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Foreword by the Prime Minister



Climate Change is quite simply the biggest challenge facing humanity. The latest report from the Inter-Governmental Panel on Climate Change leaves little doubt that human activity, and in particular greenhouse-gas emissions, is changing the world's climate, with potentially devastating consequences. But we have choices and decisions to make about how we move towards a low-carbon economy.

I am determined that the Government will provide strong leadership in meeting not only the challenge of climate change, but in addressing the imperative of ensuring secure energy supplies. This means having reliable access to the energy we need to power our economy, at affordable prices.

To meet this challenge we need to take determined long-term action to reduce carbon emissions in every aspect of the way we live, the way we use energy and the way we produce energy, including the way we generate electricity. That is why the Government has today concluded that nuclear should have a role to play in the generation of electricity, alongside other low-carbon technologies. 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.

Nuclear power is a tried and tested technology. It has provided the UK with secure supplies of safe, low-carbon electricity for half a century. New nuclear power stations will be better designed and more efficient than those they will replace. More than ever before, nuclear power has a key role to play as part of the UK's energy mix. I am confident that nuclear power can and will make a real contribution to meeting our commitments to limit damaging climate change.

Gordon Brown

January 2008



Foreword by the Rt. Hon. John Hutton MP



Energy is an essential part of modern life. We need secure, clean and sufficient supplies if we are to continue to function as a modern society. But we face two long-term challenges:

- Tackling climate change by reducing carbon dioxide emissions both in the UK and abroad
- Ensuring the security of our energy supplies

There is no single, simple solution to these challenges. That is why our White Paper on Energy, “Meeting the Energy Challenge,” set out a wide range of measures which together will set this country on the right course to meet our objectives.

In May 2007 we launched a consultation to examine whether nuclear power could also play a role in meeting these long-term challenges, alongside other low-carbon forms of electricity generation. We set out our preliminary view that it is in the public interest to give energy companies the option of investing in new nuclear power stations.

The purpose of the consultation was to subject this preliminary view, and the evidence and arguments for it set out in our consultation document, to a thorough and searching public scrutiny.

I would like to thank everyone who took part in our consultation, for sharing their views and for making clear their commitment to tackling the twin challenges of climate change and security of energy supply.

We received 2700 separate written responses to the consultation. A further 1600 people participated in meetings and events up and down the country. We have been greatly impressed by the quality of the responses we received and the contributions made at those meetings.

Following the consultation we have concluded that, in summary, nuclear power is:

- Low-carbon – helping to minimise damaging climate change
- Affordable – nuclear is currently one of the cheapest low-carbon electricity generation technologies, so could help us deliver our goals cost effectively
- Dependable – a proven technology with modern reactors capable of producing electricity reliably
- Safe – backed up by a highly effective regulatory framework
- Capable of increasing diversity and reducing our dependence on any one technology or country for our energy or fuel supplies.

However, it is clear from responses to the consultation that there are also widespread concerns about nuclear power. These demonstrated that concerns do not arise from a lack of knowledge but are genuine concerns

which need to be properly addressed. Significant points were raised in the consultation about:

- the need to combat climate change and ensure secure energy supplies
- the adequacy of protection in the areas of safety, environmental release of radioactivity and national security
- the management of radioactive waste and particularly the need to make progress towards a long-term solution
- the appropriateness of relying on energy companies for the construction, operation and decommissioning of nuclear power stations
- the risk that cost over-runs in construction, in waste management and decommissioning will undermine the economic case for nuclear and could lead to costs falling on Government
- the perception that investment in nuclear energy will “crowd out” investment in alternative technologies, particularly renewables
- the argument that the contribution nuclear energy makes to the UK’s overall energy mix is currently quite small, calling into question the materiality of any contribution nuclear might make in the future to tackling climate change and ensuring security of energy supplies
- the belief that there are better alternatives to nuclear which would also enable us to achieve our energy goals and that there should be a greater focus on saving energy
- among those supporting nuclear power, a concern about what was perceived as a growing skills gap in the nuclear industry.

And while the consultation responses showed that there is considerable support for nuclear power, many were prepared to support nuclear only on the basis that these concerns are adequately addressed.

The Government has considered all these points. There are two elements in our response. First, any contribution to meeting our objectives by nuclear power must be seen as one part of the overall approach. Our White Paper, “Meeting the Energy Challenge,” sets out a range of measures, including measures to save energy and to strengthen the Renewables Obligation to ensure that renewable electricity plays a full role in taking the UK towards a low-carbon energy economy. The UK is committed to delivering its fair share of the European Council commitment to produce 20% of its energy from renewable sources by 2020. The Prime Minister announced last November that we will launch a consultation this year on how we are to achieve our targets, and publish our full renewable energy strategy in spring 2009 once the EU directive implementing the 20% target has been agreed.

Second, we have examined the specific concerns raised in the consultation and the extent to which they can be met by the existing regulatory framework, or could be met through further development of our policies. Specifically we have taken the view that we should act to ensure that there:

- is a clear strategy and process for medium and long-term waste management, with confidence that progress will be made
- are new legislative provisions setting out a funding mechanism that requires operators of new nuclear power stations to make sufficient and secure financial provision to cover their full costs of decommissioning and their full share of costs of waste management, and



- is a further strengthening of the resources of the Nuclear Installations Inspectorate (NII) to enable it to meet a growing workload.

Having reviewed the evidence, and taking account of these points, the Government believes nuclear power should be able to play a part in the UK's future low-carbon economy. We have also carefully re-examined the impact of excluding nuclear power from our future energy mix. Our conclusion remains that not having nuclear as an option would increase the costs of delivering these goals and increase the risks of failing to meet our targets for reducing carbon dioxide emissions and enhancing energy security.

The Government believes new nuclear power stations should have a role to play in this country's future energy mix alongside other low-carbon sources; that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to facilitate this.

These steps will include the Government taking forward regulatory processes and other steps, as follows:

- undertaking a Strategic Siting Assessment and Strategic Environmental Assessment
- meeting the requirements of European law that new nuclear practices should be required to demonstrate that their benefits outweigh any health detriments (the "Justification" process)
- ensuring that the regulators and particularly the NII are adequately equipped to review new build proposals through a process of Generic Design Assessment
- bringing forward legislation to ensure that the framework for funding decommissioning and waste management liabilities is clear and properly ensures that each nuclear operator meets its costs
- making use of the provisions of the Planning Bill to ensure that nuclear development projects are treated like other critical infrastructure projects and are dealt with effectively through the use of a National Policy Statement
- working to strengthen the EU Emissions Trading Scheme so that investors have confidence in a continuing carbon market when making decisions.

In addition, to give greater confidence to the public and to investors, we will work with the NII to explore ways of enhancing further the transparency and efficiency of the regulatory regime, without diminishing its effectiveness, in dealing with the challenges of new build.

This White Paper sets out the basis for our conclusion. It explains that we have a regulatory regime in the UK that can ensure that nuclear power remains safe and secure. We have made progress since 2003 towards a long-term solution to waste management. And we are confident that the new powers we are taking will ensure that industry will meet the full costs of decommissioning and their full share of waste management and disposal costs.

The Government has reached this decision in favour of allowing energy companies the option to invest in new nuclear power stations after careful thought and consideration of all the issues. Against the challenges of climate change and security of supply, I believe that the evidence in support of new nuclear power stations is compelling and that we should positively embrace the opportunity of delivering this important part of our energy policy.

A handwritten signature in black ink, appearing to read 'John Hutton', written in a cursive style.

January 2008



The Structure of this White Paper

This White Paper sets out the decision we have taken in response to the consultation on nuclear power. It also examines the key concerns that emerged through the different strands of our consultation: we identify these in the analysis of responses to our consultation¹. Further, it explains how we have addressed these issues in reaching our conclusion on nuclear power.

In Section 1 of this White Paper we summarise the consultation process which ran between May and October 2007². This process is explained in more detail in our analysis of inputs. In Section 2 we address in detail the key issues which arose from our consultation, and explain how we have taken them into account in shaping our policy, and reaching our conclusions. In Section 3 we set out the facilitative actions that the Government will take, as we have done for other generation technologies³, to reduce the regulatory and planning risks associated with investing in new nuclear power stations. Finally, there are three annexes:

- Annex A – Alternatives to Nuclear Power
- Annex B – Justification and Strategic Siting Assessment processes: this is the summary analysis of and formal response to the technical consultation which we ran concurrently with the main nuclear consultation
- Annex C – Regulatory and Advisory Structure for Nuclear Power.

Alongside this White Paper we are publishing on the BERR website:

- An analysis of consultation responses
- An Impact Assessment of our White Paper on Nuclear Power
- A flow diagram on UK energy supply and consumption which is relevant to the analysis contained in this White Paper of nuclear power and carbon dioxide emissions.

