

## **CURRENT UK NUCLEAR ISSUES**

I will talk about two nuclear issues that are on today's political agenda in the UK. They are current political issues and the final decisions about them can still be influenced. One is the use of nuclear power to generate electricity and the other concerns the renewal of Britain's nuclear deterrent, the Trident nuclear submarine fleet.

The two topics are closely linked. The operation of a significant nuclear-weapon force, like the British one, requires the backup of a significant civil nuclear programme. Operating nuclear-power reactors are, therefore, highly desirable, to say the least, if a country wants to maintain and/or improve a nuclear-weapon force. Civilian atoms are the twin of military atoms.

Its enthusiasm for nuclear weapons is a main reason for the British Government's interest in nuclear power, although it never says so.

### **Nuclear power**

The UK relies on nuclear-power reactors for nearly 20% of its electricity. But all but one of its 18 existing nuclear-power reactors stations is due to shut down by 2023. The last one is due to shut down by 2035.

No nuclear-power reactors have been built in the UK since the 1980s, as accidents, spiraling decommissioning costs and the problem of disposing of nuclear waste eroded enthusiasm.

But with soaring oil and gas prices, dwindling fossil fuel reserves and pressure to tackle climate change, the government has renewed its support for nuclear power.

It is backing a new generation of nuclear-power stations because it believes they provide the necessary security of energy supply while helping reduce the emissions of carbon dioxide to the atmosphere to contribute to the control of global warming.

Global climate change is one of the, if not the, greatest challenges we face this century. A stable climate is necessary for sustainable economic development.

Almost all climate scientists believe that the world is heating up because of human activities that emit greenhouse gases, particularly carbon dioxide, into the atmosphere. Few serious commentators now doubt that urgent action is needed to prevent catastrophic changes in the climate.

There are two schools of thought about the best course of action. One wants to change society, a social revolution no less, to make it less consumerist and less materialistic.

This sort of society, the argument goes, will use less energy and, therefore, emit smaller amounts of greenhouse gases into the atmosphere. The production of virtually all goods requires energy and the less money people spend the less energy they consume and the less greenhouse gases are emitted into the atmosphere.

The other school is less ambitious, and perhaps, therefore, more realistic. It relies on technology to solve the problem by developing, in the long term, a new relatively carbon-free source of energy, such as nuclear-fusion reactors and, in the shorter term, developing a way to capture carbon dioxide emitted by coal- or oil-fuelled power stations, and transport it by pipeline to a place for indefinite geological disposal, perhaps in deep underground mines or in trenches deep in the oceans.

Each of these two solutions has its difficulties. A sustainable social revolution would probably take generations to bring about. A technological fix, an attractive solution, would also take time and much money to overcome very difficult technical problems.

The world faces an increasing population and demands for higher living standards. These will inevitably bring about increasing demands for energy. In the short term, low carbon sources of electricity generation are seen to be the best way of satisfying these demands, minimising the effects on global warming. Nuclear power is a relatively low carbon source of electricity.

Many political leaders are, therefore, looking to nuclear power as the main way forward to reduce the emissions of greenhouse gases and limit global climate change. The nuclear industry expects, therefore, that there will be a large increase in the global use of nuclear power for electricity generation, a so-called nuclear renaissance.

Many worry about the consequences of the use of more nuclear power. Some remember the 1986 accident at the Chernobyl nuclear plant and last year's nuclear accident at Fukushima, Japan. Another catastrophic nuclear accident cannot be ruled out. The more nuclear plants there are the greater is the probability of such an accident.

Another major concern is the disposal of large amounts of highly radioactive waste. So far, no publicly and politically acceptable solution to the waste disposal problem has been forthcoming.

But perhaps the most serious problem associated with a nuclear renaissance is the possible proliferation of nuclear weapons. A fact of nuclear life is that civil nuclear technology and military nuclear technology are identical. Any country operating nuclear reactors could, if it chose to do so, use its nuclear capabilities to fabricate nuclear weapons.

Moreover, a large terrorist group may well have the resources to acquire and detonate nuclear weapons, if it could acquire the nuclear material to do so.

In the words of US President Barack Obama, nuclear terrorism is "the single biggest threat to U.S. security, both short-term, medium-term and long-term. This is something that could change the security landscape of this country and around the world for years to come." He went on to explain that terrorist organizations like Al-Qaeda want to acquire a nuclear device, "a weapon of mass destruction that they have no compunction at using."

