REPORT ON THE 36TH ANNUAL SYMPOSIUM OF THE WORLD NUCLEAR ASSOCIATION (WNA), HELD IN LONDON IN SEPTEMBER 2011

'Nuclear's promise of a global transformation', a leader in the *Economist* proclaimed on the first anniversary of the reactor disasters at Fukushima Daiichi, 'is gone'. [1] In terms that Occupy Wall Street and Greenpeace would recognise, the London newspaper said that Japan's nuclear players had 'allowed their enthusiasm for nuclear power to shelter weak regulation, safety systems that failed to work and a culpable ignorance of the tectonic risks the reactors faced, all the while blithely promulgating a myth of nuclear safety'. Now there would be no market for nuclear large enough to allow innovative, perhaps small reactor designs to compete against each other.

On the same anniversary, others were more sanguine about nuclear's prospects. Launching its *World Energy Perspective: Nuclear Energy One Year After Fukushima*, the World Energy Council (WEC) conceded that 'very little has changed in respect of improving global governance of the nuclear sector, highlighting the need for action'. It also conceded that there was a 'critical need to inform the public about issues relating to nuclear generation technologies, safety, costs, benefits and risks'. Yet the WEC concluded that 'very little has changed, especially in non-OECD countries, in respect of the future utilisation of nuclear in the energy mix'. [2]

In this context of divided opinion, to attend the WNA's annual symposium in September 2011, six months after the Fukushima events, was a real privilege. Well attended and well organised, with many vivid speeches, the symposium provided an excellent snapshot of the state of the international nuclear power sector.

NOT SO MUCH BAD COMMUNICATIONS AS A SERIES OF APOLOGIES

Opening the conference, John Ritch, director general of the WNA, raised a key issue for the two days of discussion. The public, he argued, doesn't understand nuclear power, and especially radiation. The nuclear industry should challenge government to communicate a more enlightened public understanding of nuclear, because of the real benefits accruing from it.

A simple enough point? Perhaps. But in the final session of the conference, which was devoted to communication with the public, Malcolm Grimston, an associate fellow at the Royal Institute of International Affairs, Chatham House, directly opposed this view, in accounting for the over-reaction to Fukushima. For him, there was little sign of a global, popular turn away from nuclear. There is no mass radiophobia. The public pretty much believes what the industry tells it; but it also listens to the subconscious messages given out by the nuclear industry. When the industry says safety is the number one issue, that mistakes could have a terrible impact, and that shutdowns will thus be executed as soon as something goes wrong, it does itself no favours. When it

suggests that radioactive waste is not very dangerous, but that it's best to bury it 800 metres underground, the public cannot help but notice that nothing else is given this kind of subterranean treatment. Overall, Grimston contended, the message of the industry has been: a major accident would be so uniquely awful that we have made it practically impossible. That makes the public both scared, and suspicious.

There is much in that. If safety was really the top priority for nuclear, as airlines similarly announce, then the best course of action for both industries is to stop operations. We find a similar logic when the nuclear industry makes its key argument the fact that it is 'low carbon'. That may be fair, but the subconscious message is once again *apologetic*. Why not choose lots of wind turbines, with all their defects, if they too are low carbon but thought – probably wrongly – to be safer in construction and operation than any reactor? So long as nuclear interests communicate with a series of apologies, they will remain on the back foot.

Perhaps because the conference was for insiders, there was little forthright defence of the relatively rapid availability of nuclear power to solve the world's growing incidence of power cuts. [3] The energy density of nuclear fuels, and their relatively low contribution to running costs, wasn't much highlighted. There wasn't much talk about the relative subsidies enjoyed by nuclear as against other parts of the energy industry – and still less talk, more importantly, about whether such subsidies should be used just to lower prices, or rather to increase R&D. Overall, then, the balance of otherwise creditable optimism exhibited at the conference seemed to me all too vulnerable to aggressive anti-nuclear ideas.

FROM YUCCA MOUNTAIN TO FUKUSHIMA: ANSWERING THE WRONG CHARGES

Christopher Crane is chairman of the WNA, as well as president and chief operating officer of Exelon, the largest nuclear operator in the US. He was relatively optimistic about prospects there. With 104 reactors running at an average capacity factor of 90 per cent, Crane reported, nuclear still accounts for more than 20 per cent of America's power station fleet. Three plants had been granted licence extensions since the Fukushima events, and in Georgia and South Carolina, groundwork had begun on the Westinghouse AP1000 design, in anticipation of licences being granted.

