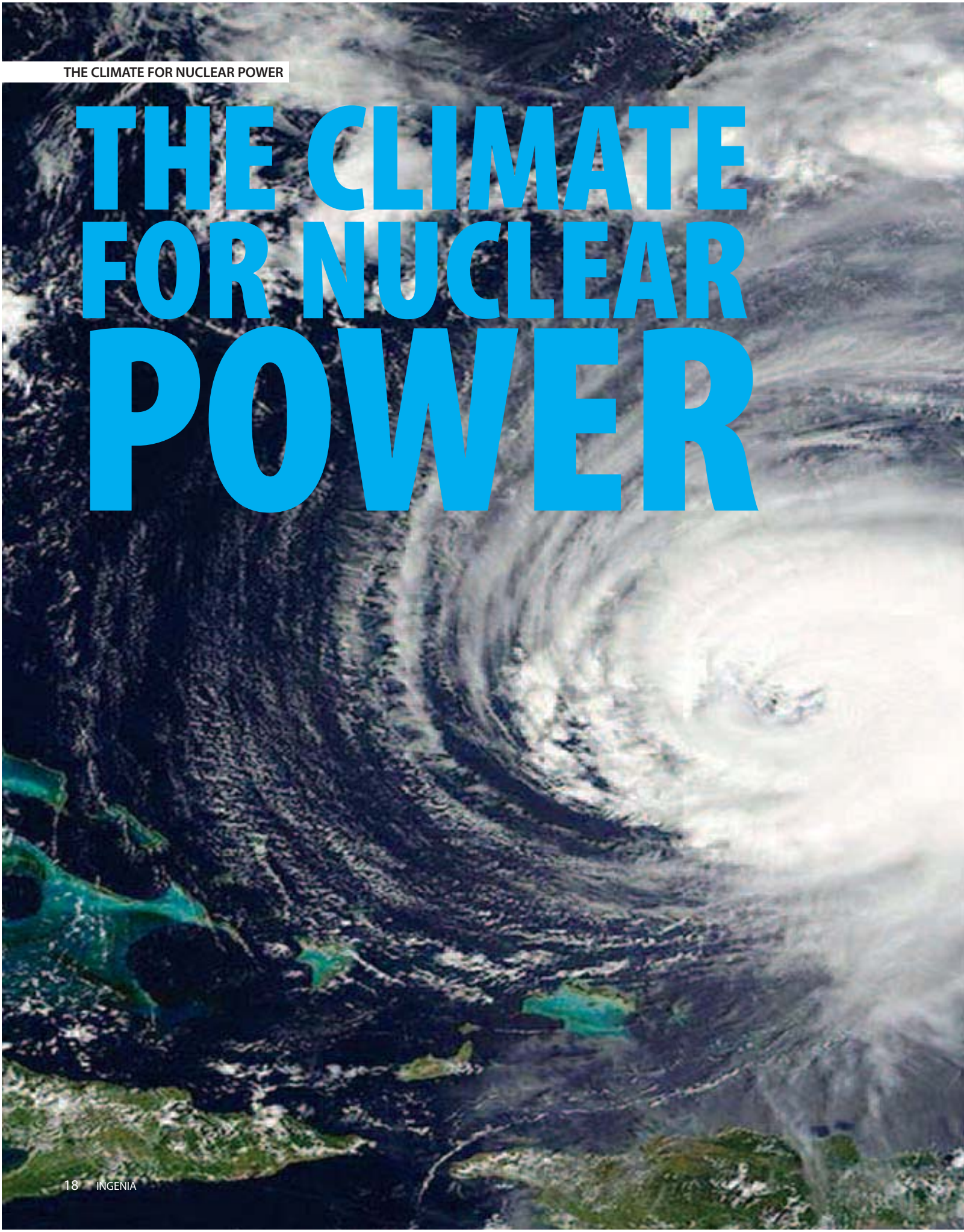
THE CLIMATE FOR NUCLEAR POWER



Hurricane Isabel Global warming may be responsible for extreme weather conditions

Nuclear energy is back on the political agenda. It even surfaced, albeit fleetingly, during the recent election campaign. If the UK is really serious about tackling climate change, Tony Cooper believes that the nuclear debate has to take centre stage, shorn of the baggage of history and simple-minded grandstanding.

