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## Review

# Review of drivers and barriers for nuclear power in the UK

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### ABSTRACT

There has been resurgence in interest in new nuclear power stations over the last couple of years. The UK Government has taken steps to encourage the private sector to build new stations in the UK, a change in its previous neutral stance toward nuclear power. This paper examines the change in government policy asking what drivers have led to this decision and what barriers were preventing new nuclear power in the past and what barriers are still faced by both government and industry. Three main drivers are discussed: security of energy supply; diminishing energy generation capacity; and climate change. The paper also examines other key factors that play a part in facilitating a shift in government policy, namely economics, public perception and waste management policy. Barriers are identified through examination of public perception, and policy. The changes to the planning system are also discussed. The paper concludes by comparing drivers and barriers for other technologies and contrasting the UK experience with that of other countries.

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## 1. Introduction

Following the general election in 1997 the UK New Labour Party came to power with a focus on renewable energy and a largely neutral stance on nuclear power, stating in its General Election Manifesto simply, “We are committed to an energy policy designed to promote cleaner, more efficient energy use and production, including a new and strong drive to develop renewable energy sources such as solar and wind energy, and combined heat and power. We see no economic case for the building of any new nuclear power stations.” (Labour Party, 1997).

Less than 11 years later, in January 2008, the New Labour Government invited energy companies to bring forward plans to build and operate new nuclear power stations (BBC, 2008; BERR, 2008k; Orr et al., 2008). John Hutton, the Secretary of State for energy said, “Giving the go ahead today that new nuclear power should play a role in providing the UK with clean, secure and affordable energy is in our country’s vital long term interest.” In

addition, measures to facilitate and encourage investment in new nuclear were set out, such as the Energy Bill, consultation on waste and decommissioning, the intention to establish a Nuclear Liabilities Finance Assurance Board, strengthening the Nuclear Installations Inspectorate and the changes to the planning system for large infrastructure projects (BERR, 2008k).

The rhetoric gets stronger by September 2008, with Hutton stating, “I’m determined to press all the buttons to get nuclear built in this country at the earliest opportunity – not only because it’s a no-brainer for our energy security, but also because it’s good for jobs and our economy. Insecure international sources of energy underline the case for a diverse mix. We are determined to get new nuclear up and running as soon as possible – securing clean low carbon energy and helping to keep the UK’s lights on.” (BERR, 2008f).

This shift in policy was not a sudden or immediate one, but it has occurred over a relatively short timescale. Why has the Government’s position regarding new nuclear build altered,

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what has brought about this change of heart? Why now, why not before? What was preventing or discouraging the government from pursuing a policy of new nuclear in previous years?

This paper examines these questions by looking at the drivers and barriers for nuclear power, starting with a review of policy over the term of office of the present government. The paper then goes on to examine the drivers for the changing policy and the barriers whose changing status has resulted in their acting as facilitators for the new nuclear-build policy. The paper then asks what barriers the government and nuclear proponents still have to overcome before – and if – any new nuclear plants are built.

## 2. UK Government policies on nuclear power

### 2.1. Policy from 1997 to present

In 1997 the newly elected New Labour Government inherited a partly privatised nuclear industry producing 28% of the UK's electricity, but with little prospect of additional nuclear power stations being built in the future. Several reasons can be attributed to this: the economics of nuclear power generation had become less favourable with the increasing contribution from efficient Combined Cycle Gas Turbine stations and a ready supply of North Sea gas, the so-called 'dash-for-gas'; nuclear was not thought necessary to meet carbon dioxide emission targets; nor was new build thought necessary for maintaining technological capacity; there was also public unease following high profile accidents such as Three Mile Island and Chernobyl; and ongoing uncertainty surrounding decommissioning and waste disposal. All these issues made further investment in nuclear power an unattractive proposition (Butler, 2008; Sadler, 2001, p. 9).

New Labour's 2001 General Election Manifesto (Labour Party, 2001) reaffirmed the Party's commitment 'to a secure, diverse and sustainable supply of energy at competitive prices' and targets for renewables, Combined Heat and Power (CHP) and fuel poverty took centre stage. Scant mentions were made of nuclear power, with just a simple and vague acknowledgement that coal and nuclear 'currently play important roles in ensuring diversity in our sources of electricity generation'. State-owned British Nuclear Fuels (BNFL) who had taken on responsibility for the Magnox stations in 1998 however, did merit special consideration, 'BNFL is an important employer and major exporter. The government insists it maintains the highest health, safety and environmental standards. We are examining the scope for turning the company into a public-private partnership'.

In February 2003, New Labour published its wide-ranging review of energy policy, the White Paper 'Our Energy Future – Creating a low carbon economy' (DTI, 2003b). The accompanying press release included a quote from the then Secretary of State for Trade and Industry, Patricia Hewitt (words lifted almost verbatim from the White Paper):

"... nuclear power is currently an important source of carbon-free electricity. But its current economics make it an unattractive option and there are also important issues of nuclear waste to be resolved. The white paper does not contain proposals for building new nuclear power stations,

but does not rule out the possibility that at some point in the future new nuclear build might be necessary if we are to meet our carbon targets. Any further decision to proceed with the building of new nuclear power stations, would only follow a full public consultation and publication of a further White Paper" (DTI, 2003a).

These remarks were reiterated when the Secretary of State introduced the White Paper to the House of Commons. Ms Hewitt went on to say,

"Let me make it plain that, although nuclear energy is a carbon-free source of energy, as I said, its economics are not attractive at the moment. The problem of radioactive waste rightly causes great concern to the public. The Secretary of State for Environment, Food and Rural Affairs is working on that issue at the moment.

It would have been foolish to announce, (...), that we would embark on a new generation of nuclear power stations because that would have guaranteed that we would not make the necessary investment and effort in both energy efficiency and in renewables. That is why we are not going to build a new generation of nuclear power stations now. We are going to put all the priority on energy efficiency and on renewables, but we have not ruled out the possibility of needing some further nuclear capacity to meet our carbon targets" (Hansard, 2003).

The White Paper contained a commitment to reduce carbon dioxide emissions by 60% by 2050. This had been the recommendation of the Royal Commission on Environmental Pollution (RCEP) in its twenty-second report 'Energy – The Changing Climate', back in 2000. RCEP had noted that unless the Government significantly ramped up energy generated by renewables or committed to new nuclear build, then the scheduled closures of the then current nuclear stations, with all but one station due to close by 2025, would result in "a direct conflict with any strategy to counter climate change, in that electricity generation will become more carbon-intensive" (RCEP, 2000, p. 146).

Despite the 2003 energy White Paper insisting repeatedly that it was a 'strategy for the long term' (e.g. DTI, 2003b, pp. 3, 8, 19), in 2005 at the Confederation of British Industry's (CBI) conference, Prime Minister Blair announced a further review of Britain's energy policy. The Prime Minister indicated that nuclear might be back on the agenda, saying, "[the review] will include specifically the issue of whether we facilitate the development of a new generation of nuclear power stations." (UK Government, 2005) Many critics believed that the Prime Minister had been swayed by intense lobbying and had already made up his mind to push for new nuclear build (Ellson and Knight, 2005). At the CBI annual dinner in May 2006, still prior to the publication of the energy review, the Prime Minister indicated that nuclear power was 'back on the agenda with a vengeance' (UK Government, 2006) provoking a further round of accusations that the consultation process was a sham and that the decision had already been taken (see BBC, 2006).