We have also published all written responses on our consultation website, except where individuals asked for their response to be treated as confidential⁴.

1 The Future of Nuclear Power, *Analysis of consultation responses*, URN 08/534, January 2008.

2 The Future of Nuclear Power, *The Role of Nuclear Power in a Low Carbon UK Economy, Consultation Document*, URN 07/970, May 2007.

3 For more details of all our energy policies see the Energy White Paper, *Meeting the Energy Challenge*, URN 07/1006, May 2007.

4 www.direct.gov.uk/nuclearpower2007

Overview

1. Following our consultation on the future of nuclear power⁵, the Government has reviewed the evidence and arguments referred to in the consultation document in the light of responses it received and in the light of any other evidence which has emerged. **The Government believes it is in the public interest that new nuclear power stations should have a role to play in this country's future energy mix alongside other low-carbon sources; that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to open up the way to the construction of new nuclear power stations. It will be for energy companies to fund, develop and build new nuclear power stations in the UK, including meeting the full costs of decommissioning and their full share of waste management costs.** This White Paper⁶ explains the basis for our decision, how we have considered responses to the consultation, and how we have taken them into account in framing our policy. We also explain in this White Paper what actions the Government will take to facilitate the construction of new nuclear power stations.
2. This White Paper constitutes the Government's formal response to the nuclear consultation, and the related technical consultations on the proposed Justification and Strategic Siting Assessment processes. A full report on all responses to the consultation is available in the Government's analysis of consultation responses⁷, which is being published simultaneously with this White Paper.

The Government's energy strategy

3. As explained in our consultation document, our decision and the steps we are taking will enable nuclear power to contribute to a low-carbon economy as part of our wider energy strategy.
4. In 2006⁸ the Government highlighted the challenges the UK faces in addressing climate change and ensuring security of energy supplies. In May 2007⁹ we set out a programme of action and a new international and domestic energy strategy to meet these challenges and deliver our four energy policy goals:
 - to put ourselves on a path to cutting the UK's man-made emissions of carbon dioxide (CO₂) – the main contributor to global warming – by some 60%¹⁰ by 2050, with real progress by 2020

5 The Future of Nuclear Power, *The Role of Nuclear Power in a Low Carbon UK Economy*, Consultation Document, URN 07/970, May 2007.

6 The Overview sets out the main conclusions and identifies specific concerns but it does not list them all. Sections 2 and 3 of the White Paper contain fuller details.

7 The Future of Nuclear Power, *Analysis of consultation responses*, URN 08/534, January 2008.

8 Energy Review, *The Energy Challenge*, July 2006.

9 Energy White Paper, *Meeting the Energy Challenge*, URN 07/1006, May 2007.

10 Compared to 1990. The Government is asking the new Committee on Climate Change to advise later this year on whether the target should be increased to 80%.



- to maintain the reliability of 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
 - to ensure that every home is adequately and affordably heated.
5. The fundamental principle of our energy policy is that competitive energy markets, with independent regulation, are the most cost-effective and efficient way of generating, distributing and supplying energy. In those markets, investment decisions are best made by the private sector and independent market regulation is essential to ensure that the markets function properly and in accordance with our wider social and environmental objectives, particularly tackling climate change. That is why we have taken action, both at home and internationally, to create a framework of incentives, rules and regulations that encourage energy saving and investment in low- carbon technologies.
6. We have strengthened our policy framework to underpin energy security and drive the reduction of CO₂ emissions through the proposals we set out in our White Paper last year¹¹, reinforced by the new approach to carbon budgeting set out in the Climate Change Bill¹². Our commitment to carbon budgeting and ensuring an effective carbon price signal will help us to meet our contribution to the EU's target for reducing greenhouse gas emissions by 2020. We shall continue to seek to influence the wider international community, notably in getting consensus on a post-2012 agreement to reduce emissions of greenhouse gases. The Energy White Paper¹³ also sets out the measures we are taking at home to enable us all to become more energy efficient and to increase the supply of energy from low-carbon sources. These measures include:
- strengthening the EU Emissions Trading Scheme (EU ETS) to build investor confidence in the long-term future of the carbon market
 - strengthening of the Renewables Obligation, increasing the Obligation to up to 20% and introducing banding
 - running a competition for a demonstrator project for Carbon Capture and Storage (CCS)
 - lowering planning barriers to the installation of domestic microgeneration of electricity
 - making it easier to find information and advice on distributed generation
 - a trial of "smart" meters to record energy use and enable consumers to manage their demand
 - raising building standards and the energy efficiency standards of the appliances we use in our homes and other buildings.
7. Furthermore, once agreement has been reached on each Member State's contribution to the EU 2020 renewable energy target¹⁴, we will bring forward appropriate measures, beyond those set out in the Energy White Paper, to increase the share of renewable energy in our mix by

11 Energy White Paper, *Meeting the Energy Challenge*, URN 07/1006, May 2007.

12 <http://www.defra.gov.uk/environment/climatechange/uk/legislation/index.htm>

13 Energy White Paper, *Meeting the Energy Challenge*, URN 07/1006, May 2007.

14 Spring European Council conclusions, 8/9 March 2007.

2020. In the meantime, the measures and market framework set out in the Energy White Paper allow us to make significant progress on this important agenda and we will continue to take binding measures through the Energy Bill.

8. We set out the Government's preliminary view on nuclear power in our Energy White Paper¹⁵. This explained how nuclear power related to our overall energy strategy. In particular, we highlighted the uncertainties we face in the availability and costs of the UK's energy supplies over the coming decades. We also need to respond to the challenges of climate change. These uncertainties relate to: future fossil fuel and carbon prices; how quickly we can achieve energy efficiency savings and the therefore likely levels of energy demand; the speed, direction and future economics of development of the renewables sector; and the technical feasibility of and costs associated with applying carbon capture and storage technologies to electricity generation on a commercial scale.
9. It is our view that, given these uncertainties, our energy strategy should be based on diversity and flexibility in the energy mix and has accordingly developed policies which keep open the widest possible range of low-carbon generating options. These options would include renewables and the use of gas and coal with CCS, as well as nuclear. Unnecessarily ruling out one of these options would, in our view, increase the risk that we would be unable to meet our climate change and energy security objectives.
10. At the Spring European Council in March 2007, an EU energy action plan was agreed underpinned by a number of ambitious climate and energy targets for 2020¹⁶. These included unilateral targets¹⁷ to reduce EU greenhouse gas emissions by 20%, rising to 30% in the context of a post-2012 international agreement; a target of 20% of the EU's energy to come from renewable sources; and a target to increase energy efficiency by 20%. The Council also underlined the central role of the EU ETS in meeting the target to reduce emissions. The Commission is expected to announce detailed proposals for meeting the renewables and emissions targets and on the future of the EU ETS in early 2008.
11. The Climate Change Bill is aimed at putting into legislation CO₂ reduction targets of 26-32% by 2020 and at least 60% by 2050. Cutting UK CO₂ emissions by 60% by 2050 will require extensive changes at all levels in the UK's energy system: in electricity generation and transmission; in energy storage and efficiency. To increase the likelihood that we will meet these targets, and meet them in the most cost-effective way, we need to make significant improvements in energy efficiency and develop a wide range of low-carbon and energy efficiency technologies including renewables and CCS.

15 Energy White Paper, *Meeting the Energy Challenge*, URN 07/1006, May 2007.

16 Spring European Council conclusions, 8/9 March 2007.

17 Compared to 1990.



12. Developments such as these will have implications for all non-renewable technologies in the UK. In a rapidly changing world, the ambitious reduction targets for 2050 and beyond, which may need to be tightened rather than relaxed in the future, place emphasis on the need to minimise the risk of failing to meet the target and reducing the costs of doing so through having as many options available as possible. Furthermore, an increasing role for electricity, and an expanded grid, for example in the context of de-carbonising and electrifying our transport or heating systems, could actually lead to an increasing demand for all forms of low-carbon electricity, including nuclear power. Hence, the Government's view is that none of these policy developments constitutes a reason to deny energy companies the option of investing in new nuclear power stations.

Why decisions on nuclear power are needed now

13. As we explained in our consultation document¹⁸, energy companies will need to build around 30-35 GW of new electricity generating capacity over the next two decades. They will have to make around two-thirds of this investment by 2020. So investment decisions made in the next few years will affect our electricity generation infrastructure for decades to come.
14. Of the 22 GW of capacity that is likely to close over the next two decades, just over a half is from carbon intensive fossil-fuel generation and about 10 GW is from nuclear power and therefore low-carbon. Companies' decisions on the type of power stations they invest in to replace this capacity will have significant implications for the level of future carbon dioxide emissions particularly beyond 2020. Currently, nuclear power provides approximately 19%¹⁹ of our electricity generation and 7.5% of total UK energy supplies²⁰ and 3.5% of total UK energy use²¹. Without our existing nuclear power stations, UK total annual carbon dioxide emissions from all energy use would be 5-12% higher than they are today if gas or coal power stations had been built instead²². A saving of 5% in our CO₂ emissions²³ is, for illustrative purposes, about the same as taking a third of the UK's 32 million cars off the road. However, based on published lifetimes, most of the existing nuclear power stations are due to close in the next two decades. Although life extensions are possible, they are not guaranteed. This adds urgency to the need to take vigorous action on many fronts if we are to achieve a low-carbon energy mix and secure energy supplies.

