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The Inevitability of New Nuclear Power Generation

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In a speech I gave in 1998 to the European Nuclear Conference in Nice I presented the conclusions of the 1998 World Energy Congress in Houston on the future of nuclear power in the global energy mix. I challenged the nuclear industry to join the energy mainstream, to focus on the substantial electricity expansion required in the developing countries in the next thirty years, and to recognise that — when it comes to greenhouse gas (GHG) emissions — the nuclear ace is not the only card in the deck.

WEC Scenarios

The World Energy Council (WEC) has argued in its global energy scenarios for many years that nuclear power should play a major role in contributing to electricity provision and in strategies to combat global warming. At 6% of total primary energy and close to 17% of total electricity generation, nuclear power is well established in key markets around the world, but its steps have been hesitant and its future clouded. This is ironic in the context of international negotiations to reduce greenhouse gas emissions and, even more importantly in this information age with our growing dependence on things digital, given the desire of countries to break out of energy poverty with a reliable, safe and competitive source of uninterruptible electricity. In this scenario, no matter how special interest groups try to cut it, new nuclear power is a key part of the world's energy wardrobe now and in the years to come.

Of course, we know that not everyone sees nuclear the same way. There are people and governments who want to take nuclear power off the table without the foggiest notion of what will replace it or how regional electricity trade or other energy relationships might be affected. There are those who exploit the nuclear industry's problems while ignoring its progress and opportunities. Everyone knows that the nuclear industry must take the necessary steps to bring down capital costs and to satisfy public concerns about safety, that governments must take a more active role in assuring prudent regulatory oversight on the dangers of nuclear proliferation, and that society as a whole must acknowledge and understand the full fuel cycle implications of adequate waste management. This latter notion applies not just to spent nuclear fuel but also to CO_2 and other emissions from fossil fuels.

The Enemy Within

The nuclear industry has been incestuous and government suckled. It has not readily embraced energy market reforms such as liberalisation or privatisation which work so effectively in its favour. It is split on big versus small, smart versus traditional reactors, which plays into the hands of those who cannot see a role for nuclear energy in cash strapped developing countries where the main growth in electricity demand will take place. Where are the young people, in science or business management, who ought to be joining this relatively new industry? And the nuclear industry exhibits surprising naiveté in thinking that its GHG-free generation technology will not be matched by major advances in fossil fuel technologies which will keep the latter — including coal — in the energy driver's seat well into the next century.

I do not see a lot of nuclear companies taking advantage of WEC's new Greenhouse Gas Emissions Reduction Programme; some nuclear players are learning how to use this registration/verification service to their advantage, but not very many. I see only a couple of them joining in WEC's major regional facilitation programmes designed to bring commercial energy to the two billion people in the world who do not now have access to it, and nuclear companies continue to stand apart when it comes to fitting energy into the bigger picture of living in one world.

Many nuclear industry executives resist the cutting of the government umbilical cord in nuclear power generation, transport and recycling of wastes. Others are running as hard as they can. Some of them speak openly of the hope to maintain what the industry has, to somehow weather the current negative storms in North America and Europe so its skill base and businesses can survive with the crumbs of plant life extension. Others believe new nuclear is a real prospect in the short term and that they ought to be shouting from the rafters about the industry's excellent progress in reducing front end costs, including construction times, in safety and maintenance productivity improvements, and in smaller, smarter reactors.

Old Versus New

It is time to state quite clearly that, while the nuclear industry is relatively young, it has come a long way and is poised to expand its role in world electricity generation. The industry will extend plant life in some markets, such as Finland or Sweden; it will build new plants in Asia. It will see the day in the twenty-first century when governments and voters accept the inevitability of new nuclear power stations in Europe, Africa, North America, Latin America, and even the Middle East.

I base this thinking on the results of WEC's Regional Forum in Zurich in June, when we examined the regional and global implications of Western Europe without nuclear power. The nuclear industry was there; the natural gas and coal industries were there; the energy media were there. The only decision makers who could not participate directly in the debate were the bureaucrats in Brussels, Paris and other capitals who are working on how to kidnap global energy policy via the Kyoto Protocol. We invited them and we are going to see them one by one because we have a message: nuclear power is here to stay!

