Britain's nuclear addiction?

With official approval for renewal of the Trident nuclear weapons system and the Hinkley Point C nuclear power station coming within weeks of each other, the links between the military and civilian nuclear industries in the UK are again in the spotlight. Stuart Parkinson, SGR, investigates.

Within a couple of months of taking office, the government of Theresa May firmly attached itself to pro-nuclear policies in both the military and energy sectors.

The first parliamentary vote of the new session in July 2016 gave the government the large majority it sought to give the final go ahead for the next generation of four nuclear submarines to carry the UK's Trident weapons. These submarines – now officially named 'Dreadnought' class – are expected to come into service from the early 2030s. The firepower of each vessel will be similar to the current generation – i.e. greater than all the bombs dropped in World War II, and sufficient to cause a nuclear winter.[1] The government has earmarked a budget of £41 billion for the construction of the submarines (including a £10bn contingency fund). Once annual running costs, new warheads and decommissioning are included, the total lifetime cost for the system is estimated to be about £200bn.[2]

Meanwhile, after a very short review completed in September, the government approved the contract with French energy corporation EDF to build the new Hinkley Point C (HPC) nuclear power station. This plant is planned to have a capacity of 3.2 gigawatts (GW), thereby supplying an estimated 8% of the UK's current electricity demand.[3] The construction cost of the plant is currently budgeted at £18bn – which could make it the most expensive object ever built on Earth. [3] This figure does not include an estimated £6.5bn of financial transaction costs or a wide range of government subsidies.[3]

Questions are increasingly being asked about whether the two programmes are connected – with a new study from the University of Sussex providing important new evidence. But before we examine that, it is worth reviewing whether HPC and the rest of the UK's current nuclear power programme is justified on its own terms.

Hinkley – no economic case?

A report published by the National Audit Office (NAO) last July[4] is the latest is a long line of analyses that have concluded that the costs of HPC are exceptionally high. In particular, the NAO warned that the current 'Contracts for Difference' subsidy scheme, which guarantees a minimum price for the plant's electricity, could cost energy consumers an extra £30bn over the 35-year lifetime of scheme – more than four times the estimate when the deal was agreed in 2013. A range of other subsidies – for example, for dealing with spent nuclear fuel, decommissioning and major accident insurance – will add further to the eventual bill. Meanwhile the costs of alternatives, such as wind and solar power, have fallen considerably in the last few years and are now well below those of nuclear. These downward trends look set to continue. The NAO report summarises the government's latest cost estimate for UK electricity generation in 2025.[4] Onshore wind and large solar will be about half the unit cost of nuclear, with offshore wind comparable in cost. Indeed, further analysis by Greenpeace shows there is good reason to believe that offshore wind will also be cheaper by then.[5]

But supply-side options are obviously not the only alternatives. Energy conservation options have long been neglected and should be a central aspect of national policy. Much has been written about the failings of the government's domestic energy conservation schemes since 2012 – including by SGR. Nevertheless, despite such failures, the government still projects that the UK's total electricity demand in 2025 will have fallen by 77 terawatt-hours (TWh) – which is three times the energy that HPC would produce.[6]

Then there is the issue of whether HPC will be built on time or to budget – or even at all. As we have discussed previously in the SGR Newsletter, there are many technical, legal and financial obstacles still to overcome. EDF is currently involved in building four other plants of this type – known as the EPR – around the world. The two under construction in Europe – in Finland and in France – are, respectively, nine years and six years late (to date), with construction costs in each case currently projected to be about *three times* the level estimated when the build began.[7] Furthermore, in the French case, the reactor pressure vessel is undergoing safety tests due to suspected weaknesses and, in the Finnish case, there is an unresolved legal dispute over the construction. The two other reactors currently under construction in China are four years late under a significantly less stringent safety regime.[8]

EDF's financial position is also precarious – which has led to its international credit rating being repeatedly downgraded and calls into question its ability to deliver on HPC. EDF's net debt is more than 37bn euros, and it is already committed to carrying out reactor upgrade programmes on the French nuclear fleet currently valued at a massive 100bn euros,[9] as well as buying a controlling stake in ailing reactor company, Areva. In the last few months, another scandal has engulfed the corporation as the French nuclear regulator has found evidence that some safety records have been falsified.[10] 18 nuclear plants were shut down while new safety checks were undertaken. There are also outstanding European legal cases against the generous subsidies available to HPC.

Factors such as these have led leading financial commentators (not to mention political and environmental ones) to call for HPC to be scrapped. In particular, *The Economist* – not known for an anti-nuclear stance – dubbed the plant 'Hinkley Pointless' in an editorial.[11]

…and the rest of the UK's planned nuclear programme?