18 The Future of Nuclear Power, *The Role of Nuclear Power in a Low Carbon UK Economy*, Consultation Document, URN 07/970, May 2007.

19 The May 2007 consultation document stated that nuclear power accounted for around 18% of electricity, based on the latest energy statistics available at that time. The most recent published data now available, in the Digest of United Kingdom Energy Statistics 2007, shows that in 2006 nuclear power accounted for 19% of the electricity generated in the UK.

20 This figure is the total amount of fuel used to generate electricity taken as part of total energy supplies. This issue is further discussed in Section 2.

21 See the simplified flow diagram of UK energy supply and consumption 2006 showing the role of nuclear at <http://www.berr.gov.uk/files/file43008.pdf>.

22 Sustainable Development Commission, *The Role of Nuclear Power in a Low Carbon Economy, Paper 2: Reducing CO₂ emissions – Nuclear and the Alternatives*, March 2006.

23 5% of our CO₂ emissions equals 29Mt CO₂.

15. It takes a long time to plan and build nuclear power stations. This means that new nuclear generation can make only a limited contribution before 2020. We will need other technologies (e.g. gas, renewables and coal) in this period. But we will need new capacity beyond 2020. To meet our 2050 CO₂ reduction target, our view is the answer lies in having a diverse and flexible energy mix and a framework which opens up, rather than closes down, low-CO₂ options.
16. Since the decision to keep open the question of nuclear power was taken in 2003²⁴ we have:
 - seen increasing evidence of climate change and wider international recognition of the need for global action
 - observed significant changes in the economics of nuclear power relative to other electricity generation technologies, driven by greater than expected increases in fossil fuel prices, and the introduction of a market price for CO₂ which requires investors to take account of the cost of CO₂ emissions in their investment decisions. Both factors increase the relative costs of fossil fuel electricity generation
 - developed the belief, based on scientific consensus and experience from abroad, that geological disposal will provide a technically possible means of disposing of radioactive waste
 - established the independent Committee on Radioactive Waste Management (CoRWM), whose main recommendations on the best means of managing existing higher activity radioactive waste were accepted by the Government
 - re-constituted CoRWM to provide scrutiny and advice on the implementation of waste management policy
 - established the Nuclear Decommissioning Authority (NDA) with expertise in waste management
 - consulted on a framework for implementing long-term waste disposal in a geological disposal facility through the Managing Radioactive Waste Safely consultation (MRWS)
 - seen a number of energy companies expressing a strong interest in investing in new nuclear power stations globally and in the UK.

Main themes in the consultation

17. The nuclear consultation showed support for the Government's preliminary view, but it also revealed a number of important concerns. A majority of people agreed that nuclear was acceptable in principle, but wanted to be satisfied that their concerns were adequately addressed. Our accompanying analysis document details these issues²⁵. People were concerned about a number of key issues. These include the need to combat climate change and ensure secure energy supplies, and the adequacy of protection in the areas of safety, environmental release of radioactivity and security. The management of radioactive waste, particularly the need to make progress towards a long-term solution was raised by many respondents. Others questioned the appropriateness of relying on energy companies for the construction,

24 For more details of all our energy policies see the Energy White Paper, *Meeting the Energy Challenge*, URN 07/1006, May 2007.

25 *The Future of Nuclear Power, Analysis of consultation responses*, URN 08/534, January 2008.



operation and decommissioning of nuclear power stations. Others were concerned about the risk that cost over-runs in construction, waste management and decommissioning will undermine the economic case for nuclear and could lead to costs falling to the Government. It was suggested that investment in nuclear will “crowd out” investment in alternative technologies, particularly renewables. It was argued that the contribution nuclear makes to the UK’s overall energy mix is currently quite small, calling into question the materiality of any contribution nuclear might make in the future to tackling climate change and ensuring secure energy supplies. Some argued that there are better alternatives to nuclear power which would enable us to achieve our energy policy goals and the need for a greater focus on measures to save energy. Among those supporting nuclear power, there was a concern about what was perceived as a growing skills gap in the nuclear industry. The responses by the Scottish Executive and the Welsh Assembly to the consultation are covered in Section 2.

18. We have considered these issues very carefully and this White Paper explains how we have taken them into account²⁶.

Nuclear power – the issues

19. In our consultation document²⁷ we first set out the context for our energy policy, as it relates to climate change and energy security. We said that in reaching our preliminary view, we had considered a number of issues relating to nuclear power, and that the consultation document set out the information and evidence that the Government had considered in reaching its preliminary view. We asked 18 specific questions designed to probe our assessment of the evidence relating to each of those issues. Following the consultation, we have reviewed the evidence and arguments referred to in the consultation document in the light of responses we received and in the light of any other evidence which has emerged. We summarise below our assessment of the inputs to the consultation²⁸ on each of the issues considered in the consultation document. We then set out our response and the basis for our conclusion that energy companies should be allowed the option of investing in new nuclear power stations. In reaching that conclusion we have taken account of the conclusions reached in relation to specific issues. However, we should emphasise that in reaching our decision we have considered the issues in the round and have given greater weight to some issues than others. Section 2 of this White Paper sets out our analysis of consultation inputs and our responses in greater detail.

26 The issues are addressed under each of the questions we asked in our consultation document.

27 The Future of Nuclear Power, *The Role of Nuclear Power in a Low Carbon UK Economy, Consultation Document*, URN 07/970, May 2007.

28 See The Future of Nuclear Power, *Analysis of consultation responses*, URN 08/534, January 2008 for more details.

Climate change and energy security

20. Climate change and energy security are the two greatest energy challenges we face. Tackling these twin challenges must be the focus of our energy policy. Climate change will have far reaching consequences for the UK and the rest of the world. The growing scientific consensus points to the need for urgent action to reduce carbon dioxide emissions. The Stern Review of the Economics of Climate Change is one of the many influential studies that highlight the economic costs of failing to tackle climate change²⁹.
21. The future pattern of energy supply and demand points to a growing mismatch between the regions where energy is needed and those where natural resources are located. The UK has historically met most of its energy needs from domestic sources. In the past, we did this with coal and more recently with oil and gas from the North Sea. However, as production from the North Sea declines, we will become more reliant on supplies of oil and gas from regions which include less stable parts of the world, and at a time of rising demand and prices. At the same time, almost a third of our coal fired power stations are likely to close for a variety of reasons, including environmental legislation³⁰, and by 2023, based on their published lifetimes, all but one of our nuclear power stations will have closed.
22. We believe there is a compelling case for action to meet these twin challenges. Our international and climate change strategy for meeting the challenges is built around four main elements:
 - promoting open, competitive energy markets in the UK and abroad
 - taking action to put a value on carbon dioxide emissions
 - promoting investment to accelerate the deployment of low-carbon energy technologies
 - putting in place policies to improve energy efficiency.
23. We set out further details of our strategy in our Energy White Paper in May 2007³¹. However, we are clear that energy efficiency and renewable technologies on their own will not be enough to meet the twin challenges of climate change and energy security.
24. Among those who took part in our consultation there was clear recognition and support for our strategy. There was also concern about the need for concerted international action on climate change. The Government fully appreciates the importance of an international response to climate change. Action in the UK alone will have a limited direct impact on global greenhouse gas emissions. It is therefore important that we use UK success in cost-effective delivery of ambitious targets as part of a concerted campaign to secure international action. The UK will, through the EU and bilaterally, use its influence to encourage the United States of America, China, India and others to engage actively in a global effort to reduce greenhouse gas

29 The Stern Review, *The Economics of Climate Change*, October 2006.

30 Directive 2001/80/EC of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants (O.J. L309/1, 27.11.2007).

31 Energy White Paper, *Meeting the Energy Challenge*, URN 07/1006, May 2007.



emissions. We also acknowledge concerns raised about our increasing reliance on imported fuel. We are confident that the measures set out in our Energy White Paper and this White Paper will ensure our future energy security.

Our conclusion

Without a clean, secure and sufficient supply of energy we would not be able to function as an economy or as a modern society. Climate change represents a significant risk to global ecosystems, the world economy and human populations. The scientific evidence is compelling that human activities are changing the world's climate. Nuclear power represents a low-carbon form of electricity generation. The majority of the UK's nuclear power stations are due to close over the next two decades. Over the same period, the UK will become increasingly reliant on imports of oil and gas, and at a time of rising global demand and prices, and when energy supplies are becoming more politicised. So in delivering the energy we need to support our economy and our society, we face two major challenges: climate change and energy security.