### **The increasing global use of plutonium**

Central to the terrorist risk is the fact that in a nuclear renaissance an increasing amount of plutonium will be used. Plutonium is a dual purpose man-made material. It can be used both to fuel nuclear-power reactors instead of uranium and as the fissile material in nuclear weapons. Plutonium is a highly toxic material, particularly for inhalation. If you breathe in a few tens of micrograms – just a speck – you will almost certainly get lung cancer. In short, plutonium is one of the most dangerous substances known to man.

A nuclear weapon containing a sphere of plutonium no larger than an orange could explode with the power equivalent to that of the explosion of about 20,000 tonnes of TNT – an explosion of this size destroyed the city of Nagasaki in 1945.

According to the International Atomic Energy Agency (IAEA), within 40 years, about 40 countries are likely to have access to fissile materials from their civil nuclear power programmes that could be used for nuclear weapons and competent nuclear physicists and engineers who could design and fabricate them. It must be expected that some of these countries will take the political decision to become nuclear-weapon powers.

Today's nuclear-power reactors use uranium as fuel. Because of the coming shortage of high-quality uranium, the nuclear industry will depend more and more on the use of plutonium to fuel nuclear reactors. After about 2030, according to current plans, a new generation of plutonium-

fuelled reactors, called fast breeder reactors, needing not much uranium, will be operated. These reactors will, it is hoped, be the core of the nuclear renaissance.

The world of the nuclear renaissance will be one containing a huge amount of plutonium, some of which will almost certainly fall into the wrong hands, including those of nuclear terrorists. The potential spread of nuclear weapons to countries and terrorists clearly has very major implications for global security. Surprisingly, in spite of President Obama's warning, it is receiving very little attention.

### **Nuclear terrorism**

There are number of nuclear terrorist activities that a terrorist group may become involved in, including: acquiring plutonium and fabricating and detonating a primitive nuclear explosive; making and detonating a radiological weapon, commonly called a dirty bomb, to spread radioactive material; and attacking a nuclear-power reactor to spread radioactivity far and wide.

Of them, nuclear terrorists would probably prefer to set off a nuclear explosive, because of the great damage it would do. Terrorists would be satisfied with a nuclear explosive device that is far less sophisticated than the types of nuclear weapons demanded by the military. Whereas the military demand nuclear weapons with predictable explosive yields and very high reliability, most terrorists would be satisfied with a relatively primitive nuclear explosive.

Nuclear-weapon experts agree that terrorist groups with access to money and qualified people could make and detonate a primitive nuclear weapon.

### **Dirty bombs**

The simplest and most primitive terrorist nuclear device is a radiological weapon or radiological dispersal device, commonly called a dirty bomb. A dirty bomb would consist of a conventional high explosive (for example, semtex, dynamite or TNT), some incendiary material (like thermite) surrounding the conventional explosive, and a quantity of a radioactive material, such as caesium-137, probably placed at the centre of the explosive.

When the conventional high explosive is detonated the radioactive material would be vaporized. The fire ignited by the incendiary material would carry the radioactivity up into the atmosphere. It would then be blown downwind, spreading radioactivity.

The use of plutonium in a dirty bomb would cause the greatest threat to human health, because of its very high inhalation toxicity, and the most extensive contamination.

The detonation of a dirty bomb is likely to result in some deaths but would not result in the hundreds of thousands of fatalities that could be caused by the explosion in a city of a crude nuclear weapon. Generally, the explosion of the conventional explosive in the dirty bomb would be the most likely cause of any immediate deaths or serious injuries. The radioactive material in the bomb would be dispersed into the air but would be soon diluted to relatively low concentrations.

If the bomb is exploded in a city, as it almost certainly would be, some people are likely to be exposed to a dose of radiation. But the dose is in most cases likely to be relatively small. A low-level exposure to radiation would slightly increase the long-term risk of cancer.

The main potential impact of a dirty bomb is psychological – it would cause considerable fear, panic and social disruption, exactly the effects terrorists wish to achieve. The public fear of radiation is very great indeed, some say irrationally so.

The explosion of a dirty bomb could result in the contamination of an area of a city and the surrounding areas with radioactivity. Areas as large as tens of square kilometres could be contaminated with radioactivity to levels above those recommended by national radiological protection authorities for the exposure of civilians to radioactivity. The area would have to be evacuated and decontaminated.

