and by the framers of European energy policy: namely that liberalisation of energy markets does not easily fit with the development of nuclear energy.

- First, it is unlikely that private investors will be able to raise capital to build new nuclear plants without some security of revenue streams. Most new plant built in liberalised electricity markets (mainly CCGT) have had relatively low fixed costs, long-term revenue guarantees, and an expected payback period of less than 15 years. For nuclear plants, with their very high fixed costs and long lives, it is not clear that customers in a liberalised market will provide credible long-term contract guarantees.
- Second, the economic risks associated with a major nuclear accident or prolonged outages are so great that it may be prohibitively expensive to insure against them. In a competitive market, when a plant shuts down, the operator not only stops earning revenue; it is often obliged to buy power to meet its obligations to customers during the outage. The relative size of these risks for nuclear plant would weigh heavily on any investor.
- Third, the development of new nuclear energy technologies involves significant fixed costs that must be spread over a very large number of plants in order to achieve the economies of scale. This has two implications. One is that it does not make sense to build a few nuclear power stations; the economic case requires many to be built. So the risks described above are magnified. Second, if a design fault or security problem were discovered, the public authorities would be obliged to shut down many plants with similar designs.

- Fourth, although the fixed cost of building nuclear plants is very high, the variable costs of running them are typically low. The result is that these plants earn significant rents when the electricity is sold at market prices that will reflect the fuel cost of plant that operate at the margin – for instance the cost of gas for a CCGT. The marginal price of electricity is likely to rise as oil prices rise (since gas prices are usually indexed to oil prices), and as the cost of CO₂ is also reflected in the marginal cost of generating electricity. Once a nuclear plant is built, the margins from energy production are significant. That has two implications. One is that nuclear operators will be under significant pressure from shareholders to avoid outages – an obvious source of public safety concern if this means maintaining them less. And the other implication is that government is tempted to intervene to cap profits on nuclear plant when electricity prices are rising. In Spain, the government recently decided to scrap capacity payments for nuclear plants.
- Fifth, companies will want to limit liability associated with a major accident, or decommissioning. There are many different ways to manage this, but the main point is that these costs are large and uncertain and companies will only invest in nuclear if government caps company liability with respect to both.

The evidence that these problems are serious is that most new nuclear plants are being built in countries like China and India that have not fully embraced liberalisation of electricity, at least not in the sense of allowing markets to determine what plants are built and what they are paid. Yes, there is some evidence of a renewed interest in nuclear plants in Western Europe and North America, but government sponsorship and/or subsidies seem to be central to all these plans. Absent strong government support for nuclear, it is very hard to see privately owned companies building nuclear plants in liberalised markets.

There are different possible responses to this analysis. One is to

acknowledge the conflict between energy policy objectives and ‘liberalised’ market outcomes and to argue that energy and environment are too important to be left to the market. In other words, governments, not markets, should drive our future energy balance. In this case, nuclear may make a come-back in Western Europe and North America, but we should not expect markets to play much of a role.

Another possible response is that markets actually will address these concerns. For instance, if gas and CO₂ prices rise, nuclear energy will become increasingly competitive and large customers may sign long-term contracts for that energy; insurance markets may cover the risks associated with nuclear accidents and the back-end risks; and investors will take the long view, financing the building of plant that requires a very long payback period since the return will justify the risk.

Perhaps the most likely policy outcome is muddling through, trying gradually to liberalise energy markets, while introducing government policies (i.e. national indicative plans) that effectively pre-determine the choice of technology through subsidies and differential regulation. In that case, I think it is sensible at least to admit that markets are no longer determining choice of technology and that we are basically moving back to a more traditional form of regulated utility. If so, then as the risks of investment fall, so should the rewards.

I think the dilemma facing nuclear energy in a competitive electricity market requires us to examine the role of competition and of markets in the EU energy policy trinity of security, sustainability and competitiveness. I suspect that there are many contradictions in this combination of objectives, and that the upcoming debate is about what role markets can and should play in meeting them. My impression is that national and EU government policy and regulations will increasingly determine the choice of technology and that markets will play a diminishing role. If so, we had better remember why liberalisation

seemed a good idea in the first place, namely that governments and monopoly had done a pretty poor job in most countries in delivering low-cost and secure supplies of energy.