As the Government stated in its consultation document, the aim of Government should be to continue to raise living standards and the quality of life by growing our economy, while at the same time using every unit of energy as efficiently as possible. We also need to transform the way we produce the energy we need for light, heat and mobility. The Government has reviewed the arguments and evidence put forward, and continues to regard climate change and the security of energy supplies as critical challenges for the UK. They require significant and urgent action and a sustained strategy between now and 2050.

Nuclear power and carbon emissions

25. Analysing CO₂ emissions throughout the lifecycle of nuclear power stations, including the studies referred to in the consultation document and considering the reasons why there are differences between studies, has enabled the Government to be confident in confirming its preliminary view that nuclear power is a low-carbon form of electricity generation that can make a significant contribution to tackling climate change. Our estimates³² of lifecycle CO₂ emissions from nuclear power are conservative, prudent and defensible. Ruling out nuclear as a low-carbon energy option would significantly increase the risk that the UK would fail to meet its CO₂ reduction targets because we would be placing greater reliance on fewer technologies, some of which have yet to be proven on a commercial scale.
26. Some respondents to the consultation expressed concerns that nuclear power can make only a small contribution to reducing our CO₂ emissions. It is not the Government's position that nuclear power alone

32 Life-cycle Assessment, *Vattenfall's Electricity in Sweden*, January 2005; OECD/IAEA, *Uranium 2005: Resources, Production and Demand*, June 2006; and British Energy, Technical Report, *Environmental Product Declaration of Electricity from Torness Nuclear Power Station*, May 2005.

is the answer to meeting our emissions targets. Rather, vigorous action is required on a range of fronts, covering both supply and demand. Our analysis shows that excluding new nuclear power stations from the energy mix increases both the costs of meeting long-term emissions targets and the risks that we will not meet them. We estimate that existing nuclear power stations save between 5-12% of the UK's total CO₂ emissions. Nuclear power can and does make a material contribution to meeting targets. We conclude that it would not make sense to forego its potential for continuing to contribute in the future merely on the grounds that it cannot on its own completely solve the challenge of meeting emissions targets.

Our conclusion

After reviewing the arguments and evidence put forward, the Government is satisfied that, throughout their lifecycle, the CO₂ emissions from nuclear power stations are low. On reasonable assumptions, these emissions are about the same as those of wind generated electricity, and are significantly lower than emissions from fossil-fuelled generation. The Government therefore concludes that new nuclear power stations could make a material contribution to tackling climate change. However, it also believes that such a contribution needs to be part of a wider strategy to cut emissions.

Security of supply benefits

27. The Government believes that increasing the number of generating technologies available would increase the diversity and reliability of our electricity generating mix. Diversity of energy sources can help to reduce our dependence on gas as reserves fall in the North Sea and reduce the impact on the UK should prices for fossil fuels rise globally. Nuclear power is a proven and reliable form of electricity generation world-wide. It is therefore important in maintaining our energy supplies. Conversely, without nuclear power, the UK would depend on fewer technologies which could expose us to greater risks to the security of our energy supplies.
28. We acknowledge that uranium for new nuclear power stations needs to be imported but sources of uranium are diverse and secure. Currently nineteen countries produce uranium. For the most part, the UK obtains its uranium from Australia. While existing global uranium reserves are expected to last at least 85 years at current extraction rates, several responses to our consultation pointed out that there is inevitably some uncertainty over how long reserves of uranium will last, given both the uncertainty in the extent of future global deployment of nuclear power and the possible lack of commercial incentives to prove new reserves. Uncertainty over future fuel sources is not unique to uranium – for example at current production rates, global oil reserves are projected to last 40 years. However, we conclude that this uncertainty is not such as to undermine the significant contribution to energy security that arises from having diverse energy supplies, including nuclear power.



Our conclusion

Having reviewed the arguments and evidence put forward, the Government concludes that allowing energy companies the option of investing in new nuclear power stations would help the UK to maintain a diverse mix of electricity generating technologies with the flexibility to respond to future developments that we cannot yet envisage. Allowing energy companies the option of investing would therefore make an important contribution to the security of our energy supplies.

Economics of nuclear power

29. Based on a range of scenarios, we have concluded that nuclear power is likely to be cost-competitive with other sources of electricity in most scenarios and particularly where there is a price put on CO₂ emissions. Even on cautious assumptions, the cost of nuclear energy compares favourably with other low-carbon electricity sources, although, in due course, it will be for energy companies to make investment decisions based on their analysis of the economics.
30. A number of concerns were raised in the consultation about the prospect of cost overruns, and uncertainty over the cost of capital. We acknowledge that major capital projects entail financial risk. Whether nuclear provides sufficiently attractive returns given its financing characteristics is a matter that investors will determine. It is ultimately for energy companies to make a judgement about the economics of nuclear power. However, on the basis of our cost-benefit analysis, we think that nuclear power is likely to be an attractive economic proposition to them.
31. In the light of points made in the consultation, we have re-examined carefully the basis of the cost-benefit analysis which we published alongside the consultation document. We have reviewed discount rates, decommissioning and waste management costs and insurance rates. We have cross checked our analyses against the concerns raised by people contributing to the consultation. Having carried out this analysis, which we detail in Section 2, we feel confident in reasserting our view that the economics of nuclear remain attractive, both from the standpoint of the potential investor and of the wider economy as a whole.
32. The Government recognises the importance of a clear carbon price framework for all low-carbon technologies, including nuclear power. We believe this is best achieved through the EU and internationally. We will therefore continue to work to strengthen the EU ETS to build investor confidence in the existence of a long-term multilateral carbon price signal. We will also keep open the option of further measures to reinforce the operation of the EU ETS in the UK should this be necessary to provide greater certainty for investors.

Our conclusion

We have reviewed the arguments and evidence put forward, and based on the conservative analysis of the economics of nuclear power, the Government concludes that, under the most likely scenarios for gas and carbon prices, nuclear power would yield economic benefits to the UK in terms of reduced emissions of CO₂ and improved security of supply. It is for investors to determine whether the financing characteristics of nuclear power provide sufficiently attractive returns. However, on the basis of our cost-benefit analysis, we believe that nuclear power is likely to be an attractive economic proposition to them.

The Government is committed to working to strengthen the EU's Emissions Trading Scheme (EU ETS) and to building investor confidence in a long-term multilateral carbon price signal. We will keep open the option of introducing further measures to reinforce the operation of the EU ETS in the UK should this be necessary to provide greater certainty for investors.

The value of having low-carbon electricity generation: nuclear power and the alternatives

33. It is difficult to predict how energy supply and demand and the electricity generation mix will develop over the very long term. The factors which contribute to this uncertainty include:
- growth in energy demand
 - the cost and availability of fossil fuels, and
 - the cost and availability of emerging low-carbon technologies.
34. The economic modelling we carried out for the Energy White Paper³³ and our consultation³⁴ indicates that if we excluded nuclear as an option, meeting our carbon dioxide emissions reduction targets would be more expensive. We also observed that, without new nuclear power to deliver a low-carbon economy by 2050, we would have to place even greater reliance on some technologies that are as yet unproven technically and commercially. Our preliminary view was therefore that giving energy companies the option of investing in new nuclear power stations lowers the costs and risk associated with achieving our energy goals of tackling climate change and ensuring energy security.
35. In the light of concerns raised in several inputs to our consultation, we have considered the argument that new nuclear capacity could harm the prospects for other low-carbon technologies. Our expectation is that if we are to meet our long-term targets for CO₂, this will mean that both nuclear and renewable technologies could have a significant share of the market, together with fossil fuel generation coupled with CCS (assuming that CCS proves to be a viable technology). We have also continued to examine the impact of not allowing energy companies the

³³ Energy White Paper, *Meeting the Energy Challenge*, URN 07/1006, May 2007.

³⁴ The Future of Nuclear Power, *The Role of Nuclear Power in a Low Carbon UK Economy, Consultation Document*, URN 07/970, May 2007.



option to invest in new nuclear power stations³⁵. Our detailed analysis (see Annex A) of the implications of going forward without nuclear power as an option, brings us to a number of conclusions:

- Reliance on single solutions for electricity supply will not allow us to meet our goals. The more diverse the range of options, the better placed the UK will be to deal with the possible futures that could unfold
- All sectors of the economy will need to contribute in the effort to reduce CO₂ emissions
- Without nuclear power as an option, it would take a greater effort to reduce emissions through more costly options both within and outside of the electricity generation sector; and we will have to rely on generation technologies, some of which, such as CCS, are as yet unproven on a commercial scale and which together have a less diverse set of characteristics
- Large changes would be needed in the electricity system in terms of the scale of new capacity needed: the EU 2020 Renewables targets will mean rapid deployment of renewable technologies in the medium term and learning how to maintain security of supply with large penetrations of wind and other intermittent renewable technologies, most likely through considerable investment in backup capacity. The overall challenges of delivering secure electricity supplies, while making the transition to the low-carbon economy, would be magnified over the long-term in the absence of a dependable low-carbon technology such as nuclear power. This would be particularly significant should safe and reliable CCS for power generation not be proven or deployed on a significant scale at reasonable costs.