The energy review was published in July 2006 (see DTI, 2006a) and backed the inclusion of nuclear power in the UK's

future energy portfolio, stating that '(t)he Government believes nuclear has a role to play in the UK not only in reducing emissions but also to maintain the diversity of our electricity generation mix' (p. 8). Greenpeace challenged the Government's consultation and review claiming that although a full public consultation had been promised before the decision on new nuclear build was taken, the Government had 'absolutely failed' in that regard (Press Association, 2006). In his judgement Mr Justice Sullivan declared that the consultation had been 'very seriously flawed', 'manifestly inadequate' and 'seriously misleading' and that the information provided to the consultees was 'wholly insufficient to enable them to make "an intelligent response"' (R. (on the application of Greenpeace Ltd) v Secretary of State for Trade and Industry [2007] EWHC 311 [2007] Env.L.R. 29). The Government were sent back to the drawing board and many critics hailed the verdict as vindication of their view that the Prime Minister had already taken the decision to back nuclear power and that the consultation was merely a rubber-stamping exercise. This was perhaps not an unreasonable assumption considering the response to the judge's verdict. The Government insisted that the judgement related to 'the process of consultation, not the principle of nuclear power' and the Prime Minister Tony Blair is quoted as saying 'this won't affect the policy at all', explaining that if nuclear power stations coming to the end of their life were not replaced, then he did not think that climate change targets could be met and that the UK would be dependent on foreign nations for gas (BBC, 2007).

In May 2007, the Government published its new energy White Paper, Meeting the Energy Challenge (see BERR, 2008d), and initiated a new consultation process for nuclear power. However, on 4 July 2007 in the Commons, in response to a question from the leader of the Liberal Democrats, the new Prime Minister Gordon Brown declared, '...we cannot rely on an energy policy that makes us wholly dependent on one or two countries or regions across the world. That is why we have made the decision to continue with nuclear power, and why the security of our energy supply is best safeguarded by building a new generation of nuclear power stations.' (Hansard, 2007)(HC Deb (2006-07) 462, col. 954) It is hardly surprising that on 7 September 2007 Greenpeace, Friends of the Earth, WWF and Green Alliance, along with several other high-profile campaign groups, formally withdrew from the consultation process claiming that the Government was 'conducting a public relations stitch-up designed to deliver a preordained policy on new nuclear power' (Vidal, 2007).

Dealing with the challenges of climate change and energy security are expressed as headline goals of the 2007 energy White Paper, whilst still insisting that competitive markets, independently regulated are the most cost-effective and efficient way of delivering the objectives (BERR, 2008d). The Government identifies four long-term goals for its energy policy, namely:

- 'To put the UK on a path to cut our carbon dioxide emissions by some 60% by about 2050, with real progress by 2020;
- To maintain reliable energy supplies;
- To promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity; and

- To ensure that every home is adequately and affordably heated.' (p. 6)

The White Paper announces the new consultation process on nuclear power and indicates the Government's preliminary view as being 'that it is in the public interest to give the private sector the option of investing in new nuclear power stations' (p. 17).

Following its second consultation on nuclear the Government finally published the nuclear power White Paper in January 2008 (BERR, 2008e). The White Paper stresses the Government's commitment to a strategy for dealing with waste, a funding mechanism for operators to ensure that they meet the costs of decommissioning and waste management, and increasing the resources of the Nuclear Installations Inspectorate. Other commitments were made to facilitate new nuclear build such as, to improve the planning system for large infrastructure projects, to run a strategic siting assessment process (SSA), perform a high-level strategic environmental assessment (SEA), to run the justification process, to assist regulators with the process of generic design assessment (GDA), and to push to strengthen the European Union Emission Trading Scheme (EU ETS) (BERR, 2008e, pp. 134–135). A flurry of consultations has resulted, too numerous to mention here but which can be viewed on the department's website at [www.berr.gov.uk](http://www.berr.gov.uk).

Critics are already accusing the Government of backtracking on its promise to ensure that all the costs of decommissioning and waste disposal would be met by the private sector. There was discussion in a Commons debate over the terminology used by the Government in terms of 'full costs' and 'full share' and it was announced that it was Government's intention to set a fixed price for waste disposal when a company comes forward with a proposal to build a new nuclear power station (Hansard, 2008a). Burke (2008) claims that this effectively caps the amount an operator would contribute to waste disposal, transferring the risk to the taxpayer and is tantamount to a subsidy.

Following its successful challenge of the original nuclear consultation, Greenpeace made a complaint to the Market Research Standards Board (MRSB) in respect of the role of the company 'Opinion Leader' in the subsequent 2007 consultation process. Opinion Leader were responsible for overseeing the citizen deliberative events. On 17 October 2008, the MRSB issued its decision stating its view that Opinion Leader had breached rule B14 of the Code of Conduct in that '...information was inaccurately or misleadingly presented, or was imbalanced, which gave rise to a material risk of respondents being led towards a particular answer' (MRSB, 2008). Critics' reaction to the judgement was scathing. Shadow energy minister Greg Clark was quoted as saying, 'These revelations call into question for a second time the way the Government is managing its nuclear policy', and Liberal Democrat energy spokesman Steve Webb voiced a common refrain, 'This ruling shows that the Government isn't even competent enough to rig its own consultation. It was hardly a secret that ministers had made their decision before their first consultation on new nuclear power'. Government's reaction too was somewhat predictable: a spokesperson for the Prime Minister declared that 'The outcome of the consultation stands, whatever the view of the Market Research Standards Board.' (Russell, 2008).

In 2001, the Government had begun its Managing Radioactive Waste Safely (MRWS) programme in an attempt to devise a practical solution to the problem of what to do with the UK's legacy nuclear waste. Following a consultation, it established the Committee on Radioactive Waste Management (CoRWM) in 2003 to assess the options and recommend a way forward. CoRWM published its report and recommendations in July 2006. CoRWM's recommendations were interim storage, followed by deep geological disposal and a staged implementation process that ensured partnerships between government and communities and communities willing to participate in the siting process (CoRWM, 2006). The Government accepted some of CoRWM's recommendations and initiated a consultation as to how to take the process forward, eventually publishing its Managing Radioactive Waste Safely White Paper in June 2008 (see defra, 2008a).

Thus, much has happened in recent years in the area of nuclear policy. In the space of five years Government has moved from a position of neutrality and cautious 'let's wait and see if we need it' to an overwhelming surge towards 'let's get it done as quickly as possible'. To fully understand this turn around it is necessary to look more closely at the reasons why nuclear has become a more attractive option and the arguments put forward against its resurgence.

### 3. Drivers for nuclear power

Generally speaking, it is possible to identify two main drivers influencing nuclear policy: energy security and climate change. The issue of energy security can be further divided into security of fuel supply and electricity-generation gap. These drivers are discussed below.

#### 3.1. Energy security – fuel supplies

Initially, it is worth noting that security of fuel supply is by no means a new issue and has been a concern for many years. Indeed it was one of the initial motives for the first meeting of the G8 (the G6 as it was then) back in 1975 following the oil crisis in 1973 (Hajnal and Kirton, 2000). It has also had a noticeable effect on nuclear policy in the past. Following the OPEC crisis and the huge increases in oil prices in the 1970s, nuclear gained momentum in the UK, eventually to result in the Sizewell B power station, the THORP reprocessing plant and a Mixed Oxide (MOX) station (Helm, 2003, p. 90).

