SONE
Supporters of Nuclear Energy

Nuclear – The green route to secure and reliable power
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Decommissioning in Perspective

Decommissioning – the dismantling and clearance – of nuclear power stations is an emotive issue which gives rise to almost as many myths and exaggerations as does the handling of nuclear waste. Public interest in it has been increased in recent years by the proposed development of the nuclear industry, the steady closure of ageing nuclear power stations and the establishment of the Nuclear Decommissioning Authority (NDA) in 2005 to manage the process.

With all this have come inflated estimates of the cost, partly because the decommissioning goes far wider than power stations to include defence, medical, research and development (R&D) and university reactors and their associated buildings and equipment.

Like any other type of power station, oil rig, gas works or coal mine, a nuclear power reactor has a finite working life. When it is over, it has to be dismantled, the plant and equipment disposed of and in some cases the site cleared, depending on its future use. This process is generally known as decommissioning.

This briefing note seeks to explain what is involved and the technical, safety and financial implications.

Background

The nuclear industry began in World War II and Britain was a pioneer of nuclear R&D. Development came rapidly when the British Government chose to produce its own atomic bomb. Small reactors were built at sites such as Harwell (Oxfordshire) and Winfrith (Dorsetshire) to understand the basic physics and two reactors at Windscale in Cumbria to provide the plutonium for military purposes. There the process required a large number of chemical processing buildings, now part of the Sellafield site.

Within a few years the Government decided to build the first nuclear power station, opened by the Queen in 1956, at Calder Hall in Cumbria, to generate electricity as well as plutonium.

Fears of coal shortages led to the construction of seven more gas-cooled Magnox nuclear power stations between 1960-71. These proved to be solid workhorses, operating for about 40 years compared with their design life of 25 years, and have been progressively closed. Only two remain open – at Oldbury, near Bristol, and Wylfa on Anglesey. Later a new generation of seven reactors called Advanced Gas-Cooled Reactors (AGRs) was built before it was decided to adopt what had become the world's mainstream water-cooled nuclear power technology in the form of the Pressurised Water Reactor (PWR) at Sizewell in Suffolk.

Other types of reactor have been built for ship and submarine propulsion and basic research and medical isotope production but only about half of the 60 or so reactors of all types remain in operation. Around 30 have either been decommissioned or are in the process of being demolished and cleared. It follows that decommissioning is a well-established aspect of the nuclear industry, even if it receives little publicity. Over the past half century the UK has acquired considerable experience of decommissioning of both reactors and their supporting laboratories and buildings housing chemical processes.

This note concentrates on nuclear power stations.

Continued over

Decommissioning stages

There are generally three stages in the process of nuclear reactor decommissioning:

1. The removal of the fuel from the power station – an extension of the regular refuelling operations carried out during the working life of a reactor. This reduces the radioactive inventory of the site by about 99 per cent. Typically, the work could take a year.
2. The removal of much of the supporting plant, mechanical equipment and storage ponds, the emptying of waste stores and general clean up. This leaves only the most massive structures contaminated with radioactive materials, which are suitably shielded from public access, although these are much less radioactive than the fuel. Much of this structural radioactivity stems from cobalt-60 which could be reduced with the use of low-cobalt steel. This stage may take 20 years. Once completed, care and maintenance can be greatly reduced and the reactor left to allow the radioactivity to decay naturally.
3. Some 50-100 years later comes the final clearance of the site, depending on whether it has been developed for further nuclear use. This lapse of time allows the natural radioactive decay of isotopes and so reduces radioactivity by a factor of 50.

This has two effects:

a) it reduces the exposure to radiation by the decommissioning staff; and

b) allows much of the eventual waste to be downgraded from intermediate (ILW) to low level waste (LLW) which can be safely buried at a low level store, currently and for the foreseeable future at Drigg, near Sellafield.

Progress

So far eight UK Atomic Energy Authority research reactors have been fully decommissioned in the UK as follows:

Five at Winfrith, Dorset;
two at Harwell, Oxfordshire; and
one at Risley, Cheshire.

In addition, reactors built by universities and training sites are in process of decommissioning.