36. In our analysis at Annex A we comment on the positive contribution of energy efficiency measures to reducing demand and hence carbon dioxide emissions as well as recognising the value in having decentralised electricity generation. However, we do not believe that these alone will be sufficient to achieve energy security.

Our conclusion

Having reviewed the arguments and evidence put forward, the Government believes that giving energy companies the option to invest in new nuclear power stations reduces the costs and risks associated with tackling climate change and ensuring energy security. Nuclear power needs to be part of an overall approach to electricity generation. We will also take further steps to support renewables, Carbon Capture and Storage and Distributed Generation as outlined in the Energy White Paper and implemented through the Energy Bill.

³⁵ Annex A is a continuation of the analysis set out in Chapter 5 of our consultation document – The Future of Nuclear Power, *The Role of Nuclear Power in a Low Carbon UK Economy, Consultation Document*, URN 07/970, May 2007.

Safety and security of nuclear power

37. The safety and security of nuclear power is of paramount concern and we have an effective regulatory framework in place to ensure that these risks are effectively managed and minimised.
38. The consultation process and the deliberative events showed public concern about safety and security. There are risks, but we consider these are very low and that our regulatory arrangements address those risks. We accept that safety and security in relation to nuclear materials must be paramount and that our regulatory arrangements must ensure that this remains the case in all circumstances. Having reviewed the arguments and evidence put forward in the consultation and responses to it, the Government is satisfied that new nuclear reactors can be managed as effectively as existing nuclear power stations. Indeed, the evidence is that new nuclear reactors are designed to be safer than those currently operating. Our regulatory arrangements are effective and proportionate, and we need to strive to ensure they remain so. In Section 2 of this White Paper we show how, in forming our conclusions, we have taken into account the concerns which have been raised about safety, security and health impacts, as well as threats from terrorism.
39. To ensure that the UK's regulatory regime can deal effectively with new and existing nuclear facilities, we have authorised the Health and Safety Executive (HSE) to increase the salary levels of its nuclear inspectors to ensure that it can recruit staff of the necessary calibre. We will work with the independent regulators to build on these developments by exploring ways of enhancing further the transparency and efficiency of the regulatory regime, without diminishing its effectiveness, in dealing with the challenges of new nuclear power stations.

Our conclusion

Having reviewed the arguments and evidence put forward, and based on the advice of the independent regulators, and the advances in the designs of power stations that might be proposed by energy companies, the Government continues to believe that new nuclear power stations would pose very small risks to safety, security, health and proliferation. We also believe that the UK has an effective regulatory framework that ensures that these risks are minimised and sensibly managed by industry.

Transport of nuclear materials

40. The transport of nuclear materials carries with it some small risks to safety and security. However, these risks are well understood and the UK can draw on several decades of experience in managing them effectively.



41. Concerns were raised during the consultation about the ability of containers used in transit to withstand accidents or about the possibility that material in transit could be accessed by terrorists. Regular safety evaluations by the International Atomic Energy Agency (IAEA) and the European Commission ensure that nuclear transport procedures continually evolve to reflect the latest technological and scientific best practice. The Government continues to believe, therefore, that the risks of transporting nuclear materials are very small and that there is an effective regulatory framework in place for managing and mitigating those risks.

Our conclusion

Having reviewed the arguments and evidence put forward, and given the safety record for the transport of nuclear materials and the strict safety and security regulatory framework in place, the Government believes that the risks of transporting nuclear materials are very small and there is an effective regulatory framework in place that ensures that these risks are minimised and sensibly managed by industry. The Government believes that this is not a reason not to allow energy companies to invest in new nuclear power stations.

Waste and decommissioning

42. In our consultation document, we set out the Government's preliminary conclusion on waste and decommissioning:

"The Government believes that new waste could technically be disposed of in a geological repository and that this would be the best solution for managing waste from any new nuclear power stations. The Government considers that waste should be stored in safe and secure interim storage facilities prior to a geological repository becoming available. We consider that it would be desirable to dispose of both new and legacy waste in the same repository facilities and that this should be explored through the MRWS process"³⁶.

43. The importance of securing effective long-term management of nuclear waste was a recurring theme in the consultation. The Government accepts that progress towards this must be a priority. It is essential that we deal with the significant quantity of legacy waste from past nuclear activities. However, we recognise that it is also essential to ensure there are safe and robust arrangements for dealing with new waste and spent fuel.
44. Following the work carried out by CoRWM, the Government's policy is that geological disposal, coupled with safe and secure interim storage, is the way forward for managing legacy waste³⁷. There should be an orderly and progressive approach to locating, developing and

³⁶ The Future of Nuclear Power, *The Role of Nuclear Power in a Low Carbon UK Economy, Consultation Document*, URN 07/970, May 2007.

³⁷ Higher activity waste which includes ILW, HLW and could include spent fuel.

commissioning a geological disposal facility. Government also accepted CoRWM's recommendation that the process should be staged so as to incorporate a series of decision points. This will allow the programme and progress to be kept under review, including on cost and value for money grounds. As we made clear in the Managing Radioactive Waste Safely (MRWS) consultation,³⁸ we are committed to making further progress on delivering a long-term waste management solution through the MRWS programme. The Government's view of geological disposal, in light of the outcome of that consultation³⁹, is set out in Box 1.

45. In the consultation on the future of nuclear power, the Government set out its preliminary view that new waste could technically be disposed of in a geological disposal facility and that this would be the best way to manage waste from new nuclear power stations. The Government also set out its view that waste should be stored in safe and secure interim storage facilities prior to a geological disposal facility becoming available. The consultation document also stated that it would be technically possible and desirable to dispose of both new and legacy waste in the same repository facilities and that this should be explored through the MRWS process.
46. The consultation provided some support for the Government's preliminary view that geological disposal would be the best solution for managing new build as well as legacy waste. But many people felt that we had made insufficient progress towards a permanent solution for existing waste. Their view was that there should be further progress before energy companies should be allowed to invest in new nuclear power stations.
47. Having taken account of the inputs to the consultation, we continue to believe that geological disposal would provide a technically possible way of disposing of existing and new radioactive waste. We have also concluded that it would be technically possible and desirable to dispose of both new and legacy waste in the same geological disposal facilities and that this should be explored through the MRWS process.
48. We are also satisfied that there are feasible mechanisms for identifying a suitable site for a geological disposal facility, through the MRWS programme. We recognise that it will be many years before a geological disposal facility could be completed. We are satisfied that interim storage will provide an extendable, safe and secure means to hold waste for as long as it takes to identify a site for, and to construct a geological disposal facility.
49. We have considered carefully whether it is right to allow operators to build new nuclear power stations before a geological disposal facility to take the waste arising from them is constructed. In practice, this will be many years in the future, so waiting for the completion of a geological disposal facility would prevent nuclear power from contributing to the new electricity generating capacity that we will need over the next 20 years as existing power stations, nuclear and fossil fuelled, reach the

³⁸ Managing Radioactive Waste Safely, *A Framework for Implementing Geological Disposal*, 25 June 2007.

³⁹ Managing Radioactive Waste Safely, *A Framework for Implementing Geological Disposal*, 25 June 2007.



end of their lives. Given the ability of interim stores to hold waste safely and securely, if necessary, for very long periods, we are satisfied that it is reasonable to proceed with allowing energy companies the option of investing in new nuclear power stations in advance of a geological disposal facility being available. On this basis we believe that it is right to confirm our preliminary view on the handling of waste from new nuclear power stations.

50. Box 1 sets out the Government's statement on the MRWS process and geological disposal.

BOX 1: GOVERNMENT STATEMENT ON THE MRWS PROCESS AND GEOLOGICAL DISPOSAL

- In October 2006, the Government⁴⁰ accepted the recommendation of the independent Committee on Radioactive Waste Management (CoRWM) that geological disposal was the best available approach to the long-term management of the UK's higher activity radioactive waste.
- CoRWM's recommendations followed more than two and a half years' work assessing all of the available options on the basis of a wide programme of engagement with the expert community, stakeholder groups and the public.
- CoRWM also recommended that progress towards geological disposal should be coupled with a robust programme of safe and secure interim storage. Again the Government accepted the Committee's recommendation saying that:

"The design of new stores will allow for a period of interim storage of at least 100 years to cover uncertainties associated with the implementation of a geological repository. The replacement of stores will be avoided wherever possible, but the NDA will ensure that its strategy allows for a safe and secure storage of the waste contained within them for a period of at least 100 years".