Take it as read that global warming is real, at least partly man-made and will be enormously costly, both environmentally and financially. Take it as read also that most people are bored by the theological nature of much of the debate and the opportunist responses of ill-informed politicians on all sides. What then really can be done and what is actually being done?

If we achieved the targets for reduction in the emissions of greenhouse gases agreed under the Kyoto Protocol to the UN Framework Convention on Climate Change, agreed in 1997, it would at best delay global warming by four years, and at huge cost, while dividing the world into opposing camps diverted from real solutions by their own defensive self-righteousness. When the UK signed up to Kyoto, emissions were already below target, leaving room for emissions to grow, as predicted and as is now happening. This made it almost impossible, as the Government acknowledges, to achieve our own domestic target of a 20% reduction in CO_2 emissions by 2010. However, even if we are bound to meet our Kyoto targets, what follows?

Over the next 15 to 20 years nuclear generation will almost cease in the UK as existing reactors reach the end of their working lives. Generation from coal-fired power stations will also cease, closed by the EU's large combustion plant directive. Even if we meet our current renewables targets, 80% of our generation will be from gas and there will be precisely zero impact on emissions of greenhouse gases. However, the gas we then burn will no longer be cheap, reliable North Sea gas: by then the UK, indeed the whole of Europe, will depend on the Organization of the Petroleum Exporting Companies (OPEC) and Russian gas pipelines. Can anyone seriously believe these powerful political monopolies will not exploit their power?

All this is however essentially trivial. If we are to be serious about combating global warming we will have to cut emissions of greenhouse gases by at least 60% over the next 50 years just to stabilise the current

Airtricity's first Scottish wind farm which consists of 12 V80 2MW turbines © EMPICS

position, never mind reverse the damage we have done.

Government recognises the problem, but hides behind platitudes about Kyoto whilst largely in denial about significant measures, given the scale of the problem and the difficulty in making long term decisions in the face of a four- or five-year electoral cycle. Environmental lobby groups prefer a disjointed debate on the evils of all alternatives pursued in isolation because a joined-up discussion would force them to face choices that would be unpopular with their various constituents.

RENEWABLE ENERGY

The Government's 2003 Energy White Paper 'Our energy future – creating a low carbon economy' emphasised renewables and improvements in energy efficiency as the principal means of achieving large cuts in emissions of greenhouse gases, culminating in a 60% reduction of CO_2 emissions by 2050. Renewable energy technologies, together with increased efficiency in energy use, clearly have enormous potential, but many renewables – wave and tidal, for example – are in their infancy. These technologies also invariably suffer from intrinsic problems of low energy density, high capital or running costs, and their own environmental or aesthetic drawbacks or a combination of these.

Wind is the most promising natural energy source. It is not, though, without drawbacks. In 2003, a heat wave killed nearly 30,000 people across Europe. During that period, with demand for air conditioning at its highest, the wind did not blow: wind farms in central Europe contributed only 1.3% of their potential to electricity generation.

The average availability for wind turbines across Europe is about 15%. Even if we assume a more charitable 25% for the windier UK, we would need to build wind capacity equivalent to our entire current conventional capacity, around 60,000 megawatts, to provide 25% of our electricity from a source available only 25% of the time. But over 20 years, demand will grow. Assuming a conservative 20% total growth to 72,000 MW would imply constructing 48,000 new 1.5 MW turbines, or 2,400 per annum, 200 per month for the next 20 years, eventually covering an area about one third of the size of Wales.

THE NEED FOR BACK-UP

However, on a surprising number of days – many of them in winter when cold, anticyclone conditions create maximum demand – there is not enough wind to generate across the UK. We would therefore need substantial back-up capacity. This will inevitably be based on gas as by then we will have closed half our existing capacity from coal and nuclear.