Decontamination is likely to be very costly (costing millions of pounds) and take weeks or, most likely, many months to complete. Radioactive contamination is by far the most threatening aspect of a dirty bomb.

## **Conclusions**

There are then good reasons to be concerned about the consequences of the use of more nuclear power. Another catastrophic nuclear accident cannot be ruled out. The more nuclear plants there are the greater is the probability of an accident.

And then there is the problem of the disposal of very radioactive waste. So far, no publicly and politically acceptable solution to the nuclear waste problem has been found.

The other concern is the increased risk of nuclear-weapon proliferation and nuclear terrorism. A terrorist group may well have the resources to

acquire and detonate nuclear explosives, if it could acquire the plutonium to do so.

In my opinion, nuclear power is, for these reasons, unacceptably dangerous. We should rely on renewable energy sources, like solar, wind and tidal, rather than nuclear.

### **The future of Trident**

Let's now move on to the second topic - the future of the Trident submarines, Britain's nuclear-weapon force. Trident is a sea-based nuclear weapons system, consisting of three parts – the submarines, the missiles they carry and the nuclear warheads on the missiles.

The lifetime of each part is limited, although each has years of use left. According to the Ministry of Defence (MOD), the current generation of four Trident submarines will begin to end their working lives during the 2020s.

The Royal Navy operates the Trident system, from the Clyde Naval Base in Scotland, with four Vanguard-class ballistic missile submarines. The submarines are armed with Trident II D-5 submarine-launched ballistic missiles; there are currently about 200 nuclear warheads in Britain's nuclear arsenal.

At least one of the strategic nuclear submarines is always on patrol as a continuous-at-sea deterrent (CASD); it carries up to 16 Trident missiles and around 48 nuclear warheads (an average of three warheads per missile). According to the 2010 Strategic Defence Review, this number is to be reduced to 8 missiles per submarine.

Prime Minister David Cameron insists that Britain must replace Trident as its nuclear deterrent.

The Treasury had previously been expected to foot the bill for the replacement system, but George Osborne, the Chancellor of the Exchequer, has now said that the MOD will have to pay all the costs.

The Ministry, however, with an "unfunded liability" of £37bn over ten years, must reduce its spending. What does this mean for the future of Britain's Trident strategic nuclear force, the UK nuclear deterrent?

The previous Labour Government was all set to replace Trident. The 2006 White Paper, *The Future of the United Kingdom's Nuclear Deterrent*, makes this crystal clear. But since then the situation changed significantly.

Firstly, on 5 April 2009, US President Barack Obama in a speech made in Prague, Czech Republic, announced the support of his Administration for a world free of nuclear weapons. Our government also claims to be committed to the goal of ultimately achieving a world free of nuclear weapons. Many will scrutinize decisions about the future of Trident with this commitment in mind.

Trident is, in the opinion of many analysts, a political weapon rather than a military one; it is less about defence and more about national prestige. A number of former very senior British military officers argue that nuclear weapons are militarily useless both in war and to combat threats from international terrorism.

The second change is that the present UK government plans to tackle the current economic crisis by eliminating the budget deficit within 4 years or so. This requires a painful examination of public expenditure in all government departments, including defence. Some current capabilities will be trimmed and some big military projects will be scrapped.

If there is to be a new Trident system, the Treasury wants the cost of it, a total some £20 billion over a decade, to be directly funded by the Ministry of Defence out of its annual budget of £37 billion. The Treasury seems to have won the battle with the MOD over the capital cost of a Trident replacement. As for Trident's running costs, the MOD has always paid and will do so in the future.

So what's the future for the aging Trident fleet of four Vanguard submarines? Liam Fox, the former Defence Secretary, undertook a Strategic Defence and Security Review a couple of years ago; entitled *A Strong Britain in an Age of Uncertainty*, it was published on 19 October 2010. Although it discussed cuts in equipment and personnel, it excluded Trident. Nevertheless, an extensive debate on Trident seems inevitable.

The coalition agreement that brought the Conservatives and Liberal Democrats into power, states that the Trident system will be replaced so that Britain will continue to have a nuclear deterrent, but that the programme would be scrutinized to ensure "value for money".