David Robinson
Madrid

Dear Editor

I got two impressions on reading the three articles on nuclear power in your February issue. First that we cannot do without a major renaissance of nuclear power if we are to meet the challenge of global warming (with which I agree); and second hope that this will occur. But hope is not going to be enough – even if that hope is shared by an increasing number of previously antagonistic commentators, by politicians and members of the public; and even if all one's concerns about proliferation, waste disposal and safety are fully met.

The question which was not addressed by your contributors is what measures are needed to ensure this hope is realised? Governments can say how supportive they are of nuclear power. But will they make the necessary business decisions happen, and how? In the UK we are particularly subject to the market, and the market is going to need a lot more than signals from the government before it will act. One way or another, however you wrap it up, the government is going to have to give bankable guarantees to the industry, to persuade it to invest. And it is unlikely to want to see a proliferation of designs and suppliers all expending a lot of effort on competing with each other. Are we going to see a stealthy progress of the generating industry back into the Public Sector? (Shades of Network Rail?)

By the same token, if France is serious about nuclear power (which it certainly seems to be) then it is not going to be bullied into the market liberalisation in this sector that the EU is calling for. Is there a fundamental conflict between the desire for nuclear power and for market liberalisation?

Charles Henderson
London

China in Africa

Lindsey Hilsum looks at Africa's joy and misgivings about Chinese investments

There are still a few zebras and elephants in Beijing, not to mention the odd giraffe. Not wandering the streets, of course, but on billboards, remnants of the November 2006 Africa Summit, when the Chinese government feted political and business leaders from 48 African countries in the biggest extravaganza of its kind China has ever held.

African leaders, accustomed to being regarded as representatives of a failed continent – 'a scar on the conscience of the world,' as Tony Blair once put it – loved the attention and flattery. Each leader was greeted by President Hu Jintao in the Great Hall of the People, and by the end of the summit the Chinese had cancelled US\$1 billion in debt, while promising another US\$3 billion in preferential loans, US\$2 billion in export credits, and a new US\$5 billion fund for Chinese investment in Africa.

China already lends Africa four times as much money as the World Bank does. With US\$1 trillion in reserves, China is awash with cash which can be used to secure long-term energy deals, subsidise Chinese companies expanding into Africa, curry diplomatic favours and buy influence.

The Sierra Leonean Ambassador to China, Sahr Johnny, explained the dynamic in an interview with Channel 4 News just before the Gleneagles summit in 2005, where Mr Blair and his rock star friends Bob Geldof and Bono tried to persuade G8 leaders to make 'saving' Africa a priority. 'The Chinese are doing more than the G8 to make poverty history,' said Mr Johnny. 'They just come and do it. They don't hold meetings about environmental impact assessment, human rights, bad governance and

good governance. I'm not saying it's right, just that Chinese investment is succeeding because they don't set high benchmarks.'

President Yoweri Museveni of Uganda, once the darling of western donors but more recently criticised for prolonging his rule and skewing elections, was scathing about his former friends. 'The western ruling groups are conceited, full of themselves, ignorant of our conditions, and they make other people's business their business,' he said, in an interview during the Beijing summit. 'The Chinese deal with you as someone who represents your country, and for them they represent their own interests and you just do business.'

China's primary interest in Africa is energy to fuel to its 10 percent annual growth.¹ According to the US Energy Information Administration, China imports 4 million barrels of oil a day, a figure expected to rise to 11 million by 2030. With the exception of South Africa, the continent's most developed economy, China's top trading partners in Africa are all oil producers – Angola, Sudan, Congo-Brazzaville, Equatorial Guinea, Gabon, Nigeria. Angola is second only to Saudi Arabia in supplying the Chinese market. Chinese customs statistics suggest that about 30 percent of the country's oil imports are from Africa.

China not only wants to secure oil supplies now, but also to establish itself in the long term as a global player in the international oil market. The China National Petroleum Corporation (CNPC), China Petroleum and Chemical Corporation (Sinopec) and the China National Offshore Oil Corporation (CNOOC) are involved in oil exploration, production and refining across Africa. As state-owned companies, they are a tool of Chinese foreign policy. According to Ian Taylor of St Andrews University,

¹ This and the following five paragraphs draw on Ian Taylor's article "China's Oil Diplomacy in Africa", *International Affairs*, 2006, vol.82:937–60.