Disruption of supplies, geo-political instability and increasing energy prices have over the last two to three years convinced governments around the world that energy security is an issue that they must take extremely seriously and policies have been ripped up and rewritten accordingly. Energy security is now talked about as part of national security and is regarded as an increasing concern (see for example Cabinet Office, 2008, pp. 20–21). NATO acknowledges a role in international energy security and sees its contribution as 'information and intelligence fusion and sharing; projecting stability; advancing international and regional cooperation; supporting consequence management; and supporting the protection of critical infrastructure' (NATO, 2008). The President of the USA, Barack Obama is rumoured (at the time of writing) to be

considering the establishment of an energy security council to coordinate policy in this area (Lovely, 2008). It is clearly an issue that is gaining increasing priority on political agendas world-wide.

Perhaps of most concern to the UK however, is the resurgence of Russia as a global superpower largely through exerting its influence over energy supplies. The World's largest natural gas reserves are located in Russia (EIA, 2008). Forty per cent of the gas imported into Europe comes from Russia and projections show that this could rise to around 60% in the future (Holz et al., 2008). European gas imports from Russia travel through three countries: Ukraine, Belarus and Moldova. In January 2006 a dispute between Russia and Ukraine which had been brewing for some time, boiled over and resulted in falling pressures and non-delivery of gas supplies to Europe. Energy prices rocketed, but no European customers were cut off from their supply, largely due to mild weather and the New Year holiday period (Stern, 2006). Although, the crisis lasted only four days and the lights stayed on, this episode sent shock waves and indignation across Europe, with many commentators claiming it to be a political move by Russia (Webb and Barnett, 2006) in order to demonstrate its authority and re-emerging confidence as a global player. A similar incident in January 2009 left several European countries without gas supplies from Russia for over a week (BBC, 2009). The recent skirmish in Georgia, and Russia's recognition of South Ossetia and Abkhazia's independence has been interpreted by many as an energy issue and geopolitical manoeuvring for influence over the strategic 'energy corridor' of the Caspian Sea basin area (see e.g., Klare, 2008).

The UK is becoming more reliant on imports, something the energy White Paper acknowledged:

- '...current projections of gas demand imply that we will need to increase our gas; import capacity by 15–30% by 2020 ...' (BERR, 2007c, p. 19);
- 'Today around 90% of the UK's energy needs are met by oil, gas and coal.' (p. 105);
- 'By 2010, gas imports could be meeting up to a third or more of the UK's total annual gas demand, potentially rising to around 80% by 2020 on the basis of existing policies. The UK is also already a net importer of oil, and by 2020 imports could be meeting up to around 75% of the UK's coal demand.' (p. 106).

North Sea production peaked in 1999, and many commentators, such as the Association for the Study of Peak Oil and Gas (ASPO) for instance, expect world production to start declining by 2040 if not sooner (Tsoskounoglou et al., 2008). Peak oil is extremely difficult to predict due to the secrecy surrounding reserve statistics. Some believe that peak oil is already upon us with some estimates suggesting dates of between 2000 and 2008 (Knustler, 2006), 2005 (Watson, 2005), or 2007 (Duncan and Youngquist, 1999). In any case, whichever theory of peak oil and/or gas is proved correct, there is no doubt that the UK can no longer rely on indigenous supplies of fossil fuels without revisiting its coal reserves (although the extent of the UK's coal reserves is itself the subject of some debate and uncertainty (Vidal, 2008)). Whilst the issue of peak oil and oil prices are of great concern, it cannot be overlooked

that oil is not used to generate electricity in the UK. However, the probable electrification of transport in the future will likely increase demand for electricity dramatically.

Nuclear energy is therefore, seen by some to be at least part of the solution for UK's energy security concerns. It is also gaining in popularity as a response to such concerns expressed in many other countries (see below). Although the UK does not have its own indigenous supplies of uranium, those countries that do have supplies to export are seen as politically stable and open to trading with the UK, including Canada and Australia. In addition, the UK's stocks of uranium and plutonium appear to be sufficient to fuel 1.5–3 pressurised water reactors (PWRs) over their projected 60-year life-time (ERM and IDM, 2007). It is believed that globally there are sufficient resources to power current or increased nuclear capacity with some estimates suggesting reserves sufficient to last approximately 85 years, depending on new discoveries and future expansion of generating capacity (BERR, 2007a).

Reprocessing or new technology may provide a longer-term solution to security of fuel supplies for nuclear plant, with the introduction of next generation technology, the so-called 'Generation IV' reactors and the possibility of thorium reactors.<sup>1</sup> Disparate views on fuel supply for nuclear plants are held, including Price and Blaise (2002), ISIS (2008), and SDC (2006). No commercial deployment of Generation IV reactors is currently planned and none is expected until at least 2030. Reprocessing in the UK has had its problems and in the nuclear White Paper published in January 2008 the Government stated its view that '*...any nuclear power stations that might be built in the UK should proceed on the basis that spent fuel will not be reprocessed...*' (BERR, 2008e, p. 114).

Whether renewables could replace existing fossil fuels and provide energy security, or energy independence as it is now being termed in the USA, is a hotly debated issue. A report by the Tyndall Centre at the University of Manchester indicated that for the UK, renewable energy has the potential to meet our energy demands without the use of nuclear energy (Tyndall, 2006). However, the International Energy Agency suggests that globally, an increase in nuclear generation of 80% and technological breakthroughs will be necessary (WNN, 2008a).

With the potential global expansion and uptake of nuclear power generation, there is also a question of whether there is enough capacity in the engineering, construction and personnel sectors to meet the demand world-wide. For instance, there is already a supply problem concerning forgings for reactor pressure vessels with only one company in the world, based in Japan, capable of fabricating and supplying this vital component (Schneider, 2008). The UK Government has also acknowledged its concern regarding the availability of suitable qualified personnel as projections indicate a growing shortage of expertise over the next 15 years. Government has responded to this challenge by establishing a National Skills Academy (see [www.nuclear.nsacademy.co.uk](http://www.nuclear.nsacademy.co.uk)).

Rutledge (2007) describes Government's attitude towards security of supply in the past as 'laissez faire' and inconsistent with its other energy policy objectives. Even though Govern-

ment has become more concerned about energy security of late, it still insists that competition in a liberalised market will provide a solution. The recent statement from the 2007 White Paper, '*Our strategy continues to be based on the principle that independently regulated, competitive energy markets, are the most cost-effective and efficient way of delivering our objectives.*' (BERR, 2007c, p. 8), sounding remarkably similar to a statement from the 1995 White Paper, 'The Prospects for Nuclear Power', that there was '*no compelling reasons for supposing that the market will not on its own accord provide an appropriate level of diversity*' (Sadler, 2001, p. 38).

Availability of resources for the long-term supply of fuel for our energy demands is a major issue. There is no doubt that fossil fuels are finite and will not meet our needs indefinitely. Whether uranium is plentiful enough to meet the needs of an expanded nuclear industry in the long-term is still a hotly debated issue dependent on many variables, not least the amount of expansion world-wide and the technology deployed.

### 3.2. Energy security – electricity-generation gap

Many scare stories have abounded of late regarding the UK's ability to meet electricity demand in the coming years (for example, see Harrabin, 2008). With talk of blackouts and shortages, nuclear advocates are claiming that a raft of new build is the only way to ensure that the lights stay on in the UK (Macalister and Wintour, 2006).

It is important to note the difference in respect of electricity and energy. These terms are often mistakenly used interchangeably leading many commentators to draw erroneous conclusions and mis-state facts, figures and statistics. In the UK in 2007, electricity only accounted for approximately 18% of the UK's total energy consumption (BERR, 2008b, pp. 13 and 14). Thirty-eight per cent of UK final energy demand is utilised in transport (BERR, 2008c, p. 12) and only 1.22% of the energy used for transport is currently met by electricity (DfT, 2008). Almost half of final energy demand is as heat, 70% of which is used by households. The majority of heat demand in households (81%) is met by gas (BERR, 2008c, p. 12).