- Delivery of these commitments by the Government and the Nuclear Decommissioning Authority (and its agents) will be supported by research and development programmes. Where appropriate, international programmes and experience will be drawn on. It is clear that geological disposal is the internationally preferred option for the long-term management of higher activity radioactive waste. There has been extensive progress towards delivery of geological disposal solutions internationally in recent decades. Within the next one or two decades, overseas geological disposal facilities are likely to become operational for spent fuel, in addition to the facilities that already exist for Intermediate Level Waste (ILW) and Low Level Waste (LLW).
- The Government also said in its response to CoRWM that it would explore the concept of voluntarism and partnership arrangements in delivery of geological disposal of the UK's higher activity radioactive waste. We set out proposals for doing this, and asked for people's views on the issue more widely in the June 2007 consultation document "Managing Radioactive Waste Safely: a Framework of Implementing Geological Disposal".

40 *Response to the Report and Recommendations from the Committee on Radioactive Waste Management (CoRWM).*

- This consultation closed on 2 November 2007. An analysis and summary of the responses has been published⁴¹. Overall there was general agreement with the Government's proposals, including that of seeking a voluntarism and partnership approach, although many detailed points were made.
- Following on from CoRWM's recommendation (in relation to existing waste), international opinion and in line with the MRWS consultation, the Government continues to see geological disposal as the way forward for the long-term management of the UK's higher activity waste.

51. Having recently completed the MRWS consultation on a framework for implementing geological disposal and the principles of voluntarism and partnership, the Government is satisfied that nothing has emerged which casts doubt on the feasibility of a geological disposal facility for new and legacy wastes. Through the MRWS programme we have the strategy and direction to deliver safe solutions for the management of the UK's new and legacy higher activity wastes. We are satisfied that this provides a feasible mechanism for identifying a suitable site for a geological disposal facility.
52. As we have said, the Government is satisfied that waste can be stored safely and securely on an interim basis for as long as it takes to complete a geological disposal facility. The Nuclear Decommissioning Authority (NDA), the implementing body for a geological disposal facility, is continuing research and development on waste management. The NDA is also carrying out a UK-wide review of interim waste storage provision to ensure that the Government policy of robust interim storage can be implemented until a geological disposal facility is available. Section 3 of this White Paper sets out that operators of new nuclear power stations will be required to pay for and ensure that interim storage is available for waste until we expect a geological disposal facility to be in a position to accept waste from new nuclear power stations and beyond that date to provide adequate contingency.
53. As set out in the consultation on *The Future of Nuclear Power*⁴², on 26 March 2007 the Government announced an update of its policy for low level waste (LLW) management⁴³. Under the new policy, the NDA is now responsible for developing and maintaining a national strategy for handling LLW from nuclear sites and for ensuring continued provision of the waste management and disposal facilities required. The LLW strategy that the NDA develops will be reflected in its annual plans and strategy document in due course, and which will be subject to public consultation.
54. The Government will put in place a framework through the Energy Bill to ensure that energy companies set aside sufficient funds to cover their decommissioning costs and their full share of waste management costs in a secure way. Further detail is set out in Section 3 of this White Paper.

41 *Summary and Analysis of Responses to the Consultation on Managing Radioactive Waste Safely; A Strategy for Implementing Geological Disposal*, January 2008.

42 *The Future of Nuclear Power, The Role of Nuclear Power in a Low Carbon UK Economy, Consultation Document*, URN 07/970, May 2007.

43 *Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom*, 26 March 2007.



55. In our consultation, we set out the Government's preliminary view on the ethical issues around whether to create new nuclear waste:

"There are also important ethical issues to consider around whether to create new nuclear waste, including the ethical implications of not allowing nuclear power to play a role, and the risks of failing to meet long-term carbon emissions targets. The Government has taken a preliminary view that the balance of ethical considerations does not require ruling out the option of new nuclear power. However, we intend that these ethical issues should be considered through this consultation document and respondents are invited to give their views."

56. The consultation set out to consider the ethical issues around whether to create new nuclear waste. The consultation also considered the ethical implications of not allowing nuclear power to play a role, and the risks of failing to meet long-term carbon emissions targets. Whilst the Government accepts that creating new waste raises ethical issues, we also agree with those who believe that nuclear power provides significant benefits for future generations as a low-carbon form of electricity generation and one that secures our energy supplies. On balance, we believe that not taking action now on climate change, by allowing energy companies to invest in new nuclear power stations, raises more significant inter-generational challenges in terms of climate change related CO₂ and on-going security of energy supplies, than does the management of radioactive waste. Thus the Government concludes that the balance of ethical considerations does not warrant ruling out the option of new nuclear power stations.

Our conclusion

Having reviewed the arguments and evidence put forward, the Government believes that it is technically possible to dispose of new higher-activity radioactive waste in a geological disposal facility and that this would be a viable solution and the right approach for managing waste from any new nuclear power stations. The Government considers that it would be technically possible and desirable to dispose of both new and legacy waste in the same geological disposal facilities and that this should be explored through the Managing Radioactive Waste Safely programme. The Government considers that waste can and should be stored in safe and secure interim storage facilities until a geological facility becomes available.

Our policy is that before development consents for new nuclear power stations are granted, the Government will need to be satisfied that effective arrangements exist or will exist to manage and dispose of the waste they will produce.

The Government also believes that the balance of ethical considerations does not rule out the option of new nuclear power stations.

Nuclear power and the environment

57. In our consultation document we examined the environmental impacts that arise at different stages of the nuclear life cycle covering landscape and construction; water use and thermal discharge; mining and milling of uranium ore; and preparation of fuel for nuclear power. We also acknowledged that the most significant environmental challenge of nuclear energy lay in the management of radioactive waste produced by nuclear power stations. Waste management is discussed above and in Section 2 of this White Paper.
58. We recognise and appreciate the concerns raised about the potential for accidents and their environmental consequences and about the environmental impact of uranium mining. We also acknowledge concerns related to the proposed reforms to the planning system, which echo responses to the Planning White Paper that the changes might remove the rights of local people in decisions on nationally significant infrastructure projects. Points were also made in response to the consultation about the landscape impacts of nuclear power stations in comparison to fossil fuel power stations and wind farms. These also noted that the land take of an on-shore wind farm can be much greater than a nuclear power station. We remain satisfied that stringent regulation here and overseas (where uranium is mined) provides adequate environmental safeguards to assess and mitigate the impacts. The Government has also undertaken to safeguard the engagement and consultation with communities affected by planning proposals in the Planning Bill. We will also carry out a Strategic Environmental Assessment (SEA), as part of the Strategic Siting Assessment (SSA).

Our conclusion

Having reviewed the arguments and evidence put forward, the Government believes that (with the exception of the waste issue discussed above) the environmental impacts of new nuclear power stations would not be significantly different to those of other forms of electricity generation and that they are manageable, given the requirements in place in the UK and Europe to assess and mitigate the impacts. Therefore, the Government believes that environmental impacts do not provide a reason not to allow energy companies the option of investing in new nuclear power stations.

In confirming the Government's view that it is in the public interest to allow energy companies the option of investing in new nuclear power stations, we propose to undertake a Strategic Environmental Assessment as part of a Strategic Siting Assessment.

The supply of nuclear fuel

59. The UK currently relies on imports of uranium (mostly from Australia) for its existing nuclear power stations, although the NDA does own around 51,000 tonnes of uranium, which could be converted into



uranium based fuel or could be combined with the UK's 86.5 tonnes of plutonium and used to make Mixed Oxide Fuel. A recent report⁴⁴, commissioned for the NDA, estimates that the UK stocks of uranium and plutonium could fuel up to three 1000-MW reactors for 60 years.

60. There continues to be a lot of focus on increases in the price of uranium and speculation that uranium resources may not be sufficient to meet growing world demand. Backed up by a number of authoritative reports⁴⁵ including one from the Inter-Governmental Panel on Climate Change⁴⁶, the evidence shows that sufficient fuel will be available to fuel a new programme of nuclear power stations constructed in the UK. Furthermore, since the price of nuclear fuel represents a much smaller part of the cost of electricity than for other technologies, even significant price increases would have only a limited effect on overall generating costs.
61. More generally, the Government's view is that the developers of new power stations will bear the risks around uranium price and availability and make a judgement about the economic impacts this has on their investment appraisal.

Our conclusion

Having reviewed the arguments and information put forward, and based on the significant evidence that there are sufficient high-grade uranium ores available to meet future global demand, and the relatively small impact that allowing energy companies to invest in new nuclear power stations in the UK would have on global demand for uranium, the Government believes that there should be sufficient reserves to fuel any new nuclear power stations constructed in the UK.