Digital Blues

One of the excellent interventions in Zurich came from Jean-Marie Bourdaire of the International Energy Agency in Paris. He is a leading energy economist, someone who has worked in the petroleum sector most of his career. One of his key points was that there is a weakness in our traditional aggregation of electricity and stationary fossil fuel end uses in most scenarios; this does not incorporate the flexibility and easy use of electricity. Electricity uses can no longer be substituted by fossil fuels and electricity trends evolve on their own in a linear relationship with GDP.

But did you know that the demand for digital power is rising faster than bit efficiencies? Under the PC hood the demand for horsepower doubles every couple of years. A billion PCs on the Internet would create an electricity demand equal to the total electricity production of the USA today! How many of you have a home office to duplicate your downtown set up? Perhaps you follow me with three integrated systems all heavily dependent on huge amounts of reliable, safe and competitive electricity.

Greening Nuclear

Bourdaire pointed out in Zurich that more than half of the annual worldwide growth in electricity demand now comes from microprocessors. The quality and reliability of the power supply is the key. When you add to this current local, national and international concerns about the environment, one might easily predict that governments will trip over each other to promote baseload electricity for their national markets and for the two billion people in the world without access to commercial energy based principally on two sources: clean coal and nuclear.

Notice how I have combined national needs with the huge potential of solving poverty in the developing world in ways which, together, prepare the world for carbon constraints; it is a lot easier in the shorter run to invest in new sustainable power in places where it does not exist than to close down cheap, efficient plants or change consumer behaviour. Energy security and environmental considerations have combined to focus energy policy on regional and international solutions which address both at the same time.

But I also slipped the word “baseload” in the above prediction so I do not have to speak too much about renewables today. I often tackle this subject with other audiences; sometimes I like to muse that nuclear power is the ultimate renewable, which does not always please the bureaucrats or the solar scientists. The fact is that each renewable faces practical barriers, as Bourdaire pointed out. In different markets different renewables have a niche role to play and much more can be done to link some renewables with combined cycle and other baseload systems to expand their share in total primary energy and to take into account the extensive role already played by biomass. But I know of no one who claims that renewables can realistically meet the bulk of future global electricity demand.

The Customer is Always Right

In Zurich, with the above analysis in mind, the participants agreed that transparency and consumer-empowerment will favour a bigger role for

nuclear power in the world's future. Roger Gale told us in Zurich that even in the USA nuclear plants can thrive in a competitive market as a highly cost effective way to generate electricity. As nuclear plants shed their initial capital cost burden, their advantage in terms of running costs becomes clear. Consolidation in the US industry serves to reinforce this.

Alan McDonald of the International Institute of Applied Systems Analysis (IIASA) in Austria described WEC/IIASA global energy perspectives out to 2050; he threw cold water on the thesis that stopping nuclear power in Western Europe would lead to a loss of GDP or an increase in global warming. Global warming, he said, is no more the saviour of nuclear power today than fossil fuel resource constraint was in the past. The issue for nuclear is economics; nuclear has to bring down costs and construction times.

Think of it: nearly one third of Western Europe's electricity is generated by nuclear reactors. A phase-out of nuclear power in that huge market, even if theoretical at this point, would have global and regional implications which have not been adequately recognised. Today the energy business is neither local nor national; it is regional and global. This evolution of the energy sector in different parts of the world sets up nuclear energy for a bigger share of the pie. In Zurich a strong case was made for future nuclear plants which benefit from advances in technology and design; and of course they will benefit also from the trend to full fuel cycle pricing for fossil fuels, at least partly due to emissions trading and clean development mechanism partnerships which address the need for carbon constraints.

Nuclear Power Economics and Politics

The point of Kyoto and greenhouse gas emissions is not to give nuclear power a free ride to a brighter future. Far from it, especially if clean coal technologies and carbon sequestration schemes are accelerated. But I believe the economics of fossil fuels will be altered by the need to build into costs of production, transmission and distribution the externalities related to carbon trades, carbon constraints, gasification or carbon sequestration. The technologies exist to do this; the only issue is when and how fast such full fuel cycle costing will impact the relative price of fossil fuel combined cycle generation as compared with new nuclear power plants.