Whilst predicting the future is always a risky and uncertain business, it is a necessary part of forward planning to anticipate the demand for electricity in the future. Infrastructure will undoubtedly take time to upgrade, replace and renew and a realistic projection of demand is essential to ensure that sufficient capacity is provided for and that companies do not suffer by providing excess and unwanted spare capacity. In the UK's privatised market it is for companies to make these decisions. However, the Government cannot abdicate all responsibility and must ensure that the correct policies are in place to encourage the development of sufficient supply. An estimated 20–25 GW of new generating capacity will be required by 2020 and companies have already announced 14 GW capacity of new build (BERR, 2007b, p. 9). Currently, nuclear power supplies approximately 19% of our electricity generation and 3.5% of total UK energy use (BERR, 2008e, p. 13).

Nearly a third of the UK's coal fired power stations are due to close by 2023, and unless extensions are granted, all but one of the nuclear power stations will have shut down (BERR, 2008e, p. 16). Of the current 19 operating nuclear reactors at

<sup>1</sup> For more information on Generation IV reactors see [www.gen-4.org](http://www.gen-4.org).

10 power stations (BERR, 2009), only three nuclear power stations are scheduled to be in operation by 2020, which equates to a reduction of 7.4 GW of generating capacity by 2020 (BERR, 2007b, p. 24). Some nuclear power stations are attempting to persuade regulators to allow them to extend their operating licenses, such as Oldbury, which was due to close down at the end of 2008 but applied to the Nuclear Installations Inspectorate (NII) for a 2-year extension (Bristol Evening Post, 2008): this has been granted (WNN, 2008b).

In terms of renewable energy sources, the UK generated just 5% of its electricity from renewables in 2007. The Government had set itself an ambitious target to ramp up electricity generated by renewables to 10% by 2010 and 20% by 2020 (BERR, 2008g). The European Union has set itself a target of generating 20% of energy from renewables by 2020 and proposed that the UK's share of that target would amount to producing 15% of energy from renewables by 2020. This equates to an almost ten-fold increase in current levels of supply (BERR, 2008i). These targets are challenging and have led many to demand urgent and radical action with some claiming that current Government policies would only produce a figure of 6% of energy generated by renewables by 2020 (Adam, 2008).

Therefore, the Government clearly needs to move forward with energy policy to meet the needs of the country in terms of energy security, whether related to fuel supply or generation capacity.

### 3.3. Climate change

The threat of climate change is perhaps one of the most forceful of the policy drivers for nuclear power. Indeed, it could be argued that the issue of climate change is singularly responsible for nuclear's recent renaissance throughout the world. Climate change is not a new phenomenon, nor is it a new policy driver, but as evidence mounts that the effects of climate change are being felt now and that the situation is more urgent and dire than even the gloomiest projections from a few years ago, the impetus and the pressure on governments to act increase.

The UK is one of few countries that are likely to meet the emissions targets set by the 1997 Kyoto Protocol (defra, 2008b). However, this needs to be viewed in context. The UK's emission reductions have been attributed to the dash-for-gas in the 1980s (Stern, 2007, p. 232) and is unlikely to be replicable. A report from the United Nations, based on emission data from 2006 (the most recent figures available), declared that although overall global emissions remain below the Kyoto baseline of 1990, this is mainly as a result of the significant reductions in emissions due to the economic decline of countries in Eastern and Central Europe following the collapse of communism, and that since 2000, the trend is for an increase in emissions (UNFCCC, 2008).

The UK's response to the challenge of climate change is to bring in legislation that legally binds the Government to reduced emissions in the form of the Climate Change Act which received Royal Assent on 27 November 2008. The Act commits the UK to reduce carbon emissions by 80% by 2050. Initially the Act received criticism for not including the emissions from aviation and shipping. However, as it was

passing through the House of Commons in October 2008, the Government bowed to pressure from campaign groups, its own Climate Change Committee and MPs and tabled an amendment to include these emissions leading to Friends of the Earth describing the Act as 'world-class' legislation (Hencke, 2008).

The European Union and the UK have committed to targets that would attempt to stabilise carbon dioxide concentrations in the atmosphere at 450 ppm (parts per million) by 2050, which is believed to be sufficient to limit the expected temperature rise to 2 °C. However, the latest science suggests that this is not going to be enough and that a target of 350 ppm is necessary if 'humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted' (Hansen et al., 2008). This will be a difficult target to reach as levels of CO<sub>2</sub> are already at 385 ppm. Some commentators believe that 450 ppm is now unattainable and that a limit of 550 ppm might be more realistic and that if we do not act quickly then even this could be beyond our capability. Some are so concerned at the urgency of the situation and governments' seeming unwillingness to make serious and radical progress, that traditional opposition to nuclear energy is being discarded. In an article arguing vociferously against coal environmentalist George Monbiot has declared that 'I have now reached the point at which I no longer care whether or not the answer is nuclear.' (Monbiot, 2008).

The Government at present does not seem to believe that it will be able to meet its carbon targets without the use of nuclear energy. The current Energy Minister, Mike O'Brien, from the Department of Energy and Climate Change stated, 'Nuclear is a crucial part of an affordable climate change policy' (Reuters UK, 2008). It is interesting to note however, that these statements are nearly always couched in economic terms, for instance, 'affordable climate change policy'. The Sustainable Development Commission has pointed out that CO<sub>2</sub> emissions would only reduce by 4–8% depending on whether existing stations are replaced, or capacity is doubled (SDC, 2006) and therefore its effectiveness at combating climate change is limited. Whether nuclear is an affordable or cheap(er) option is still to be discerned but it appears that politicians would be unable to make the argument for nuclear without stressing that it is necessary on economic grounds.

Economics and other issues are discussed in the next section, as both barriers and possible drivers for nuclear.

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## 4. The changing status of barriers – facilitating drivers?

### 4.1. Economics

The reliance on an argument that stresses the economic advantages of nuclear energy is an interesting turn around from previous governmental policy and experience. As mentioned above, in 2003 the Government was convinced that nuclear was not economical and stated this as their main reason for not entertaining the idea of new build. Perhaps most telling with hindsight was Patricia Hewitt's comment in the House of Commons when launching the 2003 Energy White Paper. Shortly after stating that the economics of

nuclear were not attractive and that going forward with nuclear would mean less investment in energy efficiency and renewables, Ms Hewitt remarked that *'we have not ruled out the possibility of needing some further nuclear capacity to meet our carbon targets'* (Hansard, 2003)(HC Deb (2002-03) 400, col. 31). So is it that nuclear is still uneconomical but we need to press ahead with it anyway in order to reduce our carbon emissions?

The economics of nuclear power is a subject that just about everyone has an opinion on: for example, see reports generated by, or for, Greenpeace (Froggatt et al., 2007), Sustainable Development Commission (SPRU and NERA, 2006), BERR (BERR, 2007d) and the World Nuclear Association (WNA, 2005). It is important to assess the bias with which such reports may or may not be written.