Supply chain and skills capacity

62. The supply of key components and skills is material in considering how new nuclear power stations might be built in the UK. The Government has acknowledged (in our consultation document and in this White Paper – see Section 2) that the supply of both skilled people and equipment will be constrained at times and that action is required, in particular, to retain skills and train a new workforce. This is not simply a UK or nuclear issue: similar constraints are seen worldwide across the energy industry. We accept that the situation is challenging but this

44 *Uranium and Plutonium*, Macro-Economic Study, June 2007.

45 House of Commons Trade and Industry Committee, *New nuclear? Examining the issues*, Fourth Report of Session 2005–06. Volume I. July 2006; Euratom Supply Agency, *Annual Report 2006*; World Energy Council, *Energy and Climate Change*, June 2007; International Energy Agency, *World Energy Outlook 2006*; Australian House of Representatives, Standing Committee on Industry and Resources, *Australia's Uranium — Greenhouse Friendly Fuel for an Energy Hungry World*, November 2006; IAEA/OECD, *Uranium 2005: Resources, Production and Demand*, June 2006; Massachusetts Institute of Technology, *The Future of Nuclear Power: an interdisciplinary MIT study*, 2003.

46 R.E.H. Sims, et al, 2007: Energy supply. In *Climate Change 2007: Mitigation*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, et al], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

will be the case however we chose to meet our future energy supplies. For nuclear build, we think that the situation is manageable.

63. The UK's nuclear sector is developing a strategy that will enable it to meet its future demand for skills. We see evidence, worldwide, of industrial investment to supply a nuclear renaissance, although we accept that demand is likely to run ahead of supply, at least some of the time, and that the non-nuclear equipment suppliers need to increase their investment. Furthermore, new nuclear power stations have long lead times, giving clear market signals during which construction and operational skills can be developed and long-lead equipment ordered. For these reasons, we believe that both the Government and project developers should keep the situation under review, but that the challenges can be managed effectively and do not constitute a reason to deny energy companies the option of investing in new nuclear power stations.

Our conclusion

Having reviewed the arguments and evidence put forward, the Government believes that the energy sector, nuclear and otherwise, faces challenges in meeting its need for skilled workers and in the capacity of the manufacturing supply chain to support new construction. However, we believe that the situation is manageable and that building new nuclear power stations does not present a significantly greater challenge than the alternatives. Indeed, a nuclear renaissance, here and around the world, presents opportunities for companies to grow and for individuals to have rewarding careers. We conclude, therefore, that the skills and supply chain situation does not provide a reason to prevent energy companies from investing in new nuclear power stations.

Reprocessing of spent fuel

64. Spent fuel created by nuclear power stations may either be disposed of or recycled, through a process called reprocessing, to separate out the useful uranium and plutonium. Reprocessing of spent fuel has a number of advantages in that it maximises the recovery of the energy from the fuel, can improve energy security by providing a source of fresh fuel, and reduces the amount of high level waste. But there are a number of disadvantages. Reprocessing creates separated plutonium (which requires long-term storage) and other waste streams (including regulated discharges) and requires the transport of spent fuel and other nuclear materials.
65. Our view remains that in the absence of any proposals from industry, new nuclear power stations built in the UK should proceed on the basis that spent fuel will not be reprocessed. As a consequence, plans for waste management and financing should proceed on this basis. This ensures that before any new nuclear power stations are built, we have a clear path for the handling of the waste that will be produced, and are confident as to its technical and economic feasibility.



Our conclusion

Having reviewed the arguments and evidence put forward, and in the absence of any proposals from industry, the Government has concluded that any new nuclear power stations that might be built in the UK should proceed on the basis that spent fuel will not be reprocessed and that plans for, and financing of, waste management should proceed on this basis.

We are not currently expecting any proposals to reprocess spent fuel from new nuclear power stations. Should such proposals come forward in the future, they would need to be considered on their merits at the time and the Government would expect to consult on them.

Our proposals on nuclear power

66. The Government has concluded that new nuclear power stations should have a role to play in our future energy mix alongside other low-carbon sources of electricity; that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to facilitate its deployment. It remains a central plank of the Government's energy policy that competitive energy markets, with independent regulation, are the most cost-effective and efficient way of generating, distributing and supplying energy, to meet the twin challenges of tackling climate change and ensuring energy security.
67. In reaching our conclusion we have carefully considered the evidence and arguments set out in the consultation document and have considered the responses to the consultation and any other relevant evidence which has emerged. In particular, we have considered a range of issues including:
 - nuclear power and carbon emissions
 - security of supply impacts of nuclear power
 - the economics of nuclear power
 - the value of having low-carbon electricity generation options: nuclear power and the alternatives
 - the safety and security of nuclear power
 - transport of nuclear materials
 - waste and decommissioning
 - nuclear power and the environment
 - the supply of nuclear fuel
 - supply chain and skills implications
 - reprocessing of spent fuel.
68. These issues are discussed elsewhere in Section 2 of this White Paper. Having considered the issues in the round, we continue to believe that we face two long-term challenges namely, tackling climate change by reducing carbon dioxide emissions both in the UK and abroad, and ensuring the security of our energy supplies.

69. There is also considerable uncertainty about the future energy mix, in particular, the pace of climate change and the pressures this will create, and geopolitical developments. There are also uncertainties relating to future fossil fuel and carbon prices; the speed at which we can achieve greater energy efficiency and therefore likely levels of energy demand here and globally; the speed, direction and future economics of development in the renewable sector; and the technical feasibility and costs associated with applying carbon capture and storage technologies to electricity generation on a commercial scale.
70. In view of the need to meet our twin energy challenges and given the uncertainties about the future energy mix, we believe that preventing energy companies from investing in new nuclear power stations would increase the risk of not achieving our long-term climate change and energy security goals, or achieving them at higher cost.
71. However, we recognise that there are significant concerns about a number of issues associated with nuclear power. For example, the public are concerned about risks in relation to safety, security, proliferation, transport and the environment. Whilst these are understandable concerns we think that the risks associated with nuclear power are small and that the existing regulatory regime is such that those risks can be effectively managed.
72. The public is also concerned about the management of radioactive waste. We recognise the importance of having a mechanism for the long-term management of radioactive waste. We are satisfied that it would be technically possible to dispose of new nuclear waste in a geological disposal facility and that such waste could be stored safely and securely until such time as the geological disposal facility is ready. We are exploring this mechanism through the MRWS process and believe it will provide a feasible mechanism for identifying a suitable site for construction of a geological disposal facility.
73. We recognise that there are also other concerns including concerns about the supply of uranium, skills and about the environmental impact of nuclear power. Whilst we accept that these are important issues, we think these issues can be managed and we do not think they provide a reason for not allowing energy companies to invest in new nuclear power stations.
74. Having considered the issues above and the other arguments and evidence raised in the consultation and in the responses to it, we have concluded that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations.
75. The next steps the Government will take to facilitate investment in new nuclear power stations are outlined in Section 3 of this White Paper.



Our conclusion

In the context of tackling climate change and ensuring energy security, the Government has concluded that it would be in the public interest to give energy companies the option of investing in new nuclear power stations.

Other considerations

76. The specific comments raised by those responding to the consultation were diverse. Many of the issues raised are already addressed at the appropriate points elsewhere in this White Paper and we have therefore only dealt with certain points below.
77. There was no clear consensus about the need either to restrict new nuclear power stations to the vicinity of existing sites – though many respondents thought that this would be likely to happen naturally anyway – or to restrict them to approximately replacing existing capacity. On the latter point, the Government has therefore decided that no specific cap on future new nuclear capacity should be applied.
78. We expect that applications for building new power stations will focus on areas in the vicinity of existing nuclear facilities. Industry has indicated that these are the most viable sites. The suitability of sites will be assessed through the forthcoming SSA process. In addition to the SSA, any developer wishing to construct a new nuclear power station would also need to obtain relevant environmental, health and safety authorisations as well as development consent. We will consult on the criteria for assessing suitable sites and then on a draft list of sites. The Government will continue to monitor whether an appropriate market in suitable sites is developing.
79. We do not think it is appropriate to restrict new nuclear power stations to the replacement of existing capacity because the fundamental principle of our energy policy is that competitive energy markets, with independent regulation, are the most cost-effective and efficient way of generating, distributing and supplying energy. In those markets, investment decisions are best made by the private sector and independent regulation is essential to ensure that the markets function effectively.
80. We have also considered whether there is a need to impose any other restrictions on new nuclear power stations and have considered the comments made in response to the consultation. Many of the comments made have been addressed elsewhere in this White Paper and we do not address them all specifically here.
81. We have, however, considered whether it is necessary to take additional steps to promote investment in renewables, alongside nuclear. We have concluded that our plans to extend the Renewables Obligation level to 20%, subject to deployment, and to target additional support to help bring emerging technologies such as offshore wind and marine to market quicker, will adequately address this concern. We will

also bring forward further measures in the light of the EU's 20% renewables target for 2020.