Nuclear stations

At several nuclear power stations, decommissioning is either at the first or second stage. Berkeley closed in 1989 and is now little more than a shell. Many large structures have been removed from Trawsfynydd, which closed in 1991, and substantial progress has been made with dismantling Bradwell and Hinkley A which closed more recently.

Work on decommissioning a 250MWe prototype fast reactor power station at Dounreay, along with its associated facilities, is at Stage 2.

In short, decommissioning is not a new technology. There is now a substantial body of experience and expertise in both the UK and across the world and commercial companies compete to provide a decommissioning service. Leave aside the radioactivity, the wastes arising from decommissioning are generally inert with little hazard attached to them.

Over the past 60 years no case has been recorded of a death from a radioactive accident whether in the operation of nuclear power stations, the handling of fuel, the disposal of waste or the decommissioning of reactors and associated plant. Compare this with the death toll wherever coal is deep-mined and accidents on our railways, which claim more than 100 lives a year.

How much?

The amount of waste from decommissioning and the cost of the entire process is subject to routine exaggeration that official bodies, established by the Government, have sadly done nothing to discourage.

Volume

The Committee on Radioactive Waste Management (CoRWM), under an avowedly anti-nuclear chairman, has claimed that enough waste has been generated to fill the Royal Albert Hall (RAH) five times over. In fact, only enough to fill the Royal Albert Hall **once** has so far accumulated after more than 50 years of military, medical, industrial and R&D operations as well as electricity generation.

The hundreds of thousands of cubic metres of waste to fill five RAHs represents an estimate of what will arise over the next 100 years or so. But that estimate must be subject to several caveats about:

1. the number of facilities involved;
2. whether all those facilities will be cleared – an unlikely outcome now that the Government has opened up the way for a nuclear power renaissance in the UK;
3. the nature of those facilities which, unlike the earliest now in process of being decommissioned or waiting for it to begin, will be designed from scratch with decommissioning in mind;
4. continuing technological developments in decommissioning and the handling of radioactive waste.

In short, CoRWM's estimate of five RAHs full of radioactive waste is no more than a stab in the dark covering the next 100 years. It takes no account of future technological progress or the pace at which decommissioning is conducted. It is as unrealistic as it is graphic.

Cost

Similarly, we have regular hysterical estimates of the cost of decommissioning initially emanating from the Nuclear Decommissioning Authority no less. The Green movement can then be relied upon to think of a number and add it to the estimate, even to the extent of doubling it. The reality is somewhat more prosaic.

We do not seek to underplay the cost of nuclear decommissioning and waste management but a certain scepticism is required in examining forecasts.

As things stand the NDA puts the cost at £72bn – and rising. It is almost certainly the top of the range because it covers virtually every facility and building ever exposed to radioactive materials as well as nuclear power stations. The majority of these were at Government establishments concerned with basic research or defence such as Windscale, Harwell, Aldermaston and Dounreay.

It is also assumed that most of these sites will be returned to greenfield status, even if not all were green fields before nuclear development. This assumption looks less realistic with every demand by anti-nuclear Greens for greater action against carbon emissions to combat global warming since nuclear power is by far the most effective means of doing so.

The range of costs estimated by the UN's International Atomic Energy Agency (IAEA) runs from $200-500 per kW for PWRs such as at Sizewell to $2,600 per kW for the earliest UK Magnox reactors. But the next generation of PWRs now being built across the world have not only been designed to facilitate decommissioning but also to generate only 10 per cent of the waste produced by Magnox reactors.

These two facts alone demonstrate the capacity for technological progress to reduce both volumes of waste and cost of decommissioning.

Subject to political decisions, which can add billions at a stroke to the bill, it seems reasonable to assume that the cost of decommissioning a typical UK reactor will now average some £600m. This may seem a lot of money. But the cost has already been met in the form of a charge on consumers throughout these plants' generation of electricity over the past 50 years of about 0.1p/kWh. The price of electricity in the future as well as now will also reflect the estimated cost of decommissioning and waste management and will be held in a segregated fund.