In 2005, Thomas (2005) performed an analysis of economic studies of nuclear power (by PIU, MIT, IEA/NEA and OXERA amongst others) and identified why many reports are criticised and their assumptions disputed. Three difficulties were listed as the main areas of controversy:

- *'Several of the variables relate to processes which have not been proven on a commercial scale, such as decommissioning, waste disposal, especially for long-lived low-level, intermediate- and high-level waste. All experience of nuclear power suggests that unproven processes could easily cost significantly more than expected. There is therefore a strong risk that forecasts of these costs could be significantly too low;*
- *For some of the variables, there is no clear 'correct' answer. For example, the discount rate could vary widely whilst there is no clear consensus on how provisions to pay for decommissioning should be arranged; and*
- *Perhaps most important, there is a lack of reliable, up-to-date data on actual nuclear plants. Utilities are notoriously secretive about the costs they are incurring, while in the past two decades, there has been only a handful of orders in Western Europe and none since about 1980 in North America. All the modern designs are therefore more or less unproven.'*

Thomas concluded that for nuclear new build to proceed in the UK *'extensive government guarantees and subsidies would be required'* (pp. 24–25).

One reason why nuclear has been looking more attractive in recent years is the new system of carbon trading. The EU ETS, the European Union Emission Trading Scheme puts a cap on carbon emissions and allocates permits. If an operator exceeds its allocated emissions then it must buy permits from companies that have emitted less than their allocation. This effectively puts a price on carbon. This potentially increases the attractiveness of nuclear energy as no carbon is released through electricity generation (although carbon is released at other points in the lifecycle of nuclear power, including mining, uranium processing, waste treatment, construction and decommissioning). Electricity generated by fossil fuels therefore, has the additional cost burden of carbon. However, the effectiveness of the EU ETS in terms of making nuclear economically attractive will depend on the price of carbon – too low and nuclear is still expensive.

Whether the current economic crisis is going to alter the situation for new nuclear build is as yet unclear. The

Government is keen to press ahead, but there is evidence that the Government's main concern may no longer be the economic viability of nuclear generation alone. South Africa has recently announced that it will reassess its previous decision to build a nuclear plant following the economic crisis (Reuters Africa, 2008). Rumours are circulating that the financial crisis will hit the energy industry (Keller, 2008) and reduce investment potential (Brumfiel, 2008b). However, how much of an impact it will have on the industry remains to be seen. The high price of energy in recent times and large profits made by the big energy companies suggest that the industry is in a better position to cope with the crisis than most (Hawkins, 2008).

Somewhat related to the financial crisis is the price of oil and the effect that this may have on the viability for nuclear investment. When the price of oil is high, as it was in July 2008 reaching \$147 per barrel (London Stock Exchange, 2008), then nuclear is a far more attractive option. However, the financial crisis has resulted in a decrease in energy demand and a corresponding reduction in the price of oil, with prices showing a month average of \$42.23 per barrel in January 2009 (OPEC, 2009). Electricity demand is forecast to fall by 7% in 2009 which could in turn lead to a fall in energy prices (prices for electricity in November 2008 were around £65/MWh down from £115 in October (Pagnamenta, 2008)). The global recession may have knock-on effects on the nuclear industry, for instance in the construction sector. Construction costs may be reduced as the cost of steel falls, but the possibility of companies not surviving the economic downturn is all too real and there may be an even bigger shortage of suppliers and expertise in the future than originally feared. It is far too early (at the time of writing) to tell whether the financial crisis will have a positive or negative long-term effect on the economic prospects of the nuclear industry.

#### 4.2. Waste management policy

Another key aspect that has made the policy turn around on nuclear more palatable is the publication in 2008 of the Government's policy on radioactive waste management, the Managing Radioactive Waste Safely (MRWS) White Paper (Defra, 2008a). There has long been criticism of the Government's lack of a policy for dealing with nuclear waste. Although a number of organisations and committees have been set up over the years to deal with this issue, it has taken until 2008 for a policy to be published.

When presenting the Science and Technology Committee's report on Radioactive Waste Management: An Update to the Lords in 2006 (4<sup>th</sup> Report, HL Paper 109) Lord Tombs said *'... the first inquiry by the Select Committee on Science and Technology was published in March 1999-eight and a half years ago. In the subsequent years, Government have shown a mixture of procrastination, indecision and, most importantly, a failure to grasp the nature of the problem which has been the subject of subsequent committee reports and government responses, leading to the chaotic situation that is the subject of today's debate.'* (Hansard, 2006).

The issue of what to do with the UK's radioactive waste is, of course, not a new one. Back in 1978 the Government established the Radioactive Waste Management Advisory Committee (RWMAC) to offer advice on the subject. In 2003

the Government set up the Committee on Radioactive Waste Management (CoRWM) to review the options on high-level radioactive waste management. Following the establishment of CoRWM it was decided that RWMAC would be put into abeyance for 2–3 years whilst CoRWM carried out its work,<sup>2</sup> in effect disbanding the organisation. In 2006 CoRWM reported to the Government and set out its recommendations that geological disposal was the preferred option with interim storage and that along with geological suitability, a process of volunteerism should be undertaken for site selection. In 2007 the Committee was reorganised with new terms of reference with its current purpose of independent scrutiny and advice.<sup>3</sup>

Although the Government largely accepted the recommendations of CoRWM and put in place a process by which to implement them, there has been criticism of the plans. The Lords Science and Technology Committee in 1999 had also made recommendations similar to that of CoRWM. The Lords Committee advised that an independent implementation body should be established through primary legislation and be subject to regular endorsements by Parliament. CoRWM also recommended an independent overseeing body but not the statutory basis or accountability to Parliament. Government has ceded responsibility for implementation of the disposal facility to the Nuclear Decommissioning Authority (NDA) and CoRWM takes up an advisory role. The Science and Technology Committee has criticised this as a ‘dilution of successive recommendations’ and ‘not the way to build up public trust’ (Hansard, 2006).

Following CoRWM’s recommendations, on 12 June 2008, the Government published its White Paper, *Managing Radioactive Waste Safely (MRWS)*, and invited communities to volunteer to host the repository. Government’s plans have raised questions regarding the system of benefits conferred on the chosen site (described by some as ‘inducements’ or ‘bribes’), the distinction between legacy waste and waste from new build and how private operators would contribute their fair share of the costs, and the security implications of interim storage (for example, see Eccleston, 2008; HC Deb (2007–08) 477, col. 477; Webster, 2006). CoRWM made it quite clear that its recommendations were specifically in respect of legacy waste and that waste arising from new nuclear build would require additional consideration. It is also worth noting that the Government has not adopted all of the recommendations put forward by CoRWM (see defra, 2006).

Consistently the lack of a solution for nuclear waste disposal and the inherent difficulty of securing the waste over such long time periods, and the intergenerational aspects of waste management have been raised as the main reasons for not proceeding with new nuclear build. Indeed, the Government itself cited this argument back in 2003. Whether the Government’s new policy regarding waste disposal is realistic, comprehensive or adequate, there is no doubt that the publication and implementation of a policy on this issue

has facilitated the Government’s announcement to encourage new build in the UK.

#### 4.3. Public perception

One other key factor influencing the decision on nuclear energy in the UK that cannot be overlooked and should not be underestimated is that of public perception. It is difficult to do justice to the amount of work that has been put into this field of research. Surveys have been conducted on this topic for decades. It is, however, possible to make certain generalisations.

Recent research into public attitudes toward nuclear power found that people living in proximity to existing nuclear facilities were more supportive of new build than the general population (Pidgeon et al., 2008). Interestingly, however, when a community in Illinois, USA, a state that is heavily-reliant on nuclear power with 11 operating reactors, were asked in a referendum, ‘*Shall our elected officials in Illinois take steps to phase out nuclear power in the state, replacing it with renewable sources such as wind and solar?*’, the vote was overwhelmingly in favour (Wasserman, 2008). Rather than indicate a difference between the attitudes of a UK or a USA citizen, this perhaps reflects the immense importance of how the question is framed. Research conducted by Bickerstaff et al. (2008) demonstrates that when the issue of nuclear power is framed alongside climate change people are more positive about nuclear energy, although still reluctant to accept its necessity as a solution.