82. We have also considered the concerns about ensuring that the private sector adequately provides for waste and decommissioning costs. This is why, in addition to the measures we will be taking in the Energy Bill, we have decided to create a Nuclear Liabilities Financing Assurance Board (NLFAB) as explained in Annex C⁴⁷.

Our conclusion

We are taking steps to facilitate nuclear new build as outlined in this White Paper. In addition, we are setting up the Nuclear Liabilities Financing Assurance Board (NLFAB), putting in place measures to ensure that the effectiveness of the Nuclear Installations Inspectorate is further enhanced, and reforming the planning system.

We think the Strategic Siting Assessment (SSA) and Strategic Environmental Assessment (SEA) processes will enable suitable sites to come forward. The Government will continue to monitor whether an appropriate market in suitable sites is developing. The Government expects that applications to build new nuclear power stations will focus on areas in the vicinity of existing nuclear facilities. However, we do not consider it is necessary to put in place additional restrictions or conditions before giving energy companies the option of investing in new nuclear power stations.

Opening up the way for new nuclear power stations

83. Many respondents supported the facilitative actions we proposed in our consultation document, including the proposals we set out in a separate consultation for Justification and a combined SSA and SEA.
84. We believe it is important to take action on a number of fronts to give confidence to investors by:
- Strengthening the EU ETS so that investors have confidence in a continuing carbon price signal when making decisions
 - Improving the planning system for major electricity generating stations in England and Wales, including nuclear power stations, by ensuring it sets a framework for development consents that gives full weight to policy and regulatory issues that have already been subject to debate and consultation at a national level, and does not reopen these issues in relation to individual applications
 - Running an SSA process to develop criteria for determining the suitability of sites for new nuclear power stations and, combined with this, taking further the consideration of the high-level

⁴⁷ We intend to create a new independent advisory body, the Nuclear Liabilities Financing Assurance Board to provide scrutiny and advice on the suitability of decommissioning programmes – see Box 4.



environmental impacts of new nuclear power stations through a formal SEA in accordance with the SEA Directive⁴⁸

- Running a process of Justification (in accordance with the Justification of Practices Involving Ionising Radiation Regulations 2004)⁴⁹, to test whether the economic, social or other benefits of specific new nuclear power technologies outweigh the health detriments
- Assisting the nuclear regulators, to pursue a process of Generic Design Assessment (GDA)⁵⁰ of industry-preferred designs of nuclear power reactors to complement the existing site-specific licensing process
- Delivering legislative arrangements to ensure that operators meet their full decommissioning costs and their full share of waste management and disposal costs. This may also enhance investor confidence by giving greater certainty on how they will be expected to meet their liabilities.

Implications for the market

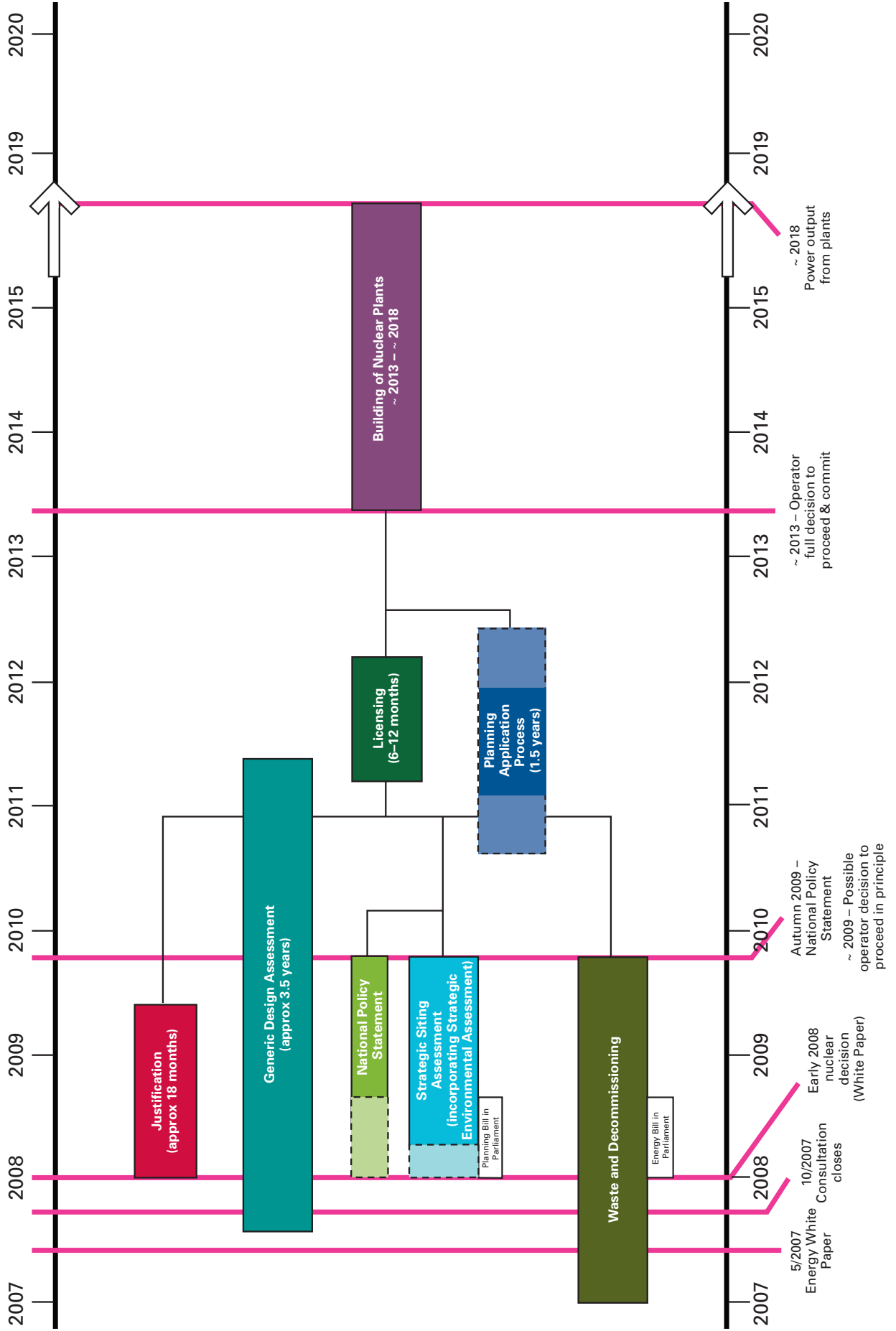
85. If new nuclear power stations are to play a role in the future it is important that the market receives a clear signal now about whether or not it can be an investment option. This White Paper gives that signal. Our clear conclusion is that allowing energy companies to invest in new nuclear power stations will reduce the risk of not achieving our long-term goals on climate change and energy security, and will reduce the cost of doing so.
86. We have also established an indicative timetable showing the fastest practical route to the building of new nuclear power station (see paragraphs 3.7-3.9). We are confident that, by working with operators, whilst upholding the highest regulatory standards, we can deliver a framework that would enable energy companies to begin construction of the first new nuclear power station in the period 2013-2014.
87. For illustrative purposes, we set out overleaf in Chart 1 a potential path to new nuclear build, including our programme of facilitative actions.

48 Directive 2001/42/EC of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (O.J. L197, 21.7.2001, p30).

49 Justification of Practices Involving Ionising Radiation Regulations 2004 (S.I. 2004/1769).

50 This is sometimes referred to generically as "pre-licensing".

Chart 1: Indicative pathway to possible new nuclear power stations





The Government's overall conclusion

88. **The Government has taken its decision to allow new nuclear power stations to be built against the very challenging backdrop of climate change and threats to our energy security. The Government's conclusion is that nuclear power is:**
- **Low-carbon – helping to minimise damaging climate change**
 - **Affordable – nuclear is currently one of the cheapest low-carbon electricity generation technologies, so could help us deliver our goals cost effectively**
 - **Dependable – a proven technology with modern reactors capable of producing electricity reliably**
 - **Safe – backed up by a highly effective regulatory framework**
 - **Capable of increasing diversity and reducing our dependence on any one technology or country for our energy or fuel supplies.**
89. **On this basis, the Government believes it is in the public interest that new nuclear power stations should have a role to play in this country's future energy mix alongside other low-carbon sources; that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to open up the way to the construction of new nuclear power stations. It will be for energy companies to fund, develop and build new nuclear power stations in the UK, including meeting the full costs of decommissioning and their full share of waste management costs. Together with the other policies set out in the Energy White Paper⁵¹, a new nuclear programme will allow us to meet our wider energy goals. So that nuclear power can make the contribution of which it is capable, the Government will vigorously take forward the facilitative steps we describe in this White Paper.**

51 Energy White Paper, *Meeting the Energy Challenge*, URN 07/1006, May 2007.