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The future will not be nuclear

BY TOM BURKE

The government is pinning its hopes on a nuclear renaissance to meet Britain's climate change goals. Planning procedures are being eased and hidden subsidies offered. But the policy is based on a misunderstanding of nuclear power's lousy economics, and will fail

Gordon Brown has not been a decisive prime minister. But there is one thing he does not dither about: nuclear power. Since the start of the year, Britain has advanced from a policy of simply replacing existing nuclear capacity to one of doubling it, and now to there being no upper limit to its share of electricity generation. Brown has undertaken a radical reform of the nuclear regulatory and planning processes, aimed at clearing the path for new reactors. It is therefore particularly poignant that this is a policy doomed to fail.

Energy prices are rising, the climate is changing and power stations are closing—so we need more nuclear power. So runs the overwhelming volume of argument in the media. But what is missing is any critical examination of the case that underpins these dire warnings from ministers and utility industry nabobs about the lights going out. The lights are not going to go out. The government's nuclear policy will fail. And all that will really matter is that we will have lost precious time in switching to a more climate-friendly method of electricity generation.

We live, these days, in what Eric Hobsbawm calls a "permanent present." Even recent history is quickly forgotten. Somewhere in my personal archive are the minutes of a cabinet meeting held in October 1979, which arrived on my desk at Friends of the Earth in a proverbial brown envelope. They recorded the decision of Margaret Thatcher's newly elected government to build ten nuclear reactors. The arguments were familiar. Oil prices were rising, An energy gap was imminent. Without a crash programme of nuclear reactors we would freeze in the dark. Sixteen years later, just one reactor had been built, at Sizewell in Suffolk. It cost more than double the original estimate. No one froze in the dark.

THE STORY OF BRITISH NUCLEAR POWER

There is nothing in the history of nuclear power in Britain to inspire confidence. Most of our 19 reactors, which together have the capacity to generate 12,000 megawatts (MW), are of a design unique to Britain. These Advanced Gas-cooled Reactors (AGRs) were in 1974 described by Arthur Hawkins, chairman of the then-nationalised industry that placed the orders, as "a catastrophe." Today, four are not working, reducing from 20 to 15 per cent the share of electricity that is produced by nuclear.

A popular mythology has developed that blames the nuclear accidents at Three Mile Island in the US and Chernobyl in Ukraine for the demise of nuclear power in Britain. Lately, the planning system has been added to this mythology. In fact, the only obstacle in the way of nuclear power for the last 20 years has been the unwillingness of electricity generators to take the risk. By the time of Chernobyl, in 1986, no nuclear power station had been ordered in Britain for eight years and in the US for 12. And the public inquiry that considered the application to build Sizewell B began in 1983 and took two years—only six months longer than the government now expects its accelerated planning procedures to take. The government then took two further years to give the go-ahead. Sizewell B opened in 1995, having taken a further eight years to build.

What actually killed nuclear power in Britain was Thatcher's decision to privatise the Central Electricity Generating Board—the previously nationalised generation utility. The City took one look at the

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books and told the government that the nuclear power stations were unsellable. They were promptly withdrawn from sale. The later privatisation of most of Britain's nuclear power stations was only possible because the burden of the decommissioning and waste management costs—now standing at over £70bn—was transferred to the taxpayer. This was a good example of a practice that has been much in the news lately in relation to the banking industry: privatising profits and socialising losses. So much for market discipline. It is an irony that the government's preferred plan for a nuclear renaissance involves renationalising British Energy as a French state-controlled utility.

Thatcher was as convinced about nuclear power as Brown. She was defeated by the lousy economics. Nuclear power has few attractions for private sector investors, especially in a competitive electricity market. All long-term investment in future electricity generation involves risks and uncertainties (including the price that will be put on carbon emissions). But nuclear power's risk profile is the worst. To be economic, nuclear power stations need to be very large (at least 1,000MW) and built in a series, ideally four or six at a time, probably on the site of existing stations. They are very capital intensive at both the start and end of their lives and, because of the initial costs, much more sensitive to the cost of capital, which can add 40 per cent or more to construction costs. They take a long time to build, and, when built, have to run continuously into a market where the wholesale electricity price can change constantly. The operators have to make adequate provision for the (currently unquantifiable) costs of waste disposal.