A Eurobarometer study was carried out in early 2008 which demonstrated that in Europe, opinion is evenly divided with 44% expressing support and 45% opposition to nuclear. However, moderate opinions were the majority with 33% fairly in favour and 28% fairly opposed. The results show remarkably similar findings to that of the IPSOS/MORI poll, that support for nuclear has increased by 7% since 2005 and Europeans are more likely to ‘not know’ and not express an opinion. The survey shows, perhaps unsurprisingly, that opinion varies between countries and that in countries that have nuclear energy opinion is more likely to be positive. Those who expressed a view in opposition to nuclear energy were subsequently asked if they would change their opinion if there was a permanent and safe solution for managing radioactive waste, 39% of people said that would make them change their mind, 48% remained opposed and 8% said there was no solution. These results are little changed from 2005. One other result worth noting is that on average, information on management of radioactive waste is most trusted when it comes from scientists (40%) and non-governmental environmental organisations (38%), only one-fifth (21%) would trust their national government and the nuclear industry and the media are seen as the least trustworthy (12%) (Eurobarometer, 2008).

Whilst public support for nuclear energy can be seen to be on the increase, it is unclear how the ‘nuclear renaissance’ may affect reaction in the future. For example, in 1999 Germany pledged to phase out nuclear energy by 2023 and Chancellor Merkel reaffirmed commitment to that goal in 2006 (Deutsche Welle, 2006). However, recently high energy prices have led to calls to reconsider the decision and Chancellor Merkel has suggested slowing down the phase out in order to assist the country to meet its carbon emissions targets. This has in turn led to increasing anti-nuclear protests. November

<sup>2</sup> Information on RWMAC can be accessed at The National Archives, see <http://collections.europarchive.org/tna/20080727101330/http://defra.gov.uk/rwmac/index.htm>.

<sup>3</sup> Information on CoRWM can be accessed at [www.corwm.org.uk](http://www.corwm.org.uk).

2008 saw the largest and most violent protests since 2001 and a spokesperson for the anti-nuclear organisation *x-tausendmal quer*, was quoted as saying that 'this is a strong sign of the renaissance of the anti-nuclear movement' (Terra Daily, 2008).

Whether the Government will have to contend with increased opposition to implementation of its nuclear new build policy from activists is unclear at this time, but it will be able to take comfort in the polls that show increasing support for nuclear within the general population.

In summary, the Government states that its change of heart in terms of nuclear policy is motivated by increasing energy prices, energy security and climate change. Whether Government's motivation is genuine and whether its response to these concerns is proportionate and reasonable is beyond the scope of this paper, but there are still many hurdles for Government to overcome as discussed in the next section.

## 5. Barriers to nuclear power

There are many issues for Government to consider as it moves forward with its nuclear agenda. Whether these issues, hurdles, or barriers, are founded on substantive difficulties or are simply ones of perception is open to debate. However, what remains apparent is that unless the Government address these barriers it will continue to face opposition and engender mistrust.

Many of these barriers are not new issues and have been points of contention for many years, but some have come to the fore only recently. Successive governments have failed to adequately address these barriers in the past and this has led to the previous reluctance of governments to take forward a policy of new build.

Some of the barriers are easy to identify and are articulated in almost every article, news story, and poll, such as the issue of waste management and intergenerational equity, safety and proliferation. However, in order to ensure that all barriers are identified it is necessary to look for opinions more widely.

### 5.1. Perception

In 2007, Butler et al. (2007) performed an analysis of the responses to the DTI's consultation on its energy White Paper, *Our Energy Challenge* (DTI, 2006b). The 527 responses<sup>4</sup> to the consultation by organisations were reviewed and comments specific to nuclear examined. Although this consultation was challenged successfully by Greenpeace, it is the last full consultation available to date on the subject of nuclear power that included the participation of 'green' groups as they symbolically pulled out of the nuclear consultation in 2007. This consultation then, is the only one which will give a truly representative spread of results. The analysis identified 22 concerns regarding nuclear energy and the number of times each concern was mentioned was recorded in order to gauge the strength of feeling regarding each issue. The results are

presented here in descending order and with the frequency of occurrence noted.

1. Nuclear Waste Disposal – 124
2. Cost of nuclear electricity generation – 71
3. Terrorist risk – 70
4. New nuclear capacity would not make much difference in reducing carbon emissions – 67
5. There should be no subsidy – 67
6. Nuclear does not offer a sustainable solution – 65
7. It undermines, or may crowd out, better options – 62
8. There are better ways of reducing CO<sub>2</sub> emissions – 54
9. Decommissioning and waste management costs – 54
10. Uranium resources finite and not indigenous – 47
11. Nuclear is not carbon neutral over its life cycle – 46
12. Safety – 46
13. UK adoption of nuclear power will encourage other countries and increase proliferation risk – 44
14. It prolongs centralised power distribution systems – 37
15. Health and environmental issues from radioactive discharges and doses – 20
16. Sea level rise and coastal erosion threatening nuclear power stations – 18
17. Can meet carbon reduction targets without nuclear power – 13
18. Reactor technology inadequacies – 11
19. Reinforces a centralised, less participatory society – 9
20. Socio-economic impacts – 7
21. Transport of nuclear material – 4
22. Link with nuclear weapons – 3

What perhaps is not surprising is that the issue of nuclear waste disposal emerged as the most prevalent in the consultation. This objection to nuclear power is ubiquitous and was the reason cited by the Government itself against proceeding with a new nuclear build policy until recently. Issues which receive a lot of media attention, the cost of nuclear power and the fear of terrorism, are also mentioned frequently. Most surprising, however, is the low incidence of the more traditional arguments against nuclear, those of the risk of transporting nuclear material and the link between nuclear power generation and nuclear weapons. This may be a result of these issues having received so much attention in the past, that these arguments are so well-rehearsed that respondents feel the case has already been established.

Overall, the responses sent in to the consultation by organisations were generally negative towards nuclear power, with 38% opposed, 21% in favour, 19% neutral and 22% offering no comment on the nuclear issue specifically.

This demonstrates that the Government will have a difficult time if it pressed ahead with a policy of encouraging new nuclear build. Whether or not the fears and anxieties expressed by people are valid, their concerns are real and a potential barrier to pro-nuclear policy and will need to be addressed and overcome if new build is to progress quickly and not suffer extensive delays.

### 5.2. Planning

The Government believes that the UK planning system has provided a barrier to new large-scale infrastructure

<sup>4</sup> The consultation responses are now archived, but submissions can be viewed by contacting BERR. At the time of writing, contact details are available at <http://www.berr.gov.uk/whatwedo/energy/whitepaper/review/consultation/consultation-submissions/page27883.html>.

developments, not just new nuclear power stations, but also wind farms and other renewable energy projects.

In his foreword to the Nuclear White Paper (BERR, 2008e), Gordon Brown stated that, ‘We have therefore decided that the electricity industry should, from now on be allowed to build and operate new nuclear power stations, subject to meeting the normal planning and regulatory requirements.’ (p. 4, emphasis added). However, the White Paper proceeded to acknowledge that the normal planning and regulatory requirements will be changed to facilitate the new build of nuclear energy and ‘to reduce the regulatory and planning risks associated with investing in new nuclear power stations.’ (p. 9) Admittedly, it is argued that other energy generating technologies will benefit from changes in the planning system and not just energy infrastructure. It has been suggested that it will be easier and faster to authorise other potentially ecologically damaging but economically beneficial projects such as airport expansions. In a similar vein to the arguments presented in support of changing planning legislation, that it is slow and cumbersome and resulted in Sizewell B taking 6 years to gain planning permission (p. 137), the planning system was blamed for Heathrow’s Terminal 5 taking 7 years (Select Committee on Transport, 2008, section 5, para 72).