The agreement also states that: "Liberal Democrats will continue to make the case for alternatives". The Liberal-Democrat opposition to a like-for-like replacement of Trident was dropped even though they have accepted that a like-for-like replacement is unsound, economically and strategically.

Nevertheless, the coalition government is intent on replacing the Trident system with a like-for-like renewal. It argues that Britain needs a continuous, credible nuclear deterrent because of the threats that exist out

there in the world and the threats that may develop in the next 50 years or so. It, therefore, firmly supports the upgrading of the current Trident system and the building of a new submarine fleet for this purpose.

The first of the four Vanguards is due to be retired in around 2024. Some experts, however, question the Government's assumption that 30 years is the maximum service life of strategic submarines. It could, they say, be longer. The Trident replacement programme is now well underway.

However, the final decision to proceed to the demonstration and manufacturing phase (the so-called main gate decision) will not be required until the end of 2014 or early 2015.

The UK National Security Council recently decided to delay the decision until after the 2015 general election. There is, therefore, plenty of time for debate and to choose an alternative.

A key decision is whether or not the UK should continue to operate a continuous-at-sea deterrence (CASD), requiring the deployment of four Vanguard submarines, so that at least one can be on operational patrol at all times.

It may be just possible to maintain CASD with 3 rather than 4 new submarines using a new submarine nuclear reactor core developed by Rolls Royce, which is more efficient than the current one and which does not require any refueling. At the moment, however, the technology required to maintain CASD with three strategic submarines does not exist. But it may well do so by 2014.

It does not seem to me very likely that the Government will move away from CASD unless the pressure to reduce spending on Trident becomes irresistible.

It is even less likely that any other cheaper alternative to a like-for-like replacement (such as a flexible, dual-use submarine for both conventional and nuclear roles or a submarine-launched nuclear cruise missile) will be seriously considered in the foreseeable future. Nor will the proposal to synchronize nuclear missile patrols with the French.

A debate about the future of Britain's nuclear deterrent should take into account the wider debate about the nuclear future and our international legal obligation, under the Non-Proliferation Treaty and other agreements, to move towards the reduction of our nuclear arsenal and to its eventual abolition.

A decision to go for a like-for-like replacement of Trident would send all the wrong signals to countries which may want to acquire nuclear weapons.

A world containing a large number of countries and terrorist groups capable of fabricating nuclear weapons, if they take the decision to do so, is a world in a state of nuclear anarchy - a world extremely hard to manage and in which the risk of nuclear war is high.. This is a main reason why the Obama Administration is keen to move towards a nuclear-weapon-free world.

If the Obama vision is to become a reality, all nuclear-weapon powers must contribute. The UK, one of the five established nuclear-weapon powers, could do so by steadily reducing the size of its nuclear deterrent. The obvious first step would be to move away from a CASD by, reducing the number of Trident submarines from four to three.

This would save significant amounts of money. The reduced nuclear deterrent would still be effective but would save billions of pounds annually. Such a move would appeal to the Liberal Democrats. It will be very interesting to see if they can persuade their Coalition partner to agree.

If, however, the UK government will not give up Trident and is determined to replace it then it should at least consider ways of significantly reducing the size of Britain's nuclear arsenal and demonstrate a willingness to move away from a continuous nuclear alert status.

If it wants its claim to be committed to the goal of ultimately achieving a world free of nuclear weapons to be taken seriously, this is the least it could do as a first step towards a programme of reducing its nuclear arsenal.

British governments have paid lip-service to nuclear disarmament for so many years now that many are, for good reasons, skeptical about their real intentions. Perhaps economic pressures will force the political leaders to fulfill their international commitment – for example, under the Non-Proliferation Treaty – to get rid of Britain's nuclear weapons.

Since nuclear weapons have no military use, this does not seem too much to ask. Only time will tell if the government will make this logical and ethical move. But I doubt if it will.

## **Conclusions**

The choice of nuclear power as a solution to climate change is a recipe for a world of many nuclear-weapon powers and probably nuclear war. People like James Lovelock, who advocate nuclear power as a solution to the problem of global warming, agree that this may well lead to nuclear war. But, they argue, many more people will be killed by the consequences of climate change than will be by nuclear wars.

We face a stark choice. Do we go for nuclear power and face nuclear war or do we develop non-nuclear sources of energy? What do you think?

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