Coal-fired stations take perhaps three to five years to build, cost a lot less per unit of generation capacity and have no back-end liabilities to speak of. They are economic to build singly and therefore each new one is less at risk of failing to sell the power it produces. Gas-fired stations can be built in smaller units much more quickly, and so are even easier to match to shifting demand. Wind turbines can be built in very small tranches, even faster than gas.

Very high, uncertain and rising capital costs on a project that will produce no revenues for a decade or more are not a compelling proposition at the best of times. Add a host of hard-to-quantify sociopolitical risks, and it is not difficult to see why nuclear power programmes have always relied on large and sustained public subsidies.

WHY IS NUCLEAR POWER SO EXPENSIVE?

There are only two honest answers to the question of how much it costs to build a nuclear power station. These are "I don't know" and "I'll tell you when I've built it." Everything else is a guess. These may come in official volumes stuffed full of impressive-looking data, but they are still guesses. Some numbers will illustrate the point. Between 1966 and 1967, reactor costs in the US exceeded estimates by an average 209 per cent. Between 1968 and 1969 they went up 294 per cent. Between 1970 and 1971 they went up 348 per cent. 1972 to 1973 was a good year, they only went up 318 per cent. But by 1974 to 1975 they were back up to 381 per cent. In 1976 they only went up 169 per cent. But by then the American utilities had given up. They have not ordered a nuclear reactor since 1974. We did little better. The cost of building Sizewell B went up "only" from £1.7bn to £3.7bn during construction.

The government's commitment to new nuclear power stations is based on just such guesses. The cost of a reactor is normally quantified by what it costs to build each kilowatt (kW) of its capacity to generate electricity. To find the cost, you multiply this by the reactor's size—measured in thousands of kW, or megawatts (MW). To this must be added the cost of financing the expenditure. In its January white paper on nuclear energy, the government's worst-case analysis assumed that the construction cost would be £1,625/kW, giving a total cost (based on a reactor size of 2,200MW) of £3.6bn. But in May, the German utility company E.ON estimated the cost at just over £3,000/kW, making the overall cost of a new reactor close to £6.7bn. Other recent guesses range from $4,000/kW (£2,162) early in 2007 to $10,000/kW in January 2008 (£5,000). This certainly looks like "I don't know" to me.

Nuclear enthusiasts argue that everything is different now. Lessons have been learned, designs have been standardised and new reactors can be built on time and to budget. But the fact that none of the three designs under consideration in Britain is operating anywhere in the world might give pause for thought.

Recent events in Finland provide further grounds for caution. There, French company Areva is building the first example of the reactor design most favoured for Britain, the so-called EPR. It has not been a success. The 1,200MW reactor is more than £1bn over its original £2.5bn budget and two years late just two years after construction began. If this is the best Finnish contractors can manage, the thought of what those who brought you the Scottish parliament or Wembley stadium might accomplish is chilling.

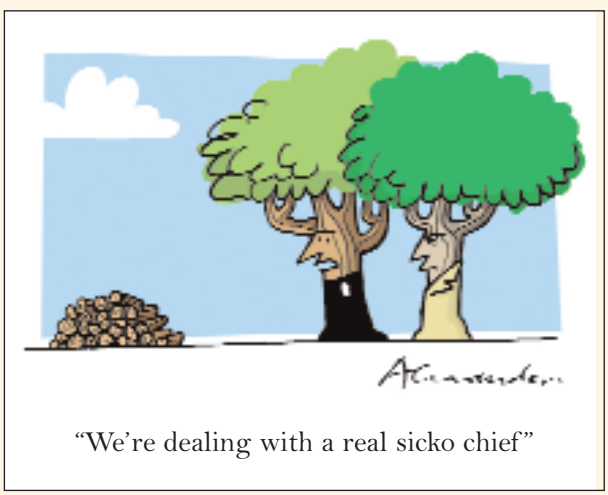
This is not just, or even mainly, about incompetence. Nuclear costs are rising disproportionately. This escalation—14 per cent a year after inflation, according to one estimate—has many causes. Nuclear power stations are intensive in metal and concrete, and their construction requires specialist skills. So they have been hit harder than other forms of power generation by the surge in engineering

costs. The nuclear supply chain has atrophied in the quarter century since there were last large programmes in the OECD countries. In the US there are now only 80 nuclear-qualified suppliers of key components, compared to 400 a decade ago.