Whether the planning system was at fault for the lengthy inquiries undertaken for these projects is beyond the scope of this paper and is discussed at length elsewhere.<sup>5</sup> However, that the planning system was seen to be a major hurdle, or barrier, to the implementation of a new policy of new nuclear build is undeniable. There is also no denying that the planning system has been criticised for many years and the introduction of new policy on nuclear power was not the only driver for introducing a new planning regime.

The new system is not without its detractors and some commentators suggest that the new procedures will have the opposite of the intended effect, only serving to delay the process even more (see for example, Ellis, 2008; Newitson, 2008): only time will tell whether the new system has the desired effect.

Interestingly, the Scottish Parliament has voted to block all new nuclear power stations proposed for Scotland (Macdonell, 2008) and will likely use planning legislation to that end. Although under devolution, energy policy is a reserved matter for the UK Parliament, the Scottish Parliament can veto new nuclear power plants through planning legislation over which it does have control.

The new planning system does not however, remove the possibility of judicial review from the process and so there is still the possibility that planning decisions may face delays. However, owing to the expense of taking action via judicial review it is unlikely that this will become common practice.

## 6. Comparison with other technologies

The drivers identified as pushing the new nuclear policy agenda forward, those of energy security and climate change,

<sup>5</sup> See for example the debate surrounding the reform of the planning system, the reviews, consultation and white paper – all available at the website of the department for Communities and Local Government [www.communities.gov.uk](http://www.communities.gov.uk).

can also be ascribed to other electricity generating technologies. Many of the barriers faced by new nuclear are also of relevance to other technologies. A brief comparison of drivers and barriers for renewable energy and carbon capture and storage (CCS) demonstrates some of the similarities.

### 6.1. Renewables

Renewables, such as wind and solar contribute to energy security by ensuring a diversity of supply and increasing the amount of electricity generated from indigenous, domestic sources. However, as renewable energy only accounted for approximately 5% of all electricity generated in the UK during 2007, mostly due to the state support given via the Renewables Obligation (RO) (BERR, 2008j, p. 29), and only 1.5% of final energy consumption in 2006 (BERR, 2008h, p. 5), it could be argued that this is not in itself a sufficiently strong driver to achieve a significant growth in the renewable energy generation market. These statistics, and the fact that most renewable generation technologies do not provide baseload power, also suggest that without major policy intervention the renewables sector is not in a position to provide the extra generating capacity needed when existing nuclear and coal-fired stations are retired. Therefore, the generation gap whilst not without influence is again unlikely to be the most significant of the drivers for increasing renewable electricity generation.

By far the strongest driver for renewable energy generation technologies is climate change and the desire to reduce carbon emissions. This is evident upon examination of the consultation document issued by the Government in June 2008. The consultation very briefly acknowledges the importance of energy security but even as it does, it refers to climate policy.

‘Ensuring security of energy supply is essential to climate and energy policy. Fundamental to securing our energy supplies is to ensure that we are not dependent on any one supplier, country or technology. By increasing the level of energy we generate domestically, we will be less dependent on imports of fuel from abroad.’ (p. 4).

The Government has committed to an 80% reduction below 1990 levels of carbon dioxide emissions by 2050 through the Climate Change Act 2008<sup>6</sup> and under the auspices of the EU, a target of 15% of energy consumption to be met by renewable energy. Considering that under current policy the UK is only due to reach a target of 5% of energy through renewables, the new EU targets are ambitious to say the least. As evidenced in the Renewables Consultation document, the Government is still confident that these targets can be met through independently regulated markets, with ‘the right interventions to correct specific market failures.’ (p. 5).

Many of the barriers faced by nuclear power are specific to the industry however; some are also shared by renewables. Reliance on the market to provide the necessary investment leaves the industries open to the vagaries and risks associated with such a strategy, as we are seeing with the recent economic crisis. Although there is much talk of the economic

<sup>6</sup> The Climate Change Act 2008 can be viewed at [http://www.opsi.gov.uk/acts/acts2008/pdf/ukpga\\_20080027\\_en.pdf](http://www.opsi.gov.uk/acts/acts2008/pdf/ukpga_20080027_en.pdf).

crisis as a catalyst for ‘green’ growth and using ‘green’ technologies as a springboard to restructuring and reinvigorating the economies of developed countries (for example see [Dickey and McNicoll, 2008](#)) much will depend on the EU ETS and the price of carbon as to whether renewables will be able to compete in a competitive market. There are fewer calls for renewables to manage without subsidy. There appears to be recognition that renewables will need some assistance to ramp up to the required capacity and achieve economy of scale. Many also point out how much direct or indirect assistance (or subsidy) the older technologies of coal and nuclear have received in the past. Cost is a ubiquitous barrier to all types of investment. In the consultation document ([BERR, 2008h](#)), the Government estimate that the investment required to meet the 15% target for renewables by 2020 will be of the order of £100 billion.

The planning regime has been as much a barrier to renewables as it has to nuclear. In its annual review, the British Wind Energy Association (BWEA) suggested that only 62% of planning applications in 2007 gained approval in contrast to 82% in 2004. It also pointed out that the average time taken had increased to a record 24 months. BWEA acknowledge that these trends could be attributed to a number of factors, including alterations in planning policy. BWEA declared that ‘*Addressing planning barriers will continue to be of primary focus for BWEA in 2008*’ ([BWEA, 2008](#)).

Skills and supply shortages will be a concern for all energy generation industries in the future. Evidence given to the House of Lords European Union Committee ([House of Lords, 2008](#)) suggested that wind turbine manufacturing capability was limited and that the prices of copper and steel were increasing the cost of offshore wind farms. The Government believe that sending a strong policy signal to the market will provide the impetus for investment and that supply chain issues can be resolved.

## 6.2. Carbon capture and storage (CCS)

Carbon capture and storage (CCS) has been getting a lot of attention recently and has been an important part of energy policy discussions. The overwhelming driver for CCS is climate change. Indeed, if it were not for climate change, CCS would not be in development at all. However, it could be argued that there is also a domestic energy security and energy generation gap driver involved with CCS. If CCS could be successfully deployed, then the UK would be in a much better position to utilise and exploit domestic reserves of coal. It has been suggested that CCS could reduce carbon dioxide emissions from fossil fuel power stations by as much as 90% and has the potential to abate 28% of global CO<sub>2</sub> emissions by 2050 ([BERR, 2008a](#)).

CCS also shares some of the barriers experienced by the nuclear industry. Both CCS and new nuclear build could be said to be new and untried technologies. Although nuclear is a mature technology, the new reactor designs slated to be built in the UK represent a new generation of plant design and to date, there are no reactors of either design operating anywhere in the world. Similarly, CCS consists of three stages: capture, transport and storage. Each of these stages are in operation in isolation, but have not been integrated as a process before.

The cost of CCS systems is also a significant barrier to their development. The European Commission estimated the cost of CCS at current levels of technological development to be approximately €70 per tonne of CO<sub>2</sub>. It expects the costs to reduce through technological improvements and to reach about €20–30 per tonne by 2020 ([European Commission, 2006](#)). This makes the EU ETS and the price of carbon of vital importance if CCS is to be cost effective in the future.