In total, there are currently proposals for 18GW of new nuclear power stations at six sites around the UK.[12] But the history of nuclear power in Britain over the last 60 years is one of repeatedly grand promises and repeatedly poor delivery – see Box. In 2006, Tony Blair announced that nuclear power "was back on the agenda with a vengeance",[13] but it has taken ten years simply for the government to sign a contract for construction to start on the first power station. Given the current situation with HPC, there seems little reason to be more optimistic about the whole programme this time around. Not only are costs likely to be as high as HPC, the other consortia involved also have serious problems. NuGen – which is planning to build at Moorside in Cumbria – is owned by Toshiba and Engie. Toshiba's financial problems are so major, it has just announced it will stop taking orders for new nuclear plants, throwing the whole project into doubt.[14] Horizon – which is planning a plant at Wylfa in Wales – is owned by Hitachi, which has major liabilities related to the Fukushima disaster. Compounding all this is the recent announcement that the UK will withdraw from the Euratom treaty as part of its Brexit plan – which has serious implications for the regulation and promotion of the industry.

In contrast, since Blair's infamous quote, the percentage of electricity from renewable energy sources in the UK has grown from just over 4% in 2006 to just under 25% in 2015.[18]

One argument often used to justify the extra costs of nuclear is its ability to provide constant 'baseload' electricity, in contrast to renewables such as wind and solar which are variable in their output. However, this argument has many flaws – not least that recent experimental and practical experience in countries such as Germany show that combinations of a range of renewable and storage technologies can and do provide a reliable supply.[19] Indeed, this is becoming cheaper and easier to do as the costs of these technologies fall. For example, the costs of lithium-ion batteries – one of the leading storage technologies – have been falling at a rate of 14% per year since 2007.[20]

Such experience is providing the basis for more projections of a non-nuclear future. For example, a study published in the leading science journal *Nature*,[21] has laid out yet another pathway towards 100% UK electricity generation from renewable energy sources, specifically wind, solar, biogas and storage technologies. New tidal power schemes, such as that proposed for Swansea Bay, increase the options further.

Even the government's own National Infrastructure Commission sees more promising options outside of nuclear. Its recent report on the UK's electricity system[22] recommends measures in three key areas – international interconnectors, energy storage, and energy demand flexibility – and argues these could save up to £8 billion a year in efficiency gains. Demand flexibility measures alone could be used to meet about 15% of peak electricity demand.

Is there another reason for government and industry enthusiasm?

The UK government's enthusiasm for nuclear power seems out of all proportion to the performance of the industry. Even when we look further afield, this enthusiasm is mystifying. Internationally, there are few signs of the long-promised 'nuclear renaissance'. In Europe, for example, no other country has such ambitious plans as the UK, and even in China, the nation with the world's largest nuclear new build programme, it is dwarfed by the expansion in other energy technologies.[15] However, the most striking indication of the mismatch comes from leading financial analysts, which shows that the worldwide investment in renewables was ten times greater than nuclear in 2015[23] – even when large hydroelectric plants are excluded. And this ratio looks likely to continue.

So what does the British government believe that others do not?

A new study from researchers at Sussex University suggests a possible answer.[15] It finds that between 2003 – when the Blair government published a white paper labelling nuclear power "unattractive" – and his 2006 speech, there was intense activity by nuclear lobbyists making the case for a change in direction. Not very surprising, perhaps. But the crucial factor was the involvement of *military* nuclear lobbyists. It seems that they supported the case for a new civilian nuclear programme – together with major investment in nuclear skills – to help head off a shortage in the technical personnel they needed to maintain the UK's nuclear warhead arsenal and especially that needed to develop new nuclear reactors to power the next generation of submarines that would carry the weapons. Since Britain's nuclear weapons are only carried on submarines – and no other military platform – there was a fear that Britain could find itself pursuing nuclear disarmament by accident in the 2020s. Hence the Sussex study has exposed a hidden subsidy that the civilian nuclear programme will effectively provide for the extremely costly nuclear weapons programme.

Indeed, the nuclear interests not only convinced senior figures across the UK political spectrum of the need for new nuclear power using the current generation of large reactors, they also convinced them of the need to rapidly increase R&D funding for 'small modular reactors' (SMRs) intended for electricity generation. The Sussex study discovered that over 40 UK corporations are now active in both civilian and military nuclear work. Although the UK only has limited R&D experience on civilian SMRs, it does have 50 years of experience developing and operating military reactors in submarines – but whether this experience is sufficiently useful remains to be seen.[24]

There are numerous technical hurdles to overcome in bringing SMRs to commercialisation.[24] It is notable especially that other major nuclear nations with much more experience of both civilian and military nuclear reactors – such as the USA – are still at an early stage. The industry, however, appears bullish. But the commercial and technical case is far from convincing.