And there is only one global provider—the Japan Steel Works (JSW)—of the heavy forging capacity needed for reactor pressure vessels. JSW is already hard-pressed by demand for new refinery equipment and can only supply five new reactor vessels a year, although it wishes to double capacity to ten vessels. But the need to fund this investment is itself contributing to rising prices, which have increased by 12 per cent in six months, and JSW now requires a 30 per cent down payment on an order. It takes six years from the date of the order to get other key components, including reactor coolant pumps and control and instrumentation equipment

The human resources needed to resuscitate the nuclear industry are in even shorter supply. Before you can even apply for permission to build a nuclear power station, you need approval for the design you plan on using. This can take several years. Yet inspectors and engineers are leaving Britain's Nuclear Installations Inspectorate (NII), some to retirement and others to more lucrative employment with contractors hoping to come to the nuclear party. The NII now has only 16 people to carry out the detailed safety approval of new reactors, a task estimated to need at least 40. What this means is that if you wanted to have a reactor up and running in Britain by 2020, you would need to have sought approval some time ago. Generous pay rises, relocation from Merseyside and a new management structure are all proposed to relieve this bottleneck. But these reforms will need time to become anchored if we are to avoid an unacceptable choice between speed and safety.

The government has pledged that there will be no subsidies for new nuclear construction. But this was never credible, and it is already possible to detect signs of retreat. In 2006 the government bravely promised to "make sure that the full costs of new nuclear waste are paid by the market." By 2008 this had mutated into the more nuanced: "The government will [set] a fixed unit price [for] waste disposal at the time when approvals for the station are given." This effectively caps the costs of nuclear waste disposal to the operator and transfers the risk of cost overruns on to the taxpayer. It is hard to argue that this is not a subsidy.



"We're dealing with a real sicko chief"

Furthermore, as Stephen Thomas from Greenwich University has pointed out, if you take E.ON's estimate of the cost of a new reactor of £3,000/kW, then the operating cost of that reactor is likely to be about £80 to generate a kW of electricity for an hour—a measurement known as a kilowatt hour (kWh). The current wholesale electricity price, which is causing ministers such headaches, is about £40/kWh. We already know what happens to nuclear operators when their operating costs exceed the price at which they can sell electricity. In 2002 British Energy lost money hand over fist and found itself technically insolvent. But the company did not go bust. In a prequel to Northern Rock, the government bailed it out to the tune of some £4bn, taking a large stake in the business. (British Energy is now profitable, thanks to rises in fossil fuel prices.)

This precedent helps to explain why utilities companies are looking at nuclear power. They know that once Britain has started down this road, there will be no going back, as other investment will be suppressed. The "no subsidies" rule will be a distant memory. The utilities companies will be in a strong position to extract from taxpayer and consumer alike what they need to keep going.

CLOSING THE GENERATION GAP

The idea that the world is on the dawn of a new nuclear age is no less of a fantasy now than it was in the early 1970s. Even the nuclear-supporting International Energy Agency's projections have little more nuclear power in operation in 2030 than there is now. That is because most of our present reactor fleet was built in a rush in the 1970s. Even with extensions, these are coming to the end of their lives. Much is made of the 32 reactors now under construction around the world, mostly in Asia. But 11 of them have been under construction for more than 20 years. Just to maintain the current number of reactors by 2025, we would have to build 250 more reactors than are currently under construction—or 15 a year between now and 2025. The build rate since 2000, almost all in Asia, has been one a year. Increasing this is certainly possible, but to do so by 15 times despite shortages of materials and manpower—and during a credit crunch—seems fanciful.