Still, as Crane observed, the possibility of disposing of nuclear waste at Yucca Mountain, Nevada, has polarised American opinion. But here President Obama's Blue Ribbon Commission on America's nuclear future, which Crane anticipated in his speech and which was published in final form in January 2012, has since illuminated some of the deeper currents in evidence at the WNA event.

Briefly: Blue Ribbon has made it clear that it wants a 'new, consent-based approach' to siting waste management facilities. [4] Yet for all its fondness for transparency, flexibility, patience, responsiveness and partnership, the Commission doesn't say *how* the *content* of communications might win consent. Indeed, for it the 'crux of the challenge' with radioactive wastes derives not from the politics that surrounds them, but rather from 'a federal/state/tribal/local rights dilemma that is far from unique to the nuclear waste issue'. Nor was the Commission allowed to give a view on the appropriateness, or otherwise, of the Yucca site. [5]

Although it wasn't really flaunted at the WNA symposium, this official brand of defensiveness and evasion is all too prevalent in the nuclear industry. But then the nuclear industry does have things to answer for. The highlight of the symposium was a speech on what went wrong at Fukushima.

Delivered by Akira Omoto, a member of the Atomic Energy Commission of Japan and a professor at the University of Tokyo, the speech painted a truly disturbing picture. First, Japan has yet to bring a probabilistic analysis of tsunami hazards to maturity. The hazard analysis used before Fukushima was deterministic; only now is attention being really being put into how multiple earthquakes, separated by time delays, can interact to produce a formidable tsunami.

What happened was an earthquake, a loss of power to Fukushima 1's offsite nuclear management centre, a tsunami, a loss of AC and DC power onsite, the collapse of coolant pumps, meltdown, and eventually, despite efforts, hydrogen explosions. This much is fairly well known; but many other factors should not be neglected. In a second lapse, Japan's Headquarters for Earthquake Research had not thought that an earthquake could have such a multi-regional impact. When the earthquake hit, the same specialists went on to misjudge the size of its source area, its magnitude, and the amount of slip.

After the accidents at Fukushima began, it became clear that nobody had thought how debris might limit the use of fire engines, tools, mobile pumps, air compressors and even hastily scavenged car batteries. Debris, hydrogen explosions and aftershocks wrecked field facilities; there was no single regulatory body with oversight and no single authority in charge of accident management; there was no centre looking after the storage of mobile equipment and, shockingly, there was no tracking of the location of essential safety systems; employee understanding of safety was poor; instrumentation to measure aspects of accidents was weak. On top of all this, earthquake damage made communicating what had happened to the outside world very hard.

Simulation of plant behaviour would have helped. So would more and more reliable means of cooling core, containment vessel and spent fuel. So would a scrubbing vent and other systems to prevent the contamination of the soil. There was compliance with regulation, but this proved of little help. What was at issue was a *failure of the imagination*: nobody imagined how chaos could assume a momentum of its own.

Fukushima shows, however, that the nuclear industry needs to say sorry about the power of the nucleus as little as it should apologise for the longevity of radioactive waste. At Fukushima, few of what Omoto described as the 'knock-on' mishaps had much to do with the properties of atomic nuclei – most were to do with utterly myopic management. Was the industry's or TEPCO's 'enthusiasm for nuclear power', as the *Economist* puts it, really to blame? Hardly. What was culpable was Japan's seismology. What was culpable was a plain, old-fashioned, non-nuclear sweating of 40-year-old assets, by a company whose forecasting was terrible and whose 'business model' allowed it to owe debts, prior to the accident, that ran into tens of billions of dollars. And all this was done against a long-term background of weak Japanese economic growth, weak Japanese political leadership, and utilities regulators who are hardly alone, in the Japanese state, in their obvious and ominous complacency and corruption.

A keynote address by George Felgate, managing director of the World Association of Nuclear Operators, backed up what Akira Omoto had to say. At Fukushima, equipment needed in a seismic event was not seismically rated, and keys to padlocks were missing. At Three Mile Island, weak workforce training ensured that the reactor stayed open just three months. At Chernobyl in 1986, operators had less than one year's experience. Today's nuclear operators have 419 plants operating and 66 under construction. What they have to answer for, then, are safety stupidities that are in fact more common around coalmines, or around fossil fuel extraction and refinement, than they are around the nuclear power sector.