Wind farms also have to be sited where there is space and wind, on the whole far from the centres of demand. This would entail a significant upgrade to the National Grid, and significantly downgrade to our aesthetic appreciation of those self-same remote places.

Wind farms are built now because the market obliges electricity suppliers to deliver a proportion of their supplies from renewable sources. Renewable Obligation Certificates currently trade at a price that shows quite clearly that wind generation costs around three times more than conventional generation. Nor have we yet had to face the costs of replacing back-up capacity.

All this, remember, to generate 25% of our needs, and replacing nuclear power stations with no net reduction in greenhouse gas emissions.

In principle, energy efficiency seems more promising. Small reductions in energy demand, sustained over a number of years, could yield a big reduction in demand over 20 to 50 years. In practice, no country has reduced energy demand, except as a by-product of industrial and economic collapse. Overall demand still rises despite the fact that the amount of energy we use per unit of GDP has fallen substantially.

Nuclear energy is the only available source of large scale, carbon-free electricity. It provides over 20% of the UK's electricity, but on present plans all but one of Britain's nuclear power stations will have closed by 2023.

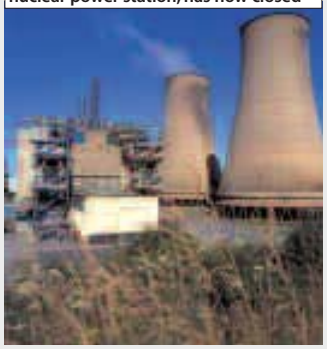
Artist's impression of the AP600, an advanced nuclear power plant

If we are really serious about global warming we will have to change our behaviour radically and rapidly, or come to terms with well known but currently pariah technologies. Let us consider one of those technologies: nuclear energy.

NUCLEAR'S TRACK RECORD

Nuclear energy is the only available source of large scale, carbon-free electricity. It provides over 20% of the UK's electricity, but on present plans all but one of Britain's nuclear power stations will have closed by 2023, reducing the nuclear contribution to about 3%. With new technology, we can build nuclear power stations in less than 10 years. These designs produce a fraction of the waste of our existing technologies and are cheaper and quicker to build. These designs are also far more flexible to operate, can be readily constructed to withstand any conceivable attack and rely on passive safety systems, such as cooling systems based more on gravity and convection, rather than pumps. The industry, however, is beset by myth and rhetoric from all sides.

Calder Hall, the world's first commercial nuclear power station, has now closed



Nuclear power has never lived up to its potential, especially in the UK. It certainly never lived up to the exaggerated claims of the early pioneers. The first generation of Magnox reactors grew out of a design intended primarily as plutonium factories. They were inefficient electricity producers, but good at producing what has now become waste.

In the longer run, a more insidious legacy was a defence-based culture of secrecy and technological elitism in which commercial judgements were secondary. The next generation of advanced gas-cooled reactors (AGRs) were again a wholly UK design, but were expensive to build and operate, inflexible and less robust than their predecessors and technically dated by the time they were operational. To compound the inherent commercial weaknesses of AGRs, the Central Electricity Generating Board (CEGB), the state-owned power monopoly, altered the design so often that it realised few of the anticipated savings from repeat build.

The true costs of nuclear power were hidden or disguised within the CEGB's accounts and not exposed to public and political scrutiny until the run up to privatisation. All this left the nuclear industry in the UK with an unreliable, expensive, unique, technologically advanced but now dated legacy, and a severely damaged reputation.

DEALING WITH WASTE

We have made a start in dealing with the legacy issues of decommissioning and waste. We will need facilities and processes to handle this legacy even if all nuclear generation ceases.

Dealing with existing waste will be very expensive, around £50 billion for decommissioning alone. That is a lot of money, but it is trivial compared to the costs of global warming or the prevention of global warming by other means, and trivial too in relation to the wealth created on the back of electricity generation from nuclear and fossil fuels. Whatever the final cost of dealing with this legacy, replacing all existing nuclear power stations would add only 10% more waste over 40 years or so. Dealing with that waste would simply involve extending, at marginal cost, programmes to which we are already committed.