The public’s perception of CCS is difficult to assess: few studies have been undertaken and many people are unfamiliar with the technology and terminology. A review of the studies that have been carried out, performed for the IPCC, found that the lack of knowledge hinders the assessment of CCS, that it is seen as treating a symptom and not the cause of the problem, and that other technologies and options such as efficiency, and renewables should be pursued as a priority. In addition, accepting the principle of CCS may not mean that storage at a particular location would receive support ([IPCC, 2005](#), section 5, p. 258). Therefore, similar to nuclear, CCS is also considered with a certain circumspection by the general public although their perception is generally more favourable when framed as an alternative to nuclear ([POST, 2005](#)).

As the carbon dioxide will likely be stored in geological features, depleted oil fields, salt mines and other underground reservoirs, and there are uncertainties surrounding the possibility of leakage (currently being researched), any storage of CO<sub>2</sub> in this context will be subject to intense and prolonged monitoring. There will need to be confidence that the gas will remain immobile. This aspect of CCS also bears similarities with the underground disposal of nuclear waste. However, it has not as yet become a topic of public disquiet, possibly because no discussion of such issues has permeated the media in the UK. [Stephens \(2006\)](#) points out that environmental advocacy groups have shown a mixed response to CCS, suggesting a balance between opposition to ‘end-of-pipe’ solutions and reluctant acceptance of the practical need for the technology.

Another barrier that CCS shares with nuclear is the belief that it will not be deployable in time to make a difference to climate change, that it will be ‘too late’. For instance, [Greenpeace \(2008b\)](#) equates CCS and nuclear as ‘false solutions’ for this reason. They argue that the solutions to climate change already exist and that priority should be given to renewables and efficiency. Greenpeace also fear that money spent on CCS will not be available for investment in these other, more sustainable technologies and that it presents a significant liability with no firm knowledge of the risks involved ([Greenpeace, 2008a](#)) – arguments that should sound eerily familiar to the nuclear sector.

## 7. Comparison with other countries

The nuclear renaissance is not confined to the UK. At the end of 2007 there were 33 reactors under construction around the world, 19 of which are in Asia. Three new reactors had been connected to the grid in China, India and Romania. In the USA, a previously moth-balled reactor was reconnected to the grid. Construction was started on seven new nuclear power stations in China, one in France, one in Russia and two in

the Republic of Korea. In Bulgaria, Lithuania and Turkey, legislation had been passed to approve nuclear power station construction. Finland, Canada and the USA all saw regulatory applications for new stations (IAEA, 2008).

In Germany, a country that enacted legislation in 2002 to completely phase out nuclear power, and a country that has been strongly anti-nuclear for many years, a sea-change appears to be occurring. Concerns over the energy generation gap expected when the last reactors are shut down, high energy prices and concerns regarding how the country will be able to meet its carbon dioxide reduction targets without nuclear power are driving a change of public opinion. Germany is currently building or planning to build up to 26 new coal-fired power stations (Deutsche Welle, 2007), which will increase the difficulty of meeting emissions targets. The opposition party (the CDU) is generally regarded as pro-nuclear and if it were victorious in the general election planned for 2009, then a change in policy could be expected (The Economist, 2008).

Gulf States, such as Saudi Arabia, the United Arab Emirates, and Bahrain, are also beginning to show interest in developing nuclear capacity. Countries traditionally associated with oil are now talking about nuclear power and are making plans to construct stations. The motivation behind the interest in nuclear in the Gulf States however, may be slightly different than that of European countries; the demand for fresh water and consequently, energy-intensive desalination plants is believed to be behind the interest in nuclear power (Brumfiel, 2008a).

However, it will be some time before the true extent of the so-called nuclear renaissance can be judged. In the USA there are 31 proposals for new nuclear power stations, but at the time of writing President Obama has not yet made his position on nuclear power clear. He appears aware of the difficulties associated with the industry but also aware of the climate change and energy security issues which are making nuclear more attractive to many countries (Cardinale, 2008). A lot of renewal licences have been granted in the USA; at the end of 2008, there were a total of 51 reactors operating with renewal licences (WNN, 2008c).

As mentioned earlier, South African utility company Eskom has recently put its plans to build new nuclear power stations on hold due to the credit crisis. The government of South Africa has reaffirmed its commitment to nuclear energy but also supported the utility in its decision, explaining that it was important that Eskom did not overextend itself (Nuclear Engineering International, 2008).

## 8. Concluding remarks

The UK Government's stated policy on nuclear energy has undergone a dramatic change in the last couple of years – from a position of cautious neutrality and a belief that it was neither economically viable, nor ethical until a solution for dealing with radioactive waste was found, to a position of advocacy and encouragement. Energy policy in general appears to have been a difficult issue for the New Labour Government, with so-called long-term policies being reviewed almost before there was time to implement them. The Government has declared

its intention to rid the UK of fuel poverty and ensure a thriving industry in renewable energy, neither of which it has successfully achieved.

The opposition, the Conservative Party, has long been a supporter of nuclear power and its latest policy repeats its support, welcoming the Government's actions. The Conservatives also agree with the Government that new nuclear power stations should be self-financing and should not involve government subsidy (The Conservative Party, 2009).

In recent years the need to replace much of the country's energy infrastructure has come to the fore. Along with high energy prices, the decline of domestic gas supplies and geopolitical manoeuvring, the need to restructure energy generation and supply in the UK has gained high-profile status. Couple this with the ever increasing understanding of the threat of climate change and the growing urgency for mitigating actions, and it is perhaps not surprising that the Government is grasping at the nuclear straw.

The establishment of the European Union's Emission Trading Scheme (EU ETS) has put a price on carbon and created some assurance of its longevity – industry knows that carbon will be a cost in the future and can plan accordingly. How long it will take before the price of carbon reaches a level where real changes are encouraged remains to be seen. The nuclear industry is one that stands to gain from a high carbon price which would make its operation more cost-effective. However, nuclear plants are extremely expensive to construct and investors may be fearful of committing to such expensive projects. Credit too will be much harder to come by in the future and could lead to projects being abandoned or postponed, as in South Africa.

The Government has recognised that existing policies and legislation are hindering its desire for industry to move forward with large projects and has amended the planning regime accordingly. However, large changes in such complicated systems often have unintended and unforeseeable consequences. Only time will tell whether the changes made to the planning laws will actually improve the situation. If we are to retain a functioning democracy it will always be possible to instigate delays to large infrastructure projects and as climate change gains momentum and governments are seen to be procrastinating, the threat of public unrest and direct action will increase.

Even though the spectre of climate change and its consequences are beginning to seep into the public's consciousness and people's antipathy toward nuclear energy appears to be lessening as the need for low-carbon energy is recognised, nuclear power still has many barriers to surmount in the coming years if it is going to become an important part of our energy mix. Whether those barriers are economic, technical, social or environmental, or even if they are simply ones of perception and misunderstanding, nonetheless they remain a challenge to the industry.

The Government and the nuclear industry are aware of the problems and difficulties they face and can therefore pre-empt and prepare to ensure that solutions are found, policies are in place, investments are made, arguments are honed and fears addressed. However, there are still many questions to be answered when assessing the future energy mix in the UK. It is still not clear whether central or distributed energy systems

would be more sustainable and the sustainability of different technologies is still very much in question. These are legitimate concerns; the choices made today will decide the future of energy generation in the UK for decades to come.

Nuclear power is not unique in the sense that the same drivers are also responsible for pushing forward policies on competing technologies such as renewable energy. It is also not unique in that other technologies share many of the barriers associated with nuclear energy. Likewise, these are not concerns for the UK alone. Climate change, peak oil and the provision of affordable energy are global issues that affect us all. The response of our government and of governments around the world will shape not only our future, but the future of our children and grandchildren.

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