The funds built up for decommissioning and waste management from Britain's first two generation of nuclear reactors – Magnox and AGRs – plus the early operation of the PWR at Sizewell, were taken over by the Government on the privatisation of the electricity industry some 20 years ago. It seems only fair that the Government should now come clean over how much went into the Treasury then and also how much was in British Energy's decommissioning fund when the Government produced a "rescue" capital reconstruction a few years ago. This would help to put in perspective the inflated estimates that are bandied about.

Based on experience in Europe, it is now expected that decommissioning and waste management will add a mere five per cent to the cost of nuclear power at the power station and only about two per cent to the price paid by the consumer.

These marginal figures underline the importance of developing nuclear power with far greater urgency than has been manifested so far. The cost of cleaning up after all is minimal when spread over the 60-year life of modern nuclear reactors.

Decommissioning and waste disposal are clearly no reason why we should forgo a source of electricity that gives us much greater security of energy supply at competitive cost and is the most economical and effective way of combating global warming.

Uranium and Plutonium

About 95 per cent of "spent" power reactor fuel, whether from civil or nuclear reactors, can be recovered as uranium and plutonium and recycled in power stations as fuel. This makes recovered uranium and plutonium an extremely valuable resource and some estimates put the value of stocks built up at Sellafield and Dounreay, for which there is an international market, at no less than £10bn.

The options for managing UK plutonium stocks in the longer term have been examined by the NDA and are to be put to the Government. Classifying the plutonium as waste is one option being considered. Any such recommendation would be a national scandal of the first order since it would advocate throwing away a resource that underpins the availability of nuclear power as a safe, clean, economic source of electricity for at least 1,000 years. So would the classification of uranium as waste, though that is not apparently contemplated.

It is generally reckoned that a tonne of uranium or plutonium has the energy content of 2-3m tonnes of coal when exploited to its full potential. Existing stocks of uranium burned in fast reactors, which use fuel sixty times more efficiently than existing reactors, have the energy equivalent of all the UK's coal reserves above and below ground.

In fact, the NDA has estimated that the UK has enough uranium and plutonium in stock to fuel three latest generation 1,000MW reactors for the whole of their 60-year lives. It has also calculated that 12,000MWe of fast reactors – the equivalent of 12 large power stations – could be fuelled by existing stocks of uranium for 700 years.

It would clearly be a criminal waste of energy resources to consign even the tiniest amount of UK stocks of uranium and plutonium to the waste bin.

We must not allow Green campaigners, in their irrational opposition to nuclear power, to persuade politicians to dump our long-term security of electricity supplies, especially when nuclear generates the cheapest power while producing next to no greenhouse gas emissions.

If you want to read more about nuclear issues or different aspects of energy policy you can download the following briefing notes from SONE's website at www.sone.org.uk:

- The Looming Energy Crisis (update)
- Uranium Availability
- Micro-generation Briefing Note
- The Hydrogen Economy
- Renewable and Alternative Sources of Electricity
- The Management of Nuclear Waste
- Plutonium in Perspective
- Nuclear Power in Perspective
- Energy and Power – Dispelling the Fog
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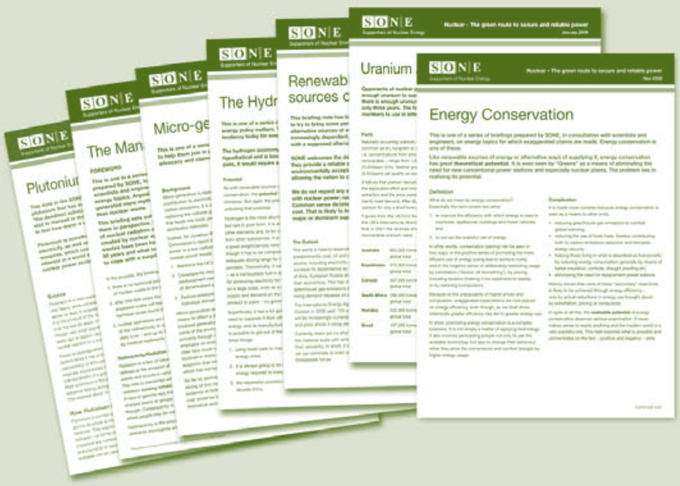
- Energy Conservation



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