While much remains to be done in reactor development and fuel cycle management, there are examples today of nuclear plants which have doubled operating profit, increased plant availability significantly, and reduced lost time accidents and injury rates almost to zero. A new plant production cost of 3 US cents/kWh could be achieved including all waste and decommissioning costs. If you couple such a number with predicted four-year construction times and with expected lifetime output per plant of 2.5 times present plant design, new nuclear power plants easily get inside the ballpark of liberalised, regional electricity baseload.

Of course, while the economics and sustainability of nuclear power look pretty good today, the play's the thing, to quote Shakespeare. And the play is public acceptance. There is an overriding need for public confidence in nuclear technology. In Zurich we found that most people in the countries with nuclear power are supportive of existing plants; raising the level of support

further, particularly with political parties dedicated to closing nuclear power down, depends fundamentally on tangible progress on the issue of radioactive waste even if, from a technical standpoint, this is not an urgent problem. The long term need in terms of public acceptance is the patient demonstration of the safety, reliability and viability of nuclear plants, and credible waste disposal. To quote another great bard, keep it simple stupid (KISS)!

The key to KISS is government leadership, not government antagonism or disinformation. Energy policy ought to focus on the long term, and it should provide the context for empowered users of electricity to compare all risks. Energy policy should be honest, open and rational, which means focussing on how nuclear power can continue to be an effective source of energy in the world where it is already present, and how it might play a bigger role in addressing the energy poverty of one third of the world's population which does not now have access to commercial energy. These are people who live in communities with small coal boilers or inefficient wood stoves, the local pollution from which (and the health impact) far exceeds the significance of CO_2 levels in the atmosphere or the dangers of highly radioactive nuclear waste. Much of the world's energy poverty today is in rural settings, but demographic trends show not only a tapering off of population growth but also substantial urbanisation. Thus, most of the next two billion people born mostly in developing countries will be urban-based, making their energy needs and environmental problems easier to address with baseload electricity generation from nuclear power.

Energy Communications

We wrapped up our Zurich meeting — and let me invite you to WEC's global energy information address (www.worldenergy.org) to read much more about it — by putting energy journalists and nuclear industry executives on the same stage at the same time. What role will fission energy play in the next decades, asked the journalists? The executives were unanimous in anticipating a continued important role for nuclear power, both inside and outside Europe. Even the natural gas industry in Europe calls for nuclear power to remain on the table, and the coal industry in Poland predicted a 12% role for nuclear power in that market by 2010!

Another question zeroed in on the problems facing nuclear power today. Again the executives highlighted discriminatory government policies, investor short-termism and the economics of combined cycle natural gas plants as the key challenges. Public acceptance, always important to any business, is principally focussed on the back-end of the fuel cycle. On disposal facilities, even though the industry is young, the executives I heard called for a lot more than just wishful exhibits and explanations.

It was on the subject of when new nuclear plants will be required that I really perked up in Zurich. Until then I was hearing a lot about the nuclear doldrums and God Save Kyoto so we justify plant life extensions. Our Zurich panellists agreed that starting in 2010 existing capacities in Western Europe would have to be replaced. Prospects for new investments depended on the ability of manufacturers to offer competitive designs and to reduce construction times, but generation costs of 2.5 US cents/kWh and four year construction are

attainable targets. In Finland, France and Poland, at least, it sounded to me as if new nuclear plant was inevitable.

It is clear that the nuclear industry itself has to take responsibility for solving its own problems and shaping its future. The industry should enter the mainstream of WEC's work on multi-energy, global programmes to achieve a better understanding and growing place for nuclear power. But, the nuclear future is also a political issue. Governments ought to do three things:

- First, governments have to lead a broad public debate on energy and environmental problems and the options to solve them.
- Second, governments of richer nations should provide long promised assistance to those whose reactors are not so safe to raise safety standards of their installations.
- Third, governments need to create a level playing field in energy by making sure that other energy sources cover the full costs of the environmental effects they cause.

Conclusion

I see the future of nuclear power as first and foremost a business that has to prove itself in the marketplace. I welcome the evidence of the nuclear industry's recent success in this regard, that it has become more transparent, less arrogant about public concerns and, above all, ready to address customer choice. These are the key reasons why I believe new nuclear power generation is inevitable, not just in countries such as Korea and Japan, but also in Europe and the United States. It is my firm hope that the nuclear industry will also join WEC in making nuclear power part of the solution to the commercial energy needs of Africa, Latin America, Asia, and parts of Central and Eastern Europe.