ASIA AND THE END OF GERMAN NUCLEAR POWER

After Japan, Germany is the country where the post-Fukushima atmosphere in nuclear circles is particularly tragic. Elsewhere in the East and in South Africa, by contrast, a stronger commitment to economic growth has created an atmosphere more conducive to nuclear new-build.

In passionate style, Jong-Shin Kim, president and CEO of Korea Hydro and Nuclear Power, reported how his country had gone from nuclear hardware importer to exporter in just 40 years. Without nuclear, he said, the Republic of Korea's economy, which is host today to the world's fifth largest nuclear industry, would have developed much more slowly than it has done to date.

Kim's argument is hard to fault. Today, nuclear represents 23 per cent of Korea's installed electricity capacity and 31 per cent of its electricity generation; by 2030, about 40 reactors may provide 59 per cent of the country's power. Korea is not a developing country any more, and its aggressive pursuit of nuclear power has had a lot to do with that happy transformation.

In her review of Chinese nuclear safety regulatory system, Harvard's Yun Zhou was uncompromising about some of China's problems with nuclear. China runs 14 reactors, generating 12 GWe; she has 27 in construction; she hopes to generate 60-70GWe by nuclear means in 2020. However China's government does see the shortcomings of the 25 or more Generation II reactors it wants to build. It is more risk-averse on public safety after the Wenzhou high-speed train collision of 23 July 2011. It knows that its young industry still has an incomplete regulatory system, even if it has had a fast declining number of incidents. However after Fukushima it only rethought the short-term, and is likely still to make its nuclear targets for 2020.

That may prove too sanguine a verdict. The East is not immune from German tendencies in nuclear power, and the legitimacy issues that surround the governments of Korea, China and India could well complicate the full-speed-ahead approach. Still, at the conference Madhukar Kotwal, president of heavy engineering at Indian contractors Larsen & Toubro, gave a visually thrilling account of his company's capabilities. In revealing slides, Kotwal showed some impressive components: safety and main vessels for fast breeder reactors, as well as large forgings and castings, tubes and high pressure pipes, end shields, steam generators, steam turbines, reactor doors, coolant pumps, fuelling machines and – low-tech, but exported to the UK, Switzerland and most recently the US – dry shielded canisters for the storage of waste.

About his country's 'nuclear sunset', Ralf Güldner, President of the German

Atomic Forum, could only be pessimistic. He showed how, after the German media hysterically and mendaciously portrayed the non-lethal events at Fukushima as the *cause* of Japan's enormous (about 19,000) death-count, the German government completed a legislative programme effectively ending nuclear power in just four and half months – despite the fact that stress tests on Germany's reactor fleet had showed that every device was up to regulations or better. The result is that, by contrast with Korea, Germany will now become a net importer of electricity, mainly from France and the Czech Republic. Its use of two coal-fired electricity plants in Austria will help raise emissions of CO_2; electricity prices have already risen; $300bn will now be needed for German renewable energy.

CONCLUSION: THE BARRIER TO NUCLEAR POWER IN THE WEST IS POLITICAL

The account above doesn't do full justice to the symposium, and in particular to its important excursions into uranium mining, the nuclear fuel market, passive safety (Generation IV) reactors, or the R&D that must, now more than ever, surround the disposal of spent fuel. Certainly Fukushima has pointed up the need for operators to take care of business with DC and AC power, so that systems blackouts are avoided.

Perhaps the *Economist* is right. Perhaps there will now be no market for nuclear large enough to allow innovative competition. However to me the paper given by Jérôme Le Page, senior utilities analyst at MSCI ESG Research, seems more convincing. For the moment a tentative nuclear renaissance in the West and Japan has been ended not by Fukushima, but by *political reaction* to that nasty, though far from murderous, turn of events. There will be more regulatory uncertainty, leading to lower nuclear new-build. There will be more fear over safety and waste.

At the symposium I learned that, aiming at youth, the Korea Nuclear Energy Promotion Agency is developing a mobile app entitled *Learn the truth about radiation*. I also learned that Korea boasts a *musical* around the theme of nuclear power. I'm not saying that these communications will be or are completely effective, but at least the attitude and posture are broadly right.

It will be a long time before this kind of stance returns to popularity in the West.

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