UK nuclear power programmes – a history of major problems

The UK's nuclear power programmes have had an especially difficult history. They have suffered from long construction delays, major cost overruns and poor performance – as well as environmental problems.[15,16]

The first programme built Magnox reactors between the early 1950s and the early 1970s. In 1955, the scale of the programme was planned to between 5 and 6 gigawatts (GW), but it was later scaled back to only 3GW due to a variety of problems.[15] The early reactors of this type were dual use, so they could produce both weapons grade plutonium as well as electricity. Such a design would later come back to haunt the industry – for example, North Korea is currently using a similar design to produce plutonium for its nuclear weapons programme, having obtained it on the pretext of building a plant for electricity generation.[17]

The second programme consisted of Advanced Gas-cooled Reactors (AGRs). These power stations were especially beset by major construction delays, cost overruns and poor performance, with the original completion date for the programme being pushed back from 1976 to 1989. Britain remains the only the country in the world with AGRs, as no other country wanted to repeat our bad experience.[15,16]

Plans for a third programme were announced in 1979 by the Thatcher government, with the aim of building 15GW. But the poor economics meant only one Pressurised Water Reactor (PWR) was eventually completed in 1994 with a capacity of just over 1GW.[15]

Other British nuclear projects have also encountered major problems.[15] The Windscale Pile 1 facility, used to produce weapons grade plutonium, caught fire in 1957 spreading a plume of radioactive material around the surrounding area. The UK's fast breeder reactor programme – which ran from the 1950s until 1994 – cost many billions and never led to a commercial plant. Nuclear fuel reprocessing – carried out using several facilities – has been a technical and commercial failure. For example, one of these facilities – the MOX production plant – produced only 1% of its planned output and made a lifetime net loss of £2.2bn.

We should also not forget the legacy of radioactive waste. The latest estimate for the total cost of management and disposal is a staggering £110bn – and there is ample scope for this cost to rise further.[15]

Gordon MacKerron, a professor of science and technology policy, has described it as "thin".[25]

An open debate

The UK government claims that it needs a large programme of new nuclear power to improve energy security, reduce carbon pollution and keep energy bills low. But they continue to fail to make a convincing case – especially when there is a wealth of evidence to the contrary. Now that there is new academic analysis revealing the crucial role of military nuclear interests in supporting this agenda, it is surely time to have a full and frank debate about what really are the best civilian energy options for the UK.

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The landmine ban: 20 years on

Steve Wright, Leeds Beckett University, looks at the achievements of campaigners and governments in reducing the casualties from landmines.

2017 marks the twentieth anniversary of the adoption of the Ottawa Treaty that banned anti-personnel mines, more commonly known as landmines. Upon reaching such a milestone, it is important to reflect on how campaigners succeeded in getting the ban agreed and what has been achieved in the two decades since.

The Ottawa Treaty[1] defines a landmine as "a munition designed to be placed under, on or near the ground or other surface area and to be exploded by the presence, proximity or contact of a person or a vehicle". Such a precise definition doesn't quite capture the horror of an indiscriminate weapon which transforms limbs into offal, and persists years after a military conflict is over, threatening the life of civilians and denying them access to valuable land to grow food, build schools etc. These explosive remnants of war had been placed in their millions – yet, through implementation of the treaty, considerable progress has been made on reducing the threat – see Box.

Achieving the ban – and progress since

An insight into how the ban was achieved was provided recently when Leeds Beckett University awarded the founders of the Mines Advisory Group (MAG), Lou and Rae McGrath, Honorary Doctorates of Law, for the tremendous work these brothers had contributed to the campaign to make the Ottawa Treaty a reality. At the award ceremony, Lou said: "The landmine campaign grew from a group of determined individuals with experience of the impact that landmines had on communities throughout the world, knowing it was an indiscriminate weapon that continued to maim and kill long after conflicts had ceased. When it began in 1992, emails were not the norm and there was no social media. Yet by 1997, when the treaty was signed the International Campaign network represented over a thousand human rights, medical, religious, children's, peace, veterans, development, arms control, environmental, humanitarian and women's groups from over 60 countries. The Mine Ban Treaty was brought about by civil society responding to a man-made catastrophe and forcing their governments to the table."

Determination was an absolute necessity for the success of this campaign. In the early days of MAG, the McGrath brothers were working out of a caravan in Cockermouth in northwest England. Their primary focus was the practicalities of de-infesting countries like Afghanistan and Mozambique. Rae's own book[3] provides a detailed account of the meticulous thought

The Ottawa Treaty – key facts and figures[2]

Since the treaty came into legal force in 1999:

- 29 nations have been declared 'mine free' – out of 61 reported to contain mined areas. The remaining 32 nations have action plans to eliminate their mine-fields.
- 158 nations no longer hold any stockpiles of anti-personnel mines.
- 49 million mines have been destroyed by these nations.
- 162 nations have ratified or acceded to the treaty. However, six key nations – which together still retain stockpiles of tens of millions of mines – have yet to join the treaty. These six are China, India, Pakistan, Russia, South Korea, and the USA.