Arriving at an acceptable solution for radioactive waste is not an insuperable problem. Finland is currently building its fifth nuclear reactor. The country's parliament ratified a final decision on waste disposal in May 2001, with 159 votes in favour and three against. Both decisions – on the waste repository and the fifth reactor – were the culmination of a long process of open public consultation and debate, of the sort that is long overdue in this country.

In the UK that debate must address the structure of the electricity market. As a commodity market designed to reward efficient production of electricity in the short run, it

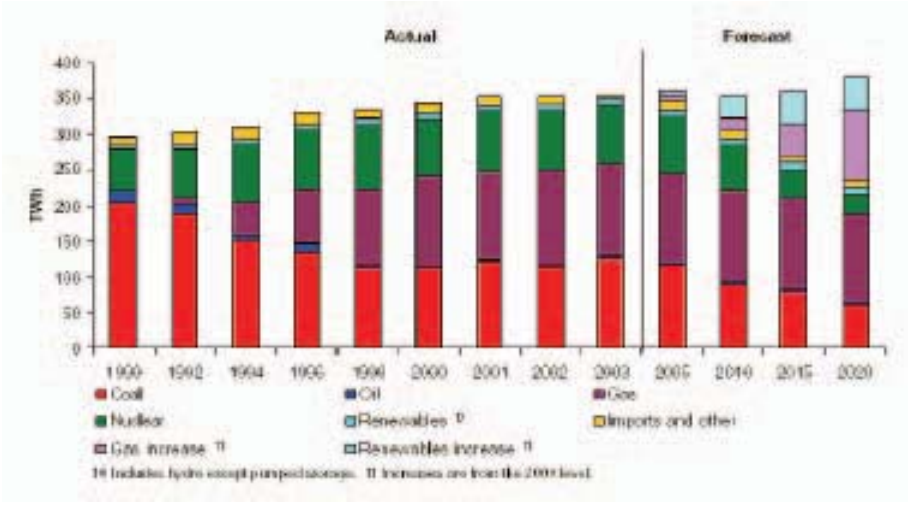


Figure 1: The Government prediction of UK electricity fuel mix (JESS report, November 2004)

cannot create the incentives to invest in technologies such as nuclear power that take a long time to deliver their output. Indeed, volatility of wholesale prices has deterred investors from investing in any generating capacity other than wind, which attracts a subsidy.

Who in the private sector would invest in new nuclear power stations? Again, Finland offers an interesting model: there the utility, TVO, operates as a not-for-profit company to provide electricity to its shareholders, a group of large industrial energy users, who share the risks and rewards of their investment.

A consortium approach to financing in the UK is the most likely route to spread the risk and avoid one company being wholly exposed. But investment of any sort will be forthcoming only when there is a degree of certainty and predictability in the market. For a start, the costs of nuclear stations have to be transparent and credible, and investors will need to be able to predict with some certainty their liabilities for decommissioning and waste management. This requires a clear policy route for waste.

TAKING THE LEAD

It is the job of Government to choose the desired outcomes on behalf of us all. It must then ensure that we have the market structures and regulatory rules to deliver those outcomes, leaving the choices of technology to the market. Longer term stability and security of supply and reduced emissions of greenhouse gases go unrewarded and therefore play no part in the market's investment decisions. The market could, however, be readily restructured to reward such outcomes.

Market reforms that encourage the emergence of long term trading and appropriate financial instruments, and reward low carbon energy sources, could deliver deeper reductions in emissions of greenhouse gases and continuing energy security at a far lower cost than ad hoc Government intervention.
A serious and rational debate about the role of nuclear power, compared to the alternatives, shorn of their myths, will, I am sure, conclude that nuclear power is the greenest, safest, most reliable and cost-effective energy source.

BIOGRAPHY – Tony Cooper
Tony Cooper is a non-Executive Director on the Board of the Nuclear Decommissioning Authority (NDA), before which he was Chairman of the Nuclear Industry Association (NIA). He was appointed to the DTI Energy Advisory Panel as an inaugural member by the previous Government and elected in April 1998 to the EU Joint Energy Consultation Committee.