Britain is a very long way from facing a choice of building more nuclear or freezing in the dark. There *is* a real problem—three problems to be precise—with energy security, but none can be solved by nuclear power. The most urgent is the threat of interruptions to our oil supply, which could bring Britain to a halt. But our oil for transport cannot be replaced by nuclear electricity. Preventing instability in the middle east and reducing oil dependence by more efficient transport and logistics are the solutions here.

Much has been made of the threat of becoming overdependent on imported gas, particularly from Russia. Leaving aside that Russia is more dependent on our revenues than we are on its gas, half of our gas is used for heating domestic space and water, and cannot be replaced without a big transformation of our infrastructure. More is used for industrial processes, leaving under a third for electricity generation. But much of that is used to generate electricity at peak times because gas turbines are easy to switch on and off to meet short-term demand spikes. Nuclear power stations must be run continuously to be economic.

Ministers now often invoke the "generation gap" that will emerge as some 22,000MW of existing coal and nuclear capacity is closed between now and 2020, much by 2015. If this is not replaced by new nuclear power, runs the argument, then carbon-intensive gas or coal will have to be used at the expense of the climate. The British head of EDF, Vincent de Rivas, promises that he can deliver new nuclear electricity to the grid by 2017. But the government's own nuclear consultation is more realistic. It assumes that were an order placed today under its accelerated regulatory procedures, it would still be eight years before construction started. For a wholly new design, construction would take a further five years, at least. The government has yet to explain how a power station that won't open before 2021 can meet a "generation gap" it expects to appear by 2015.

Of course, no government will let the lights go out. So this generation gap is more a rhetorical device than a genuine threat. The government is now committed to producing at least 35 per cent of our energy from renewable sources by 2020. That may fill some of the purported gap. Energy efficiency will fill more. If nuclear cannot fill the remainder—perhaps 2,500MW—then coal will do it.

Some doubt whether the renewables target is achievable. In fact, it is more likely to be met than Brown's hopes for nuclear. Last year the world added about 2,000MW of additional nuclear capacity through improving the performance of existing reactors. Photovoltaic solar energy alone, one of the least economically attractive of the renewables, added 2,300MW. Wind power, which on many estimates already delivers electricity more cheaply than nuclear, added eight times as much.

Nuclear power is a low-carbon source of electricity, and will therefore avoid whatever tax is levied on carbon emissions. But it won't help Britain meet its climate change targets. The goal is to keep the eventual rise in global average temperature to below 2 degrees Celsius—the threshold of dangerous climate change. This means that greenhouse gas emissions must peak before 2020 and then decline steeply. But if building the 15 reactors a year needed to replace the world's current capacity is going to be impossible—as it is—it is difficult to see how it could play a bigger role in reducing global carbon emissions.

The top climate priority is to very quickly make coal use carbon-neutral by deploying carbon capture and storage technologies. This is mainly for geopolitical reasons. The International Energy Agency forecasts 14,000MW of new coal-fired power stations by 2030. China is building new coal-fired plants at the rate of 2,000MW a week. It also has the world's most ambitious nuclear power programme, aiming to build 40 nuclear power stations by 2030. This latter effort would still provide only 4 per cent of China's electricity. Three quarters will come from coal. If this happens without the Chinese using carbon capture and storage, the government, and the world, will not achieve its climate change objectives. We will be saying hello to a four degree jump in temperatures and goodbye to prosperity and security for 60m Britons.

If we want others to make their coal burning carbon-neutral, we must do so ourselves. Actions speak louder than words. In the next three years, Britain will spend £2.8bn a year on cleaning up its nuclear legacy. We will spend nothing on deploying carbon capture and storage—the world's most important technology for ensuring climate security.

No one should doubt the good intentions of those who are arguing for a switch of scarce capital, materials and skills into nuclear power in Britain. It is not their intentions that are in question, but their analysis. We have been here before, with equally serious people arguing that there was no alternative to a nuclear future. In 1975 the UK Atomic Energy Authority told the royal commission on environmental pollution that by 2000 Britain would have 104 nuclear reactors. This did not happen not because the nuclear industry lacked support. Then, as now, government, business leaders, the unions and the media were all onside. It failed because economic reality intruded. It will do so again—but this time the consequence of going down the nuclear cul-de-sac will be much more serious. ■

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